Inside view of GRAPES-3 tracking muon telescope

Bending of cosmic rays in Earth's magnetic field

Cosmic Ray Laboratory
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Coverage Of
Transient Weakening of Earth's Magnetic Shield Probed by GRAPES-3

VOLUME II: ENGLISH LANGUAGE

Cosmic Ray Laboratory, Ooty

APRIL 2017
Summary of worldwide coverage on GRAPES-3 discovery in 91 countries in 1003 reports

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<td>113</td>
<td>Pakistan</td>
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<td>UK</td>
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<td>163</td>
<td>UK</td>
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<td>Did a solar storm damage Earth’s magnetic field?</td>
<td>164</td>
<td>UK</td>
<td>English</td>
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<td>Earth’s magnetic shield is ‘WEAKENING’ leaving us vulnerable to radiation</td>
<td>178</td>
<td>UK</td>
<td>English</td>
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<td>UK</td>
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<td>Scientists record breach in magnetic field</td>
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<td>Crack discovered in Earth's magnetic shield</td>
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<td>Crack discovered in Earth's magnetic shield</td>
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<td>In force field of Earth the scratch has been found</td>
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<td>Earth's magnetic shield has cracked</td>
<td>186</td>
<td>USA</td>
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<td>Earth’s magnetosphere cracked under pressure</td>
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<td>Crack In Earth’s Magnetic Shield Detected</td>
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<td>What will be the consequences of a crack in earth's magnetic field?</td>
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<td>USA</td>
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<td>Scientists Record Breach in Magnetic Field</td>
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<td>USA</td>
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<td>A Crack in the Earth’s Magnetic Shield</td>
<td>204</td>
<td>USA</td>
<td>English</td>
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<tr>
<td>127</td>
<td>Massive Crack In Earth’s Magnetic Shield</td>
<td>206</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>128</td>
<td>Is The Earth’s Magnetic Field Gradually Deteriorating:</td>
<td>208</td>
<td>USA</td>
<td>English</td>
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<td>Something Dangerous Awaiting Us?</td>
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<td>A recent cosmic burst cracked the Earth’s magnetic field wide Open</td>
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<td>USA</td>
<td>English</td>
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<tr>
<td>Sr No</td>
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<td>GRAPES-3 Telescope Recorded A Crack in Earth’s Magnetic Shield</td>
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<td>216</td>
<td>USA</td>
<td>English</td>
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<td>133</td>
<td>Alarming Crack Detected in Earth’s Magnetic Shield – What</td>
<td>218</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
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<td>Does the Future Hold?</td>
<td></td>
<td></td>
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<td>Solar Flare Burst Cracked The Earth’s Magnetic Field, Caused Radio Blackouts?</td>
<td>219</td>
<td>USA</td>
<td>English</td>
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<tr>
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<td>Crack Discovered in Earth’s Magnetic Shield</td>
<td>221</td>
<td>USA</td>
<td>English</td>
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<td>136</td>
<td>Cosmic-ray detector finds possible crack in Earth’s magnetic Shield</td>
<td>222</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>137</td>
<td>Potentially Dangerous Cosmic Rays Are Leaking Into Earth’s Atmosphere — Are We Safe?</td>
<td>224</td>
<td>USA</td>
<td>English</td>
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<td>Scientists Record Breach In Earth’s Magnetic Field</td>
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<td>The Earth’s Magnetic Shield Cracked, Are We Doomed?</td>
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<td>THE EARTH’S MAGNETIC SHIELD CRACKED, ARE WE DOOMED?</td>
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<td>Cosmic Rays Entering Earth: Dangerous Radiation Could Penetrate Cracked Magnetic Field</td>
<td>236</td>
<td>USA</td>
<td>English</td>
</tr>
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<td>As If We Don't Have Enough To Worry About, Now There's A Crack In Earth's Magnetic Shield</td>
<td>238</td>
<td>USA</td>
<td>English</td>
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<td>Indian Scientists Detect Crack In Earth's Magnetic Shield</td>
<td>239</td>
<td>USA</td>
<td>English</td>
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<td>Scientists Detect A Crack In Earth's Magnetic Field After A Severe Solar Storm</td>
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<td>English</td>
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<td>Scientists Detect Crack in Earth's Magnetic Shield; Is our Planet's Magnetic Field Disappearing?</td>
<td>241</td>
<td>USA</td>
<td>English</td>
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<td>Earth’s Magnetic Shield Vital for Humanity Cracks, Indian Researchers Discover</td>
<td>243</td>
<td>USA</td>
<td>English</td>
</tr>
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<td>Indian scientists detect crack in Earth’s magnetic shield</td>
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<td>India uses recycled pipes to detect solar storms (bbc.com)</td>
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<td>USA</td>
<td>English</td>
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<td>Holes in Earth’s Magnetic Field</td>
<td>251</td>
<td>USA</td>
<td>English</td>
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<td>GRAPES-3 indicates a crack in Earth’s magnetic shield</td>
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<td>Could Earth’s Protective Shield Be Cracking?</td>
<td>253</td>
<td>USA</td>
<td>English</td>
</tr>
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<td>Crack In Earths Magnetic Shield</td>
<td>255</td>
<td>USA</td>
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<td>POWERFUL GEOMAGNETIC STORM: EARTH’S MAGNETOSPHERE HAS CRACKED!</td>
<td>258</td>
<td>USA</td>
<td>English</td>
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<td>The Planet’s Magnetic Field Was Cracked Open By A Solar Storm</td>
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<td>159</td>
<td>Earth’s Magnetic Shield Almost Cracked by Massive Solar Storm</td>
<td>261</td>
<td>USA</td>
<td>English</td>
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<tr>
<td>160</td>
<td>The Planet’s Magnetic Field Was Cracked Open By A Solar Storm</td>
<td>263</td>
<td>USA</td>
<td>English</td>
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<td>162</td>
<td>Study: Solar flare caused a 'crack' in protective field around Earth</td>
<td>266</td>
<td>USA</td>
<td>English</td>
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<td>163</td>
<td>A Solar Storm Put A Crack In Earth’s Magnetic Field</td>
<td>267</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
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<td>GRAPES-3 Indicates a Crack in Earth’s Magnetic Shield</td>
<td>269</td>
<td>USA</td>
<td>English</td>
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<td>Earths Magnetic Shield Crack Found</td>
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<td>USA</td>
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<td>The Crack On Earths Magnetic Shield Edition</td>
<td>272</td>
<td>USA</td>
<td>English</td>
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<td>167</td>
<td>Scientists have just detected a crack in Earth’s magnetic Shield</td>
<td>273</td>
<td>USA</td>
<td>English</td>
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<td>The Crack On Earths Magnetic Shield Edition</td>
<td>275</td>
<td>USA</td>
<td>English</td>
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<td>169</td>
<td>Is Earths Protective Shield Cracking</td>
<td>276</td>
<td>USA</td>
<td>English</td>
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<td>A Solar Storm Put A Crack In Earth’s Magnetic Field</td>
<td>282</td>
<td>USA</td>
<td>English</td>
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<tr>
<td>171</td>
<td>Researchers Have Found Evidence of Cracking in the Magnetosphere</td>
<td>284</td>
<td>USA</td>
<td>English</td>
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<td>Cosmic-ray detector finds possible crack in Earth’s magnetic Shield</td>
<td>286</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
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<td>Massive Solar Flare Cracks Earth’s Magnetic Shield</td>
<td>288</td>
<td>USA</td>
<td>English</td>
</tr>
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<td>289</td>
<td>USA</td>
<td>English</td>
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<td>175</td>
<td>Earth’s Magnetic Shield Weakened, Develops a Crack, Indian telescope GRAPES-3 Detected</td>
<td>290</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>176</td>
<td>Thru world's largest and most sensitive cosmic ray monitor, located in India, Scientists detect crack in Earth’s magnetic Shield</td>
<td>292</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>177</td>
<td>Crack Found In Earth’s Magnetic Shield</td>
<td>293</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.i4u.com/2016/11/117077/crack-found-earth-s-magnetic-shield">http://www.i4u.com/2016/11/117077/crack-found-earth-s-magnetic-shield</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>178</td>
<td>GRAPES-3 Indicates a Crack in Earth’s Magnetic Shield</td>
<td>294</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>179</td>
<td>A Recent Geomagnetic Storm Cracked Earth’s Magnetic Shield And Endangered Life By Exposing Atmosphere To Deadly Cosmic Radiation</td>
<td>296</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>Sr No</td>
<td>Title</td>
<td>Page</td>
<td>Country</td>
<td>Language</td>
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<td>---------</td>
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</tr>
<tr>
<td>180</td>
<td>Crack In Earth’s Magnetic Field Alerts Scientists</td>
<td>300</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>181</td>
<td>Did a Solar Storm Damage Earth’s Magnetic Field?</td>
<td>301</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.labroots.com/trending/space/4631/solar-storm-damage-earth-s-magnetic-field">http://www.labroots.com/trending/space/4631/solar-storm-damage-earth-s-magnetic-field</a></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>182</td>
<td>Cosmic rays leaking into earth’s atmosphere; High intensity event may cause unexpected damage</td>
<td>303</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>183</td>
<td>Is Earth’s protective shield cracking? Bursts of deadly cosmic rays raises fears that our planet’s magnetic field is Disappearing</td>
<td>305</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>184</td>
<td>Earth’s Magnetic Shield Vital for Humanity Cracks, Indian Researchers Discover</td>
<td>309</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>185</td>
<td>Crack discovered in Earth’s magnetic shield</td>
<td>311</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>186</td>
<td>Crack In Earth’s Magnetic Shield Greater Than Expected</td>
<td>312</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>187</td>
<td>Scientists detect crack in Earth’s magnetic field, here is why you should care</td>
<td>313</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>188</td>
<td>Cosmic-Ray Detector Finds Possible Crack in Earth’s Magnetic Shield</td>
<td>314</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>189</td>
<td>Solar flare radiation burst ‘cracked’ Earth’s magnetic field, caused radio blackouts</td>
<td>315</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>190</td>
<td>Crack Detected in Earth’s Magnetic Shield, Causing Supercharged Aurora Borealis, Radio Signal Blackouts In High Latitude Countries</td>
<td>316</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>Sr No</td>
<td>Title</td>
<td>Page</td>
<td>Country</td>
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<td>---------</td>
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</tr>
<tr>
<td>191</td>
<td>Cosmic Burst Cracked Earth’s Magnetic Field Wide Open</td>
<td>318</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>192</td>
<td>Cosmic Burst Cracked Earth’s Magnetic Field Wide Open</td>
<td>321</td>
<td>USA</td>
<td>English</td>
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<td>193</td>
<td>A recent cosmic burst cracked the Earth’s magnetic field wide Open</td>
<td>323</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>194</td>
<td>Crack in Earth’s magnetic shield detected</td>
<td>324</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>195</td>
<td>Solar flare radiation burst ‘cracked’ Earth’s magnetic field, caused radio blackouts</td>
<td>326</td>
<td>USA</td>
<td>English</td>
</tr>
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<td></td>
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<tr>
<td>196</td>
<td>GRAPES-3 Indicates a Crack in Earth’s Magnetic Shield</td>
<td>327</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>197</td>
<td>GRAPES-3 muon telescope indicates a crack in Earth’s magnetic shield</td>
<td>329</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>198</td>
<td>Solar storms can weaken Earth’s magnetic field</td>
<td>330</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.zenexp.com/solar-storms-can-weaken-earths-magnetic-field-2945279/2">http://www.zenexp.com/solar-storms-can-weaken-earths-magnetic-field-2945279/2</a></td>
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<td></td>
</tr>
<tr>
<td>199</td>
<td>GRAPES-3 Telescope Records Cosmic Ray Burst, Highlights Crack In Earth’s Magnetic Field</td>
<td>331</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>200</td>
<td>Cosmic Ray Detector Finds Possible Crack in Earth’s Magnetic Shield</td>
<td>333</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>201</td>
<td>India’s Telescope Detects Crack in the Earth’s Magnetic Shield</td>
<td>334</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>202</td>
<td>Earth’s Magnetic Shield Weakened, Develops a Crack, Indian telescope</td>
<td>335</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td></td>
<td>GRAPES-3 Detected</td>
<td></td>
<td></td>
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<td>----------</td>
</tr>
<tr>
<td>203</td>
<td>Study: Solar Flare Caused A ‘Crack’ In Protective Field Around Earth</td>
<td>336</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>204</td>
<td>Indian Scientists Have Detected a Crack in Earth’s Magnetic Shield</td>
<td>337</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>205</td>
<td>Giant Coronal Mass Ejection Created A Crack In Earth’s Magnetic Shield</td>
<td>338</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>206</td>
<td>TH-SUNDAY - GRAPES-3 facility - first to detect effect of solar storms on earth’s magnetic field, gets an upgrade</td>
<td>341</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>207</td>
<td>Hole found in Earth’s magnetic field – humanity at risk of cosmic radiation</td>
<td>342</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>208</td>
<td>Earth's Magnetic Field Has A Crack</td>
<td>343</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>209</td>
<td>GRAPES-3</td>
<td>344</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>210</td>
<td>How India Uses Recycled Pipes To Detect Ferocious Solar Storms</td>
<td>346</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>211</td>
<td>Hole found in earth's magnetic field-humanity at risk of cosmic radiation</td>
<td>348</td>
<td>USA</td>
<td>English</td>
</tr>
<tr>
<td>212</td>
<td>GRAPES-3 indicates a crack in Earth's magnetic shield</td>
<td>349</td>
<td>Vietnam</td>
<td>English</td>
</tr>
<tr>
<td></td>
<td><a href="http://reporter.vn/article/97355/grapes-3-indicates-a-crack-in-earths-magnetic-shield">http://reporter.vn/article/97355/grapes-3-indicates-a-crack-in-earths-magnetic-shield</a></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>213</td>
<td>Solar Flare Caused a ‘Crack’ in Protective Field Around Earth</td>
<td>350</td>
<td>Vietnam</td>
<td>English</td>
</tr>
</tbody>
</table>
Transient Weakening of Earth’s Magnetic Shield Probed by a Cosmic Ray Burst

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The GRAPES-3 tracking muon telescope in Ooty, India measures muon intensity at high cutoff rigidities (15–24 GV) along nine independent directions covering 2.3 sr. The arrival of a coronal mass ejection on 22 June 2015 18:40 UT had triggered a severe G4-class geomagnetic storm (storm). Starting 19:00 UT, the GRAPES-3 muon telescope recorded a 2 h high-energy (∼20 GeV) burst of galactic cosmic rays (GCRs) that was strongly correlated with a 40 nT surge in the interplanetary magnetic field (IMF). Simulations have shown that a large (17×) compression of the IMF to 680 nT, followed by reconnection with the geomagnetic field (GMF) leading to lower cutoff rigidities could generate this burst. Here, 680 nT represents a short-term change in GMF around Earth, averaged over 7 times its volume. The GCRs, due to lowering of cutoff rigidities, were deflected from Earth’s day side by ∼210° in longitude, offering a natural explanation of its night-time detection by the GRAPES-3. The simultaneous occurrence of the burst in all nine directions suggests its origin close to Earth. It also indicates a transient weakening of Earth’s magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.

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Introduction.—The geomagnetic field (GMF) [1] shields Earth from energetic charged particles by deflecting them away over several Earth radii (R_E) [2]. Eruptive solar processes produce coronal mass ejections (CMEs) that are large plasma structures with embedded turbulent magnetic fields, that are ejected into the heliosphere from the solar corona [3]. The space weather is driven by these CMEs that can have profound societal impact by triggering severe storms that disrupt space, and ground-based communication. The largest storm in recorded history was the famous Carrington event of 1859 that disrupted a relatively robust communication system of telegraph lines of that era for several hours [4,5]. However, the occurrence of a similar event today could cripple the suite of smart devices including mobile phones, computer networks, etc., on Earth, and satellites in space. This is due to the widespread use of VLSI circuits in these devices, which may not survive the high radiation environment produced by a Carrington-like event [6,7].

The reconfiguration of the magnetic field through reconnection is the key to interpret the energy release in coronal mass ejections (CMEs), and the generation of solar magnetic field through dynamo action [8]. The magnetic field, and associated turbulence in the CMEs causes slow (~days) reduction in the galactic cosmic ray (GCR) intensity called Forbush decrease (FD) events [9–12]. The CMEs containing a southward directed IMF induce reconnection, whereby, the magnetic field ahead of Earth’s bow shock is “opened up” [13] producing storms [14,15]. The GMF shields Earth by deflecting GCRs away, resulting in a threshold, termed “cutoff rigidity,” below which GCRs cannot reach Earth [16]. Episodes of increase in the GCR intensity due to decrease in the cutoff rigidity “R_c” during storms have also been reported earlier [2,17,18].
On 21 June 2015, a symmetric full-halo CME erupted from the sunspot region NOAA 2371 associated with a double peaked M2-class solar flare. It appeared in the SOHO/LASCO C2 images at 02:36 UT, and reached Earth on 22 June 2015 18:40 UT, and triggered a severe G4-class storm producing radio blackouts, and Aurore Borealis. Two preceding CMEs had arrived on 21 June 2015 16:45 UT, and 22 June 2015 05:45 UT, respectively, and both had originated from the same sunspot region. The CME parameters, including the solar wind speed ($V_{SW}$), magnetic field ($|B|$), and $B_z$, its component perpendicular to the ecliptic plane, measured by the WIND spacecraft (at L1, $1.5 \times 10^6$ km from Earth) are available on OMNIWeb. The WIND data, time shifted to the bow-shock nose already accounted for propagation delay from the spacecraft [21] available on OMNIWeb, were used here. In Figs. 1(a) and 1(b) the arrival of the three CMEs are marked by jumps in $V_{SW}$, and $|B|$, respectively. For 2 h, the passage of the third CME enhanced $|B|$ to 44 nT (Fig. 1b), and $B_z$ to $-40$ nT [Fig. 1(c)].

**Burst detection by GRAPES-3.**—The large area (560 m$^2$) GRAPES-3 tracking muon telescope in Ooty, India, due to its near-equatorial location, experiences high cutoff rigidities (15–24 GV). It measures the muon intensity along nine independent directions in the sky by detecting $\geq 1$ GeV muons produced by the GCRs in the atmosphere [22,23]. Thus, the muons serve as proxies for GCRs, and hence the terms “muon rate,” and “GCR intensity” (GCRI) will be used interchangeably. The nine muon directions are labeled NE(northeast), N, NW, E, V(vertical), W, SE, S, SW (southwest) in a 2.3 sr field of view, as listed in Fig. 3. The GRAPES-3 detects $1.5 \times 10^8$ muons per hour, which provides an accurate estimate of the GCRI variation [23–25]. The muon rate is corrected for instrumental and atmospheric pressure variations [26]. The corrected muon rates are yet modulated by the solar diurnal anisotropy (SDA) at a frequency of 1 cycle per day (cpd), and to a lesser extent by two higher harmonics. By the use of a fast Fourier transform (FFT) based filter, SDA can be largely eliminated. However, the use of FFT requires observed data to be converted into an uninterrupted time series of $2^N$ intervals, where $N$ is a positive integer. Accordingly, the muon rates measured every four min for $2^{13} = 8192$ intervals spanning 23 days from 12 June 2015 18:28 UT to 4 July 2015 12:36 UT were used here. To remove the contribution of SDA on the muon rate, the FFT spectrum was subjected to a smooth filter to reject frequencies from 0.5 to 3.5 cpd. The inverse FFT of the filtered spectrum yielded a muon rate free from the influence of SDA as shown in Fig. 1(d) [10,26].

As seen from Fig. 1(d), an FD was in progress 4.5 h after the arrival of first CME on 21 June 16:45 UT. In the midst of this FD, a 2 h muon burst (19:00–21:00 UT) correlated with $B_z$ is clearly seen from Fig. 1(d), and Fig. 1(c), respectively, as indicated by the arrows. Another FFT filter

**FIG. 1.** Top 3 panels show WIND data time shifted to the bow-shock nose: (a) $V_{SW}$, (b) $|B|$, (c) $B_z$, (d) GRAPES-3 muon-rate. Vertical dashed lines indicate CME arrival times (UT).

**FIG. 2.** Muon-rate (solid line) and $-B_z$ (broken line) on 22 June 2015, correlation coefficient $R = -0.94$. 

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PRL 117, 171101 (2016) PHYSICAL REVIEW LETTERS

week ending 21 OCTOBER 2016

171101-2
was used to eliminate the frequencies < 0.5 cpd to remove
the slow FD contributions. The muon data now contain
only frequencies > 3.5 cpd. The muon rate, and $-B_z$, data
at 4 min resolution are shown in Fig. 2. $B_z$ was delayed by
32 min which maximized its correlation with the muon data
to $R = -0.94$, highlighting the intimate connection of the
GCRI on Earth, and the $B_z$ in space. Every 4 min, $\sim 10^6$
muons are detected in each of the nine directions, resulting
in a statistical error of $\sim 0.1\%$. Thus, an excess of $9.2 \times 10^5$
on a background of $2.9 \times 10^8$ muons during this 2 h
interval implies a significance in excess of 50$\sigma$.

The nine muon profiles obtained after inverse FFT are
shown by the solid lines in Fig. 3. The burst amplitudes
show a gradual decline from north (N = 1.8%) to south
(SW = 0.8%) directions. Each direction shows a simulta-
neous GCRI surge from 19:00 UT, reaching a maximum at
20:00 UT. For an interplanetary phenomenon, the expected
time offset between V, and directions NE, E, SE is
$-100$ min. Similarly, the offset between V, and NW, W,
SW is 100 min based on the 25$^\circ$ angle between them.
However, the observed offsets between V, and NE, E, SE,
NW, W, SW, measured via a cross correlation yielded a
mean of $(-3 \pm 4)$ min, consistent with a value of zero
within the 4 min time resolution. As expected, the time
offsets between V, and N, S were also zero. Thus, the near
simultaneity of the GCR burst in all directions strongly
suggests its origin close to Earth, possibly within the
magnetosphere.

Simulation of GCR burst.—We tested the hypothesis that
the burst was generated by a sudden lowering of the cutoff
rigidities by recalculating $R_c$ for a GMF perturbed via
reconnection with the IMF. The telescope field of view was

![Graph with data points and labels](image-url)
divided into $360^\circ \times 60^\circ$ grid, each $1^\circ$ in azimuth and zenith directions. In a magnetic field, the trajectory of protons arriving at Earth is the same as that of antiprotons ($\bar{p}$) of the same rigidity leaving Earth. Thus, to simulate the proton trajectories, $\bar{p}$ of increasing rigidity moving away from Earth were launched from each grid point. Their trajectories were traced to a distance “D” [16] in a GMF modeled by IGRF-11 [27], after adding the IMF ($B_x$, $B_y$, $B_z$ averaged every 4 min) to the respective GMF components. The smallest rigidity $\bar{p}$ escaping Earth defines the $R_c$ for that direction. Equivalently, a proton of $R_c$ would be the lowest rigidity particle to reach Earth from outer space along the same trajectory. We varied $D$ from 1.5 to $25R_E$, and found that $R_c$ gradually reduced and reached its asymptotic value at $D = 2R_E$, which was used thereafter.

The production of muons in the atmosphere due to interaction of GCRs above $R_c$ was simulated by Monte Carlo code CORSIKA [28]. The simulated muons satisfying the trigger requirements of the muon telescope were binned into the nine directions mentioned above. The difference between the muon rates before, and after adding the IMF was calculated for every 4 min. The interval 18:40–19:00 UT was used as the baseline to estimate the change in rates both for the data, as well as simulations. The simulated amplitudes were significantly smaller ($\sim 0.05\%$) than the measured ($\sim 1.0\%$) ones. These simulations were repeated after enhancing the IMF by a factor $2 < f < 20$. The results obtained showed that the amplitudes scaled with $f$. A simultaneous minimization of $\chi^2$ for the nine pairs of observed, and simulated profiles yielded $f = 17$.

The nine simulated profiles are shown in Fig. 3 by broken lines. Very high correlations ($-0.89 \pm 0.05$) between the measured, and simulated profiles are seen in all nine cases. The reduction in $R_c$ varied from 0.5 in the south to 0.7 GV in the north. It is remarkable that a simple model with a common compression factor $f = 17$ ($B_c = -680$ nT) reproduced the amplitude, and the shapes of all nine profiles quite well. Since the burst was caused by a decrease of the GMF out to $D = 2R_E$, thus, this decrease of 680 nT, was averaged over a volume of $(2^{3/2} - 1) = 7V_E$ surrounding Earth where $V_E$ is the volume of Earth.

The GCRs near the cutoff experience a large deflection in the GMF. To estimate this “deflection,” asymptotic directions were calculated for $5 \times 10^4$ protons. Protons of rigidities from $R_{ci}$ to $R_{ci} + \Delta R_{ci}$ GV for $i = 1, 9$ directions were simulated. Here $\Delta R_{ci}$, were the changes in the respective cutoff rigidities (0.5–0.7 GV). Trajectories for the most probable rigidity for the nine directions, viewed from the north pole are shown in Fig. 4(a). These trajectories are bending $195^\circ$–$230^\circ$; thus, the asymptotic directions lie in the opposite hemisphere. In Fig. 4(b) an equatorial view of these trajectories is shown. Thus, the GCRs producing the muon burst detected on the night side were deflected $\sim 210^\circ$ from the day side.

**Discussion.**—The frozen-in, IMF component $-B_z = 40$ nT could be enhanced via compression of the CME-sheath region. During this storm, Earth’s bow-shock nose was compressed from 11.4 to $4.6R_E$ [20]. The implied reduction in the area suggests that $-B_z$ would have been enhanced by a factor $(11.4/4.6)^2 = 6.14$. Additionally, assuming the CME shock to be quasiperpendicular, it could further enhance $B_z$ by a factor $< 4$ [29]. Thus, $-B_z = 40$ nT measured at L1, could, in principle, be enhanced by a factor $< 4 \times 6.14 = 24.6$ to $< 980$ nT. Thus, the reduction of 680 nT possibly induced by reconnection with the GMF, was $\sim 70\%$ of its maximum possible value.

An examination of the worldwide neutron monitor data showed that Almaty, and Nor-Amberd stations located on the night side recorded increased rates coincident with GRAPES-3. However, no significant increase was seen by the instruments on the day side [30]. The 32 min delay of the burst relative to the IMF could be due to the GCRs diffusing across a turbulent IMF [11,12]. The long-term changes in the GMF are typically measured from satellites [1]; however, GCRs provide an inexpensive and yet reliable probe of the short-term changes in the GMF over a large volume ($7V_E$). The fortuitous location of GRAPES-3 on the night side, opposite to the reconnection site on the day side, enabled the detection of this burst. The burst had

![FIG. 4. GCR trajectories near the cutoff rigidity responsible for the burst viewed from the (a) north pole and (b) the equator. NW, N, NE shown in blue, W, V, E in green, SW, S, SE in red.](image-url)
occurred due to reduction of the cutoff rigidities from a temporary reconnection-induced 680 nT decrease in the IMF to 680 nT spread over 7 times Earth’s volume, and subsequent reconnection with the GMF leading to lower cutoff rigidities may have generated this burst. A ∼ 210° bending of the GCRs due to lowering of cutoff rigidities resulted in detection of this day-side burst on the night side by the GRAPES-3. The occurrence of the burst indicates a 2 h weakening of Earth’s magnetic shield, which may hold clues for a better understanding of future superstorms.

We thank D. B. Arjunan, G. P. Francis, V. Jayakumar, S. Kingston, K. Manjunath, S. Murugapandian, B. Rajesh, K. Ramadass, V. Santoshkumar, C. Shobana, and R. Sureshkumar for their help in running the experiment. We gratefully acknowledge access to the Neutron-Monitor Database of the European Union.

Conclusions.—The GRAPES-3 muon telescope in Ooty, India detected a 2 h burst of GCRs starting 22 June 2015 19:00 UT that was strongly correlated with a 40 nT surge in the IMF. Monte Carlo simulations showed compression of IMF to 680 nT spread over 7 times Earth’s volume, and subsequent reconnection with the GMF leading to lower cutoff rigidities may have generated this burst. A ∼ 210° bending of the GCRs due to lowering of cutoff rigidities resulted in detection of this day-side burst on the night side by the GRAPES-3. The occurrence of the burst indicates a 2 h weakening of Earth’s magnetic shield, which may hold clues for a better understanding of future superstorms.

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[28] https://www.ikp.kit.edu/corsika/.
Indian scientists detect crack in Earth’s magnetic shield

Washington/Pune: The world’s largest and most sensitive cosmic ray monitor, located in India, has recorded a burst of galactic cosmic rays that indicates a crack in the Earth’s magnetic shield, according to scientists.

The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth’s magnetosphere and triggering a severe geomagnetic storm.

The GRAPES-3 muon telescope located at Tata Institute of Fundamental Research’s Cosmic Ray Laboratory in Ooty in Tamil Nadu recorded a burst of galactic cosmic rays of about 20 GeV last year lasting for two hours.

It triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries, according to the study published in the journal Physical Review Letters this week.

Earth’s magnetosphere extends over a radius of a million kilometres, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations.

Numerical simulations performed by the GRAPES-3 researchers, including Pravata K Mohanty, indicate that the Earth’s magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.

Earth’s magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015.

The data was analysed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray Laboratory in Ooty.

Solar storms can cause major disruption to human civilisation by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

PTI
Indian scientists detect crack in Earth’s magnetic shield

By Dailyexcelsior

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Source: PTI
Pipe lines that detect fiery solar storms

What does a sensational scientific discovery about a solar storm in the Earth’s magnetic field have to do with old, recycled steel pipes which lay buried for more than a decade under a now-defunct gold mine in India? Almost everything. More than 3,700 such

Read on the original site
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Solar storms can cause major disruption to human civilisation by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

Source – PTI
A giant crack has been discovered in the Earth’s magnetosphere. The GRAPES-3 muon telescope recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015 lasting for two hours. The crack was discovered by researchers at Tata Institute of Fundamental Research’s (TIFR) Cosmic Ray Laboratory in Ooty, India, using data recorded by the GRAPES-3 muon telescope (Gamma Ray Astronomy PeV EnergieS 3rd establishment), the world’s largest and most sensitive cosmic ray telescope. They noticed that data from June 22, 2015, showed a two-hour-long burst of cosmic radiation ramming Earth at 2.5 million km (1.55 million miles) per hour. The burst measured 20 GeV – that’s 20 giga electronvolt or 20 billion electron volts.

The GRAPES-3 experiment located at the Cosmic Ray Laboratory (CRL) consists of two major components, first an array of 400 plastic scintillator detectors, and second a large area muon telescope. The GRAPES-3 led by Prof. Sunil K. Gupta, has participation of about 30 scientists from 7 universities in India, and from 5 in Japan.
Earth's magnetosphere extends over a radius of a million kilometers. It acts as the first line of defense and protect us from the continuous flow of solar and galactic cosmic rays, thus save life on our planet from these high intensity energetic radiations. NASA made observations from NASA's IMAGE spacecraft and the joint NASA/European Space Agency Cluster satellites, that immense cracks sometimes develop in Earth according to NASA in an article from 2003.

Numerical simulations performed by the GRAPES-3 collaboration indicate that the Earth's magnetic shield temporarily cracked due to the occurrence of magnetic reconnection which allows the lower energy galactic cosmic ray particles to enter our atmosphere. Earth's magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on June 22 2015. The data was analyzed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers.

In fact, all detector systems, signal processing electronics were designed, and made in the
CRL, Ooty ensures prompt repair in cases of equipment failure, thus enabling uninterrupted operation since 2000 leading to the detection of this burst. This work has recently been published in Physical Review Letters.

By crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications Solar storms can cause major disruption to human civilization. The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor operating on Earth which has an important role to study similar events as said above.
Indian scientists detect crack in Earth’s magnetic shield

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Source From PTI
Small Crack In Earth Magnetic Shield: Indian Scientist

Indian Scientists are playing the vital part in the various event in all over the world.

Recently one of the Indian Scientist has tracked and stated that the world largest and powerful sensitive cosmic ray has monitored and store the information about the earth in which there is the crack on the earth magnetic shield.

This crack has occurred because of the particle called as giant plasma which is ejected from the solar corona has struck the earth at very high speed which can cause the high level geomagnetic storm.

This issue has been fetched through the telescope located in Tata Institute of Fundamental Research’s Cosmic Rays Laboratory located in Ooty, Tamil Nadu.

The telescope named as GRAPES-3 muon has recorded this burst consecutively for more than 2 hours about 20 GeV. This huge destruction in magnetic shield has affected radio signals especially in the high latitude countries, reported in physical reviews of International Journal.

Before the launch of GRAPE-3 Muon telescope, various research and simulation is undergone by the team of Parvata K Mohanty. Magnetic shield bent has been detected during the 180 degree of circulation occur for day and night. This was tracked exactly on 22 June 2015.
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Crack in Earth’s Magnetic Shield Detected

What is the importance of Earth’s Magnetic Shield?
In short Magnetic Shield protects animals and humans from harmful radiation, charged particles and meteorites and causes the spectacular Northern Lights.

The GRAPES-3 muon telescope, at TIFR’s Cosmic Ray Laboratory in Ooty, in India, recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015, lasting for two hours.
A study published in Physical Review Letters has revealed the extent of the high-intensity event for the first time.

The burst occurred when a giant cloud of plasma ejected from the solar corona, struck our planet at a speed of about 1.55 million miles (2.5 million kilometres) per hour.

on 22 June, 2015, particles from a giant cloud of fast-moving plasma penetrated the Earth’s atmosphere. The particles, which originated from the surface of the Sun, were moving at about 2.5 million kilometres per hour when they struck our planet’s atmosphere.

The magnetic field bent these particles about 180 degrees, where they were detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015.

This high-speed strike caused the Earth’s magnetosphere – the area containing the planet’s magnetic field – to shrink from 11 times to four times the Earth’s radius. The charged particles in Earth’s magnetosphere usually deflect solar winds which would otherwise bring harmful ultraviolet radiation to the Earth’s surface.

Analysis carried out by researchers working on the GRAPES-3 telescope indicated that for a short while, the Earth’s magnetosphere cracked, letting some low-energy galactic cosmic rays penetrate the atmosphere.

According to the study, the burst in cosmic activity indicated a “transient weakening of Earth’s magnetic shield”. Further research into the chance event may “hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth,“

This would cause widespread havoc on Earth including black outs and exposure to harmful UV radiation

Many scientists claim that The Earth's magnetic field has weakened by 15 per cent over the last 200 years and this could be a sign that the Earth’s poles are about to flip. We are currently due for flip but do not know when that will happen

If switch happens we would get exposed to solar winds capable of punching holes into ozone layer. It will destroy out power grids and there will be no electricity for many months, climate on earth will get changed and rate of cancer will increase.

Friday, November 4, 2016

Tags – Earth Magnetic Field Crack India
Scientists have detected a crack in Earth’s magnetic shield

cyberog.blogspot.in/2016/11/scientists-have-detected-crack-in.html

Earth is such a habitable place, thanks in no small part to the vast magnetic field that surrounds our planet, shielding us from harsh solar winds and cosmic radiation.

But scientists have been investigating one of the most powerful geomagnetic storms in recent history, and they’ve discovered that our protective barrier isn’t as secure as we thought it was. Turns out, our magnetosphere has been cracked.

Researchers have been analysing data from the GRAPES-3 muon telescope in Ooty, India, which recorded a massive burst of galactic cosmic rays on 22 June 2015.

For 2 hours, Earth’s magnetosphere was being bombarded by these particles, which emit immensely high-energy radiation, and travel through space at nearly the speed of light.

These things are so powerful, they can easily penetrate the hull of a spacecraft, and Earth’s magnetic shield is our first line of defence against them.

About 40 hours before the June 22 event, a giant cloud of plasma was ejected from the Sun’s corona (or outer atmosphere), and eventually struck the magnetosphere at speeds of about 2.5 million kilometres per hour.

That’s not exactly news, because at the time, it triggered a severe geomagnetic storm that was responsible for radio signal blackouts in many high latitude countries in North and South America.

It also resulted in a supercharged aurora borealis - which is created when charged particles from outer space reach Earth’s atmosphere.

But now researchers have finally realised the full extent of that relentless bombardment of cosmic rays.

A team from the Tata Institute of Fundamental Research in India performed numerous simulations based on the GRAPES-3 data from that day, and the results indicate that the magnetosphere had been temporarily cracked, and that’s why things went so haywire in our radio systems.

In fact, the team says the bombardment was so relentless, it caused a severe compression of the magnetosphere, forcing it to shrink from 11 to 4 times the radius of Earth.

The researchers suspect that the geomagnetic storm was powerful enough to actually 'reconfigure' our magnetic shield, prising open weak spots to let radiation and cosmic rays slip through.

"This vulnerability can occur when magnetised plasma from the Sun deforms Earth’s magnetic field, stretching its shape at the poles and diminishing its ability to deflect charged particles," Katherine Wright explains on the American Physical Society website.

The fact that this happened at all is a concern, say the researchers, because it suggests that our magnetic field is changing - or rather, weakening - in certain parts.

"The occurrence of this burst also implies a 2-hour weakening of Earth’s protective magnetic shield during this
"[This] indicates a transient weakening of Earth’s magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space."

So the good news is our magnetosphere was only temporarily cracked, but the bad news is that it can be cracked at all.

There's not a whole lot we can do about that, but the researchers hope that by continuing to search for these cracks as they happen - and in past events - we'll be better prepared to deal with the next time those cosmic rays burst through and wreak havoc.

Source: Science Alert
SHOCK ALERT: Hole found in Earth's magnetic field - humanity at risk of cosmic radiation

A HUGE hole has been detected in the Earth's magnetic shield, leaving millions of human beings vulnerable to deadly cosmic radiation, scientists have warned.

From analysing data from the GRAPES-3 muon telescope in Ooty, India, experts have concluded that the magnetosphere has come under such heavy bombardment in recent years that it weakening.
On June 22, 2015, there was a massive burst of galactic cosmic rays which traumatised the Earth's magnetic shield for two hours.

Roughly 40 hours before the Earth was bombarded by cosmic rays, the sun ejected a giant cloud of plasma which caused high energy radiation to strike the Earth’s magnetosphere at 2.5 million kilometres per hour.
The storm wreaked havoc on technology with radio signal blackouts reported in North and South America.

However, it is not until now that scientists have been able to understand the full extent of the damage caused by the storm.
Experts from the Tata Institute of Fundamental Research in India ran several simulations based on the data from the telescope and found that the magnetosphere had been cracked for a little while on the day.
The magnetosphere protects Earth from cosmic rays

Worryingly, the bombardment was so intense the magnetosphere was forced to shrink from 11 to four times the Earth’s radius.
While small amounts of radiation would have little effect on life on Earth, prolonged exposure to higher amounts of radiation can lead to cancer.

![An illustration of the magnetic shield](image)

The team say in their research published in Physical Review Letters that the storm was so powerful that it managed to “reconfigure” the magnetic shield and opening small cracks in Earth’s first line of defence. This has dangerous implications for the future, the team says.
A solar flare stemming from the sun

They write: "The occurrence of this burst also implies a two-hour weakening of Earth’s protective magnetic shield during this event. "[This] indicates a transient weakening of Earth’s magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space."
Massive breach in Earth’s magnetic field, records scientists

Scientists have recorded the events that spread out after the Earth’s magnetic shield was breached.

Openings in the planet's magnetic field is very common, but it is not easy to collect the data while such event are in progress.

A cosmic ray monitoring facility reported a burst of cosmic rays connected with the opening.

The magnetic field breach was caused due to charged particles from Sun that struck the Earth at high speed.

The GRAPES-3 muon telescope situated at the Cosmic Ray Laboratory (CRL) in Ooty, southern India, reported a burst of galactic cosmic rays close to 20 gigaelectronvolts (GeV) on 22 June 2015.

"In this case, the magnetic field was breached for two hours and then came back to normal. The magnetic field strength decreased only by 2%," Dr. Sunil Gupta, lead scientist at the CRL told the BBC.

Earth’s magnetic shield, or magnetosphere, spreads over a radius of a million kilometres. It protects the planet’s biosphere from the constant flow of solar and other cosmic radiation.

The Sun periodically sends out large clouds of charged particles into space in events known as coronal mass ejections (CMEs). Each particle can include a billion tons of charged gas or plasma.

The vast cloud of plasma send out from the solar corona in 2015 caused huge compression of the Earth’s magnetosphere and resulted in a terrible geomagnetic storm. In turn, this generated aurora borealis (northern lights), and radio signal blackouts in many high-latitude countries.

Numerical simulations carried out by the GRAPES-3 team on this event shows that the Earth’s magnetic shield temporarily opened up due to the incoming solar plasma. Due to this, the lower energy galactic cosmic ray particles entered into our space.

The GRAPES-3 Muon telescope’s collection of a large area and directional measurement enabled the accidental observations.

A major event could occur any time having a significant effect on human infrastructure. As such, there are ongoing experiments carried out to improve the prediction of this so-called space weather.

“They can short circuit power supplies such as high voltage transformers which are the major power source for our cities, interrupt communication satellites and will affect the internet, mobile phones and other devices that use electricity,” said Dr. Harrison.

In addition, he said, a vast solar storm could also endanger humans in space, with the potential for damage to or the loss of spacecraft. But, such events are rare.

Scientists at CRL thinks that a large amount of data available would enable them to predict such events and take preventative measures. But the real challenging task is to devise proper electronic hardware that can give a
reliable alert, Dr. Gupta said.

The study has been published in the journal Physical Review Letters.

Supriya Bhosale
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Solar storms can cause major disruption to human civilisation by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications. -PTI
What an Ooty Based Telescope is Telling Us About the Earth’s Magnetic Field, the Sun and the Universe

A protective sheath covering the earth, bombarding cosmic rays, violent storms in the upper atmosphere – these are not figments of imagination from a sci-fi novel but are rather accurate descriptions of the space surrounding the earth. In fact, the space around our planet is chock full of high energy particles whizzing around, like the solar wind, a steady stream of charged particles emanating from the sun and Galactic Cosmic Rays (GCR), ultra high energy particles of cosmic origins travelling at nearly the speed of light. Why then don’t we have to bother about the effects of such high energy particles that can affect our electronic gadgets and damage our DNA? The answer is the geomagnetic field, the magnetic field of the earth, extending from the core out into space a distance of several earth radii, forming a region around the earth called the magnetosphere. The GMF acts as our natural shield by deflecting high energy charged particles away from the earth.

However, an event of solar origin, called coronal mass ejection (CME) can interfere with the shielding ability of the GMF. Once in a while, a blob of plasma is thrown off from the active regions on the sun’s surface and travel outward through space. These ejections, called CMEs have significant magnetic fields of their own. If they happen to pass through the vicinity of our planet, strong interactions take place between the GMF and the CME field, just as two bar magnets brought close interact with each other, causing intense electromagnetic disturbances in earth’s atmosphere – events termed as geomagnetic storms. During such events, entryways are opened for cosmic rays to enter the atmosphere. These storms, apart from creating beautiful displays of light in the sky, called auroras, can also be harmful to the earth and its inhabitants. The electromagnetic disturbances caused in the ionosphere affect power grids on the ground, satellite hardware and radio and radar systems. Navigation systems like the GPS and the simple magnetic compass are rendered useless, while astronauts, devoid of the atmosphere’s protection, are at risk of radiation exposure.

Considering their impact, studying geomagnetic storms is undoubtedly imperative. Also important is the study of cosmic rays entering our atmosphere. While studying galactic cosmic rays afford us a glimpse into their sources outside our solar system and even beyond our galaxy, those of solar origin would let us learn more about our own star and the impact of its behaviour and processes on our planet. It is with these precise objectives that a state of the art research facility, the Gamma Ray Astronomy PeV Energies – phase 3 (GRAPES-3) was set up in the Cosmic ray Laboratory at Ooty in 2000 as a collaboration of the Tata Institute of Fundamental Research, Mumbai and the Osaka City University, Osaka, Japan. At present many institutions from India and Japan are in collaboration in this experiment that has generated significant results over the course of the past few years.

GRAPES-3 is all eyes and ears for subatomic energetic particles called muons. Muons form when nuclei of atoms in the upper atmosphere are bombarded by cosmic rays and can act as a proxy for the cosmic ray count. The huge 560 m² area tracking muon detector, housed underground to filter out low energy particles, is the largest area tracking detector anywhere. The telescope measures muon intensity in nine independent directions and has a count rate of ~10^8 per hour. Also detected by the facility are air showers, the multitude of secondary particles formed due to the cosmic ray-nuclei collisions, cascading towards the earth. With 400 air shower detectors spread over an area of 25,000 m², GRAPES-3 array is the highest density air shower array in the world.

Recently, GRAPES-3 made news for having witnessed a breach in the magnetic shield of the earth. On the night of 22nd June 2015, a statistically significant surge in muon count, a burst of galactic cosmic rays entering the atmosphere, was observed for a duration of two hours, due to a transient weakening of the GMF. Earlier, on 21st June, the Solar and Heliospheric Observatory (SOHO) of NASA, positioned in space, photographed a CME erupting from the sunspot region NOAA 2371. 40 hours later, the CME reached the earth and the resulting interaction with the GMF caused a geomagnetic storm of severity 4 out of 5 on the National Oceanic and
Atmospheric Administration (NOAA) scale.

The study by Prof. Sunil Gupta, senior professor at the Tata Institute of Fundamental Research (TIFR) and head of the Cosmic Ray Laboratory, and his team, which appeared in the October issue of Physical Review Letters concluded that a temporary reconfiguration of the earth’s magnetic field due to interaction with the passing CME had caused the observed GCR burst. The simultaneous occurrence of the burst in all nine directions suggested a source close to the earth, possibly inside the magnetosphere, marking the CME event as the prime suspect. Furthermore, experimental data shows that the burst was neatly correlated with the surge in the Interplanetary Magnetic Field (IMF) caused by the CME. Extensive simulations by the team have confirmed that a weakening of the GMF caused the surge in galactic cosmic ray intensity. “Discovery of this burst demonstrates that the weakening of earth’s magnetic field is an important condition in triggering a geomagnetic storm, and thus provides a firmer basis for understanding this complex phenomenon”, says Prof. Gupta about their discovery.

In the aftermath of this significant detection, apart from demonstrating the direct impact of space weather phenomena on earth’s magnetic field and consequently life on the planet, scientists propose monitoring of GCR intensity as an early warning system for an impending geomagnetic storm. “GCRs being high energy particles move at nearly the speed of light and can in principle complement the existing early warning system consisting of satellites located in space”, Prof. Gupta explained. Although implementation of this proposal would involve years of observation, studies and testing, the fact that a few hours of early warning can help prevent many of the debilitating effects of a storm is incentive enough for the scientists to further explore this possibility.

With these and more experiments in progress, The GRAPES-3 experiment continues being one of our most effective tools to study our own star, our planet’s magnetic shield and to unwrap more mysteries of the universe galactic cosmic rays bring with them.
Crack in Earth’s Magnetic Shield Detected by Indian Scientists

The GRAPES-3 muon telescope, the world’s largest and most sensitive cosmic ray monitor, located at Tata Institute of Fundamental Research’s Cosmic Ray Laboratory in Ooty in Tamil Nadu recorded a burst of galactic cosmic rays of about 20 GeV last year lasting for two hours. It indicates a crack in the Earth’s magnetic shield, according to scientists.

The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a very high speed of about 2.5 million kilometres per hour struck our planet, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth.

It triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries, according to the study published in the journal Physical Review Letters this week.

Earth’s magnetosphere extends over a radius of a million kilometres, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations.

The study indicate that the Earth’s magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.

Earth’s magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015.

The data was analysed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray Laboratory in Ooty.

Solar storms can cause major disruption to human civilisation by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications. source: PTI
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GRAPES-3 indicates a crack in Earth’s magnetic shield that reveal burst in cosmic rays

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“The simultaneous occurrence of the burst in all nine directions suggests its origin close to Earth,” the authors wrote in the study, published in Physical Review Letters.

The burst occurred when a giant cloud of plasma ejected from the solar corona, struck our planet at a speed of about 2.5 million kilometres per hour, causing a severe compression of Earth’s magnetosphere – the region around the planet which holds the magnetic field – from 11 to 4 times the radius of Earth.

The researchers suspect that the geomagnetic storm was powerful enough to actually ‘reconfigure’ our magnetic shield, forcing open weak spots to allow radiation and cosmic rays slip through. It also brought down radio signals and sparked vivid northern lights across many countries in the north of the world. It also resulted in a supercharged aurora borealis, which is created when charged particles from outer space reach Earth’s
atmosphere.

The researchers explained the fact that this happened at all is a concern, as it suggests that our magnetic field is changing – or rather, weakening – in certain parts.

“The occurrence of this burst also implies a 2-hour weakening of Earth's protective magnetic shield during this event,” the researchers report.

“[This] indicates a transient weakening of Earth’s magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”

The data was examined and understood through comprehensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray Laboratory in Ooty.
Indian Scientist’s detect a Crack in Earth’s Magnetic Field

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It triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries, according to the study published in the journal Physical Review Letters this week. Earth’s magnetosphere extends over a radius of a million kilometres, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations.

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**Post your valuable comments**

Never Miss  US woman poisons co-workers by putting cleaner in coffee maker
A recent cosmic burst cracked the Earth’s magnetic field wide open

A burst of galactic cosmic rays was recorded by the GRAPES-3 muon telescope located at TIFR’s Cosmic Ray Laboratory in Ooty. That burst of rays occurred when the sun let loose a giant cloud of plasma that struck our planet at a speed of roughly 2.5 million kilometers.
Earth’s magnetic shield damaged; can cause super solar storms

As per a study, recently published in Physical Review Letters, a crack has been detected in the Earth’s magnetic shield because of which enormous cosmic rays enter into the atmosphere and cause gigantic geomagnetic storms.

It was GRAPES-3 muon telescope located at Tata Institute of Fundamental Research’s Cosmic Ray Laboratory in Ooty, India, which in June 2015 detected a rise in cosmic ray levels. It was then concluded that our planet’s magnetic shield must have got damaged.

This happened in 2015 when for two hours on June 22, particles from a big cloud of fast-moving plasma entered into the Earth’s atmosphere. The particles had originated from the surface of the Sun and they were travelling at about 2.5 million kilometers per hour. These particles crashed into Earth’s atmosphere with speed and caused the Earth’s magnetosphere to shrink from 11 times to four times the Earth’s radius. The penetration of particles also resulted in a severe geomagnetic storm. The magnetic storm brought down radio signals in many high latitude countries in the northern part of the world.

The Earth’s magnetosphere acts as the first line of defence, shielding the planet from the continuous flow of solar and galactic cosmic rays. The role of the charged particles present in the Earth’s magnetosphere is to deflect solar winds. This is how harmful ultraviolet radiation do not penetrate into the Earth’s surface.

It is a known fact that exposure to ultraviolet radiation can result in chronic harmful effects on the skin, eye, and immune system. The rays also speed up aging of the skin and cause further damage. Ultraviolet radiation also causes our skin to tan in the Sun. The worst it can do is cause cancer. The radiation is especially dangerous for pilots flying at high altitudes.

The burst in cosmic activity lead to weakening of Earth’s magnetic shield because of which in future super-storms may occur. Such super solar storms can result in major devastation of modern technological infrastructure on Earth like large electrical power grids, global positioning systems (GPS), satellite operations and communications.
Scientists detect a crack in Earth’s magnetic shield – Techworm

GRAPES-3 indicates a crack in Earth’s magnetic shield that reveal burst in cosmic rays

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“[This] indicates a transient weakening of Earth’s magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”

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Source: Science Alert
Solar Flare Burst Causes Crack In Earth’s Magnetic Field; How Does It Affect The Human Life?

Scientists have found a crack in the Earth’s protective magnetic shield. The crack caused by the solar flare which has exposed the planet to offensive radiation.

The largest and the most sensitive cosmic ray monitor in the world, the GRAPES-3 muon telescope located at Tata Institute of Fundamental Research’s Cosmic Ray laboratory in Ooty observed the crack.

It detected a burst of the galactic cosmic radiation. The breach on magnetic shield caused when a massive blast of giant cloud of plasma which has been excluded by solar corona struck Earth at a very high speed. This caused a massive geomagnetic storm.

The source of the cosmic ray was a huge solar plasma which can travel for 40 hours to reach the Earth from sun. The giant plasma ran at more than 2.5 million kilometers miles per hour.

In a post, Science Alert stated that the storm was the powerful geomagnetic storms in recent history.

Effects on Earth

It causes radio blackouts in countries situated in the high altitudes.

It causes the magnetosphere to be reduced by 11 to 4 times the radius of the Earth.
Though, the science based blog, Science Explorer stated that not to worry about this as solar storms will not highly affect the human civilization. But when occurred it could damage infrastructures and interrupt technology. It can paralyze lives on Earth by destructing important GPS systems, massive electrical power grids, satellite functionalities and other communication systems.

The storm can change the climate on the Earth and increase the rate of cancer.

It could be more dangerous for the astronauts who are in space.

**Importance of magnetosphere**

The magnetosphere protects the lives on Earth from the continuous flow of solar and galactic cosmic rays. It prevents solar winds blowing directly into Earth’s atmosphere.

Harmful particles from space constantly head towards Earth. The magnetic field confronted them.

The magnetosphere ensures that the planet has an atmosphere of life-giving gases like oxygen.

In their report, the scientists said that they are unable to repair the crack. However, the scientists claimed that it could “hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”
Indian scientists detect crack in Earth’s magnetic shield

OrangeNews9 11/6/2016

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Crack in Earth's magnetic shield detected

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Solar storms can cause major disruption to human civilisation by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.
A crack in Earth's magnetic shield has been spotted by researchers at Tata Institute of Fundamental Research. The researchers were able to identify the crack analyzing the data gathered by India's GRAPES-3 muon telescope.

The news has caused panic among people, thinking that the protective layer of our earth is slowly vanishing. But how true is this?

According to Wired, the fissure which was first discovered in 2015, has let galactic cosmic rays leak into the Earth's atmosphere and caused huge geomagnetic storms in the northern hemisphere. The increased amount of cosmic rays penetrating our atmosphere has led to disrupted communication signals and knocked out radio signals.

The event, according to Science Alert is one of the most powerful geomagnetic storms in recent history.

In fact, results of the researchers' numerous simulations show that the cosmic bombardment, with speed of about 2.5 million kilometers per hour, was so unyielding, it caused a severe compression of the magnetosphere, forcing it to shrink from 11 to 4 times the radius of Earth.

"Earth's magnetic field deflects most cosmic rays, protecting living things from harmful radiation. But large geomagnetic storms can reconfigure this protective shield, opening up weak spots that let radiation and cosmic rays slip through. This vulnerability can occur when magnetized plasma from the Sun deforms Earth's magnetic field, stretching its shape at the poles and diminishing its ability to deflect charged particles," Katherine Wright explains on the American Physical Society website.

Science Explorer said that solar storms can cause major disruption to human civilization because it will interrupt technology and damage infrastructure. While, it is dangerous for the astronauts who are in space, there is no direct threat for the people on earth, unless the radiation bombardment ensues in the long run which may result to changing climate and drive up rates of cancer.

The researchers said there is nothing much we can do to repair the crack but we can study the crack to make us more ready in case more of it will occur in the future.

courtesy: natureworldnews
339. Crack in Earth’s Magnetic Field

The magnetic field surrounding the earth shield us from harsh solar winds and cosmic radiation. The scientists have detected recently that our magnetosphere has been cracked.

Researchers have been analysing data from the GRAPES-3 muon telescope in Ooty, India, which recorded a massive burst of galactic cosmic rays on 22-06-2015. For 2 hours, Earth’s magnetosphere was being bombarded by these particles, which emit immensely high-energy radiation, and travel through space at nearly the speed of light. These things are so powerful, they can penetrate the hull of a spacecraft, and Earth’s magnetic shield is our first line of defence against them.

The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth’s magnetosphere and triggering a severe geomagnetic storm. Earth’s magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015.

Solar storms can cause major disruption to human civilisation by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications. The team were optimistic the knowledge gained would have positive results though, claiming it could “hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”

About these ads
Cosmic Ray lab scientists track solar storm

Even as the recent publication of the findings of the Cosmic Ray Laboratory (CRL) in Ooty on solar storm and its impact on the earth’s magnetic shield in 2015 has created ripples, here is a recapitulation of the extra terrestrial event that has rocked the scientific world. The CRL of the Tata Institute of Fundamental Research (TIFR) here recorded a geomagnetic storm, otherwise known as solar storm, which weakened the earth’s magnetic field, the shield which protects the planet from the invasion of the cosmic rays. When most parts of world was asleep on June 2, 2015, the ever vigilant team of scientists at the CRL witnessed showers of cosmic rays hitting the earth through the ‘muon tracking telescope’.

‘Muons’ are sub-atomic particles that are produced when the cosmic rays travel through the atmosphere. The CRL recorded a sudden burst of ‘muons’ indicating increase in cosmic ray intensity. With its state-of-the-art high performance detectors, the ‘Grapes-3’ (Gamma Ray Astronomy at PeV Energies Phase-3), experiment at CRL could observe this rare activity. Dr Sunil K. Gupta, head of the CRL stated that the earth’s magnetic field (EMF) is aligned along north-south direction, and exerts its influence up to 50,000-km above the surface of the earth. The EMF acts as a shield by preventing the entry of most of the low energy cosmic rays into the atmosphere.

Though the cosmic rays continuously travel down to the earth, the low energy cosmic ray particles are bent by the EMF, and are sent back into space. But, the high energy cosmic ray particles which are small in number enter the earth’s atmosphere and get detected by the cosmic ray observatories across the world, he noted. “At the CRL in Ooty the scientists observed a sudden burst of cosmic ray activity on June 22, indicating that something had changed in the EMF above. Further studies showed that the burst of magnetized plasma from the sun, otherwise known as coronal mass ejection, which contains particles traveling with a high speed of thousand kilometers in a second, and having a low strength magnetic field in it, had affected the EMF. It is known that when the two magnets with their magnetic poles in opposite directions are brought close together, the magnetic field around it becomes weak.

A very similar thing happened on June 22, 2015, causing a geomagnetic storm by opening up weak spots in the EMF. This weakening of the EMF was about two per cent for two hours, as per the calculations of the CRL scientists, which paved the way for the invasion of cosmic ray particles during those two hours. They also found the margin of error to be below 0.1 per cent making it a very accurate study”, Dr Gupta explained.
However, as the solar storm moved past the earth, the EMF got restored back to its normal value after the said two hours. Only in the high altitude places on earth, nearer to the north and south poles, the disturbance to power lines and radio communication was noticed. As the coronal mass ejection from the sun takes nearly two days to reach the earth, the real ejection on sun had happened two days prior to the recording of cosmic ray muons in CRL, Ooty, he pointed out.

However, in case of a bigger solar storm in future the weakening of EMF could be much more, which would then adversely affect the functioning of the satellites, and other electrical and electronic devices on ground which can cause a major disruption. The ‘GRAPES-3’ due its location near the equator is relatively immune from such disruptions. The ‘Grapes-3’ offers the possibility to do ground-based studies of the same phenomenon from the safety of its location in South India, Dr. Gupta said and added that it took little more than a year to completely analyze and verify the data to publish a report on the said event.

The Cosmic Ray Laboratory (CRL) of the Tata Institute of Fundamental Research (TIFR) in Ooty is the ‘numéro uno” in its respective field in the world as its indigenous technology and related facilities along with large study area make it the best standing example for ‘make in India” concept too, said Atul Jain, scientist-in-charge of the CRL Ooty. He said that the ‘Grapes-3’ experiment was done in a world class lab designed to study cosmic rays. ‘Grapes-3’ is equipped with an array of 400 plastic scintillator detectors in a large area to detect the cosmic ray showers. Its ‘muon tracking telescope’ is the world’s largest such telescope which is known for its accuracy and superiority.

The cosmic ray detection process starts with plastic scintillator detectors, which receives the signals of cosmic ray showers. They are then processed at the modern cutting edge technologies and further simulated at the computing cluster. Finally, at the control room the signals are further analyzed to prepare the data, he explained. Mr Jain said that instrumentation, equipment and the electronics involved in the ‘Grapes-3’ experiment, wherein Japan is a collaboration partner, has been designed, developed and fabricated with indigenous in-house technology that has made CRL self-reliant and keeps it flag flying high in this field of fundamental research.

B. Srinivasa Rao, chief engineer and scientific officer at CRL said that to detect ‘muon’, the CRL designed near six meters hallow steel tubes, which are filled with inert gas and tungsten wires to receive ‘muonsignals’. As of
now 3,200 such tubes have been placed in clusters in the CRL, which is protected by concrete slabs that filters cosmic rays but allows ‘muons’ enter the tube, he explained. Stating that all the signals received from detectors placed across the CRL premises in Ootty is finally analyzed and studied at the control room, P.Jagadeesan, scientific officer at CRL said that the lab was functioning round the year without any break to record the cosmic ray and ‘muon signals’ from the outer space and to prepare data and to arrive at the inference.

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Indians detect crack in Earth's magnetic shield

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It triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries, according to the study published in the journal Physical Review Letters this week.

Earth's magnetosphere extends over a radius of a million kilometres, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations.

Numerical simulations performed by the GRAPES-3 researchers, including Pravata K Mohanty, indicate that the Earth's magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower
energy galactic cosmic ray particles to enter our atmosphere.

Earth’s magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015.

The data was analysed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray Laboratory in Ooty.

Solar storms can cause major disruption to human civilisation by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

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A giant cloud of plasma moving at a speed of 2.5 million kilometres per hour struck Earth last year, causing a severe compression of its magnetosphere.

The world’s largest and most sensitive cosmic ray monitor, located in India, has recorded a burst of galactic cosmic rays that indicates a crack in the Earth’s magnetic shield, according to scientists.

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Solar storms can cause major disruption to human civilisation by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.
Earth’s magnetic protect quickly cracked because of to the occurrence of magnetic reconnection.

**Pune:** The world’s major and most sensitive cosmic ray check, located in India, has recorded a burst of galactic cosmic rays that suggests a crack in the Earth’s magnetic protect, according to researchers.

The burst happened when a huge cloud of plasma ejected from the solar corona struck Earth at a quite superior pace leading to substantial compression of the Earth’s magnetosphere and triggering a critical geomagnetic storm.

The GRAPES-3 muon telescope located at Tata Institute of Elementary Research’s Cosmic Ray Laboratory in Ooty in Tamil Nadu recorded a burst of galactic cosmic rays of about 20 GeV previous 12 months lasting for two hours.

The burst happened when a huge cloud of plasma ejected from the solar corona, and transferring with a pace of about 2.5 million kilometres for every hour struck our earth, leading to a critical compression of Earth’s magnetosphere from eleven to 4 periods the radius of Earth.

It induced a critical geomagnetic storm that created aurora borealis and radio signal blackouts in lots of superior latitude nations, according to the study revealed in the journal Actual physical Overview Letters this 7 days.

Earth’s magnetosphere extends above a radius of a million kilometres, which acts as the initial line of defence, shielding us from the ongoing flow of solar and galactic cosmic rays, consequently safeguarding lifestyle on our earth from these superior depth energetic radiations.

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Solar storms can cause key disruption to human civilisation by crippling large electrical electric power grids, international positioning systems (GPS), satellite functions and communications.

(This tale has not been edited by NDTV employees and is auto-created from a syndicated feed.)

Resource hyperlink
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Hope you enjoyed this article and gained information about Shocking News – ISRO Indian Scientists Detect Crack in Earths Magnetic Shield
There is a crack in the Earth’s magnetic shield

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Solar storms can cause major disruption to human civilisation by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.
Earth is our home planet, the only known planet which supports life. The third planet from the sun. Earth supports life because it is the correct distance from the sun, it has just the right temperature not too hot or too cold. Most importantly it has water and oxygen thanks to its atmosphere which protects us from the ultraviolet rays from the sun.

The magnetosphere is the earths magnetic environment. The earth is a huge dipole (2 pole) magnet. The earth magnetic field is caused by its molten iron--nickel core. This magnetic field is aligned with the north and south poles, and has reversed many times during geologic history. The magnetosphere protects the earth from space radiation, which is contributed mainly by our suns solar winds. These are highly charged particles blasted out of the sun like steady winds. Nothing good can come from the destruction of our magnetosphere.

Scientists have recently discovered that our magnetosphere is no longer as secure as it once was, a crack in our magnetic field was discovered. The telescope and cosmic ray detector GRAPES-3 was used to publish analysis of a solar storm that occurred in June 2015 leaving the planet with no magnetic field for 2 hours. A giant cloud of plasma originating from the suns corona ejected and 9 minutes later crashed into our magnetosphere at 2.5 million kilometers per hour causing massive radio-signal blackouts in many countries in North and South America, and fueling huge aurora's.
A year after the storm has struck scientist are just staring to realize the amount of damage done to our atmosphere and warn that the magnetic field has weaken which may cause a flip of the earths poles.

National University Bangladesh
Telescope upgrade to sniff out solar storms

It can accurately determine the time taken for the solar storm to travel to the earth

SHUBASHREE DESIKAN

The GRAPES-3 experiment at TIFR’s Cosmic Ray Laboratory in Ootacamund is getting upgraded. The telescope made news last year when it detected the effect of a solar storm that hit the earth in June 2015. The upgrade will play a major role in getting precise information about the propagation of storms in 'the last million miles' (from the L1 point) of their journey from the Sun to the Earth.

The upgraded detector will have an increased coverage of the sky and improved capacity to determine the direction of incident cosmic rays. The latter property, of being able to discern the direction of detected particles, makes it unique among cosmic ray detectors in the world; it can also to measure the intensity of the particles. Since the enhanced facility can cover a wider field of view (from present 37% to 57%), the chances of spotting solar storms will be higher.

The sun is at a distance of 150 million kilometres from the earth, and satellites have been placed at a distance of nearly 1.5 million kilometres, at the so-called L1 point, where they orbit the Sun along with the Earth. Since charged particles from a solar storm will first impact the satellites before hitting the earth, they act as an early warning system. Depending on the speed of the storm, it will take about 20-40 minutes to reach the earth from the L1 point.

However, the GRAPES-3 may differ from the satellite estimates of the travel time. This is what Sunil Gupta, Head of the GRAPES-3 experiment, terms traversing the 'last million miles'. He says: “GRAPES-3 has an important role in understanding the propagation of storms from the L1 point to its impact on the Earth. We have seen indications that the actual time taken may not be what the satellites predict.”

Cross section: A closeup of the muon telescope showing detectors in two layers, to help fix the direction of the incident particles. - Special Arrangement

Taking preventive steps
It is important to know the time when plasma will reach the earth, accurately, so that preventive and protective measures can be put into place in case a solar storm were to strike the earth.

If the earth’s magnetic field were to be weakened by extreme solar storms, charged particles would shower on to the planet. Apart from rendering electronic devices defunct, charged particles in an extreme solar storm can also short current carrying over-head high voltage lines, leading to large-scale transformers burn out and thereby, power blackouts. A 2008 study conducted by the U.S. National Academy of Sciences estimated that an extreme event could lead to a loss of 40% of transformers in the U.S., which, in turn, could take years to restore.

The up side is that the way to prevent such a disaster is well understood: simply switch off the power lines on being informed of an approaching solar storm! And for this to be possible, an accurate determination of the time taken for the solar storm to travel to the earth is needed, which is where the GRAPES-3 set up comes in.
Solar Flare Radiation burst ‘cracked’ Earth’s magnetic field, Caused Radio Blackouts

This should have been anticipated. Flares are directional jets and they must naturally have hot spots capable of a deep penetration of Earth’s magnetic field. So we have a crack.

At the same time we must have been many times over geological time of which we may have evidence, although I am not too optimistic there. Super strong events might cause real damage but most will not.

In fact the geologic record tells us that mass extinctions are exceedingly rare.

We still need to harden our electronic devices.

The magnetic field that protects Earth from deadly cosmic radiation may be more vulnerable than previously thought. A crack in the shield caused by a solar flare which exposed the planet to a bombardment of radiation has been detected.

Researchers from the Tata Institute of Fundamental Research in India made the discovery when analyzing a galactic cosmic ray burst that caused radio blackouts across North and South America and a supercharged aurora borealis in 2015.

The cosmic ray source was a giant solar plasma cloud that travelled 40 hours from our sun to reach Earth, where the researchers believe it caused a transient “weakening of Earth’s magnetic shield”, according to their findings published in the journal Physical Review Letters.

The sun’s flare was so intense the team claim it would have shrunk the magnetic field from 11 times the radius of Earth to four times its radius before it eased, allowing the shield to recover.

Researchers used data from the GRAPES-3 muon telescope in Ooty, India, to simulate the burst. Results indicated the effect on Earth would have required a crack in the magnetic field that lasted approximately two
hours.

Unfortunately not a lot can be done to protect Earth from any future cracks in the shield, which could leave the planet under constant exposure to radiation and could potentially lead to the eradication of our atmosphere.

The team were optimistic the knowledge gained would have positive results though, claiming it could “hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”

Astronauts onboard the International Space Station (ISS) fall within the field’s 56,000km extension around Earth but future voyagers to Mars would likely be exposed to the rays for long periods.
Indian scientists detect crack in Earth’s magnetic shield

The world’s largest and most sensitive cosmic ray monitor, located in India, has recorded a burst of galactic cosmic rays that indicates a crack in the Earth’s magnetic shield, according to scientists.

The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth’s magnetosphere and triggering a severe geomagnetic storm.

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Earth’s magnetosphere extends over a radius of a million kilometres, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations.

Numerical simulations performed by the GRAPES-3 researchers, including Pravata K Mohanty, indicate that the Earth’s magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.

Earth’s magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015.

The data was analysed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray Laboratory in Ooty.

Solar storms can cause major disruption to human civilisation by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

Courtesy: PTInews
Analysis of a cosmic event from June 2015 revealed Earth's magnetic shield cracked, allowing cosmic rays to leak into the atmosphere and causing geomagnetic storms in the Northern Hemisphere.

The GRAPES-3 muon telescope in Ooty, India, detected a spike in cosmic ray levels in June 2015, but the severity of the event wasn't revealed until November 2016 through a study published in the scientific journal Physical Review Letters.

The study reports for two hours on June 22, 2015, particles from a giant cloud of fast-moving plasma penetrated the Earth's atmosphere at approximately 1.6 million mph. The particles, originating from the surface of the sun, caused the Earth's magnetosphere to shrink from 11 times to 4 times the earth's radius -- allowing harmful solar winds to breach the Earth's surface.

Earth's magnetosphere acts as the first line of defense between the Earth and the flow of galactic cosmic rays, which shield life on the planet from harmful ultraviolet radiation. It has a radius of over 620,000 miles, according to Wired.

Numerical simulations of the event performed by the GRAPES-3 collaboration propose that the Earth’s magnetic shield cracked due to magnetic reconnection, allowing low-energy galactic cosmic ray particles to enter the atmosphere.

"This vulnerability can occur when magnetized plasma from the Sun deforms Earth’s magnetic field, stretching its shape at the poles and diminishing its ability to deflect charged particles," Katherine Wright explains on the American Physical Society's website.

The solar wind triggered a severe geomagnetic storm at the time of the event, generating vivid aurora borealis -- also known as "northern lights" -- and radio signal blackouts in many high-altitude countries.

The study reports the surge in cosmic activity indicates "transient weakening of Earth’s magnetic shield."
The study authors remain optimistic for Earth geomagnetic future, saying the research may “hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth.”
Indian scientists detect crack in Earth's magnetic shield

gogreenindia-krish.blogspot.in/2016/12/indian-scientists-detect-crack-in.html

srinivasan krishnaswamy

The world's largest and most sensitive cosmic ray monitor, located in India, has recorded a burst of galactic cosmic rays that indicates a crack in the Earth's magnetic shield, according to scientists. The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth's magnetosphere and triggering a severe geomagnetic storm.

- The GRAPES-3 muon telescope located at Tata Institute of Fundamental Research's Cosmic Ray Laboratory in Ooty in Tamil Nadu recorded a burst of galactic cosmic rays of about 20 GeV last year lasting for two hours. The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometres per hour struck our planet, causing a severe compression of Earth's magnetosphere from 11 to 4 times the radius of Earth.

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1-15, March 2017: A new canyon formation off the coast of Visakhapatnam and close to Kovvada, time crystals, Earth Tremors in India, Indus Script identifications, Hailstorms and thunder showers.

The GRAPES-3 muon telescope, the world's largest of its kind, at the Cosmic Ray Laboratory in Ooty, a hill station in the southern state of Tamil Nadu, the scientists recorded a two-hour burst of galactic cosmic rays that invaded the atmosphere on 22 June 2015. The magnetic field breach was the result of charged particles from the Sun striking the Earth at high speed.

How India uses recycled pipes to detect ferocious solar storm

9 hours ago at 15:15 on 01-03-2017: More than 3,700 such pipes are actually at the heart of a most significant scientific finding. A team of Indian and Japanese scientists recently published an internationally-feted paper which recorded the events that unfolded after a breach in the Earth's magnetic shield. Using the GRAPES-3 muon (a sub-atomic particle) telescope, the world's largest of its kind, at the Cosmic Ray Laboratory in Ooty, a hill station in the southern state of Tamil Nadu, the scientists recorded a two-hour burst of galactic cosmic rays that invaded the atmosphere on 22 June 2015. The magnetic field breach was the result of charged particles from the Sun striking the Earth at high speed.
Indian Scientists Detect Crack In Earth’s Magnetic Shield

The world’s largest and most sensitive cosmic ray monitor, located in India, has recorded a burst of galactic cosmic rays that indicates a crack in the Earth’s magnetic shield, according to scientists.

A team of Indian scientists in the southern Indian state of Tamil Nadu recorded an explosion of galactic cosmic rays indicating a crack in the Earth’s magnetic shield.

Moving at a speed of about 2.5 million kilometres per hour, the explosion caused a severe compression of the magnetosphere.

The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth’s magnetosphere and triggering a severe geomagnetic storm.

A similar burst of galactic cosmic rays was recorded last year by GRAPES-3 muon telescope located at the Tata Institute of Fundamental Research’s Cosmic Ray Laboratory in Ooty, a town in the southern Indian state of Tamil Nadu.

GRAPES-3 (Gamma Ray Astronomy PeV EnergieS phase-3) is a collaboration of Tata Institute of Fundamental Research and several Indian and Japanese institutes.

It is designed to study cosmic rays with an array of air shower detectors and a large area muon detector; and it is the largest and most sensitive cosmic ray monitor operating on Earth.

The plasma which ejected from the solar corona moved at a speed of about 2.5 million km/hand struck Earth, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of the planet.

The burst triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries.

Earth’s magnetosphere is like a defence system protecting the Earth from the continuous flow of solar and galactic cosmic rays.
Extending over a radius of millions of kilometres, the magnetosphere protects life on Earth from the high intensity energy radiations.

GRAPES-3 researches, including those by Pravata K Mohanty, performed numerical simulations, indicating that the Earth’s magnetic shield temporarily cracked due to the occurrence of magnetic re-connection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.

Earth’s magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the telescope.

An in-house team of physicists and engineers at the laboratory in Ooty analysed and interpreted the data through extensive simulation over several weeks.

Solar storms can cause major disruption to human civilisation by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.
A huge hole has been detected in the Earth’s magnetic shield, leaving millions of human beings vulnerable to deadly cosmic radiation, scientists have warned. From analysing data from the GRAPES-3 muon telescope in Ooty, India, experts have concluded that the magnetosphere has come under such heavy bombardment in recent years that it is weakening.

On June 22, 2015, there was a massive burst of galactic cosmic rays which traumatised the Earth’s magnetic shield for two hours. Roughly 40 hours before the Earth was bombarded by cosmic rays, the sun ejected a giant cloud of plasma which caused high energy radiation to strike the Earth’s magnetosphere at 2.5 million kilometres per hour.>

The Earth's Magnetic Field Is Cracked, So Are We In Any Danger?

Source: https://www.labroots.com/videos/2310/the-earth-s-magnetic-field-is-cracked-so-are-we-in-any-danger

The Earth is protected by a powerful magnetic field that helps keep us and other life forms safe from ejections from the Sun. These ejections launch charged particles and cosmic rays, but the magnetic field helps deflect a vast majority of these to help us avoid radiation.

On the other hand, it was recently found that there was a crack in the Earth's magnetic field, which brings up the question: are we still safe from the charged particles and cosmic rays that are always bombarding us from the Sun?

The short answer is yes, but the reason why is a little more confusing. Although the cracked magnetic field was still very much effective at repelling charged particles away from us, the trick it had to deal with were cosmic rays leaking through the cracks.

Most of these were probably absorbed by the Earth's magnificent atmosphere before reaching us, but still, this crack allowed more than usual to penetrate the planet, so it's definitely something experts will need to keep an eye on.

Importantly, strong enough ejections from the Sun can knock out lots of electronics on Earth, including the satellites that orbit the planet, airplanes that fly in the sky, and even the technology on the ground. Keeping ourselves safe from these kinds of bombardments is essential to life, so understanding the magnetic field is important in itself.
Solar Flare Radiation Burst ‘cracked’ Earth’s Magnetic Field, Caused Radio Blackouts

Source: https://www.rt.com/viral/365328-magnetic-field-cracked-solar/

Researchers from the Tata Institute of Fundamental Research in India made the discovery when analyzing a galactic cosmic ray burst that caused radio blackouts across North and South America and a supercharged aurora borealis in 2015.

The cosmic ray source was a giant solar plasma cloud that travelled 40 hours from our sun to reach Earth, where the researchers believe it caused a transient “weakening of Earth’s magnetic shield”, according to their findings published in the journal Physical Review Letters.

The sun’s flare was so intense the team claim it would have shrunk the magnetic field from 11 times the radius of Earth to four times its radius before it eased, allowing the shield to recover.

Researchers used data from the GRAPES-3 muon telescope in Ooty, India, to simulate the burst. Results indicated the effect on Earth would have required a crack in the magnetic field that lasted approximately two hours.

Unfortunately not a lot can be done to protect Earth from any future cracks in the shield, which could leave the planet under constant exposure to radiation and could potentially lead to the eradication of our atmosphere.

The team were optimistic the knowledge gained would have positive results though, claiming it could “hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”

Astronauts onboard the International Space Station (ISS) fall within the field’s 56,000km extension around Earth but future voyagers to Mars would likely be exposed to the rays for long periods.
Scientists have recorded the events that unfolded after the Earth's magnetic shield was breached.

Openings in the planet's magnetic field are not uncommon, but it is rarer to get the opportunity to gather data while such an event is in progress, BBC reported.

A cosmic ray monitoring facility recorded a burst of cosmic rays associated with the opening.

The magnetic field breach was the result of charged particles from the Sun striking the Earth at high speed.

The GRAPES-3 muon telescope located at the Cosmic Ray Laboratory (CRL) in Ooty, southern India, recorded a burst of galactic cosmic rays of about 20 gigaelectronvolts (GeV) on June, 22, 2015.

"In this case the magnetic field was breached for only two hours and then returned back to normal. The magnetic field strength reduced only by two percent," Dr Sunil Gupta, lead scientist at the CRL, said.

Earth's magnetic shield, or magnetosphere, extends over a radius of a million kilometres. It protects the planet's biosphere from the continuous flow of solar and other cosmic radiation.

The Sun periodically ejects vast clouds of charged particles into space in events known as coronal mass ejections (CMEs). Each one can contain a billion tonnes of charged gas, or plasma.

The giant cloud of plasma ejected from the solar corona in 2015 caused massive compression of the Earth's magnetosphere and triggered a severe geomagnetic storm. In turn, this generated aurora borealis (northern lights), and radio signal blackouts in many high latitude countries.

Numerical simulations performed by the GRAPES-3 team on this event indicate that the Earth's magnetic shield temporarily opened up in response to the incoming solar plasma, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.

Dr. Gupta said that the CRL's measurements of the two-hour breach "gives us much more comprehensive
The GRAPES-3 Muon telescope’s combination of a large area and directional measurement enabled the accidental observations.

"We have been aware of impacts on the Earth from solar activity for a long time through the discovery of CMEs, but the Indian study adds a new element to this Endeavour, with detailed analysis of a major particle event during the arrival of a particular cloud," Dr. Richard Harrison, head of space physics and chief scientist at the Rutherford Appleton Laboratory in Oxfordshire, UK, said.

A major event could occur any time with potentially significant impacts on human infrastructure. As such, there are ongoing efforts to improve the prediction of this so-called space weather.

"They can short circuit power supplies such as high voltage transformers which provide power to our cities, disrupt communication satellites and therefore will affect, for example, the Internet, mobile phones and just about anything that uses electricity," said Harrison.

In addition, he said, a major solar storm could also threaten humans in space, with the potential for damage to or the loss of spacecraft — although such events are expected to be rare.

Scientists at CRL hope that the vast amount of data now available would enable them to better predict such events and take preventative measures. But the real challenge is to devise appropriate electronic hardware that can issue a reliable alert, Gupta said.
Subsequently a severe geomagnetic storm around the earth's shield was triggered which led to an aurora borealis, which can be credited for radio signal blackouts in high latitude countries.

The GRAPES-3 muon telescope located at Tata Institute of Fundamental Research's Cosmic Ray Laboratory in Ooty in Tamil Nadu recorded a burst of galactic cosmic rays of about 20 GeV previous year lasting for two hours.

The study reports for two hours on June 22, 2015, particles from a giant cloud of fast-moving plasma penetrated the Earth's atmosphere at approximately 1.6 million mph.

The researchers explained the fact that this happened at all is a concern, as it suggests that our magnetic field is changing - or rather, weakening - in certain parts.

GRAPES-3 (Gamma Ray Astronomy PeV EnergieS phase-3) is a collaboration of Tata Institute of Fundamental Research and several Indian and Japanese institutes.

Scientists were able to obtain a precise estimation of the full extent of the weakening and damage to the magnetosphere caused by the heavy cosmic ray bombardment after a recent analysis of data collected using the GRAPE-3 muon telescope in Ooty, India.

The simulations revealed that the radiation caused multiple small cracks in the magnetosphere that exposed the Earth to potentially harmful radiation. It causes the magnetosphere to be compressed by 11 to 4 times the radius of the Earth.

"The simultaneous occurrence of the burst in all nine directions suggests its origin close to Earth", the authors wrote in the study, published in Physical Review Letters.
In this instance, the process was powerful enough to open a crack through which a burst of cosmic rays slipped through.

The study reveals that the Earth's magnetosphere is more vulnerable than previously thought, the researchers said.

Scientists hope to create a magnetosphere to protect Earth in the event of an incoming solar storm which could wipe out humanity.

Solar storms can cause major disruption to human civilization by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

This research can help us understand how future superstorms of cosmic rays could affect the planet and our technological infrastructure, and even endanger the wellbeing of astronauts living on the International Space Station.
Experts have recently found that Earth’s magnetic shield cracked open due to a super-strong geomagnetic storm that managed to reconfigure our planet's magnetic shield. Our planet's magnetosphere extends over a radius of a million kilometers, and acts as the ‘first line of defense’, protecting us from the continuous flow of solar and galactic cosmic rays.

The magnetosphere is a large area that encompasses our planet. Its presence alone protects the planet from charged particles of the solar wind and deflects them around Earth.

This enormous protective natural layer around our planet extends thousands of miles into space and its magnetism is so important and influential that it affects technology, life forms on the planet and weather patterns as well.

Scientists used the telescope and cosmic ray detector GRAPES-3 and published the analysis of a solar storm that occurred in June of 2015, leaving us without a magnetic shield for TWO hours.

The giant cloud of plasma -which originated in the Sun’s corona- ejected in June 2015 and eventually crashed into our planet magnetosphere at a speed of about 2.5 million kilometers per hour. The damage caused by the collision was of epic proportions.

As this occurred, it caused massive radio-signal blackouts in many high-latitude countries in North and south America. This supermassive storm also caused supercharged aurora borealis.

But over a year after the solar storm struck our magnetosphere, experts have been able to realize the extent of damage caused by the bombardment of solar rays.
According to experts from the Tata Institute of fundamental Research in India, after performing simulations based on data gathered by the GRAPES-3 satellite from that day, the magnetosphere of Earth cracked open, meaning that after all its not as secure as we thought it was.

Scientists concluded that the geomagnetic storm was so great that it actually managed to RECONFIGURE our magnetic shield.

“This vulnerability can occur when magnetized plasma from the Sun deforms Earth’s magnetic field, stretching its shape at the poles and diminishing its ability to deflect charged particles,” Katherine Wright explains on the American Physical Society website. The research has been published in Physical Review Letters.

This is something we need to worry about. Experts say that the fact that this occurred means that our magnetic field is changing and even weakening in certain parts.

“The occurrence of this burst also implies a 2-hour weakening of Earth’s protective magnetic shield during this event,” the researchers report.

“[This] indicates a transient weakening of Earth’s magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”

In previous articles we reported about how our planet’s magnetic field is collapsing and our planet’s poles are flipping. This could result in catastrophic events on our planet.

Scientists warn that in the last two centuries the magnetic field has weakened, suggesting that it could be a tell-tale sign that Earth’s poles are about the flip. While experts believe a flip is overdue, they still cannot tell when it might occur. According to researchers, the Earth’s magnetic field is in constant movement and every 2-3 hundred thousand years or so the polarity of our planet flips.
A team at the GRAPES-3 muon telescope in India has determined an unusually powerful burst from the Sun's corona in 2015 caused cracking in Earth's magnetosphere, allowing more radiation than normal to seep into Earth. The research underscores the need for spacecraft and aircraft makers to design better systems to accommodate rare occurrences like this.
Solar flare radiation burst ‘cracked’ Earth’s magnetic field, caused radio blackouts

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The magnetic field that protects Earth from deadly cosmic radiation may be more vulnerable than previously thought. A crack in the shield caused by a solar flare which exposed the planet to a bombardment of radiation has been detected.

Researchers from the Tata Institute of Fundamental Research in India made the discovery when analyzing a galactic cosmic ray burst that caused radio blackouts across North and South America and a supercharged aurora borealis in 2015.

The cosmic ray source was a giant solar plasma cloud that travelled 40 hours from our sun to reach Earth, where the researchers believe it caused a transient "weakening of Earth’s magnetic shield", according to their findings published in the journal Physical Review Letters.

The sun’s flare was so intense the team claim it would have shrunk the magnetic field from 11 times the radius of Earth to four times its radius before it eased, allowing the shield to recover.

Researchers used data from the GRAPES-3 muon telescope in Ooty, India, to simulate the burst. Results indicated the effect on Earth would have required a crack in the magnetic field that lasted approximately two hours.

Unfortunately not a lot can be done to protect Earth from any future cracks in the shield, which could leave the planet under constant exposure to radiation and could potentially lead to the eradication of our atmosphere.

The team were optimistic the knowledge gained would have positive results though, claiming it could “hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”
How India uses recycled pipes to detect ferocious solar storms

What does a sensational scientific discovery about a solar storm in the Earth’s magnetic field have to do with old, recycled steel pipes which lay buried for more than a decade under a now-defunct gold mine in India?

Almost everything.

More than 3,700 such pipes are actually at the heart of a most significant scientific finding.

A team of Indian and Japanese scientists recently published an internationally-feted paper which recorded the events that unfolded after a breach in the Earth's magnetic shield.

Using the GRAPES-3 muon (a sub-atomic particle) telescope - the world’s largest of its kind - at the Cosmic Ray Laboratory in Ooty, a hill station in the southern state of Tamil Nadu, the scientists recorded a two-hour burst of galactic cosmic rays that invaded the atmosphere on 22 June 2015.

The magnetic field breach was the result of charged particles from the Sun striking the Earth at high speed.

Solar storms of such high magnitudes can knock out satellites and aircraft autopilots, cause catastrophic power outages, and take us, according to a lead scientist Dr Sunil Gupta, "back to the Stone Age".

according to 【null】 〜によると

Dr  【略語】  = Doctor

Sunil Gupta

The world's largest and most sensitive cosmic ray telescope located in Ooty is made up of four-decades old recycled zinc-coated steel pipes.

"Necessity is the mother of invention. When you don't have the money to buy new, expensive stuff, you look within the system to find out your own solutions to reduce costs. India’s scientists have mastered the art of recycling and coming up with their own inexpensive solutions," Pallava Bagla, India correspondent for Science magazine, told me.

A notable example: India’s 2014 operation mission to Mars, cost the exchequer 4.5bn rupees ($67m;£54m), almost 10 times less than the American Maven orbiter. (This prompted Prime Minister Narendra Modi to quip that India's real-life Martian adventure cost less than Hollywood film Gravity.) The Ooty laboratory’s annual budget is about $375,000.

The 6m (19.65 ft) long pipes, which acted as sensors in the telescope, lay in underground caverns below the centuries-old Kolar Gold Fields in southern Karnataka state, home to one of the world's deepest gold mines, for
nearly two-decades.

The pipes were imported from Japan - where they are normally used at building construction sites - to help a team of Indian and Japanese scientists examine neutrinos, sub-atomic particles produced in high energy interactions in the galaxy and beyond. The scientists had laid them 2km (1.24 miles) below the earth for their experiment.

When gold prices fell to unprofitable levels and the fields began shutting down in the early 1990s, authorities planned to remove the pipes and dispose them off as scrap. "We said we want to re-use them for our experiments," Dr Gupta told me.

Eventually, some 7,500 of the pipes were transported by truck to a hilly 100-acre campus that the laboratory shares with a radio astronomy centre. The place skirts a forest populated by deer, bison, tigers and wild boars. Recently, CCTV cameras captured a tiger strolling past the sensors at night.

Work on recording cosmic rays in Ooty began in right earnest in 1998, when the scientists began making muon sensors from the discarded pipes to research high energy cosmic rays.

Today, 3,712 steel tubes, stacked up against layers of concrete, are housed across 560 sq m in four squat brown-and-white colour buildings, home to the world's largest such muon telescope. There are a couple of dozen such telescopes in the world, but none as powerful as the one in Ooty.

At the laboratory, a small group of scientists and assorted helpers - local gardeners and carpenters, for example - continue to recycle the old pipes, so that they can be used as cosmic ray detectors.

To do this, they open the pipes and clean them with high pressure water jets. They insert a 100 micron - as thick as a strand of human hair - tungsten wire into the pipe and anchor it at both ends with hemetic seals. The pipes are then filled with a gas comprising methane and argon and an electric potential run through it to enable it to become an effective sensor.
Scientists record breach in magnetic field

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Scientists have recorded the events that unfolded after the Earth's magnetic shield was breached.

Openings in the planet's magnetic field are not uncommon, but it is rarer to get the opportunity to gather data while such an event is in progress.

A cosmic ray monitoring facility recorded a burst of cosmic rays associated with the opening.

The magnetic field breach was the result of charged particles from the Sun striking the Earth at high speed.

The GRAPES-3 muon telescope located at the Cosmic Ray Laboratory (CRL) in Ooty, southern India, recorded a burst of galactic cosmic rays of about 20 gigaelectronvolts (GeV) on 22 June 2015.

"In this case the magnetic field was breached for only two hours and then returned back to normal. The magnetic field strength reduced only by 2%," Dr Sunil Gupta, lead scientist at the CRL said.

Earth's magnetic shield, or magnetosphere, extends over a radius of a million kilometres. It protects the planet's biosphere from the continuous flow of solar and other cosmic radiation.

The Sun periodically ejects vast clouds of charged particles into space in events known as coronal mass ejections (CMEs). Each one can contain a billion tonnes of charged gas, or plasma.

The giant cloud of plasma ejected from the solar corona in 2015 caused massive compression of the Earth's magnetosphere and triggered a severe geomagnetic storm. In turn, this generated aurora borealis (northern lights), and radio signal blackouts in many high latitude countries.

Numerical simulations performed by the GRAPES-3 team on this event indicate that the Earth's magnetic shield temporarily opened up in response to the incoming solar plasma, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.

Dr Gupta said that the CRL's measurements of the two-hour breach "gives us much more comprehensive information over a much larger region of space than the satellite based instruments".

The GRAPES-3 Muon telescope's combination of a large area and directional measurement enabled the accidental observations.

"We have been aware of impacts on the Earth from solar activity for a long time through the discovery of CMEs, but the Indian study adds a new element to this endeavour, with detailed analysis of a major particle event during the arrival of a particular cloud," Dr Richard Harrison, head of space physics and chief scientist at the Rutherford Appleton Laboratory in Oxfordshire, UK, told BBC News.

A major event could occur any time with potentially significant impacts on human infrastructure. As such, there are ongoing efforts to improve the prediction of this so-called space weather.

"They can short circuit power supplies such as high voltage transformers which provide power to our cities, disrupt communication satellites and therefore will affect, for example, internet, mobile phones and just about anything that uses electricity," said Dr Harrison.
In addition, he said, a major solar storm could also threaten humans in space, with the potential for damage to or the loss of spacecraft - although such events are expected to be rare.

Scientists at CRL hope that the vast amount of data now available would enable them to better predict such events and take preventative measures. But the real challenge is to devise appropriate electronic hardware that can issue a reliable alert, Dr Gupta said.
Indian scientists detect crack in Earth’s magnetic shield

The world’s largest and most sensitive cosmic ray monitor, located in India, has recorded a burst of galactic cosmic rays that indicates a crack in the Earth’s magnetic shield, according to scientists. The GRAPES-3 muon telescope located at Tata Institute of Fundamental Research’s Cosmic Ray Laboratory in Ooty in Tamil Nadu recorded a burst of galactic cosmic rays of about 20 GeV last year lasting for two hours. The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometers per hour struck our planet, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth.

It triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries, according to the study published in the journal Physical Review Letters. Earth’s magnetosphere extends over a radius of a million kilometers, which acts as the first line of defense, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations.

Numerical simulations performed by the GRAPES-3 researchers, including Pravata K Mohanty, indicate that the Earth’s magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.

Earth’s magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015. The data was analysed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at Cosmic Ray Laboratory in Ooty. Solar storms can cause major disruption to human civilisation by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

Science and technology important in India-UK ties: PM Narendra Modi

Prime Minister Narendra Modi on Monday said science, technology and innovation has a significant role in India’s bilateral engagement with the UK.

“To boost entrepreneurship, science and technology is very important. Science, technology and innovation has a very significant role in our (India-UK) relationship,” Modi said in his speech at the India-UK Tech Summit in New Delhi.

PM Modi also thanked British Prime Minister Theresa May for choosing India as her first bilateral visit outside Europe.

“We must encourage greater mobility and participation of young people in education and research opportunities,” PM Modi said. “Our countries face economic challenges which directly affect trade and commerce. We together have to create new opportunities,” he added.

courtesy – www.thehindu.com
Indian scientists detect crack in Earth's magnetic shield

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The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth's magnetosphere and triggering a severe geomagnetic storm.

The GRAPES-3 muon telescope located at Tata Institute of Fundamental Research’s Cosmic Ray Laboratory in Ooty in Tamil Nadu recorded a burst of galactic cosmic rays of about 20 GeV last year lasting for two hours.

The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometres per hour struck our planet, causing a severe compression of Earth's magnetosphere from 11 to 4 times the radius of Earth.

It triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries, according to the study published in the journal Physical Review Letters this week.

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Solar storms can cause major disruption to human civilisation by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

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India’s Telescope Detects Crack in the Earth’s Magnetic Shield

Observations from India’s GRAPES-3 cosmic-ray telescope indicated a crack in the Earth’s magnetic shield, which was weakened by a geomagnetic storm in 2015.

Source Nature World News
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Sound bites

• The GRAPES-3 muon telescope recorded a burst of galactic cosmic rays of about 20 GeV, on June 22, 2015, lasting for two hours. The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometres per hour struck our planet, causing a severe compression of Earth’s magnetosphere from 11 to four times the radius of Earth. It triggered a severe geomagnetic storm that generated aurora borealis, and radio signal blackouts in many high-latitude countries.

GRAPES-3 indicates a crack in Earth's magnetic shield

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor recorded a burst of galactic cosmic rays that indicated a crack in the Earth's magnetic shield. The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth's magnetosphere and triggering a severe geomagnetic storm.

Read more
Recycled Telescope

A team of Indian and Japanese scientists in Tamil Nadu have published ground breaking research into the effects of a breach in the Earth’s magnetic shield. They used the GRAPES-3 muon (a sub-atomic particle) telescope – the world’s largest of its kind – which is made of 3,700 recycled zinc-coated steel pipes, more than four decades old, which were used because the cost of buying new was prohibitive.

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A recent cosmic burst cracked the Earth’s magnetic field wide open

Our magnetic field may not be all it’s cracked up to be.

On June 22, 2015, a burst of galactic cosmic rays was recorded by the GRAPES-3 muon telescope located at TIFR's Cosmic Ray Laboratory in Ooty.

That burst of rays occurred when the sun let loose a giant cloud of plasma that struck our planet at a speed of roughly 2.5 million kilometers per hour, causing a severe compression of Earth's magnetosphere from 11 to 4 times the radius of Earth.

As you can imagine, the cosmic bombardment triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries.

http://www.rawstory.com/2016/11/a-recent...wide-open/
Life saved in a magical way despite Crack in Earth's magnetic shield

"The occurrence of this burst also implies a two-hour weakening of Earth's protective magnetic shield during this event", the study said. The impact triggered a strong geomagnetic storm that resulted in aurora borealis and radio signal blackouts in many high-latitude countries.

The magnetic field is vital for deflecting cosmic rays and protecting earth's inhabitants from harmful radiation.

The Earth's magnetic shield cracked temporarily, exposing the Earth's atmosphere to deadly cosmic radiation.

A similar burst of galactic cosmic rays was recorded a year ago by GRAPES-3 muon telescope located at the Tata Institute of Fundamental Research’s Cosmic Ray Laboratory in Ooty, a town in the southern Indian state of Tamil Nadu. It is available at Tata Institute of Fundamental Research’s Cosmic Ray laboratory in Ooty, Tamilnadu.

Earth's magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the telescope. The particles, originating from the surface of the sun, caused the Earth's magnetosphere to shrink from 11 times to 4 times the earth's radius - allowing harmful solar winds to breach the Earth's surface.

A artist's depiction of the Earth's magnetosphere deflecting solar wind and radiation

Scientists hope their continued work with GRAPES-3 will offer an improved understanding of the stresses put on the magnetosphere by intense storms, to better predict vulnerabilities in the future.
The weakness was revealed by a burst of galactic cosmic rays, detected by GRAPES-3 during a severe geomagnetic storm in June 2015. Extending over a radius of millions of kilometres, the magnetosphere protects life on Earth from the high intensity energy radiations.

Astronauts on deep space missions outside the Earth's protective magnetosphere - such as during a trip to Mars - are particularly vulnerable to the effect of high-energy cosmic radiation.

Powerful solar storms can cause widespread disruption of modern civilization by tripping electrical power grids, global positioning systems and satellite communications.

This analytical output was revealed post-rigorous simulations over many weeks through the 1280-core computing farm that was developed by the native physicists and engineers of the GRAPES-3 team at the Cosmic Ray Laboratory in Ooty.
Scientists record breach in magnetic field

Scientists have recorded the events that unfolded after the Earth's magnetic shield was breached.

Openings in the planet's magnetic field are not uncommon, but it is rarer to get the opportunity to gather data while such an event is in progress.

A cosmic ray monitoring facility recorded a burst of cosmic rays associated with the opening.

The magnetic field breach was the result of charged particles from the Sun striking the Earth at high speed.

The GRAPES-3 muon telescope located at the Cosmic Ray Laboratory (CRL) in Ooty, southern India, recorded a burst of galactic cosmic rays of about 20 gigaelectronvolts (GeV) on 22 June 2015.

"In this case the magnetic field was breached for only two hours and then returned back to normal. The magnetic field strength reduced only by 2%," Dr Sunil Gupta, lead scientist at the CRL told the BBC.

Earth's magnetic shield, or magnetosphere, extends over a radius of a million kilometres. It protects the planet's biosphere from the continuous flow of solar and other cosmic radiation.

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The giant cloud of plasma ejected from the solar corona in 2015 caused massive compression of the Earth's magnetosphere and triggered a severe geomagnetic storm. In turn, this generated aurora borealis (northern lights), and radio signal blackouts in many high latitude countries.

Numerical simulations performed by the GRAPES-3 team on this event indicate that the Earth's magnetic shield temporarily opened up in response to the incoming solar plasma, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.

Dr Gupta said that the CRL's measurements of the two-hour breach "gives us much more comprehensive information over a much larger region of space than the satellite based instruments".

The GRAPES-3 Muon telescope's combination of a large area and directional measurement enabled the accidental observations.

"We have been aware of impacts on the Earth from solar activity for a long time through the discovery of CMEs, but the Indian study adds a new element to this endeavour, with detailed analysis of a major particle event during the arrival of a particular cloud," Dr Richard Harrison, head of space physics and chief scientist at the Rutherford Appleton Laboratory in Oxfordshire, UK, told BBC News.

A major event could occur any time with potentially significant impacts on human infrastructure. As such, there are ongoing efforts to improve the prediction of this so-called space weather.

"They can short circuit power supplies such as high voltage transformers which provide power to our cities, disrupt communication satellites and therefore will affect, for example, internet, mobile phones and just about anything that uses electricity," said Dr Harrison.

In addition, he said, a major solar storm could also threaten humans in space, with the potential for damage to or the loss of spacecraft - although such events are expected to be rare.

Scientists at CRL hope that the vast amount of data now available would enable them to better predict such events and take preventative measures. But the real challenge is to devise appropriate electronic hardware that can issue a reliable alert, Dr Gupta said.
The findings have been published in the journal Physical Review Letters.

Earth’s Magnetic Shield Vital for Humanity Cracked, Indian Researchers Discover

Earth’s Magnetic Shield Vital for Humanity Cracked, Indian Researchers Discover © Photo: pixabay Life 03:22 05.11.2016(updated 03:24 05.11.2016) Get short URL 52965271 Earth’s magnetosphere, an invisible and highly-charged atmospheric layer that protects life on the planet from external radiation, was briefly cracked, Indian scientists have revealed, after analyzing a powerful geomagnetic storm from last year that was caused by the Sun.

The blast was registered in June 2015 after a huge cloud of plasma released from the Sun struck the Earth at a speed of some 2.5 million kph.

The report in Physical Review Letters states that the impact of the solar storm caused the Earth’s
magnetic shield to compress, leading to massive geomagnetic atmospheric anomalies. Storm effects included aurora borealis and radio signal interruptions across several continents.

@osaublog2

#OSAU1A And the beautiful results we get from plasma in the solar winds, Van Allen belts and our magnetosphere!

At the time, India’s GRAPES-3 muon telescope, the world’s most sensitive cosmic-ray monitoring system, recorded a powerful blast of solar energy that lasted for over two hours. Moon Silhouettes by Mark Gee Mark Gee. National Maritime Museum NASA Scientists Unravel Mystery of Moon's Surface Swirls Having analyzed the data, a GRAPES-3 team of researchers from India and Japan performed simulations that pointed to the possibility that the planet’s magnetic shield opened for a brief period of time, allowing cosmic ray particles to enter the Earth’s atmosphere. "It indicates a transient weakening of Earth’s magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space," the report says. The magnetosphere, the Earth’s energetic protecting shield, prevents the highly-dangerous radiation of the Sun from destroying life on the planet. However, powerful geomagnetic storms can deform the magnetosphere, allowing energetic particles to reach the surface.

Read more: https://sputniknews.com/art_living/201611051047089607-earth-magneti...
November 5, 2016
Lola
Posted with permission from STEAM Register

Our magnetic field may not be all it's cracked up to be.

Lola Gayle, STEAM Register

On June 22, 2015, a burst of galactic cosmic rays was recorded by the GRAPES-3 muon telescope located at TIFR's Cosmic Ray Laboratory in Ooty.

That burst of rays occurred when the sun let loose a giant cloud of plasma that struck our planet at a speed of roughly 2.5 million kilometers per hour, causing a severe compression of Earth's magnetosphere from 11 to 4 times the radius of Earth.

As you can imagine, the cosmic bombardment triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries.

Thankfully, we are protected by the Earth's magnetic field. This shield extends over a radius of a million kilometers and is our first line of defense against the continuous flow of solar and galactic cosmic radiation.

Note: Earth's magnetic field, also known as the geomagnetic field, is the magnetic field that extends from the Earth's interior out into space, where it meets the solar wind, a stream of charged particles emanating from the Sun.
If something should go wrong, we’re really in for it. And during this particular two-hour 20 GeV blast, it almost did.

According to a statement from the Tata Institute of Fundamental Research, "Numerical simulations performed by the GRAPES-3 collaboration on this event indicate that the Earth's magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere. Earth's magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around midnight on June 22, 2015."

See Also: Our Sun Could One Day Unleash A Deadly Superflare
The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor recorded a burst of galactic cosmic rays that indicated a crack in the Earth's magnetic shield. Credit: TIFR

Phew! A near miss this time. But thankfully the GRAPES-3 muon team is keeping an eye to the sky.

Results of this work are published in the journal Physical Review Letters.

See Also: The Changing Shape of the Van Allen Belts

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India’s Telescope Detects Crack in the Earth’s Magnetic Shield

Short resume:

shield 90%
magnetic 90%
telescope 90%
cosmic 80%

Observations from India’s GRAPES-3 cosmic-ray telescope indicated a crack in the Earth’s magnetic shield, which was weakened by a geomagnetic storm in 2015.

Source Nature World News
– Read More…
Indian scientists’ Cosmic-ray detector finds possible crack in Earth’s magnetic shield

Geomagnetic storms can trigger incredible light shows. Here, charged particles can be seen exciting the gas in the upper atmosphere of the northern hemisphere.
The world’s largest, most sensitive cosmic-ray detector has identified a potential crack in Earth’s magnetic field.

The weakness was revealed by a burst of galactic cosmic rays, detected by GRAPES-3 during a severe geomagnetic storm in June 2015. The storm as triggered by a plasma cloud ejected from the sun’s corona.

It was one of the largest geomagnetic storms in recent history, generating an intense aurora borealis and thwarting radio communication systems among the most northern latitudes. The storm was strong enough to compress Earth’s magnetosphere for several hours.

The GRAPES-3 muon telescope is a massive array situated in southern India, a joint effort among scientific institutes in Japan and India. Data revealing the cosmic ray breach were analyzed by scientists at Tata Institute of Fundamental Research in Mumbai.

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Life itself has Earth’s magnetosphere to thank. Its ability to block out the harmful rays and particles flying through space allowed life to flourish. But as the latest research suggests, it’s not a fail-safe shield.

High-intensity storms can reveal stress fractures, so to speak. Researchers suggest the 2015 storm triggered a phenomenon called magnetic reconnection, whereby magnetic energy is simultaneously converted into kinetic energy, thermal energy and particle acceleration.

In this instance, the process was powerful enough to open a crack through which a burst of cosmic rays slipped through.
Scientists hope their continued work with GRAPES-3 will offer an improved understanding of the stresses put on the magnetosphere by intense storms, to better predict vulnerabilities in the future.

Researchers published their analysis of the potential magnetosphere crack this week in the journal Physical Review Letters.

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The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometres per hour struck our planet, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth.

It triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries, according to the study published in the journal Physical Review Letters this week.

Earth’s magnetosphere extends over a radius of a million kilometres, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations.

Numerical simulations performed by the GRAPES-3 researchers, including Pravata K Mohanty, indicate that the Earth’s magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.

Earth’s magnetic field bent these particles about 180° from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015.

The data was analysed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray Laboratory in Ooty.

Solar storms can cause major disruption to human civilisation by crippling large electrical power grids, global positioning systems, satellite operations and communications.
A HUGE crack has been detected in the Earth’s magnetic shield, leaving the people of Earth vulnerable to cosmic radiation, scientists have warned.

By SEAN MARTIN

From analysing data from the GRAPES-3 muon telescope in Ooty, India, experts have concluded that the magnetosphere has come under such heavy bombardment in recent years that it weakening.

On June 22, 2015, there was a massive burst of galactic cosmic rays which traumatised the Earth’s magnetic shield for two hours.

Roughly 40 hours before the Earth was bombarded by cosmic rays, the sun ejected a giant cloud of plasma which caused high energy radiation to strike the Earth’s magnetosphere at 2.5 million kilometres per hour.

The storm wreaked havoc on technology with radio signal blackouts reported in North and South America.

However, it is not until now that scientists have been able to understand the full extent of the damage caused by the storm.

Experts from the Tata Institute of Fundamental Research in India ran several simulations based on the data from the telescope and found that the magnetosphere had been cracked for a little while on the day.

Worryingly, the bombardment was so intense the magnetosphere was forced to shrink from 11 to four times the Earth’s radius.

While small amounts of radiation would have little effect on life on Earth, prolonged exposure to higher amounts of radiation

Source: Jews News
If you're looking for something to take your mind off of the presidential election, this might do the trick. A giant crack has been discovered in the Earth's magnetosphere – our first line of defense against those pesky cosmic rays that bring down electrical power grids, mess up global positioning systems, garble communications and make your skin look like the last rotisserie chicken in the grocery store oven at closing time. What's worse, the crack opened over a year ago and we're just learning about it now. Have you forgotten about who's running yet?

The crack was discovered by researchers at Tata Institute of Fundamental Research's (TIFR) Cosmic Ray Laboratory in Ooty, India, using data recorded by the GRAPES-3 muon telescope (Gamma Ray Astronomy PeV EnergieS 3rd establishment), the world's largest and most sensitive cosmic ray telescope. They noticed that data from June 22, 2015, showed a two-hour-long burst of cosmic radiation ramming Earth at 2.5 million km (1.55 million miles) per hour. The burst measured 20 GeV – that's 20 gigaelectronvolt or 20 billion electron volts.

The GRAPES-3 muon telescope

What happens when that kind of cosmic force meets Earth's magnetosphere? According to the report published recently in Physical Review Letters, the protective sphere surrounding the planet was severely dented from 11 to four times the radius of the Earth. Simulations created by the GRAPES-3 researchers showed that the magnetosphere cracked during the two-hour bombardment, allowing lower energy galactic cosmic ray particles to enter the atmosphere.

Illustration of cosmic wind passing through a crack in the magnetosphere before hitting Earth

Didn't anyone notice this on June 22nd, 2015? The data shows a strong geomagnetic storm occurred at the time, causing an aurora borealis and radio blackouts in high-latitude countries near the poles, but nothing disastrous. Did we take a cosmic bullet in an area that only caused a flesh wound? The study suggests this, along with a warning.

The simultaneous occurrence of the burst in all nine directions suggests its origin close to Earth. It also indicates a transient weakening of Earth's magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.

OK, we're all concerned occasionally about astronauts on the ISS and Elon Musk doesn't want the passengers on his Mars ships to arrive at the Red Planet extra-crispy, but what about us on Earth? We all know what kind of problems a loss of the electrical and communications grid can cause and none of us want to wake up to the smell of frying skin. But what's really disconcerting is that it's taken over a
year for the news of this crack in the magnetosphere to come out. Why did it take so long? What else haven't we been told about it?

Still worried about the election?

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Still worried about the election?

Cosmic-ray detector finds possible crack in Earth’s magnetic shield

By Guest Author

Source: Signs of the Times

Life itself has Earth’s magnetosphere to thank, but as the latest research suggests, it’s not a fail-safe shield.

The world’s largest, most sensitive cosmic-ray detector has identified a potential crack in Earth’s magnetic field. The weakness was revealed by a burst of galactic cosmic rays, detected by GRAPES-3 during a severe geomagnetic
Indian scientists detect crack in Earth’s magnetic shield

NEW DELHI: The world’s largest and most sensitive cosmic ray monitor, located in India, has recorded a burst of galactic cosmic rays that indicates a crack in the Earth’s magnetic shield, according to scientists.

The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth’s magnetosphere and triggering a severe geomagnetic storm.

The GRAPES-3 muon telescope located at Tata Institute of Fundamental Research’s Cosmic Ray Laboratory in Ooty in Tamil Nadu recorded a burst of galactic cosmic rays of about 20 GeV last year lasting for two hours.

The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometres per hour struck our planet, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth.

It triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries, according to the study published in the journal Physical Review Letters this week.
OOTY - The suggested breach of the Earth’s line of defense from outer space was found by the GRAPES-3 experiment. As we speak the Earth may be vulnerable to dangerous matter from outer space. It seems the Earth magnetic shield may have cracked. The shield is the Earth’s first line of defense against outer space radiation. How did we come to this conclusion of colossal proportions? We can credit the GRAPES-3 experiment with this new proposition. The GRAPES-3 experiment is a study of different rays which affect the Earth. The study consists of a Cosmic Ray Laboratory (CRL) in Ooty, India. The lab contains two components; an array of 400 plastic scintillator detectors along with a large area muon telescope. The GRAPES-3 experiment is led by Professor Sunil K.Gupta, who oversees a team of 30 scientists from 7 different universities from all over India, and 5 members are even from Japan. According to the GRAPES-3 team the muon telescope observed a burst of galactic cosmic rays on the 22nd of June in 2015. The rays which recorded for about 20 GeV lasted for two hours. The rays were shot from a giant cloud of plasma ejected from the Sun. The cloud originated from within the solar corona and moved with a speed of about 2.5 million km/hours. The cloud of rays was then recorded to have struck the Earth. The collision resulted in a severe compression of Earth’s magnetosphere.

The magnetosphere was cracked to such an extent its size went from 11 to 4 times the radius of Earth.

Subsequently a severe geomagnetic storm around the earth’s shield was triggered which led to an aurora
borealis, which can be credited for radio signal blackouts in high latitude countries.

Basically the Earth’s magnetic shield temporarily cracked and allowed lower energy galactic cosmic ray particles to enter.

Published in The Nation newspaper on 06-Nov-2016
How India uses recycled pipes to detect ferocious solar storms

1. Mar 2, 2017 #1

Dragon4 FULL MEMBER

Image copyright SCIENCE PHOTO LIBRARY
Image caption Artwork: The Earth's magnetosphere protects the planet from a continuous flow of cosmic radiation

What does a sensational scientific discovery about a solar storm in the Earth's magnetic field have to do with old, recycled steel pipes which lay buried for more than a decade under a now-defunct gold mine in India?

Almost everything.

More than 3,700 such pipes are actually at the heart of a most significant scientific finding.

A team of Indian and Japanese scientists recently published an internationally-feted paper which recorded the events that unfolded after a breach in the Earth's magnetic shield.

Using the GRAPES-3 muon (a sub-atomic particle) telescope - the world's largest of its kind - at the Cosmic Ray Laboratory in Ooty, a hill station in the southern state of Tamil Nadu, the scientists recorded a two-hour burst of galactic cosmic rays that invaded the atmosphere on 22 June 2015.

The magnetic field breach was the result of charged particles from the Sun striking the Earth at high speed.

Solar storms of such high magnitudes can knock out satellites and aircraft autopilots, cause catastrophic power outages, and take us, according to one of the scientists leading the research, Dr Sunil Gupta, "back to the Stone Age".
Solar storms

![Aurora Borealis](image)

*Image copyright DR P. MARAZZI/SCIENCE PHOTO LIBRARY*

*Image caption* Auroras are one of the consequences of geomagnetic storms

- The sudden release of magnetic energy stored in the Sun’s atmosphere can cause a bright flare
- This can also release bursts of charged particles into space
- These solar “eruptions” are known as coronal mass ejections or CMEs
- When headed in our direction, the charged gas collides with the magnetic “sheath” around Earth
- The subsequent disturbances in the Earth’s magnetic envelope are called solar storms
- They can interfere with technology: satellites, electrical grids and communications systems
- They can also cause aurorae - Northern and Southern Lights - to be seen at lower latitudes
- The largest such solar storm in recorded history took place in 1859 and disrupted a robust and new communication system involving telegraph lines

*Scientists record breach in magnetic field*

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**Low-cost telescope**

The world's largest and most sensitive cosmic ray telescope located in Ooty is made up of four-decades old recycled zinc-coated steel pipes.

"Necessity is the mother of invention. When you don't have the money to buy new, expensive stuff, you look within the system to find out your own solutions to reduce costs. India's scientists have mastered the art of recycling and coming up with their own
inexpensive solutions," Pallava Bagla, India correspondent for Science magazine, told me.

A notable example: India’s 2014 operation mission to Mars, cost the exchequer 4.5bn rupees ($67m;£54m), almost 10 times less than the American Maven orbiter. (This prompted Prime Minister Narendra Modi to quip that India’s real-life Martian adventure cost less than Hollywood film Gravity.) The Ooty laboratory’s annual budget is about $375,000.

Image copyright HARI ADIVAREKAR

Image caption The zinc-coated steel pipes once lay under one of the deepest gold mines in the world
The 6m (19.65 ft) long pipes, which acted as sensors in the telescope, lay in underground caverns below the centuries-old Kolar Gold Fields in southern Karnataka state, home to one of the world's deepest gold mines, for nearly two-decades.

The pipes were imported from Japan - where they are normally used at building construction sites - to help a team of Indian and Japanese scientists examine neutrinos, sub-atomic particles produced in high energy interactions in the galaxy and beyond. The scientists had laid them 2km (1.24 miles) below the earth for their experiment.

**Highly sensitive**

When gold prices fell to unprofitable levels and the fields began shutting down in the early 1990s, authorities planned to remove the pipes and dispose them off as scrap. "We said we want to re-use them for our experiments," Dr Gupta told me.

Eventually, some 7,500 of the pipes were transported by truck to a hilly 100-acre campus that the laboratory shares with a radio astronomy centre. The place skirts a forest populated by deer, bison, tigers and wild boars. Recently, CCTV cameras captured a tiger strolling past the sensors at night.

Work on recording cosmic rays in Ooty began in right earnest in 1998, when the scientists began making muon sensors from the discarded pipes to research high energy cosmic rays.

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*Image copyrightNASA/SDO/AIA*

*Image caption* The Sun periodically ejects vast clouds of charged particles into space.
Mohammad Haroon, a gardener at the facility, has learnt to weld the old pipes. Today, 3,712 steel tubes, stacked up against layers of concrete, are housed across 560 sq m in four squat brown-and-white colour buildings, home to the world’s largest such muon telescope. There are a couple of dozen such telescopes in the world, but none as powerful as the one in Ooty.
At the laboratory, a small group of scientists and assorted helpers - local gardeners and carpenters, for example - continue to recycle the old pipes, so that they can be used as cosmic ray detectors.

**Making the sensors**

To do this, they open the pipes and clean them with high pressure water jets. They insert a 100 micron - as thick as a strand of human hair - tungsten wire into the pipe and anchor it at both ends with hermetic seals. The pipes are then filled with a gas comprising methane and argon and an electric potential run through it to enable it to become an effective sensor.

Finally, they are laid out in rows - below two metres of concrete, which act as absorbers - to become a muon telescope.

The fabled **jugaad** - an Indian colloquial word that means ingenious improvisation in the face of scarce resources - extends to using the pipes as sensors.

When the scientists at the laboratory wanted to make doubly sure that the old pipes were not leaking, they modified a helium spray gun by attaching a 7-cent injection syringe needle to the nozzle of the gas jet to help them to carry out the precise leak tests.

![Image copyright HARI ADIVAREKAR](image_url)

*Image caption* A cosmic ray signal captured on an oscilloscope at the laboratory
Image copyright TIFR

The opening in the magnetic shield was detected with the GRAPES-3 muon telescope

"Every day, we make 10 such recycled pipes ready for our experiments. The plan was to make very sensitive sensors to detect the weakest of signals. We wanted to measure cosmic rays with higher sensitivity than ever done before", says Atul Jain, a scientist at the facility.

**Home grown**

The laboratory itself is a shining example of home-grown innovation. The majority of the electronic equipment is designed, assembled and manufactured in-house. The software for the computer programmes is locally made.

The 40GB of raw data from cosmic rays that it generates every day is stored and processed by a cluster of computers which has been largely assembled in-house, cutting costs and saving hefty maintenance fees. Old computers are stripped for parts. A locally developed cooling system using fans saves electricity and protects the computers.
Image copyright HARI ADIVAREKAR
Image caption A spray gun modified in house for the precise locations of leaks by attaching a syringe needle
At the moment, the scientists plan to pore over 17 years of data on cosmic rays recorded by the lab's sensors to find out whether they offer more clues about forecasting space weather and advance warnings about solar flares. They say there have been some 38 severe solar storms in the past 17 years.

"We should be able to sift through our data to find out more about them. For us, they are a gift from the Sun, because they add to our knowledge on space weather," says Dr Gupta.


*Thanks x 3*

2. Mar 2, 2017 #2

3. Mar 2, 2017 #3

Upagrah FULL MEMBER

Not a single line about caste, toilet or corruption. I could not believe the article is by BBC.

...new directives to its editorial staff?

*Thanks x 1*
anant_s SENIOR MEMBER

I've heard of a similar neutrino detection scheme for cosmic radiation detection but this is really ingenious. Just shows if you have right will, money isn't a constraint even in high end science research.

@thesolar65 @Levina

Thanks x 4

RISING SUN SENIOR MEMBER

Dragon4 said: ↑

Image copyright SCIENCE PHOTO LIBRARY
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The magnetic field breach was the result of charged particles from the Sun striking the Earth at high speed.

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Image copyrightHARI
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*Image caption* A cosmic ray signal captured on an oscilloscope at the laboratory  
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The laboratory itself is a shining example of home-grown innovation. The majority of the electronic equipment is designed, assembled and manufactured in-house. The software for the computer programmes is locally made.

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computers are stripped for parts. A locally developed cooling system using fans saves electricity and protects the computers.

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At the moment, the scientists plan to pore over 17 years of data on cosmic rays recorded by the lab's sensors to find out whether they offer more clues about forecasting space weather and advance warnings about solar flares. They say there have been some 38 severe solar storms in the past 17 years.

"We should be able to sift through our data to find out more about them. For us, they are a gift from the Sun, because they add to our knowledge on space weather," says Dr Gupta.


Click to expand...

You beat me in posting this news. Actually while returning home in local, I saw this news and wanted to share it once I finished dinner after reaching home. But alas you posted first. I was just wondering how many more such kind of jugaad type of innovations are happening in this country which have means of surpassing their foreign counterparts not only in research but also value on the ground.
Indian scientists detect moment in Earth’s captivating shield

Washington/Pune: The world’s largest and many supportive vast ray monitor, located in India, has available a detonate of galactic vast rays that indicates a moment in a Earth’s captivating shield, according to scientists.

The detonate occurred when a hulk cloud of plasma ejected from a solar halo struck Earth during a really high speed causing vast application of a Earth’s magnetosphere and triggering a serious geomagnetic storm.

The GRAPES-3 muon telescope located during Tata Institute of Fundamental Research’s Cosmic Ray Laboratory in Ooty in Tamil Nadu available a detonate of galactic vast rays of about 20 GeV final year durability for dual hours.

The detonate occurred when a hulk cloud of plasma ejected from a solar corona, and relocating with a speed of about 2.5 million kilometres per hour struck a planet, causing a serious application of Earth’s magnetosphere from 11 to 4 times a radius of Earth.

It triggered a serious geomagnetic charge that generated halo borealis and radio vigilance blackouts in many high embodiment countries, according to a investigate published in a biography Physical Review Letters this week.

Earth’s magnetosphere extends over a radius of a million kilometres, that acts as a initial line of defence, helmet us from a continual upsurge of solar and galactic vast rays, so safeguarding life on a world from these high energy enterprising radiations.

Numerical simulations achieved by a GRAPES-3 researchers, including Pravata K Mohanty, prove that a Earth’s captivating defense temporarily detonate due to an occurrence of captivating reconnection, permitting a reduce appetite galactic vast ray particles to enter a atmosphere.

Earth’s captivating margin focussed these particles about 180 degree, from a day-side to a night-side of a Earth where it was rescued as a detonate by a GRAPES-3 muon telescope around mid-night on 22 Jun 2015.

The information was analysed and interpreted by endless make-believe over several weeks by regulating a 1280-core computing farm that was built-in-house by a GRAPES-3 group of physicists and engineers during a Cosmic Ray Laboratory in Ooty.

Solar storms can means vital intrusion to tellurian civilisation by crippling vast electrical energy grids, tellurian positioning systems (GPS), satellite operations and communications.

PTI
Scientists have detected a crack in Earth’s magnetic shield

published on November 4, 2016 by Author M Atif Bangash

Earth is such a habitable place, thanks in no small part to the vast magnetic field that surrounds our planet, shielding us from harsh solar winds and cosmic radiation.

But scientists have been investigating one of the most powerful geomagnetic storms in recent history, and they’ve discovered that our protective barrier isn’t as secure as we thought it was. Turns out, our magnetosphere has been cracked.

Researchers have been analysing data from the GRAPES-3 muon telescope in Ooty, India, which recorded a massive burst of galactic cosmic rays on 22 June 2015.

For 2 hours, Earth’s magnetosphere was being bombarded by these particles, which emit immensely high-energy radiation, and travel through space at nearly the speed of light.

These things are so powerful, they can easily penetrate the hull of a spacecraft, and Earth’s magnetic shield is our first line of defence against them.

About 40 hours before the June 22 event, a giant cloud of plasma was ejected from the Sun’s corona (or outer atmosphere), and eventually struck the magnetosphere at speeds of about 2.5 million kilometres per hour.

That’s not exactly news, because at the time, it triggered a severe geomagnetic storm that was responsible for radio signal blackouts in many high latitude countries in North and South America.

It also resulted in a supercharged aurora borealis – which is created when charged particles from outer space reach Earth’s atmosphere.

But now researchers have finally realised the full extent of that relentless bombardment of cosmic rays.

A team from the Tata Institute of Fundamental Research in India performed numerous simulations based on the GRAPES-3 data from that day, and the results indicate that the magnetosphere had been temporarily cracked, and that’s why things went so haywire in our radio systems.

In fact, the team says the bombardment was so relentless, it caused a severe compression of the magnetosphere, forcing it to shrink from 11 to 4 times the radius of Earth.

The researchers suspect that the geomagnetic storm was powerful enough to actually ‘reconfigure’ our magnetic shield, prising open weak spots to let radiation and cosmic rays slip through.

“This vulnerability can occur when magnetised plasma from the Sun deforms Earth’s magnetic field, stretching its shape at the poles and diminishing its ability to deflect charged particles,” Katherine Wright explains on the American Physical Society website.

The fact that this happened at all is a concern, say the researchers, because it suggests that our magnetic field is changing – or rather, weakening – in certain parts.

“The occurrence of this burst also implies a 2-hour weakening of Earth’s protective magnetic shield during this event,” the researchers report.

“[This] indicates a transient weakening of Earth’s magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of
the astronauts in space."

So the good news is our magnetosphere was only temporarily cracked, but the bad news is that it can be cracked at all.

There’s not a whole lot we can do about that, but the researchers hope that by continuing to search for these cracks as they happen – and in past events – we’ll be better prepared to deal with the next time those cosmic rays burst through and wreak havoc.

The research has been published in *Physical Review Letters*. 
Hole found in Earth’s magnetic field – humanity at risk of cosmic radiation

A HUGE hole has been detected in the Earth’s magnetic shield, leaving millions of human beings vulnerable to deadly cosmic radiation, scientists have warned.

Analyzing data from the GRAPES-3 muon telescope in Ooty, India, experts have concluded that the magnetosphere has come under such heavy bombardment in recent years that it weakening.
On June 22, 2015, there was a massive burst of galactic cosmic rays which traumatized the Earth’s magnetic shield for two hours.

Roughly 40 hours before the Earth was bombarded by cosmic rays, the sun ejected a giant cloud of plasma. This caused high energy radiation to strike the Earth’s magnetosphere at 2.5 million kilometres per hour.

The storm wreaked havoc on technology, with radio signal blackouts reported in North and South America.

However, it is not until now that scientists have been able to understand the full extent of the damage caused by the storm.

Experts from the Tata Institute of Fundamental Research in India ran several simulations based on the data from the telescope. They found that the magnetosphere had been cracked, on the day. We had a hole in the earth shield!

Worryingly, the bombardment was so intense the magnetosphere was forced to shrink from 11 to four times the Earth’s radius.
While small amounts of radiation would have little effect on life on Earth, prolonged exposure to higher amounts of radiation can lead to cancer.

The team say in their research published in Physical Review Letters that the storm was so powerful that it managed to “reconfigure” the magnetic shield and opening small cracks in Earth’s first line of defense.

This has dangerous implications for the future, the team says.

They write: “The occurrence of this burst also implies a two-hour weakening of Earth’s protective magnetic shield during this event.

“[This] indicates a transient weakening of Earth’s magnetic shield, and may hold clues for a better understanding of future super-storms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”

Mary Greeley News

www.marygreeley.com

Earth’s magnetic shield vital for humanity cracked, Indian researchers discover

Published November 5, 2016, 12:54 PM

By Philippines News Agency

MOSCOW — Earth’s magnetosphere, an invisible and highly-charged atmospheric layer that protects life on the planet from external radiation, was briefly cracked, Indian scientists have revealed, after analyzing a powerful geomagnetic storm from last year that was caused by the Sun.

The blast was registered in June 2015 after a huge cloud of plasma released from the Sun struck the Earth at a speed of some 2.5 million kph.

The report in Physical Review Letters states that the impact of the solar storm caused the Earth’s magnetic shield to compress, leading to massive geomagnetic atmospheric anomalies. Storm effects included aurora borealis and radio signal interruptions across several continents.

At the time, India’s GRAPES-3 muon telescope, the world’s most sensitive cosmic-ray monitoring system, recorded a powerful blast of solar energy that lasted for more than two hours.

Having analyzed the data, a GRAPES-3 team of researchers from India and Japan performed simulations that pointed to the possibility that the planet’s magnetic shield opened for a brief period of time, allowing cosmic ray particles to enter the Earth’s atmosphere.

“It indicates a transient weakening of Earth’s magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space,” the report says.
The magnetosphere, the Earth’s energetic protecting shield, prevents the highly-dangerous radiation of the Sun from destroying life on the planet. However, powerful geomagnetic storms can deform the magnetosphere, allowing energetic particles to reach the surface.

Tags: atmospheric anomaly, discovery, Earth, Earth’s magnetic shield vital for humanity cracked Indian researchers discover, magnetic shield, magnetosphere, Manila Bulletin
The Earth’s energetic protecting shield right), prevents the highly-dangerous radiation of the Sun from destroying life on the planet. (NASA Photo)

MOSCOW, Nov. 5 (PNA/Sputnik) — Earth’s magnetosphere, an invisible and highly-charged atmospheric layer that protects life on the planet from external radiation, was briefly cracked, Indian scientists have revealed, after analyzing a powerful geomagnetic storm from last year that was caused by the Sun.

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The magnetosphere, the Earth’s energetic protecting shield, prevents the highly-dangerous radiation of the Sun from destroying life on the planet. However, powerful geomagnetic storms can deform the magnetosphere, allowing energetic particles to reach the surface. (PNA/Sputnik)
The GRAPES-3 muon telescope recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015 lasting for two hours. The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometers per hour struck our planet, causing a severe compression of Earth's magnetosphere from 11 to 4 times the radius of Earth. It triggered a severe geomagnetic storm that generated aurora borealis, and radio signal blackouts in many high latitude countries.
GRAPES-3 indicates a crack in Earth's magnetic shield | Astronomy and Space | Pinterest

Susan Granquist ha salvato su Astronomy and Space
GRAPES-3 indicates a crack in Earth's magnetic shield
Scientists have just detected a crack in Earth’s magnetic shield

Experts have recently found that Earth’s magnetic shield cracked open due to a super-strong geomagnetic storm that managed to reconfigure our planet’s magnetic shield. Our planet's magnetosphere extends over a radius of a million kilometers, and acts as the ‘first line of defense’, protecting us from the continuous flow of solar and galactic cosmic rays.

The magnetosphere is a large area that encompasses our planet. Its presence alone protects the planet from charged particles of the solar wind and deflects them around Earth.

This enormous protective natural layer around our planet extends thousands of miles into space and its magnetism is so important and influential that it affects technology, life forms on the planet and weather patterns as well.

Scientists used the telescope and cosmic ray detector GRAPES-3 and published the analysis of a solar storm that occurred in June of 2015, leaving us without a magnetic shield for TWO hours.

The giant cloud of plasma -which originated in the Sun’s corona- ejected in June 2015 and eventually crashed into our planet magnetosphere at a speed of about **2.5 million kilometers per hour**. The damage caused by the collision was of epic proportions.

As this occurred, it caused massive radio-signal blackouts in many high-latitude countries in North and south America. This supermassive storm also caused supercharged aurora borealis.

But over a year after the solar storm struck our magnetosphere, experts have been able to realize the extent of damage caused by the bombardment of solar rays.
According to experts from the Tata Institute of fundamental Research in India, after performing simulations based on data gathered by the GRAPES-3 satellite from that day, the magnetosphere of Earth cracked open, meaning that after all its not as secure as we thought it was.

Scientists concluded that the geomagnetic storm was so great that it actually managed to RECONFIGURE our magnetic shield.

“This vulnerability can occur when magnetized plasma from the Sun deforms Earth’s magnetic field, stretching its shape at the poles and diminishing its ability to deflect charged particles,” Katherine Wright explains on the American Physical Society website. The research has been published in Physical Review Letters.

This is something we need to worry about. Experts say that the fact that this occurred means that our magnetic field is changing and even weakening in certain parts.

“The occurrence of this burst also implies a 2-hour weakening of Earth's protective magnetic shield during this event,” the researchers report.

“[This] indicates a transient weakening of Earth’s magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”

In previous articles we reported about how our planet's magnetic field is collapsing and our planet's poles are flipping. This could result in catastrophic events on our planet.

Scientists warn that in the last two centuries the magnetic field has weakened, suggesting that it could be a tell-tale sign that Earth’s poles are about the flip. While experts believe a flip is overdue, they still cannot tell when it might occur. According to researchers, the Earth’s magnetic field is in constant movement and every 2-3 hundred thousand years or so the polarity of our planet flips.

The post Scientists have just detected a crack in Earth’s magnetic shield appeared first on EWAO.
A magnetosphere is that area of space, around a planet, that is controlled by the planet's magnetic field. The shape
Scientists saw a “crack” magnetic shield of the Earth

MOSCOW, 3 Dec – RIA Novosti. Indian physicists saw as the magnetic shield of Earth that protects us from solar flares and cosmic rays, occasionally “crack” and skips through cosmic rays in cases when it cut emissions of the Sun, according to a paper published in the journal Physical Review Letters.

The earth, unlike Venus and other planets in the Solar system, has its own magnetic field, which is generated by the movement of the liquid streams of metal in its core. This magnetic field plays the role of a "shield", which reflects cosmic rays, charged particles of high energies, and protects the Earth from solar wind and coronal mass ejections on the Sun.

Traces of its existence are the so-called van Allen belts — two regions at altitudes of about 6 thousand and 60 thousand kilometers from the Earth’s surface, where there are a large number of protons and electrons of high energies, “caught” the Earth's magnetic field and moving in a kind of a magnetic trap. Their interaction with the atmosphere produces beautiful polar lights, and, in times of solar flares, caused radio interference and other technical problems.

The Indian telescope of the GRAPES-3 revealed an unusual “gaps” in these protective zones, observing the effects of solar flares at the end of June 2015. On this day the Sun in the sun, an outbreak of class M2, which was shining threw to the Ground in a giant cloud of hot plasma, which collided with the planet magnetosphere at about 4 p.m. Moscow time and caused her to shrink almost three times.

This process, as shown by the observations of Indian scientists, was accompanied by a sharp increase in the number of muons of high energy charged particles, heavy “cousins” of electrons that occur in the atmosphere by collisions of cosmic rays with air molecules. Increased concentration of muons, the researchers note, was observed for two hours that caused them to explore what caused this process.

As noted by the authors, a similar outbreak in the rate of “bombardment” of the Earth by cosmic rays were unusual for the reason that at that time in India it was midnight, and the point where the GRAPES-3 were located.
actually on the opposite side of the zone of a planet’s magnetosphere, where he hit the ejection from the Sun.

Using the data collected with this telescope, scientists have built a computer model of the magnetic shield of the Earth and tried to understand for example what could cause such a sharp flash in the intensity of cosmic rays. Their calculations showed that this is likely not to blame some outer factors, such as the explosions of supernovae or gamma-ray burst, and the Earth itself.

Scientists believe that the collision of coronal mass ejections with magnetosphere has led to the fact that it is, figuratively speaking, “hold” – in it there was a kind of hole in the collisions of magnetic field lines with each other, their reconnection and explosive energy release.

These holes were closed immediately, and thus cosmic rays could actually freely bombard the Earth in the regions over such a “crack” for two hours, and the very magnetic field “helped” particles to fall on the night side of the planet, tightening their trajectory in a special way.

This fact, as according to Indian researchers, should be considered when building and sending satellites into orbit, as the discovery of such “cracks” on them can bring the probe out of action or deprived of its connection with the Earth. In addition, such phenomena can be dangerous for the ISS crew. Therefore, the authors recommend to conduct a series of experiments with the AMS instrument aboard the station to evaluate the potential hazard to astronauts and cosmonauts.
Earth’s Magnetic Shield Vital for Humanity Cracked, Indian Researchers Discover

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At the time, India’s GRAPES-3 muon telescope, the world’s most sensitive cosmic-ray monitoring system, recorded a powerful blast of solar energy that lasted for over two hours.

Mark Gee. National Maritime Museum

NASA Scientists Unravel Mystery of Moon’s Surface Swirls

Having analyzed the data, a GRAPES-3 team of researchers from India and Japan performed simulations that pointed to the possibility that the planet’s magnetic shield opened for a brief period of time, allowing cosmic ray particles to enter the Earth’s atmosphere.

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Indian scientists detect crack in Earth's magnetic shield

The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth's magnetosphere and triggering a severe geomagnetic storm.

The GRAPES-3 muon telescope located at Tata Institute of Fundamental Research's Cosmic Ray Laboratory in Ooty in Tamil Nadu recorded a burst of galactic cosmic rays of about 20 GeV last year lasting for two hours.

The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometres per hour struck our planet, causing a severe compression of Earth's magnetosphere from 11 to 4 times the radius of Earth.

It triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries, according to the study published in the journal Physical Review Letters this week.

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The data was analysed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray
Laboratory in Ooty.

Solar storms can cause major disruption to human civilisation by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.
In the early hours of June 21, 2015, a giant cloud of magnetised plasma was ejected from the Sun in a solar flare. Forty hours later, those particles slammed into Earth’s magnetosphere, triggering a severe geomagnetic storm that knocked out radio signals in North and South America. New observational data from the GRAPES-3 cosmic-ray telescope in India show that an unusually high flux of cosmic rays breached the magnetosphere during this storm, resulting in a 2-hour-long cosmic-ray shower on Earth. Simulations performed by the GRAPES-3 collaboration, which includes researchers from India and Japan, suggest that the burst of cosmic rays was allowed to enter because the geomagnetic storm temporarily weakened Earth’s polar magnetic field.

Earth’s magnetic field deflects most cosmic rays, protecting living things from harmful radiation. But large geomagnetic storms can reconfigure this protective shield, opening up weak spots that let radiation and cosmic rays slip through. This vulnerability can occur when magnetised plasma from the Sun deforms Earth’s magnetic field, stretching its shape at the poles and diminishing its ability to deflect charged particles. Numerical simulations performed by the GRAPES-3 researchers suggest that this is exactly what happened following the June 21 solar flare, allowing the cosmic-ray breach that their telescope detected.

Sorce

“Only in our dreams are we free. The rest of the time we need wages.”
— Terry Pratchett, Wyrd Sisters
Hole found in Earth’s magnetic field – humanity at risk of cosmic radiation

endtimenews.tv/2017/02/15/hole-found-in-earths-magnetic-field-humanity-at-risk-of-cosmic-radiation/

February 15, 2017

A Huge hole has been detected in the Earth's magnetic shield, leaving millions of human beings vulnerable to deadly cosmic radiation, scientists have warned. From analysing data from the GRAPES-3 muon telescope in Ooty, India, experts have concluded that the magnetosphere has come under such heavy bombardment in recent years that it weakening. On June 22, 2015, there was a massive burst of galactic cosmic rays which traumatised the Earth’s magnetic shield for two hours. Roughly 40 hours before the Earth was bombarded by cosmic rays, the sun ejected a giant cloud of plasma which caused high energy radiation to strike the Earth’s magnetosphere at 2.5 million kilometres per hour. FULL STORY
A recent powerful geomagnetic storm cracked and shrunk the Earth’s magnetic field, leaving human populations vulnerable and exposed to deadly cosmic radiations, scientists have revealed in a new study.

The recent transient cracking and weakening of the Earth’s magnetosphere was discovered in a new analysis of data from the GRAPES-3 muon telescope in Ooty, India.

According to research scientists, the weakening and cracking of the magnetosphere was caused by heavy bombardment of the Earth’s magnetic field by high-energy cosmic rays following a massive coronal mass ejection (CME) from the Sun.

The Sun released a massive cloud of plasma associated with a surge of high-energy radiation that hit the magnetosphere at 2.5 million kilometers per hour, causing a dramatic compression of the Earth’s magnetic shield from about 11 to four times the radius of Earth.

The impact triggered a violent geomagnetic storm that generated a supercharged aurora borealis and widespread radio signal blackouts in North and South America.

The Earth’s magnetic shield cracked temporarily, exposing the Earth’s atmosphere to deadly cosmic radiation.

The GRAPE-3 muon telescope at the Tata Institute of Fundamental Research (TIFR) in Ooty, India, recorded the burst of galactic cosmic rays of about 20 GeV associated with the coronal mass ejection (CME) from the Sun on June 22, 2015, according to Phys.org.

The storm was so powerful that it caused widespread radio signal blackouts in high latitude countries and North and South America. The Earth’s magnetosphere reeled under the force of the assault and multiple cracks appeared in the magnetic shield.

Scientists were able to obtain a precise estimation of the full extent of the weakening and damage to the magnetosphere caused by the heavy cosmic ray bombardment after a recent analysis of data collected using the GRAPE-3 muon telescope in Ooty, India.

The GRAPE-3 muon telescope is the largest and most sensitive cosmic ray monitor, according to Phys.org. Analysis of data obtained from the telescope showed that the burst of cosmic rays disrupted the Earth’s magnetic shield.

The analysis, conducted by experts at the Tata Institute of Fundamental Research (TIFR), involved using data collected from the telescope to run multiple simulations of the impact of the cosmic ray bombardments on the magnetosphere.
An artist's depiction of the Earth’s magnetosphere [Image by Marc Ward/Shutterstock]

The simulations revealed that the radiation caused multiple small cracks in the magnetosphere that exposed the Earth to potentially harmful radiation. Scientists were also worried to discover that the intense bombardment caused the magnetosphere to shrink from 11 times to four times the Earth’s radius.

But the magnetosphere recovered from the damage and weakening after the bombardment subsided, the scientists said.

According to the researchers in a paper published in the *Physical Review Letters*, data analysis and simulations showed that sufficiently intense cosmic ray bombardment of the magnetosphere could “reconfigure” and disrupt the Earth’s magnetic shield.

The scientists noted that the results of their study has far-reaching implications because the Earth’s magnetosphere is very vital to life on Earth as it shields the atmosphere from deadly cosmic rays.
An artist's depiction of the Earth's magnetosphere deflecting solar wind and radiation [Image by Koya979/Shutterstock]

The study reveals that the Earth’s magnetosphere is more vulnerable than previously thought, the researchers said.

“The occurrence of this burst also implies a two-hour weakening of Earth's protective magnetic shield during this event,” the study said. “It indicates a transient weakening of Earth’s magnetic shield.”

Powerful solar storms can cause widespread disruption of modern civilization by tripping electrical power grids, global positioning systems and satellite communications.

Scientists fear that sustained intense bombardment of the magnetosphere could damage it permanently and expose Earth to powerful high-energy radiation that could strip Earth of its protective atmosphere and end life on Earth.

Although there is nothing that modern science and technology can do to help in the event of such catastrophe, scientists said the results of the new study and the knowledge obtained could “hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”

Astronauts on deep space missions outside the Earth's protective magnetosphere — such as during a trip to Mars — are particularly vulnerable to the effect of high-energy cosmic radiation.

[Featured Image by Aaron Rutten/Shutterstock]
Crack discovered in Earth's magnetic shield

The GRAPES-3 muon telescope located at TIFR's Cosmic Ray Laboratory in Ooty recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015 lasting for two hours.

0 Comments

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Earth's magnetosphere extends over a radius of a million kilometers, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations. Numerical simulations performed by the GRAPES-3 collaboration on this event indicate that the Earth's magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere. Earth's magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015. The data was analyzed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray Laboratory in Ooty.

This work has recently been published in Physical Review Letters.

Solar storms can cause major disruption to human civilization by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor operating on Earth is playing a very significant role in the study of such events. This recent finding has generated widespread excitement in the international scientific community, as well as electronic and print media.

Story Source: via Science Daily

Materials provided by Tata Institute of Fundamental Research. Note: Content may be edited for style and length.
Scientists record breach in magnetic field

BBC: Scientists have recorded the events that unfolded after the Earth's magnetic shield was breached.

Openings in the planet's magnetic field are not uncommon, but it is rarer to get the opportunity to gather data while such an event is in progress.

A cosmic ray monitoring facility recorded a burst of cosmic rays associated with the opening. The magnetic field breach was the result of charged particles from the Sun striking the Earth at high speed.

The GRAPES-3 muon telescope located at the Cosmic Ray Laboratory (CRL) in Ooty, Southern India, recorded a burst of galactic cosmic rays of about 20 gigaelectronvolts (GeV) on 22 June 2015.

"In this case the magnetic field was breached for only two hours and then returned back to normal. The magnetic field strength reduced only by 2%," Dr. Sunil Gupta, lead scientist at the CRL told the BBC.

Earth's magnetic shield, or magnetosphere, extends over a radius of a million kilometres. It protects the planet's biosphere from the continuous flow of solar and other cosmic radiation.

The Sun periodically ejects vast clouds of charged particles into space in events known as coronal mass ejections (CMEs). Each one can contain a billion tonnes of charged gas, or plasma.

The giant cloud of plasma ejected from the solar corona in 2015 caused massive compression of the Earth's magnetosphere and triggered a severe geomagnetic storm. In turn, this generated aurora borealis (northern lights), and radio signal blackouts in many high latitude countries.

Numerical simulations performed by the GRAPES-3 team on this event indicate that the Earth's magnetic shield temporarily opened up in response to the incoming solar plasma, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.

Dr Gupta said that the CRL's measurements of the two-hour breach "gives us much more comprehensive information over a much larger region of space than the satellite based instruments".

The GRAPES-3 Muon telescope's combination of a large area and directional measurement enabled the accidental observations.

"We have been aware of impacts on the Earth from solar activity for a long time through the discovery of CMEs, but the Indian study adds a new element to this endeavour, with detailed analysis of a major particle event during the arrival of a particular cloud," Dr Richard Harrison, head of space physics and chief scientist at the Rutherford Appleton Laboratory in Oxfordshire, UK, told BBC News.

A major event could occur any time with potentially significant impacts on human infrastructure. As such, there are ongoing efforts to improve the prediction of this so-called space weather.

"They can short circuit power supplies such as high voltage transformers which provide power to our cities, disrupt communication satellites and therefore will affect, for example, internet, mobile phones and just about anything that uses electricity," said Dr Harrison.

In addition, he said, a major solar storm could also threaten humans in space, with the potential for damage to or the loss of spacecraft - although such events are expected to be rare.

Scientists at CRL hope that the vast amount of data now available would enable them to better predict such events and take preventative measures. But the real challenge is to devise appropriate electronic hardware that can issue a reliable alert, Dr Gupta said.
The findings have been published in the journal Physical Review Letters.
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via Science Daily
A new study led by a team out of India has found that Earth’s protective magnetic field cracked after an intense geomagnetic storm observed by the GRAPES-3 muon telescope on.................
According to NASA in an article from 2003 they made observations from NASA's IMAGE spacecraft and the joint NASA/European Space Agency Cluster satellites, immense cracks sometimes develop in Earth"... Read More

Sinjin Mitchell

Indian scientists detect crack in Earth's magnetic shield

The world's largest and most sensitive cosmic ray monitor, located in India, has recorded a burst of galactic cosmic rays that indicates a crack in the Earth's magnetic shield, according to scientists.

The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth's magnetosphere and triggering a severe geomagnetic storm.

The GRAPES-3 muon telescope located at Tata Institute of Fundamental Research's Cosmic Ray Laboratory in Ooty in Tamil Nadu recorded a burst of galactic cosmic rays of about 20 GeV last year lasting for two hours.

The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometres per hour struck our planet, causing a severe compression of Earth's magnetosphere from 11 to 4 times the radius of Earth.

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Earth's magnetosphere extends over a radius of a million kilometers, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations. Numerical simulations performed by the GRAPES-3 collaboration on this event indicate that the Earth's magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere. Earth's magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015. The data was analyzed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray Laboratory in Ooty.

This work has recently been published in *Physical Review Letters*.

Solar storms can cause major disruption to human civilization by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

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GRAPES-3 indicates a crack in Earth's magnetic shield

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor recorded a burst of galactic cosmic rays that indicated a crack in the Earth's magnetic shield. The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth's magnetosphere and triggering a severe geomagnetic storm.

The GRAPES-3 muon telescope located at TIFR's Cosmic Ray Laboratory in Ooty recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015 lasting for two hours.

The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometers per hour struck our planet, causing a severe compression of Earth's magnetosphere from 11 to 4 times the radius of Earth. It triggered a severe geomagnetic storm that generated aurora borealis, and radio signal blackouts in many high latitude countries.

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This work has recently been published in Physical Review Letters. ...Read More...
A Solar Storm Put A Crack In Earth’s Magnetic Field

By Robin Andrews

04/11/2016, 18:17

A particularly potent aurora appearing over Iceland. Pigprox/Shutterstock

Earth’s magnetic field is partly responsible for a couple of things that all humans enjoy. Firstly, it conspires with the solar wind to create those beautiful, ephemeral aurorae. Secondly, by preventing so much damaging radiation making it to the surface, it stops us all dying – that, inarguably, is rather wonderful.

As a new study in Physical Review Letters has revealed, though, there was recently a “crack” in it.

Back in June 2015, the GRAPES-3 muon telescope based in India – one which is designed to pick up on highly energetic interactions – spotted an increase in the flow of galactic cosmic rays (GCRs) permeating through our atmosphere. This type of radiation originates from outside our Solar System, although in this case, its source appeared to be relatively close by in our stellar neighborhood.

A detailed analysis led by researchers at the Tata Institute of Fundamental Research (TIFR) found that the plasma cloud got through an unusual, temporary gap in Earth’s magnetic field.

This GCR invasion coincided with a coronal mass ejection moving at 2.5 million kilometers per hour (1.6 million miles per hour), one that was so energetic that it caused the entire planet’s magnetic field to shrink from being 11 times the radius of Earth to just four times that. As reported by Wired, this triggered a geomagnetic storm that both boosted the dramatic iridescence of the Northern Lights, but also brought down radio networks for some time.

This storm was ranked as a G4 on the National Oceanic and Atmospheric Administration (NOAA) scale, which means it was rated as “severe”. It is highly likely that this powerful storm caused the crack to appear.
A powerful coronal mass ejection seen emerging from the Sun on August 31, 2012. NASA

These storms have the potential to cause trillions of dollars of damage to communications networks and electrical grids, and even endanger the lives of astronauts onboard the International Space Station. In fact, the team note in their study that “depending on the orbital variation of the cutoff rigidities, the astronauts on the International Space Station would have received a high, and variable radiation dose during the burst.” This would have included NASA astronaut Scott Kelly, who spent 340 days in low-Earth orbit.

Fortunately, the crack lasted for just a few hours, and the magnetic field returned to its original size and strength shortly afterwards. There’s a good chance that this astrophysical injury would have occurred in Earth’s past, but this particular phenomenon just hasn’t been detected until now. Of course, it’s almost certain that it will happen again.

If anything, this study is a powerful reminder of how frighteningly energetic our local star actually is. There’s pretty much nothing we can do about its violent outbursts, but a better understanding of their behavior can allow us to prepare for future geomagnetic storms.
Telescope records magnetic breach of Earth

Scientists in India have managed to capture elusive data from a breach of the Earth’s magnetic field. Scientists at the Cosmic Ray Laboratory in Ooty, Southern India used a telescope called the GRAPES-3 muon telescope to record a giant cloud of plasma from the sun breaching the Earth’s magnetic field for a couple of hours. They found that the Earth’s shield opened up and allowed low-energy cosmic rays into our atmosphere. The observations were made completely by chance but have given scientists insight into what happens during a magnetic breach and prepared them to observe future breaches with the same telescope.
Did a solar storm damage Earth’s magnetic field?

A review of data, relating to the summer of 2015, suggests a solar storm struck the Earth’s magnetic field. This unprecedented event lasted a couple of hours, and it could have shrunk the Earth’s magnetosphere.

The collected data, reported this month by astrophysicists and highlighted by Wired, indicated that a giant cloud of fast-moving plasma from the Sun struck the Earth’s magnetic field (or ‘magnetosphere’) shrunk from 11 times the Earth’s radius to just four for the two hour period.

The magnetosphere is the region of space surrounding an astronomical object (in this case, our planet) where charged particles are controlled by that object's magnetic field. To give an idea of the strength of the field, NASA scientists have suggested the Earth's magneto tail may cause "dust storms" on the Moon. The storms are created through the potential magnetic difference between the day side and the night side of the moon.

The review of the 2015 event suggests a solar storm of such intensity passed Earth's magnetosphere (which provides a natural defence against cosmic radiation). The impact of this storm was to hit technology in several regions of the Northern hemisphere through electromagnetic pulses. A solar storm (or solar flare) is a sudden flash of brightness observed near the Sun's surface. It involves a very broad spectrum of energy emissions.

Scientists, Laboratory Roots reports, are concerned the event has put a permanent dent in the Earth’s magnetic field. This is concerning should further events of this magnitude occur in the future, since the magnetic field is our main protection against solar radiation. This doesn’t mean immediate harm to life but such events could further damage electrical equipment and there is a risk, in some areas, of increased skin cancer. And this is all dependent upon future solar storms of a similar magnitude.

The research indicates humanity must be mindful of our magnetic field and the role it plays. However, there isn’t much we can do to protect the planet other than continue to monitor.

The event has been described in the journal Physical Review Letters. The paper is titled "Transient Weakening
of Earth’s Magnetic Shield Probed by a Cosmic Ray Burst.

The GRAPES-3 tracking muon telescope in Ooty, India measures muon intensity at high cutoff rigidities (15–24 GV) along nine independent directions covering 2.3 sr. The arrival of a coronal mass ejection on 22 June 2015 18:40 UT had triggered a severe G4-class geomagnetic storm (storm). Starting 19:00 UT, the GRAPES-3 muon telescope recorded a 2 h high-energy ( ) burst of galactic cosmic rays (GCRs) that was strongly correlated with a 40 nT surge in the interplanetary magnetic field (IMF). Simulations have shown that a large ( ) compression of the IMF to 680 nT, followed by reconnection with the geomagnetic field (GMF) leading to lower cutoff rigidities could generate this burst. Here, 680 nT represents a short-term change in GMF around Earth, averaged over 7 times its volume. The GCRs, due to lowering of cutoff rigidities, were deflected from Earth’s day side by in longitude, offering a natural explanation of its night-time detection by the GRAPES-3. The simultaneous occurrence of the burst in all nine directions suggests its origin close to Earth. It also indicates a transient weakening of Earth’s magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.
Scientists record breach in magnetic field

The Earth’s magnetosphere protects the planet from a continuous flow of cosmic radiation

Scientists have recorded the events that unfolded after the Earth’s magnetic shield was breached.

Openings in the planet’s magnetic field are not uncommon, but it is rarer to get the opportunity to gather data while such an event is in progress.

A cosmic ray monitoring facility recorded a burst of cosmic rays associated with the opening.

The magnetic field breach was the result of charged particles from the Sun striking the Earth at high speed.

The GRAPES-3 muon telescope located at the Cosmic Ray Laboratory (CRL) in Ooty, southern India, recorded a burst of galactic cosmic rays of about 20 gigaelectronvolts (GeV) on 22 June 2015.

The opening in the magnetic shield was detected with the GRAPES-3 muon telescope

“In this case the magnetic field was breached for only two hours and then returned back to normal. The magnetic field strength reduced only by 2%,” Dr Sunil Gupta, lead scientist at the CRL told the BBC.

Earth’s magnetic shield, or magnetosphere, extends over a radius of a million kilometres. It protects the planet’s biosphere from the continuous flow of solar and other cosmic radiation.

The Sun periodically ejects vast clouds of charged particles into space in events known as coronal mass ejections (CMEs). Each one can contain a billion tonnes of charged gas, or plasma.

The giant cloud of plasma ejected from the solar corona in 2015 caused massive compression of the Earth’s magnetosphere and triggered a severe geomagnetic storm. In turn, this generated aurora borealis (northern lights), and radio signal blackouts in many high latitude countries.

The Sun periodically ejects vast clouds of charged particles into space

Numerical simulations performed by the GRAPES-3 team on this event indicate that the Earth’s magnetic shield temporarily opened up in response to the incoming solar plasma, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.

Dr Gupta said that the CRL’s measurements of the two-hour breach “gives us much more comprehensive information over a much larger region of space than the satellite based instruments”.

The GRAPES-3 Muon telescope’s combination of a large area and directional measurement enabled the accidental observations.

Auroras are one of the consequences of geomagnetic storms

“We have been aware of impacts on the Earth from solar activity for a long time through the discovery of CMEs, but the Indian study adds a new element to this endeavour, with detailed analysis of a major particle event during the arrival of a particular cloud,” Dr Richard Harrison, head of space physics and chief scientist at the Rutherford Appleton Laboratory in Oxfordshire, UK, told BBC News.

A major event could occur any time with potentially significant impacts on human infrastructure. As such, there are ongoing efforts to improve the prediction of this so-called space weather.
“They can short circuit power supplies such as high voltage transformers which provide power to our cities, disrupt communication satellites and therefore will affect, for example, internet, mobile phones and just about anything that uses electricity,” said Dr Harrison.

In addition, he said, a major solar storm could also threaten humans in space, with the potential for damage to or the loss of spacecraft – although such events are expected to be rare.

Scientists at CRL hope that the vast amount of data now available would enable them to better predict such events and take preventative measures. But the real challenge is to devise appropriate electronic hardware that can issue a reliable alert, Dr Gupta said.

The findings have been published in the journal Physical Review Letters.

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Indian muon trackers get a handle on solar storms

The GRAPES-3 experiment is a special telescope-array established in Ooty to detect muons from cosmic ray showers. The experiment has detected a surge in muon intensity correlated with a weakening of t

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Narendra Modi
@narendramodi
GRAPES-3 locates crack in magnetic field of Earth; Will it lead to doom?

Short resume:

- cosmic
- 90%
- grapes
- 80%
- crack
- 70%
- solar
- 60%

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The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor recorded a burst of galactic cosmic rays that indicated a crack in the Earth's magnetic shield. The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth's...
The magnetic field that protects Earth from deadly cosmic radiation may be more vulnerable than previously thought. A crack in the shield caused by a solar flare which exposed the planet to a bombardment of radiation has been detected.

Researchers from the Tata Institute of Fundamental Research in India made the discovery when analyzing a galactic cosmic ray burst that caused radio blackouts across North and South America and a supercharged aurora borealis in 2015.

The cosmic ray source was a giant solar plasma cloud that travelled 40 hours from our sun to reach Earth, where the researchers believe it caused a transient “weakening of Earth’s magnetic shield”, according to their findings published in the journal Physical Review Letters.

The sun’s flare was so intense the team claim it would have shrunk the magnetic field from 11 times the radius of Earth to four times its radius before it eased, allowing the shield to recover.

Researchers used data from the GRAPES-3 muon telescope in Ooty, India, to simulate the burst. Results indicated the effect on Earth would have required a crack in the magnetic field that lasted approximately two hours.

Unfortunately not a lot can be done to protect Earth from any future cracks in the shield, which could leave the planet under constant exposure to radiation and could potentially lead to the eradication of our atmosphere.

Continue reading: https://www.rt.com/viral/365328-magnetic-field-cracked-solar/

Cosmic Rays Have Left Earth’s Magnetic Shield Weakened

by Ryan Keenan

The magnetic shield surrounding earth is the real protector for earth, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations coming from the sun and space in general. If these happened to reach Earth with their full potential they would likely wreak havoc on our environment, atmosphere and the overall climate of Earth. Another major affect would be an increase of EMP bursts reaching earth with enough power to severely impact our technology.

The technology that managed to find the leak in our magnetic field is the GRAPES-3 muon telescope in Ooty. What it managed to find is a significant spike in cosmic ray levels, showing that earth’s magnetic shield may have been weekend by this massive burst. This was first discovered back in June 2015, however it has taken more than a year for a full report of the incident to be drawn up, the study published in Physical Review Letters gives a full analysis of the incident showing us all the important data.

The strike that managed to penetrate through the earth’s atmosphere looks to have lasted for around 2 hours in which time it managed to shrink the earths magnetosphere from 11 times to four times the Earth’s radius. Our layer of protection from spaces deadly radiation has now been massively shrunk.

As well as the solar winds shrinking the earth’s atmosphere it’s also reported a sever magnetic storm brought down radio signals towards the norther regions of earth as well as magnificent northern light displays. The worry for many in their respective fields is now that earth will become much more prone to solar storms that were experienced on such a high scale here. To show that radiation from the sun can have an impact on earth all you have to look at is the increasing incidences of pilots flying at high altitude developing cancer.
For the future, what does this mean you might ask. Well this might be the first sign that these solar storms can do damage to us, although this was a big blast from the sun it’s not something that can’t happen again and most importantly it’s not as bad as it can get. It does pose the question of how much our earth can take, everyone’s read the stories of a super ejection of energy from the sun knocking out all our electrical systems, sending us back a thousand years, you could be experiencing the first signs that it is an inevitability for the future.

All in all, we can do is hope for the best, without being able to control how the sun works, yet, so for us it’s a case of just studying and hoping for the best. So, what do you guys thinks, does this shows that the earth truly is fragile and that we may have an inevitable scary future, or is this a freak event that doesn’t pose any threat to earth in the future.
Scientists have accessible a events that unfolded after a Earth’s captivating defense was breached.

Openings in a planet’s captivating margin are not uncommon, though it is rarer to get a eventuality to accumulate information while such an eventuality is in progress.

A immeasurable ray monitoring trickery accessible a detonate of immeasurable rays compared with a opening.

The captivating margin crack was a outcome of charged particles from a Sun distinguished a Earth during high speed.

The GRAPES-3 muon telescope located during a Cosmic Ray Laboratory (CRL) in Ooty, southern India, accessible a detonate of galactic immeasurable rays of about 20 gigaelectronvolts (GeV) on 22 Jun 2015.

“In this box a captivating margin was breached for usually dual hours and afterwards returned behind to normal.

The captivating margin strength reduced usually by 2%,” Dr Sunil Gupta, lead scientist during a CRL told a BBC.

Earth’s captivating shield, or magnetosphere, extends over a radius of a million kilometres. It protects a planet’s stratosphere from a continual upsurge of solar and other immeasurable radiation.
The Sun intermittently ejects immeasurable clouds of charged particles into space in events famous as coronal mass ejections (CMEs). Each one can enclose a billion tonnes of charged gas, or plasma.

The hulk cloud of plasma ejected from a solar halo in 2015 caused immeasurable application of a Earth’s magnetosphere and triggered a serious geomagnetic storm. In turn, this generated halo borealis (northern lights), and radio vigilance blackouts in many high embodiment countries.

Numerical simulations achieved by a GRAPES-3 group on this eventuality prove that a Earth’s captivating defense temporarily non-stop adult in response to a incoming solar plasma, permitting a reduce appetite galactic immeasurable ray particles to enter a atmosphere.

Dr Gupta pronounced that a CRL’s measurements of a two-hour crack “gives us most some-more extensive information over a most incomparable segment of space than a satellite formed instruments”.

The GRAPES-3 Muon telescope's multiple of a immeasurable area and directional dimensions enabled a random observations.

“We have been wakeful of impacts on a Earth from solar activity for a prolonged time by a find of CMEs, though a Indian investigate adds a new component to this endeavour, with minute research of a vital molecule eventuality during a attainment of a sold cloud,” Dr Richard Harrison, conduct of space production and arch scientist during a Rutherford Appleton Laboratory in Oxfordshire, UK, told BBC News.

A vital eventuality could start any time with potentially poignant impacts on tellurian infrastructure. As such, there are ongoing efforts to urge a prophecy of this supposed space weather.

“They can brief circuit energy reserve such as high voltage transformers that yield energy to a cities, interrupt communication satellites and therefore will affect, for example, internet, mobile phones and only about anything that uses electricity,” pronounced Dr Harrison.

In addition, he said, a vital solar charge could also bluster humans in space, with a intensity for repairs to or a detriment of booster – nonetheless such events are approaching to be rare.

Scientists during CRL wish that a immeasurable volume of information now accessible would capacititate them to improved envision such events and take medicine measures. But a genuine plea is to digest suitable electronic hardware that can emanate a arguable alert, Dr Gupta said.

The commentary have been published in a journal Physical Review Letters.
A Sneaky Solar Storm Put A Crack In Earth's Magnetic Field

It may come as no shock to you that the sun releases an enormous amount of radiation, but did you know that in some cases it can release an unusually large amount of radiation and charged particles known as a solar storm. Thankfully however the Earth has something called a magnetic field, a sort of invincible barrier that surrounds the Earth preventing the damaging radiation from reaching the surface and killing us. Not only that but in doing so, it creates those beautiful, ephemeral aurorae.

But what if I told you that last year the Earth was hit by such a large solar storm that it caused a “crack” in its magnetic field. Well a new study in Physics Review Letters has revealed just that. Back in June of 2015, the Indian based GRAPES-3 muon telescope – one which is designed to pick up highly energetic interactions – spotted an increase in the flow of galactic cosmic rays (GCRs) permeating through our atmosphere. This type of radiation originates from outside our Solar System, although in this case, the radiation seemed to be coming from somewhere close to our stellar hood.

After a detailed analysis led by researchers at the Tata Institute of Fundamental Research (TIFR), they found that the plasma cloud had gotten through an unusually and thankfully temporary gap in Earth’s magnetic field.

This GCR bombardment coincided with a coronal mass ejection moving at 2.5 million kilometres per hour (1.6 miles per hours), one that was so energetic that it caused the entire planets magnetic field to shrink from eleven times the radius of the Earth to about four. This triggered a geomagnetic storm that was ranked G4 on the National Oceanic and Atmospheric Administration (NOAA) scale, or in other words “severe”. Resulting in both the enhancement of the Northern Lights and bringing down radio networks. It is highly likely that this powerful storm was the cause of the crack.

These solar storms have the potential to cause trillions of dollars of damage as communication networks, electric grids and even astronauts on board the International Space Station can be shut down and/or immobilised. In fact, the team of researchers noted in their study that “depending on the orbital variation of the cutoff rigidities, the astronauts on the International Space Station would have received a high, and variable radiation dose during the burst.” This would have included NASA astronaut Scott Kelly, who spent 340 days in low-Earth orbit.
Fortunately for us, the crack only lasted a few hours and the Earth’s magnetic field returned to its original size and strength. But it just goes as a powerful reminder of how frighteningly energetic our neighbouring stars and even our own sun is. Although there is pretty much nothing we can do about these cosmic blasts. We are getting better at understanding their behaviour and once we know that, we can better prepare for future geomagnetic storms.

What do you think of these findings? Let us know what you think in the comments below.
Earth’s magnetic shield is ‘WEAKENING’ leaving us vulnerable to radiation

By Daily Express -

November 4, 2016

32

From analysing data from the GRAPES-3 muon telescope in Ooty, India, experts have concluded that the magnetosphere has come under such heavy bombardment in recent years that it weakening.

On June 22, 2015, there was a massive burst of galactic cosmic rays which traumatised the Earth’s magnetic shield for two hours.
Transient Weakening of Earth's Magnetic Shield Probed by a Cosmic Ray Burst.


Physical review letters

Abstract: The GRAPES-3 tracking muon telescope in Ooty, India measures muon intensity at high cutoff rigidities (15-24 GV) along nine independent directions covering 2.3 sr. The arrival of a coronal mass ejection on 22 June 2015 18:40 UT had triggered a severe G4-class geomagnetic storm (storm). Starting 19:00 UT, the GRAPES-3 muon telescope recorded a 2 h high-energy (∼20 GeV) burst of galactic cosmic rays (GCRs) that was strongly correlated with a 40 nT surge in the interplanetary magnetic field (IMF). Simulations have shown that a large (17×) compression of the IMF to 680 nT, followed by reconnection with the geomagnetic field (GMF) leading to lower cutoff rigidities could generate... Read More

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OpenLearn Live bites into the chocolates in box of online learning and research to find the strawberry creams. (Your favourite chocolate might make the metaphor work better). This page will be updated across the day.

The crack in space

As if 2016 wasn't packed full enough of things to worry about, scientists have found a crack in the magnetic shield which protects us from cosmic rays. Wired reports:

The GRAPES-3 muon telescope in Ooty, India, detected a spike in cosmic ray levels, indicating that the Earth’s magnetic shield may be damaged. Though the burst of rays was recorded back in June 2015, a study just published in Physical Review Letters has revealed the extent of the high intensity event for the first time.

For two hours on 22 June, 2015, particles from a giant cloud of fast-moving plasma penetrated the Earth’s atmosphere. The particles, which originated from the surface of the Sun, were moving at about 2.5 million kilometres per hour when they struck our planet’s atmosphere.

This high-speed strike caused the Earth’s magnetosphere – the area containing the planet’s magnetic field – to shrink from 11 times to four times the Earth’s radius. The charged particles in Earth’s magnetosphere usually deflect solar winds which would otherwise bring harmful ultraviolet radiation to the Earth’s surface.
Solar Flare Caused a ‘Crack’ in Protective Field Around Earth (Video)

November 14, 2016

A team of scientists suspects that Earth’s magnetic field cracked due to a solar flare.

A news release by the Tata Institute of Fundamental Research in India reports that the two-hour event was spotted by the GRAPES-3 muon telescope on June 22, 2015.

The release goes on to state that “The burst occurred when a giant cloud of plasma ejected from the solar corona, and…struck our planet, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth.”

This area is considered to be a shield from strong radiation. A geomagnetic storm is believed to have resulted from the activity, as The Wire reports, which “allowed an unusually high flux of cosmic ray particles to arrive on Earth.”

According to the institute, consequent simulations indicated that “the Earth’s magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.”

While such damage can’t necessarily be avoided in the future, the team believes the research could help to enable “a better understanding of future superstorms.”
`Scientists record breach in magnetic field' LINK

"Scientists have recorded the events that unfolded after the Earth’s magnetic shield was breached. Openings in the planet's magnetic field are not uncommon, but it is rarer to get the opportunity to gather data while such an event is in progress. A cosmic ray monitoring facility recorded a burst of cosmic rays associated with the opening. The magnetic field breach was the result of charged particles from the Sun striking the Earth at high speed. The GRAPES-3 muon telescope located at the Cosmic Ray Laboratory (CRL) in Ooty, southern India, recorded a burst of galactic cosmic rays of about 20 gigaelectronvolts (GeV) on 22 June 2015."
Crack discovered in Earth's magnetic shield

The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometers per hour struck our planet, causing a severe compression of Earth's magnetosphere from 11 to 4 times the radius of Earth. It triggered a severe geomagnetic storm that generated aurora borealis, and radio signal blackouts in many high latitude countries.

Earth's magnetosphere extends over a radius of a million kilometers, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations. Numerical simulations performed by the GRAPES-3 collaboration on this event indicate that the Earth's magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere. Earth's magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015. The data was analyzed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray Laboratory in Ooty.

This work has recently been published in Physical Review Letters.

Solar storms can cause major disruption to human civilization by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor operating on Earth is playing a very significant role in the study of such events. This recent finding has generated widespread excitement in the international scientific community, as well as electronic and print media.

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See also:
Astrophysics from Institute of fundamental investigations Tata found out scratch in the earth's magnetosphere maintaining the protection of the planet from the cosmic rays and solar irradiation.

It appeared because of the giant cloud of blood plasma that was excluded from the outer layers of the atmosphere of the Sun (crown). In the article published in the magazine Physical Review Letters scientists reported about the discovery.

On the 22-nd of June 2015 muonic telescope GRAPES-3 situated in the city Udhagamandalam in India the explosion of galactic cosmic rays (GCR) with the energy of nearly twenty gigaelectronvolt (twenty billion electronvolt). The activity of GCR has continued during two hours and matched the encountering of magnetosphere with the coronal mass ejection.

The encountering caused the compression of magnetosphere almost thrice. It led to the capable geomagnetic storm which encouraged polar lights and hindrances in the radio signals in the countries located in the high latitudes.

Computer modeling showed that explosion of GCR happened because of the appearance of the temporary scratch in the force field of the Earth which, in its turn, created because of the magnet re-joining. The latest represents the process of magnetic field lines re-building, as a result of what in the atmosphere of the Earth the particles of cosmic rays penetrated.

Galactic cosmic rays are called elementary particles and cores of atoms that are moving with the high energies in cosmic space. They appear while explosions of superstars as well as exclude active pulsars.
Earth’s magnetic shield has cracked

Earth is habitable because of the magnetic field that surrounds the planet and which defends it from solar storms and cosmic radiation.

However, scientists have investigated one of the strongest geomagnetic storms in the recent history and found that the protective barrier is not as safe as we think. Specifically, the Earth’s magnetic shield is cracked.

They analyzed data from the telescope GRAPES-3 located in Ooty, India, which has seen a massive explosion of cosmic rays on 22 June 2015. During 2 hours, the magnetosphere of the Earth was attacked by particles derived from this phenomenon, radiant energy and space travel speed of light and the first line of defense of Earth against them is this magnetic shield.

About 40 hours before the event from June 22, a giant cloud of plasma was issued by the solar corona and probably hit the magnetosphere at a speed of 2.5 km / h. At the same time, it has triggered a strong geomagnetic storm.

Following these events, scientists at the Tata Institute of Fundamental Research have realized the true risk of these cosmic rays, saying that their force was so powerful that it caused a compression of the magnetosphere. Moreover, they believe that the geomagnetic storm was so strong that it reconfigured the magnetic shielding, radiation and sunlight passing through its vulnerabilities. This phenomenon should worry us, because of Earth’s magnetic field changes, or, in the worst cases, is weaker.

There is no reliable method by which we can stop this process, but the researchers hope that future studies will lead to better management and defense against this danger.
Plasma bursts. Total radio blackouts. Auroras flashing in space like cosmic Christmas lights. If all this galactic chaos sounds eerily enough like a studio brainstorming session for the next Ridley Scott movie, it could be—but it actually happened.

The most epic disaster movie that never existed was captured by the GRAPES-3 muon telescope at the Tata Institute of Fundamental Research in Ooty, India. The opening scene was a coronal mass ejection. Plasma spewing from the solar corona, that glowing halo of ionic violence surrounding the sun, zoomed toward Earth at over 2,000 times the speed of sound. When the force of the impact on our magnetosphere compressed it to less than half its million-kilometer radius, it literally cracked under pressure. This phenomenon roused a beast of a geomagnetic storm so monstrous, it splashed the northern sky with rainbows of aurora borealis and made sure no one in the the uppermost latitudes would be tuning in to the radio anytime soon.

“The simultaneous occurrence of the burst in all nine directions suggests its origin close to Earth,” says Dr. Pravata K. Mohanty, who studied this phenomenon at the Tata Institute with his astrophysicist colleagues. “It also indicates a transient weakening of Earth’s magnetic shield.”

Inside the GRAPES-3 muon telescope, aka the most massive and sensitive cosmic monitor ever.

Think of the magnetosphere as an invisible shield that defends our planet from showers of harmful cosmic rays issuing from the sun and other stars. It is an expanse of space surrounding our planet in which charged particles are manipulated by Earth’s magnetic field (generated by electrical currents around its liquid metal core), and
usually deflects these death rays. Unfortunately, even such a superpowered line of defense isn’t invincible. Data from GRAPES-3 indicates that the fissure which set off all sorts of pseudo-apocalyptic phenomena is the result of magnetic reconnection. When electrically conductive plasmas warp the magnetosphere and convert magnetic energy into thermal and kinetic energy, it’s about as close to anarchy as you can get at the molecular level.

Geomagnetic storms can do much worse than disconnect the classic rock station. They wreak havoc on anything electrical even if you don’t see sparks flying from the phone lines like they would in some epic sci-fi catastrophe scene. These storms can also mess with pipelines and throw planes, ships, satellites and even your car’s GPS off course. While this means migraines for astronomers and air traffic controllers, can it really suck your Caribbean cruise into the gaping chasm of the Bermuda Triangle? Probably not. Humans are also at risk for radiation poisoning from a disruption in the magnetic field, though this potentially lethal threat to astronauts is highly unlikely for those of us who are earthbound.

While the magnetosphere did self-heal like something out of science fiction, this wasn’t before a sprinkling of particles from cosmic rays (hardly as glittery as it sounds) floated through the crack into our atmosphere. GRAPES-3 interpreted these particles as evidence of a solar burst when Earth’s magnetic field started acting strange and bent them across every time zone. Mohanty and his colleagues remain excited about and what this phenomenon can tell us, hinting that “[it] may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”

Meaning, the analysis of data from cosmic monitors like GRAPES-3 could influence more advanced protection measures in the face of an impending solar storm, and keep disaster movies where they belong—on DVD.

(Via Science Daily)
Crack In Earth's Magnetic Shield Detected

The world's largest and most sensitive cosmic ray monitor, located in India, has recorded a burst of galactic cosmic rays that indicates a crack in the Earth's magnetic shield, according to scientists.

The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth's magnetosphere and triggering a severe geomagnetic storm.

The GRAPES-3 muon telescope located at Tata Institute of Fundamental Research's Cosmic Ray Laboratory in Ooty in Tamil Nadu recorded a burst of galactic cosmic rays of about 20 GeV last year lasting for two hours.

The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometres per hour struck our planet, causing a severe compression of Earth's magnetosphere from 11 to 4 times the radius of Earth.

It triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries, according to the study published in the journal Physical Review Letters this week.

Earth's magnetosphere extends over a radius of a million kilometres, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations.

Numerical simulations performed by the GRAPES-3 researchers, including Pravata K Mohanty, indicate that the Earth's magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.

Earth's magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015.

The data was analysed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray Laboratory in Ooty.

Solar storms can cause major disruption to human civilisation by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.
The GRAPES-3 muon telescope located at Tata Institute of Fundamental Research's (TIFR's) Cosmic Ray Laboratory in Ooty recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015 lasting for two hours.

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The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor recorded a burst of galactic cosmic rays that indicated a crack in the Earth's magnetic shield

Credit: TIFR

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The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor operating on Earth is playing a very significant role in the study of such events. This recent finding has generated widespread excitement in the international scientific community, as well as electronic and print media.

Contacts and sources:

Pravata K Mohanty
Tata Institute of Fundamental Research

Citation: Transient Weakening of Earth’s Magnetic Shield Probed by a Cosmic Ray Burst
APS Physics highlight:

Indian scientists detect crack in Earth’s magnetic shield

The world’s largest and most sensitive cosmic ray monitor, located in India, has recorded a burst of galactic cosmic rays that indicates a crack in the Earth’s magnetic shield, according to scientists. The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth’s magnetosphere and triggering a severe geomagnetic storm. The GRAPES-3 muon telescope located at Tata Institute of Fundamental Research’s Cosmic Ray Laboratory in Ooty in Tamil Nadu recorded a burst of galactic cosmic rays of about 20 GeV last year lasting for two hours. The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometres per hour struck our planet, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth. It triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries, according to the study published in the journal Physical Review Letters this week. Earth’s magnetosphere extends over a radius of a million kilometres, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations. Numerical simulations performed by the GRAPES-3 researchers, including Pravata K Mohanty, indicate that the Earth’s magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower…more detail
‘Pipe’lines that detect fiery solar storms

What does a sensational scientific discovery about a solar storm in the Earth’s magnetic field have to do with old, recycled steel pipes which lay buried for more than a decade under a now-defunct gold mine in India? Almost everything. More than 3,700 such pipes are actually at the heart of a most significant scientific finding. A team of Indian and Japanese scientists recently published an internationally-feted paper which recorded the events that unfolded after a breach in the Earth’s magnetic shield. Using the GRAPES-3 muon (a sub-atomic particle) telescope — the world’s largest of its kind — at the Cosmic Ray Laboratory in Udagamandalam, Tamil Nadu, the scientists recorded a two-hour burst of galactic cosmic rays that invaded the atmosphere on June 22, 2015. The magnetic field breach was the result of charged particles from the Sun striking the Earth at high speed. Solar storms of such high magnitudes can knock out satellites and aircraft autopilots, cause catastrophic power outages, and take us, according to one of the scientists leading the research, Dr Sunil Gupta, “back to the Stone Age”. The world’s largest and most sensitive cosmic ray telescope located in Udagamandalam is made up of four-decades old recycled zinc-coated steel pipes. “Necessity is the mother of invention. When you don’t have the money to buy new, expensive stuff, you look within the system to find out your own solutions to reduce costs. India’s scientists have mastered the art of recycling and coming up with their own inexpensive solutions,”...
What will be the consequences of a crack in earth's magnetic field?

If a part of magnetic field disappears over arctic or around equator, will other parts (China or Australia) be affected?

4 Answers

Bob Singer, Degreed in Digital Electronics Technology and has been a science enthusiast since getting his first Microsc...
Written Nov 9

As others have already said, you can’t “crack” a magnetic field any more than you can crack a water balloon. The Earth’s magnetic field is stronger in some areas and weaker in others, but it is more than strong enough to deflect solar radiation to the poles where it strikes atmospheric gasses and creates auroras. Even there, there is no increased radiation on the surface. So there is no need to worry.

Wade Schmaltz, works at Here and There
Written Nov 9

That author was quoting the source, and the source was using colourful language, perhaps to draw attention. A crack in a magnetic field is virtually impossible. That’s like trying to find a cold spot over a fire.

The original paper on the subject, which was published recently, doesn’t mention a crack. The review letter publication, however, does mention a crack. It’s just a meaningless superlative in this context.

The study speaks of a solar storm which hit us on June 22, 2015. Did you feel it?
Here’s the abstract:

Transient Weakening of Earth's Magnetic Shield Probed by a Cosmic Ray Burst submitted by P. K. Mohanty, et. al. - Phys. Rev. Lett. 117, 171101 – Published 20 October 2016 Issue Vol. 117, Iss. 17 — 21 October 2016 Other publications, all paraphrasing the same headline:

- GRAPES-3 Telescope Records Cosmic Ray Burst, Highlights Crack In Earth’s Magnetic Field - Tech Times November 8, 2016
- The impact triggered a strong geomagnetic storm that resulted in aurora borealis and radio signal blackouts in many high-latitude countries.
- India’s Telescope Detects Crack in the Earth’s Magnetic Shield - Nature World November 4, 2016

We had some pretty good auroras up north here, but nobody lost any power over it. I didn’t know there was a solar storm accompanied with the recent aurora displays. There are the odd warnings, but I didn’t hear a peep.

- Geomagnetic Storms - the NOAA Space Weather Prediction Center, NOAA / NWS Space Weather Prediction Center - the home page

In 1989 there was some trouble from a geomagnetic storm.

- The Day the Sun Brought Darkness - a recap of the old news from NASA (report dated 20 years after the fact, which is 7 years ago now)
- A Scary 13th: 20 Years Ago, Earth Was Blasted with a Massive Plume of Solar Plasma [Slide Show]

I can’t find anything more recent than that anywhere else. I guess that “crack” wasn’t so big after all.

If we get a big Coronal Mass Ejection (CME) and it’s geoeffective (ie. - aimed right at us), it could knock out the power in far northern and southern latitudes like it did in Quebec 27 years ago. That only lasted a day, but it effected the whole province and there were minor ripples felt further south in neighbouring states due to the loss of power in Quebec. Our grids are connected, but there was ample power for our southern neighbours, with some minor tweaking by the power distribution facilities down there.

It’s not quite spring yet in March, and it would have been cold without power. People don’t do so well without heat in Quebec in March. There’s nothing like a warm fire and a cup of hot chocolate on a cold winter’s night.
If that happened in India, you would be up and running without batting an eye. China in the winter could have more trouble. Equatorial latitudes are at lower risk.

According to this archive site, there was a peak activity period from 18–21h UTC on June 22, 2015 and another on June 25, 2015 from 03–06h UTC. I understand Norway upgraded their power distribution equipment after the Quebec incident. I don’t know what equipment India and China are using right now.

Oversimplified non-technical language.

You can’t have a crack in a magnetic field. It is a continuous (although not necessarily uniform) surface. You can have peaks and troughs, but those don’t sound so dramatic or headline worthy.

Localised weakening will allow some increase in ionising radiation, in much the way the ozone hole let’s in more UV. That’s not going to ricochet around once ‘inside’ and flood the planet more generally.

The other point to consider is that the magnetic field has been there for billions of years, in much the same form, so there is nowt unusual going on.

And we can’t do much about it anyway.

There are much larger threats looming that we can do summat about.
Scientists have recorded the events that unfolded after the Earth’s magnetic shield was breached.

Openings in the planet’s magnetic field are not uncommon, but it is rarer to get the opportunity to gather data while such an event is in progress.

A cosmic ray monitoring facility recorded a burst of cosmic rays associated with the opening.

The magnetic field breach was the result of charged particles from the Sun striking the Earth at high speed.

The GRAPES-3 muon telescope located at the Cosmic Ray Laboratory (CRL) in Ooty, southern India, recorded a burst of galactic cosmic rays of about 20 gigaelectronvolts (GeV) on 22 June 2015.

“In this case the magnetic field was breached for only two hours and then returned back to normal. The magnetic field strength reduced only by 2%,” Dr Sunil Gupta, lead scientist at the CRL told the BBC.

Earth’s magnetic shield, or magnetosphere, extends over a radius of a million kilometres. It protects the planet’s biosphere from the continuous flow of solar and other cosmic radiation.

The Sun periodically ejects vast clouds of charged particles into space in events known as coronal mass ejections (CMEs). Each one can contain a billion tonnes of charged gas, or plasma.
The giant cloud of plasma ejected from the solar corona in 2015 caused massive compression of the Earth’s magnetosphere and triggered a severe geomagnetic storm. In turn, this generated aurora borealis (northern lights), and radio signal blackouts in many high latitude countries.

Numerical simulations performed by the GRAPES-3 team on this event indicate that the Earth’s magnetic shield temporarily opened up in response to the incoming solar plasma, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.

Dr Gupta said that the CRL’s measurements of the two-hour breach “gives us much more comprehensive information over a much larger region of space than the satellite based instruments”.

The GRAPES-3 Muon telescope’s combination of a large area and directional measurement enabled the accidental observations.

“We have been aware of impacts on the Earth from solar activity for a long time through the discovery of CMEs, but the Indian study adds a new element to this endeavour, with detailed analysis of a major particle event during the arrival of a particular cloud,” Dr Richard Harrison, head of space physics and chief scientist at the Rutherford Appleton Laboratory in Oxfordshire, UK, told BBC News.

A major event could occur any time with potentially significant impacts on human infrastructure. As such, there are ongoing efforts to improve the prediction of this so-called space weather.

“They can short circuit power supplies such as high voltage transformers which provide power to our cities, disrupt communication satellites and therefore will affect, for example, internet, mobile phones and just about anything that uses electricity,” said Dr Harrison.

In addition, he said, a major solar storm could also threaten humans in space, with the potential for damage to or the loss of spacecraft – although such events are expected to be rare.

Scientists at CRL hope that the vast amount of data now available would enable them to better predict such events and take preventative measures. But the real challenge is to devise appropriate electronic hardware that can issue a reliable alert, Dr Gupta said.
GRAPES-3 indicates a crack in Earth’s magnetic shield

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor recorded a burst of galactic cosmic rays that indicated a crack in the Earth’s magnetic shield Credit: TIFR

The GRAPES-3 muon telescope located at TIFR’s Cosmic Ray Laboratory in Ooty recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015 lasting for two hours.

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This work has recently been published in *Physical Review Letters*

Solar storms can cause major disruption to human civilization by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor operating on Earth is playing a very significant role in the study of such events. This recent finding has generated widespread excitement in the international scientific community, as well as electronic and print media.


**Journal reference:** Physical Review Letters

**Provided by:** Tata Institute of Fundamental Research

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*Original article on phys.org*
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Research paper:
Scientists have just detected a crack in Earth’s magnetic shield

Experts have recently found that Earth’s magnetic shield cracked open due to a super-strong geomagnetic storm that managed to reconfigure our planet’s magnetic shield. Our planet’s magnetosphere extends over a radius of a million kilometers, and acts as the ‘first line of defense’, protecting us from the continuous flow of solar and galactic cosmic rays.

The magnetosphere is a large area that encompasses our planet. Its presence alone protects the planet from charged particles of the solar wind and deflects them around Earth.

This enormous protective natural layer around our planet extends thousands of miles into space and its magnetism is so important and influential that it affects technology, life forms on the planet and weather patterns as well.

Scientists used the telescope and cosmic ray detector GRAPES-3 and published the analysis of a solar storm that occurred in June of 2015, leaving us without a magnetic shield for TWO hours.

The giant cloud of plasma -which originated in the Sun’s corona- ejected in June 2015 and eventually crashed into our planet magnetosphere at a speed of about 2.5 million kilometers per hour. The damage caused by the collision was of epic proportions.

As this occurred, it caused massive radio-signal blackouts in many high-latitude countries in North and south America. This supermassive storm also caused supercharged aurora borealis.

But over a year after the solar storm struck our magnetosphere, experts have been able to realize the extent of damage caused by the bombardment of solar rays.

According to experts from the Tata Institute of fundamental Research in India, after performing simulations based on data gathered by the GRAPES-3 satellite from that day, the magnetosphere of Earth cracked open, meaning that after all its not as secure as we thought it was.

Scientists concluded that the geomagnetic storm was so great that it actually managed to RECONFIGURE our magnetic shield.
“This vulnerability can occur when magnetized plasma from the Sun deforms Earth’s magnetic field, stretching its shape at the poles and diminishing its ability to deflect charged particles,” Katherine Wright explains on the American Physical Society website. The research has been published in Physical Review Letters.

This is something we need to worry about. Experts say that the fact that this occurred means that our magnetic field is changing and even weakening in certain parts.

“The occurrence of this burst also implies a 2-hour weakening of Earth’s protective magnetic shield during this event,” the researchers report.

“[This] indicates a transient weakening of Earth’s magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”

In previous articles we reported about how our planet’s magnetic field is collapsing and our planet’s poles are flipping. This could result in catastrophic events on our planet.

Scientists warn that in the last two centuries the magnetic field has weakened, suggesting that it could be a tell-tale sign that Earth’s poles are about the flip. While experts believe a flip is overdue, they still cannot tell when it might occur. According to researchers, the Earth’s magnetic field is in constant movement and every 2-3 hundred thousand years or so the polarity of our planet flips.
A Crack in the Earth’s Magnetic Shield

The muon telescope known as GRAPES registered a crack of the magnetic shield of our planet. The telescope is situated at TIFR’s Cosmic Ray Laboratory in Ooty. The burst of rays was enrolled to appear on June 22 and measured approximately 20 GeV. The phenomenon happened due to a mass of plasma which was spurted from the solar corona.

- Scientists revealed a crack in the Earth’s magnetic shield.
- GRAPES-3 telescope helped them detect the cause to fix try to fix it.

This moved at a speed of 2.5million kilometers per hour, hitting Terra. The results were devastating. It caused a critical compression of the magnetosphere up to four times the radius of our planet. The phenomenon triggered a geomagnetic storm powerful enough to produce aurora borealis. Other effects registered were the radio blackouts that affected so many countries located at high latitude.

The radius of our planet’s magnetosphere extends up to a million kilometers, performing acts of defense meant to protect us from cosmic rays and solar flows. Due to these features of auto-protection which were developed, life on this planet is safe, being kept at a great distance from the increased intensity of energetic radiations.

The simulations which were generated with the help of the GRAPES-3 suggested that the magnetic shield of the Earth is temporarily damaged. The factor which determined this remarkable phenomenon is the magnetic reconnection.

This event made possible the incursion of the particles of lower intensity from the galactic cosmic rays into our
atmosphere. These particles were bent at approximately 180 degrees by the force of the magnetic field around our planet. This process of deterioration of the particles had started when the telescope discovered the crack in the magnetic shield and started a combat against the cosmic rays.

The team of engineers and physicists at the Cosmic Ray Laboratory in Ooty have examined and interpreted the data offered by the GRAPES-3 telescope, using extensive simulation. This was based on the development of a 1280-core computing station which was built inside, during the research. The study which was conducted by such a knowledgeable team of scientists was recently published in the Physical Review Letters magazine.

There can appear significant turmoil in the human civilization when massive electrical power grids are damaged, being generated by solar storms. Other causes contributing to the civilization’s disruption are creating deficiencies in satellite operations and communications, but also in global positioning systems.

Image courtesy of: wikipedia
Massive Crack In Earth’s Magnetic Shield

November 4, 2016

We owe a lot of credit for our survival as a species to the magnetic field surrounding our pale blue space marble, making it just habitable enough of a place for us to reside.

Recently, we have been experiencing one of the most powerful geomagnetic storms in history. Unfortunately for us, scientists have found out that the all-powerful protective barrier that we rely on really isn’t as safe and secure as we once believed.

Data from the GRAPES-3 muon telescope in Ooty, India has recorded massive bursts of cosmic rays on June 22, 2015. For a few hours, the Earth’s magnetosphere was beaten by the bursts, which give off insanely high-energy radiation levels, not to mention they travel fairly close to the speed of light. These bursts are so immensely powerful, that they’re easily able to pierce through the hull of a spaceship.

Almost two days before the event on June 22, massive plasma cloud exploded from the Sun’s corona and struck the Earth’s magnetic shield at roughly 2.5 million kilometers per hour – that’s quite a powerful punch. So much so, in fact, that it was the cause of a very severe geomagnetic storm which was responsible for radio blackouts almost entirely throughout the northern hemisphere.

After all this time, scientists have recently discovered the extent of the damage, and it most certainly isn’t pretty.

Essentially, there’s a crack in the magnetosphere, which explains why radio systems went completely haywire. The blast was so strong, that it caused the magnetosphere to shrink down to only 4 times the radius of Earth, compared to its normally health 11-fold size. With such massive amounts of damage, it’s quite possible there are more weak spots littering the magnetosphere, potentially allowing radiation and cosmic rays to leak through into our atmosphere.
Fortunately, the crack was only temporary, and our magnetosphere is well on its way to becoming completely healthy again. However, the fact that this even happened is quite unsettling – if it’s happened once, it could most certainly happen twice. And if it were to happen again, then who knows what sort of damage would be caused? It could potentially be enough to completely eliminate our entire technological infrastructure and wreak havoc for years to come.
Is the Earth’s magnetic field really fading out? Could this mean that something dangerous involving death await us?
(NOAA/National Weather Service's Space Weather Prediction Center via Getty Images)

It might just be something that we regularly take for granted but we have a lot to be thankful for the Earth’s magnetic field such as being protected from the sun’s harmful radiation and as well as the very spectacular Northern Lights. However, a new study has recently revealed that there is an apparent temporary crack in Earth’s magnetic field that would likely allow dangerous galactic cosmic ray particles to get through our atmosphere.
Researchers said this is a possible sign that our magnetic shield is deteriorating. In return, experts warn that this phenomenon would likely cause a massive widespread destruction on Earth such as power disruption and a prolonged exposure to the harmful UV radiation. It has also been revealed that a sudden collapse of the earth’s magnetic field could mean that billions of people across the globe are likely to be exposed to dangerous solar winds and radiation.

According to the authors of the study as revealed in the Physical Review Letters, the GRAPES-3 muon telescope at the TIFR’s Cosmic Ray Laboratory in Ooty, India, has apparently recorded a sudden bursting of galactic cosmic rays about 20 GeV last year in June which experts claim to have lasted for two hours. Muons are said to make up much of the cosmic radiation reaching the earth's surface.

Additionally, Daily Mail has also revealed that the earth’s magnetic field plays a vital part in everybody’s life in the planet but has already weakened by 15 percent in over the last 200 years. Furthermore, scientists believe that this is a probable sign that the earth's poles are bound for a big switch.

Experts believe that we are already way past the switch, but they have emphasized that they are just not certain yet when is this going to happen. If this switch would take place, our planet earth is allegedly about to be exposed to a more powerful solar winds that are capable of creating bigger holes into the ozone layer and of course, causing the thinning of the earth’s magnetic field.

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A recent cosmic burst cracked the Earth’s magnetic field wide open

Lola Gayle, STEAM Register

Our magnetic field may not be all it’s cracked up to be.

On June 22, 2015, a burst of galactic cosmic rays was recorded by the GRAPES-3 muon telescope located at TIFR’s Cosmic Ray Laboratory in Ooty.

That burst of rays occurred when the sun let loose a giant cloud of plasma that struck our planet at a speed of roughly 2.5 million kilometers per hour, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth.

As you can imagine, the cosmic bombardment triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries.

Thankfully, we are protected by the Earth’s magnetic field. This shield extends over a radius of a million kilometers and is our first line of defense against the continuous flow of solar and galactic cosmic radiation.
Note: Earth’s magnetic field, also known as the geomagnetic field, is the magnetic field that extends from the Earth’s interior out into space, where it meets the solar wind, a stream of charged particles emanating from the sun.

Schematic illustration of Earth's magnetic field. Credit: Peter Reid, The University of Edinburgh

See Also: Our Sun Could One Day Unleash A Deadly Superflare

If something should go wrong, we're really in for it. And during this particular two-hour 20 GeV blast, it almost did.

According to a statement from the Tata Institute of Fundamental Research, "Numerical simulations performed by the GRAPES-3 collaboration on this event indicate that the Earth's magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere. Earth's magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around midnight on June 22, 2015."
A recent cosmic burst cracked the Earth’s magnetic field wide open

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor recorded a burst of galactic cosmic rays that indicated a crack in the Earth's magnetic shield. Credit: TIFR

Phew! A near miss this time. But thankfully the GRAPES-3 muon team is keeping an eye to the sky.
Indian scientists detect crack in Earth's magnetic shield

submitted 5 months ago by BrownVendetta

517 comments  share

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sorted by: best

[-] DSMB  732 points 5 months ago

So basically a huge plume of plasma was ejected towards Earth, which sort of overpowered the magnetic field, penetrating it and causing a teensy bit of interference.

And when the plasma impact ended, the magnetic field returned to its normal state because, well, a bit of plasma ain't gonna stop the Earth's iron core rotating.

That's the gist of it as far as I can tell.

permalink embed

[-] ZereXTheCool  488 points 5 months ago

So, are you saying that we need to plant a bomb in the Earth's core to restart the spinning process? Because I am pretty sure you are.

permalink embed parent

[-] Silidistani  13 points 5 months ago

Would the interference have produced a braking force on the core by a teensy little bit if it was enough to disrupt the magnetic field?

permalink embed parent

[-] scotchirsh  11 points 5 months ago

I can't see how it would have any impact on the core whatsoever. (To the best of my knowledge) the magnetosphere is a byproduct of the swirling molten iron outer core, they're not symbiotic. It would be like putting a shade in front of a light bulb just disrupts the radiance, but doesn't affect the filament.

permalink embed parent

[-] The-Corinthian-Man  14 points 5 months ago

Actually, having charged objects move through a magnetic field moves them, and the "equal and opposite reaction" is effected onto the source of the field. So it would have an effect on the core.

That being said, minuscule and therefore negligible.

permalink embed parent

[-] Shotzo  3 points 5 months ago

If something creates a magnetic field, and another object is affected by said field, then the original object which created the field is also affected.

You can't have a magnet pull something without physics equaling out the forces in some way.

permalink embed parent

[-] missingdogchitown  3 points 5 months ago

yes but think of the mass necessary to project a magnetic field so far. it would take a significant amount of time at a constant plasma ejection to apply any real braking force.
on the core.

to:

It'sSidebar

This is the best tl;dr I could make, original reduced by 70%. (I'm a bot)

The world's largest and most sensitive cosmic ray monitor, located in India, has recorded a burst of galactic cosmic rays that indicates a crack in the Earth's magnetic shield, according to scientists.

Numerical simulations performed by the GRAPES-3 researchers, including Pravata K Mohanty, indicate that the Earth's magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.

Earth's magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015.

LastDawnOfMan 2 points 5 months ago

I didn't see anything from the scientists in the article about a "crack" and the concept of a crack makes no sense in real life or on the context of the scientist's statements.

So I'm writing off the whole "crack" idea as typical dumbshit journalist shoveling bullshit every time they touch an article that's science related.

If you want to think about holes in the magnetosphere think north and south poles and why we have aurorae.
GRAPES-3 Telescope Recorded A Crack in Earth’s Magnetic Shield

edfromct 11/4/2016

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor recorded a burst of galactic cosmic rays that indicated a crack in the Earth’s magnetic shield. The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth’s magnetosphere and triggering a severe geomagnetic storm.

Reported in Phys.org

The GRAPES-3 muon telescope located at TIFR’s Cosmic Ray Laboratory in Ooty recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015 lasting for two hours.

The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometers per hour struck our planet, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth. It triggered a severe geomagnetic storm that generated aurora borealis, and radio signal blackouts in many high latitude countries.

Earth’s magnetosphere extends over a radius of a million kilometers, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations. Numerical simulations performed by the GRAPES-3 collaboration on this event indicate that the Earth’s magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere. Earth’s magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015. The data was analyzed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray Laboratory in Ooty.

This work has recently been published in Physical Review Letters

Solar storms can cause major disruption to human civilization by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor operating on Earth is playing a very significant role in the study of such events. This recent finding has generated widespread excitement in the international scientific community, as well as electronic and print media.
GRAPES-3 Indicates a Crack in Earth's Magnetic Shield

Published: November 3, 2016.
Released by Tata Institute of Fundamental Research

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The GRAPES-3 muon telescope located at TIFR's Cosmic Ray Laboratory in Ooty recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015 lasting for two hours.

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Journal reference: dx.doi.org/10.1103/PhysRevLett.117.171101

The above story is based on materials provided by Tata Institute of Fundamental Research.

Translate this page: Chinese French German Italian Japanese Korean Portuguese Russian Spanish
To say that Earth depends on its magnetic field to protect our planet, shielding us from harsh solar winds and cosmic radiation is an understatement! That’s why it caught the attention of scientists using the GRAPES-3 telescope sound a crack in Earth’s magnetic shield during one of the most powerful geomagnetic storms in Earth’s history, and they’ve concluded that our protective barrier isn’t as secure as previously thought. And as it turns out that our magnetosphere has been cracked – as this specific incident illustrates. The GRAPES-3 experiment located at the Cosmic Ray Laboratory (CRL) in Ooty consists of two major components, first an array of 400 plastic scintillator detectors, and second a large area muon telescope. The GRAPES-3 led by Prof. Sunil K. Gupta, has the participation of about 30 scientists from 7 universities in India, and from 5 in Japan. An Abstract in Physical Review Letter sees this as an alarming situation that could endanger earth and astronauts! As they put it, “The simultaneous occurrence of the burst in all nine directions suggests its origin close to Earth. It also indicates a transient weakening of Earth’s magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”

The GRAPES-3 muon telescope recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015 lasting for two hours. The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometers per hour struck our planet, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth. It triggered a severe geomagnetic storm that generated aurora borealis, and radio signal blackouts in many high-latitude countries.

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Story Source:

Materials provided by Tata Institute of Fundamental Research. Note: Content may be edited for style and length.
Solar Flare Burst Cracked The Earth’s Magnetic Field, Caused Radio Blackouts?

Meera V Nair

First Posted: Nov 07, 2016 02:55 AM EST

Solar Flare created a crack in the magnetic field of the Earth.

(Photo: NOAA/National Weather Service's Space Weather Prediction Center via Getty Images)

A recent study detected that a crack in the magnetic shield of the Earth caused by a solar flare has exposed the planet to offensive radiation. The magnetic field which protects the Earth from hazardous cosmic radiation may be more vulnerable, than ever thought before.

As per a report published in Weather.com, a study was published about the event which stated that the flare triggered a geomagnetic storm that emitted a burst of cosmic rays. These cosmic rays have weakened the Earth's magnetic shield. The source of the cosmic ray was huge solar plasma which traveled for 40 hours from the Sun to reach the Earth. The study was published in a journal named Physical Review Letters.
According to RT.com, researchers from Tata Institute of Fundamental Research in India made a discovery while analyzing a galactic cosmic ray burst that caused radio blackouts across North and South America. The intensity of the sun's flare was so deep that the researchers claimed it would have reduced the magnetic field from 11 times the radius of the Earth to four times its radius, thus, allowing the shield to recover.

Researchers utilized the data from the GRAPES-3 muon telescope in Ooty, India, in order to kindle the burst. This telescope is the largest and most sensitive cosmic ray monitor. The result directed towards the effect on Earth would have required a crack in the magnetic field which lasted for nearly two hours. Nothing more can be done to protect the Earth from any future cracks. It can leave the planet under steady exposure to radiation and it can also lead to the eradication of our atmosphere.

It is described as one of the most powerful geomagnetic storms in the history. Scientists believe that the rays temporarily weakened the polar magnetic field, thus, allowing the cosmic rays to enter the field. The magnetic field of the Earth generally averts the most cosmic rays, protecting us from harmful radiation.
Crack Discovered in Earth’s Magnetic Shield

By Soren Dreier

The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometers per hour struck our planet, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth. It triggered a severe geomagnetic storm that generated aurora borealis, and radio signal blackouts in many high latitude countries.

Earth’s magnetosphere extends over a radius of a million kilometers, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations.

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This work has recently been published in Physical Review Letters.

Solar storms can cause major disruption to human civilization by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

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Cosmic-ray detector finds possible crack in Earth's magnetic shield

Life itself has Earth's magnetosphere to thank, but as the latest research suggests, it's not a fail-safe shield.

© NASA/UPI
Geomagnetic storms can trigger incredible light shows. Here, charged particles can be seen exciting the gas in the upper atmosphere of the northern hemisphere.

The world's largest, most sensitive cosmic-ray detector has identified a potential crack in Earth's magnetic field.

The weakness was revealed by a burst of galactic cosmic rays, detected by GRAPES-3 during a severe geomagnetic storm in June 2015. The storm as triggered by a plasma cloud ejected from the sun's corona.

It was one of the largest geomagnetic storms in recent history, generating an intense aurora borealis and thwarting radio communication systems among the most northern latitudes. The storm was strong enough to compress Earth's magnetosphere for several hours.

The GRAPES-3 muon telescope is a massive array situated in southern India, a joint effort among scientific institutes in Japan and India. Data revealing the cosmic ray breach were analyzed by scientists at Tata Institute of Fundamental Research in Mumbai.

Researchers published their analysis of the potential magnetosphere crack this week in the journal Physical Review Letters.

Life itself has Earth's magnetosphere to thank. Its ability to block out the harmful rays and particles flying through space allowed life to flourish. But as the latest research suggests, it's not a fail-safe shield.

High-intensity storms can reveal stress fractures, so to speak. Researchers suggest the 2015 storm triggered a phenomenon called magnetic reconnection, whereby magnetic energy is simultaneously converted into kinetic energy, thermal energy and particle acceleration.

In this instance, the process was powerful enough to open a crack through which a burst of cosmic rays slipped
through.

Scientists hope their continued work with GRAPES-3 will offer an improved understanding of the stresses put on the magnetosphere by intense storms, to better predict vulnerabilities in the future.
A crack in Earth’s magnetic shield has been spotted by researchers at Tata Institute of Fundamental Research. The researchers were able to identify the crack analyzing the data gathered by India’s GRAPES-3 muon telescope.
The news has caused panic among people, thinking that the protective layer of our earth is slowly vanishing. But how true is this?

According to Wired, the fissure which was first discovered in 2015, has let galactic cosmic rays leak into the Earth’s atmosphere and caused huge geomagnetic storms in the northern hemisphere. The increased amount of cosmic rays penetrating our atmosphere has led to disrupted communication signals and knocked out radio signals.

The event, according to Science Alert is one of the most powerful geomagnetic storms in recent history.

In fact, results of the researchers’ numerous simulations show that the cosmic bombardment, with speed of about 2.5 million kilometers per hour, was so unyielding, it caused a severe compression of the magnetosphere, forcing it to shrink from 11 to 4 times the radius of Earth.

“Earth’s magnetic field deflects most cosmic rays, protecting living things from harmful radiation. But large geomagnetic storms can reconfigure this protective shield, opening up weak spots that let radiation and cosmic rays slip through. This vulnerability can occur when magnetized plasma from the Sun deforms Earth’s magnetic field, stretching its shape at the poles and diminishing its ability to deflect charged particles,” Katherine Wright explains on the American Physical Society website.

Science Explorer said that solar storms can cause major disruption to human civilization because it will interrupt technology and damage infrastructure. While, it is dangerous for the astronauts who are in space, there is no direct threat for the people on earth, unless the radiation bombardment ensues in the long run which may result to changing climate and drive up rates of cancer.

The researchers said there is nothing much we can do to repair the crack but we can study the crack to make us more ready in case more of it will occur in the future.

The research has been published in Physical Review Letters.

Source:
natureworldnews.com
Scientists record breach in Earth’s magnetic field

Published on February 5, 2017
Written by Siva Parameswaran

Image copyright: SCIENCE PHOTO LIBRARY
Artwork: The Earth’s magnetosphere protects the planet from a continuous flow of cosmic radiation

Scientists have recorded the events that unfolded after the Earth’s magnetic shield was breached. Openings in the planet’s magnetic field are not uncommon, but it is rarer to get the opportunity to gather data while such an event is in progress.

A cosmic ray monitoring facility recorded a burst of cosmic rays associated with the opening. The magnetic field breach was the result of charged particles from the Sun striking the Earth at high speed.

The GRAPES-3 muon telescope located at the Cosmic Ray Laboratory (CRL) in Ooty, southern India, recorded a burst of galactic cosmic rays of about 20 gigaelectronvolts (GeV) on 22 June 2015.
“In this case the magnetic field was breached for only two hours and then returned back to normal. The magnetic field strength reduced only by 2%,” Dr Sunil Gupta, lead scientist at the CRL told the BBC.

Earth’s magnetic shield, or magnetosphere, extends over a radius of a million kilometres. It protects the planet’s biosphere from the continuous flow of solar and other cosmic radiation.

The Sun periodically ejects vast clouds of charged particles into space in events known as coronal mass ejections (CMEs). Each one can contain a billion tonnes of charged gas, or plasma.

The giant cloud of plasma ejected from the solar corona in 2015 caused massive compression of the Earth’s magnetosphere and triggered a severe geomagnetic storm. In turn, this generated aurora borealis (northern lights), and radio signal blackouts in many high latitude countries.
Numerical simulations performed by the GRAPES-3 team on this event indicate that the Earth’s magnetic shield temporarily opened up in response to the incoming solar plasma, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.

Dr Gupta said that the CRL’s measurements of the two-hour breach “gives us much more comprehensive information over a much larger region of space than the satellite based instruments”.

The GRAPES-3 Muon telescope’s combination of a large area and directional measurement enabled the accidental observations.
Image caption: Auroras are one of the consequences of geomagnetic storms

“We have been aware of impacts on the Earth from solar activity for a long time through the discovery of CMEs, but the Indian study adds a new element to this endeavour, with detailed analysis of a major particle event during the arrival of a particular cloud,” Dr Richard Harrison, head of space physics and chief scientist at the Rutherford Appleton Laboratory in Oxfordshire, UK, told BBC News.

A major event could occur any time with potentially significant impacts on human infrastructure. As such, there are ongoing efforts to improve the prediction of this so-called space weather.

“They can short circuit power supplies such as high voltage transformers which provide power to our cities, disrupt communication satellites and therefore will affect, for example, internet, mobile phones and just about anything that uses electricity,” said Dr Harrison.

In addition, he said, a major solar storm could also threaten humans in space, with the potential for damage to or the loss of spacecraft – although such events are expected to be rare.

Scientists at CRL hope that the vast amount of data now available would enable them to better predict such events and take preventative measures. But the real challenge is to devise appropriate electronic hardware that can issue a reliable alert, Dr Gupta said.

The findings have been published in the journal Physical Review Letters.

Read more at www.bbc.co.uk

Related

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Hole found in Earth’s magnetic field – humanity at risk of cosmic radiation

A HUGE hole has been detected in the Earth’s magnetic shield, leaving millions of human beings vulnerable to deadly cosmic radiation, scientists have warned.

Analyzing data from the GRAPES-3 muon telescope in Ooty, India, experts have concluded that the magnetosphere has come under such heavy bombardment in recent years that it weakening.
On June 22, 2015, there was a massive burst of galactic cosmic rays which traumatized the Earth’s magnetic shield for two hours.

Roughly 40 hours before the Earth was bombarded by cosmic rays, the sun ejected a giant cloud of plasma. This caused high energy radiation to strike the Earth’s magnetosphere at 2.5 million kilometres per hour.

The storm wreaked havoc on technology, with radio signal blackouts reported in North and South America.

However, it is not until now that scientists have been able to understand the full extent of the damage caused by the storm.

Experts from the Tata Institute of Fundamental Research in India ran several simulations based on the data from the telescope. They found that the magnetosphere had been cracked, on the day. We had a hole in the earth shield!

Worryingly, the bombardment was so intense the magnetosphere was forced to shrink from 11 to four times the Earth’s radius.
While small amounts of radiation would have little effect on life on Earth, prolonged exposure to higher amounts of radiation can lead to cancer.

The team say in their research published in Physical Review Letters that the storm was so powerful that it managed to “reconfigure” the magnetic shield and opening small cracks in Earth’s first line of defense.

This has dangerous implications for the future, the team says.

They write: “The occurrence of this burst also implies a two-hour weakening of Earth’s protective magnetic shield during this event.

“This indicates a transient weakening of Earth’s magnetic shield, and may hold clues for a better understanding of future super-storms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”

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Credit http://www.express.co.uk/news/science/728799/Solar-storm-magnetic-s...

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The Earth's Magnetic Shield Cracked, Are We Doomed?

15/12/2016

Space

Dec 15, 2016 04:00 AM ET

Earth's magnetosphere protects us from harmful radiation in space, but scientists have just found a crack in it. Are we doomed?

BY TRACE DOMINGUEZ

We have good news and bad news, Earthlings: First the bad news: According to recently disclosed data from the GRAPES-3 muon telescope in India, the Sun spit out a ginormous mass coronal ejection in June of last year that essentially cracked the Earth's magnetic field. As a result, some cosmic radiation leaked through.

The good news is that the crack was temporary, the cosmic radiation was (mostly) absorbed by particles in the atmosphere, and everything should be fine down here in the troposphere. However, a similar solar storm could be trouble for astronauts in orbit - on the International Space Station, say. Intrepid explorers Trace Dominguez and Julian Huguet have the details in today's DNews report.

Read More:

ScienceAlert: Scientists have detected a crack in Earth's magnetic shield

Universe Today: Can Solar Flares Hurt Astronauts?

Space.com: What Are Cosmic Rays?
Earth’s magnetosphere protects us from harmful radiation in space, but scientists have just found a crack in it. Are we doomed?

How Radiation Changes Your DNA – https://youtu.be/PQjL4ZDuq2o

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Scientists have detected a crack in Earth’s magnetic shield
http://www.sciencealert.com/scientists-have-detected-a-crack-in-earth-s-magnetic-shield
“Scientists have been investigating one of the most powerful geomagnetic storms in recent history, and they’ve discovered that our protective barrier isn’t as secure as we thought it was. Turns out, our magnetosphere has been cracked.”

Can Solar Flares Hurt Astronauts?
http://www.universetoday.com/92897/can-solar-flares-hurt-astronauts/
“In a nutshell, cosmic rays are bad. Especially in large, long-term doses. Now the astronauts aboard the ISS are still well within Earth’s protective magnetic field and so are shielded from much of the cosmic radiation that passes through our solar system daily. And, strangely enough, when solar flares occur – such as today’s – the amount of cosmic radiation the ISS encounters actually decreases.”

What Are Cosmic Rays?
http://www.space.com/32644-cosmic-rays.html
“Cosmic rays are atom fragments that rain down on the Earth from outside of the solar system. They blaze at the speed of light and have been blamed for electronics problems in satellites and other machinery. First discovered in 1912, many things about cosmic rays remain a mystery more than a century later.”
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Special thanks to Julian Huguet for co-hosting DNews!
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Cosmic Rays Entering Earth: Dangerous Radiation Could Penetrate Cracked Magnetic Field

By Mandy Adams, Jan 03, 2017 09:52 AM EST

IN SPACE - OCTOBER 28: In this handout photo from the Solar & Heliospheric Observatory, a major solar eruption is shown in progress October 29, 2003. This X18 flare is the strongest flare since August 16, 1989 when an X20 flare occurred. A large coronal mass ejection has been hurled towards the Earth and could hit the Earth's magnetosphere by October 30. (Photo: Solar & Heliospheric Observatory/NASA via Getty Images)

Dangerous cosmic rays seen through India's monitors reveal that there is a crack in the magnetic field protecting
the earth from high energy radiation. The galactic rays ejected by the sun’s corona resulted to a colorful display of aurora borealis in high latitude countries.

The Cosmic Ray Laboratory at Tata Institute of Fundamental Research located in Ooty, Tamil Nadu. The GRAPES-3 muon telescope recorded a two-hour surge in the number of cosmic rays with energies amounting to 20 GeV.

**Cosmic Rays Entering Earth**

Cosmic rays come from a cloud of plasma from the sun’s corona. The rays which were traveling at the speed of 2.5 kilometers per hour resulted in a geomagnetic storm. The magnetosphere, a layer of the Earth’s atmosphere, protects the planet by diffusing cosmic rays. This first line of defense from the sun’s high-energy rays might have a major problem.

Physical Review, a journal covering the same phenomenon, detailed the result of the cosmic rays. This surge in energy hitting the earth's atmosphere could put lives in jeopardy if not addressed properly. According to the GRAPES-3 team, which included Dr. Pravata K. Mohanty, there was a temporary crack in the magnetic shield. This crack was the result of magnetic reconnection. As a result, cosmic rays entering Earth made is past the atmosphere.

**Catastrophic Solar Storms**

As noted in Tech2, solar storms could cause major disruptions in satellite and global communications and in power grids. Although the aurorae borealis is a regular sight in countries near the magnetic poles, a major solar storm can cause a lot of damage.

A report by Macedonia Online noted that US President Barack Obama was also concerned of a major disruption. In October 2016, he issued an executive order calling for greater accuracy in space weather forecasts. The same ruling called for proper preparation in case a major geomagnetic disturbance threatens the electrical power grid.

The biggest solar storm recorded was the Carrington Event in 1859. It disrupted the communication between two continents. Predictive Science senior researcher Pete Riley projected a 12 percent chance that the same event will happen in 2020. Given the threats posed by cosmic rays entering Earth, proper preparation is definitely warranted.

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As If We Don't Have Enough To Worry About, Now There's A Crack In Earth's Magnetic Shield

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Submitted by: trimble • 3 months ago Science

This is probably all for the better -- let's get this over with.

An excerpt from Space Daily:

The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometers per hour struck our planet, causing a severe compression of Earth's magnetosphere from 11 to 4 times the radius of Earth.

It triggered a severe geomagnetic storm that generated aurora borealis, and radio signal blackouts in many high latitude countries.

Earth's magnetosphere extends over a radius of a million kilometers, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations.

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The Trending 10

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Indian Scientists Detect Crack In Earth's Magnetic Shield

The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth's magnetosphere and triggering a severe geomagnetic storm.

The GRAPES-3 muon telescope located at Tata Institute of Fundamental Research's Cosmic Ray Laboratory in Ooty in Tamil Nadu recorded a burst of galactic cosmic rays of about 20 GeV last year lasting for two hours.

The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometres per hour struck our planet, causing a severe compression of Earth's magnetosphere from 11 to 4 times the radius of Earth.

It triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries, according to the study published in the journal Physical Review Letters this week.

Earth's magnetosphere extends over a radius of a million kilometres, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations.

Scientists Detect a Crack in Earth’s Magnetic Field After a Severe Solar Storm

Earth’s magnetic shield creates a barrier between that which makes our world a habitable place, and those elements which would destroy our planet. Unfortunately, due to a powerful geomagnetic storm, this barrier now contains a crack.

Since a massive burst of galactic cosmic rays occurred on June 22, 2015, researchers have been studying the data from the GRAPES-3 muon telescope in Ooty, Italy. According to the telescope, the Earth’s magnetosphere was attacked by particles which emit a massive amount of high-energy radiation and travel through space at about the same velocity as the speed of light.

Around 40 hours before the event took place, the Sun’s corona ejected a gigantic cloud of plasma, which made its way to the Earth’s magnetosphere at speeds of around 2.5 million kilometers per hour.

In a detailed analysis led by the Tata Institute of Fundamental Research (TIFR), it was discovered that the plasma particles found their way through a strange and temporary gap in the magnetic field of planet Earth.

Due to the plasma’s entry into the field, it caused the size of the field itself to shrink from being 11 times the radius of Earth to a mere four times. The result was a geomagnetic storm that boosted the illumination of the Northern Lights, but also devastated various radio networks for quite a bit of time.

The National Oceanic and Atmospheric Administration rated the storm as a G4, or as a severe storm. Many researchers believe that his storm was the likely culprit of the crack. Thankfully, the crack was only temporary, however, this incident went to show scientists worldwide that the magnetic field can indeed become cracked. Unfortunately, there isn’t much that can be done to prevent that from happening again either. What can be said for the occurrence is that scientists and researchers will become better prepared for such an event if it were to happen again in the near future.
Scientists have revealed that the Earth's magnetic shield is getting weaker. (YouTube)

The world's largest and most sensitive cosmic ray monitor has identified a burst of galactic cosmic rays indicating a potential crack in the Earth's magnetic shield, a new study revealed.

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According to scientists, the cosmic-ray detector located in India revealed weakness in the Earth's magnetic shield after a giant cloud of plasma ejected from the sun's corona hit Earth at a speed of about 2.5 million kilometers per hour.

It caused heavy compression of the Earth's magnetosphere, from 11 to four times the radius of Earth, allowing dangerous lower energy galactic cosmic ray particles to enter our atmosphere and triggering a severe geomagnetic storm on 22 June 2015.

It was one of the largest geomagnetic storms in recent past, creating an intense aurora borealis and radio signal blackouts among the most northern latitude countries, according to the research study published in the journal Physical Review Letters this week.

The burst of galactic cosmic rays of about 20 GeV, which lasted for about two hours, was detected by GRAPES-3 muon telescope situated in southern India at Tata Institute of Fundamental Research's Cosmic Ray Laboratory in Ooty in Tamil Nadu. The GRAPES-3 is a collective effort among scientific institutes from Japan and India.

Mathematical simulations conducted by the GRAPES-3 researchers, including Pravata K Mohanty, showed that the Earth's magnetic protection fractured briefly due to the occurrence of magnetic reconnection.

It might not be something we take too seriously. However, we should be thankful of the Earth's magnetosphere
which stretches over a radius of a million kilometers. It acts as the primary line of defense, shielding us from the constant flow of solar and galactic cosmic rays, harmful high-intensity energetic radiation, charged particles, and meteorites thus protecting life on our planet.

The crack indicates that Earth's magnetic shield is weakening. If this continues, it could cause widespread havoc on Earth including thwarting power systems and leaving plant and animal life vulnerable to ultraviolet radiation.

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Earth's Magnetic Shield Vital for Humanity Cracks, Indian Researchers Discover

November 6, 2016
NewsDesk2
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**November 6, 2016:** According to scientists, the world’s largest and one of the most sensitive cosmic ray monitors, located in India recorded a burst of galactic cosmic rays which indicates a crack in the magnetic shield of the earth.

According to PTI report, "The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth’s magnetosphere and triggering a severe geomagnetic storm."

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A burst of galactic cosmic rays was recorded last year, of about 20 GeV that lasted for two hours. It was recorded by the GRAPES-3 muon telescope located at Tata Institute of Fundamental Research’s Cosmic Ray Laboratory in Tamil Nadu.

When a huge cloud of plasma moving with a speed of 2.5 million kilometres per hour ejected from the solar corona and struck our planet, the burst took place, causing a severe compression of Earth’s magnetosphere.

"It triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries, according to the study published in the journal Physical Review Letters this week."

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The magnetosphere of the Earth extends over a radius of a million kilometres, which acts as a shield—the first line of defence, protecting us from the continuous flow of solar and galactic cosmic rays and guarding our planet from all these energetic radiations of high intensity.

Numerical simulations performed by the GRAPES-3 researchers, including Pravata K Mohanty indicates, "The Earth’s magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere."

"Earth’s magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015."

*Indian researchers discover a crack in the magnetic shield of the earth*

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Through extensive simulation, the data was interpreted and analysed at the Cosmic Ray Laboratory in Ooty.

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Indian scientists detect crack in Earth’s magnetic shield

Washington/Pune: The world's largest and most sensitive cosmic ray monitor, located in India, has recorded a burst of galactic cosmic rays that indicates a crack in the Earth's magnetic shield, according to scientists.

The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth’s magnetosphere and triggering a severe geomagnetic storm.

The GRAPES-3 muon telescope located at Tata Institute of Fundamental Research’s Cosmic Ray Laboratory in Ooty in Tamil Nadu recorded a burst of galactic cosmic rays of about 20 GeV last year lasting for two hours.

The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometres per hour struck our planet, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth.

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Earth’s magnetosphere extends over a radius of a million kilometres, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations.

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Earth’s magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.

Earth’s magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015.

The data was analysed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray Laboratory in Ooty.

Solar storms can cause major disruption to human civilisation by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

PTI
With humble materials you can do some pretty amazing science.
I'm surprised that given the stingy budgets of many American labs that this isn't more typical.

It's difficult to imagine an article like this about the US. "MIT researchers study solar storms using cheap recycled materials." It doesn't sound right.

It's a bit illogical though. All of us owe our current prosperity and standard of living due to people in the past finding cheaper ways to do things.

We owe our current prosperity to companies aggressively cutting costs to make more profit.

Labs generally don't care about unit economics. They're more concerned with cutting edge proof of concept

Bro, I don't care what this article is trying to sell you. Science is never cheap. It is awesome that these scientist figure out some creative way to cut cost. If everyone is starting to do this on the large scale, the human civilization will stop developing.
> Science is never cheap.

History disagrees. Some of the most fundamental discoveries were made using little more than junk laying around the scientist's laboratory.

You don't need a billion dollar budget to do important work. If you think you do, human civilization will stop developing because it's too busy applying for grants.

reply

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> Science is never cheap

I mean we got penicillin from moldy bread. "Never" is a strong word.

EDIT: It was from a moldy petri dish. The basic point still stands.

reply

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macgyver

"he MacGyvered a makeshift jack with a log" Origin 1990s: from Angus MacGyver, the lead character in the television series MacGyver (1985–1992), who often made or repaired objects in an improvised way.

reply

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Recycled pipes to detect cosmic solar storms?

BBC News Wed, 2017-03-01 09:35

Engineering level: India

Activity from BBC News
Powerful geomagnetic storm cracks Earth’s magnetosphere

Earth’s magnetosphere was briefly cracked after a powerful geomagnetic storm propagated from the sun last year.

The blast was registered in June 2015 after a huge cloud of plasma released from the Sun struck the Earth at a speed of some 2.5 million kph.

Our protection from external radiation shortly disappeared in 2015, based on the analysis of data from India’s GRAPES-3 muon telescope, the world’s most sensitive cosmic-ray monitoring system.

The impact of the solar storm caused the Earth’s magnetic shield to compress, leading to massive geomagnetic atmospheric anomalies.

The powerful blast of solar energy lasted for over two hours. Storm effects included aurora borealis and radio signal interruptions across several continents.

The new data indicate a transient weakening of Earth’s magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.

Here a video about this imprecident storm:
The magnetosphere, the Earth’s energetic protecting shield, prevents the highly-dangerous radiation of the Sun from destroying life on the planet. However, powerful geomagnetic storms can deform the magnetosphere, allowing energetic particles to reach the surface.

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Holes in Earth’s Magnetic Field

Written by Bob Meyers

A hole has been detected in the Earth’s magnetic shield. Data from the GRAPES-3 muon telescope in Ooty, India shows the magnetosphere has come under such heavy bombardment in recent years that it weakening. Researchers in India made the discovery when analyzing a galactic cosmic ray burst that caused radio blackouts across North and South America and a supercharged aurora borealis in 2015. The magnetic field that protects Earth from deadly cosmic radiation may be more vulnerable than previously thought. A crack in the shield caused by a solar flare which exposed the planet to a bombardment of radiation has been detected.

The cosmic ray source was a giant solar plasma cloud that travelled 40 hours from our sun to reach Earth, where the researchers believe it caused a transient “weakening of Earth’s magnetic shield”, according to their findings published in the journal Physical Review Letters.

Unfortunately not a lot can be done to protect Earth from any future cracks in the shield, which could leave the planet under constant exposure to radiation and could potentially lead to the eradication of our atmosphere.
Cosmic-ray detector finds possible crack in Earth's magnetic shield

The world's largest, most sensitive cosmic-ray detector has identified a potential crack in Earth's magnetic field.

The weakness was revealed by a burst of galactic cosmic rays, detected by GRAPES-3 during a severe geomagnetic storm in June 2015. The storm as triggered by a plasma cloud ejected from the sun's corona.

It was one of the largest geomagnetic storms in recent history, generating an intense aurora borealis and thwarting radio communication systems among the most northern latitudes. The storm was strong enough to compress Earth's magnetosphere for several hours.

The GRAPES-3 muon telescope is a massive array situated in southern India, a joint effort among scientific institutes in Japan and India. Data revealing the cosmic ray breach were analyzed by scientists at Tata Institute of Fundamental Research in Mumbai.

Researchers published their analysis of the potential magnetosphere crack this week in the journal Physical Review Letters.

Life itself has Earth's magnetosphere to thank. Its ability to block out the harmful rays and particles flying through space allowed life to flourish. But as the latest research suggests, it's not a fail-safe shield.

High-intensity storms can reveal stress fractures, so to speak. Researchers suggest the 2015 storm triggered a phenomenon called magnetic reconnection, whereby magnetic energy is simultaneously converted into kinetic energy, thermal energy and particle acceleration.

In this instance, the process was powerful enough to open a crack through which a burst of cosmic rays slipped through.

Scientists hope their continued work with GRAPES-3 will offer an improved understanding of the stresses put on the magnetosphere by intense storms, to better predict vulnerabilities in the future.
Could Earth’s Protective Shield Be Cracking?

The earth’s magnetic shield is responsible for protecting us against meteorites and charged particles and offering radiation shielding capabilities. It is also responsible for the stunning Northern Lights. But you don’t think about this everyday do you? After all, it’s one of those things that we simply take for granted. But as it turns out, a temporary crack has developed in the earth’s magnetic shield, which is allowing damaging cosmic ray particles to enter the earth’s atmosphere.

![Image](image-url)

What is Magnetic Reconnection?

We don’t see magnetic reconnection on earth. The plasma that makes up 99% of the universe contains magnetic fields which affect the way charged particles in its vicinity move. Usually, the magnetic fields inside these plasmas don’t merge with others or break pattern. However, there are times when the entire pattern changes to something new as these field lines get close to one another. Magnetic reconnection simply taps into the energy stored in the magnetic field and transforms it into kinetic and heat energy, sending particles all along the field lines. Sounds simple enough, but the amount of energy released can actually be devastating. It is this energy that could be responsible for causing UV radiation as well as widespread blackouts.

The Burst That Was

A GRAPES-3 muon telescope in India recorded a burst of cosmic rays that lasted for 2 hours. The fact that the burst happened in all 9 directions suggests that the origin was close to our planet. This also shows the weakening of the planet’s magnetic shield and could hold clues about future storms that have the potential to cripple technological infrastructure here and damage the shield’s radiation shielding capabilities. The burst took place when a cloud of plasma struck earth at a speed of 2.5 million kms/ hr. It caused a compression in the magnetosphere, reducing it from 11 times to 4 times the radius of the planet.
Solar Winds and their Role

The sun’s atmosphere is also made up of plasma, where negative and positively charged particles are separated at immense temperatures. These particles streams out from the corona, filling solar wind in the solar system. However, the sun’s control reduces as the plasma travels further away. Think of this as a squirt gun spraying water. The initial sprays are smooth, but it slowly begins to break into droplets and eventually into a mist.

A Flip in the Poles

Geomagnetic storms are becoming more and more disruptive due to our increasing dependence on technical systems that can be affected by electrical currents. The planet’s magnetic shield has already weakened by as much as 15% within the last 200 years, and this could mean that the poles are about to flip. Some experts believe that a flip is long overdue, but when this occurs, is anybody’s guess. And once that happens, the planet would get exposed to solar winds which could punch a hole in the ozone layer, destroying existing radiation shielding capabilities, knocking out power grids, devastating earth as we know it forever.
Crack in Earth’s magnetic shield

By admin

Earth is such a habitable place, thanks in no small part to the vast magnetic field that surrounds our planet, shielding us from harsh solar winds and cosmic radiation. But scientists have been investigating one of the most powerful geomagnetic storms in recent history, and they’ve discovered that our protective barrier isn’t as secure as we thought it was. Turns out, our magnetosphere has been cracked.

Researchers have been analysing data from the GRAPES-3 muon telescope in Ooty, India, which recorded a massive burst of galactic cosmic rays on 22 June 2015. For 2 hours, Earth’s magnetosphere was being bombarded by these particles, which emit immensely high-energy radiation, and travel through space at nearly the speed of light. These things are so powerful, they can easily penetrate the hull of a spacecraft, and Earth’s magnetic shield is our first line of defence against them.

About 40 hours before the June 22 event, a giant cloud of plasma was ejected from the Sun’s corona (or outer atmosphere), and eventually struck the magnetosphere at speeds of about 2.5 million kilometres per hour. That’s not exactly news, because at the time, it triggered a severe geomagnetic storm that was responsible for radio signal blackouts in many high latitude countries in North and South America. It also resulted in a supercharged aurora borealis – which is created when charged particles from outer space reach Earth’s atmosphere.

But now researchers have finally realised the full extent of that relentless bombardment of cosmic rays. A team from the Tata Institute of Fundamental Research in India performed numerous simulations based on the GRAPES-3 data from that day, and the results indicate that the magnetosphere had been temporarily cracked, and that’s why things went so haywire in our radio systems. In fact, the team says the bombardment was so relentless, it caused a severe compression of the magnetosphere, forcing it to shrink from 11 to 4 times the radius of Earth. The researchers suspect that the geomagnetic storm was powerful enough to actually ‘reconfigure’ our magnetic shield, prising open weak spots to let radiation and cosmic rays slip through.

“This vulnerability can occur when magnetised plasma from the Sun deform[s] Earth’s magnetic field, stretching its shape at the poles and diminishing its ability to deflect charged particles,” Katherine Wright explains on the American Physical Society website. The fact that this happened at all is a concern, say the researchers, because it suggests that our magnetic field is changing – or rather, weakening – in certain parts. The occurrence of this burst also implies a 2-hour weakening of Earth’s protective magnetic shield during this event,” the researchers report. This indicates a transient weakening of Earth’s magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”

So the good news is our magnetosphere was only temporarily cracked, but the bad news is that it can be
cracked at all. There’s not a whole lot we can do about that, but the researchers hope that by continuing to search for these cracks as they happen – and in past events – we’ll be better prepared to deal with the next time those cosmic rays burst through and wreak havoc.
The world's largest and most sensitive cosmic ray monitor is the GRAPES-3 muon telescope located at the Tata Institute of Fundamental Research's Cosmic Ray Laboratory in Ooty, Tamil Nadu. The monitor detected a burst of galactic cosmic rays that suggested a break in the earth's magnetic field. The crack triggered aurora borealis and radio signal blackouts in several high latitude countries.
Powerful Geomagnetic Storm: Earth's Magnetosphere has cracked!

Surrounded by a bubble in space tens of thousands thousands of miles wide called the magnetosphere Earth should be well protected. This magnetic force field serves as a shield protecting us from solar storms.

However, according to new observations and data from NASA's IMAGE spacecraft and the joint NASA/European Space Agency, cracks can develop in the magnetosphere and remain open for hours.

Researchers investigating one of the most powerful geomagnetic storms in recent history, have found that our magnetosphere has been cracked, and warn that this could leave the people of Earth vulnerable to cosmic radiation.

Analysing data from the GRAPES-3 muon telescope in Ooty, India, they performed numerous simulations based on the GRAPES-3 data from that day. In addition to the fact that the magnetosphere had been temporarily cracked, the team found that the bombardment had been so relentless, it caused a severe compression of the magnetosphere, forcing it to shrink from 11 to 4 times the radius of Earth.

Researchers suspect that the geomagnetic storm was powerful enough to actually 'reconfigure' our magnetic shield, opening up weak spots to let radiation and cosmic rays slip through.

The fact that this happened is a concern, because it suggests that our magnetic field is changing or rather, weakening in certain parts.
The Planet’s Magnetic Field Was Cracked Open By A Solar Storm

On August 31, 2012 a long filament of solar material that had been hovering in the sun's atmosphere, the corona, erupted out into space at 4:36 p.m. EDT. The coronal mass ejection, or CME, traveled at over 900 miles per second. The CME did not travel directly toward Earth, but did connect with Earth's magnetic environment, or magnetosphere, causing aurora to appear on the night of Monday, September 3. Picured here is a lighten blended version of the 304 and 171 angstrom wavelengths. Cropped Credit: NASA/GSFC/SDO NASA image use policy. NASA Goddard Space Flight Center enables NASA's mission through four scientific endeavors: Earth Science, Heliophysics, Solar System Exploration, and Astrophysics. Goddard plays a leading role in NASA's accomplishments by contributing compelling scientific knowledge to advance the Agency's mission.

The Earth’s magnetic field is important. Not only does it work in conjunction with solar wind to create beautiful aurorae, but it also keeps us all alive. Personally, I think the second reason is the most important, but then again, I’ve never seen the aurorae in person. The magnetic field actually prevents radiation from making it to the surface of our planet, which in turn, keeps us from dying. Needless to say, when something goes wrong with our magnetic field, it’s kind of a big deal.

This is why the new study in Physical Review Letters that revealed the recent “crack” in Earth’s magnetic field has come as quite a shock.

In June of 2015, the GRAPES-3 muon telescope located in India spotted an increase in flow of galactic cosmic rays, or GCRs, infiltrating our atmosphere. The telescope is designed to pick up on highly energetic interactions, like the ones the GCRs create. Although this specific type of radiation comes from a source outside of our Solar System, it still appeared to be fairly close, at least from somewhere in our stellar neighborhood.

After further analysis, researchers at the Tata Institute of Fundamental Research found that the rays got through an unusual, and thankfully temporary gap in our planet's magnetic field. The invasion of GCRs occurred around the same time as a coronal mass ejection, which moved about 1.6 million miles per hour.
This highly energetic ejection caused the entire magnetic field of the Earth to shrink from being 11 times the radius of the planet, to just four times larger. Not only did this trigger a geometric storm that added to the beauty of the famous Northern Lights, but it’s also responsible for bringing down radio networks for some time.

The geometric storm was ranked by the National Oceanic and Atmospheric Administration as a G4, which simply means severe. It’s incredibly likely that this severe storm was to blame for the crack in the magnetic field to appear.

These storms are powerful, and they don’t have be to ranked as severe in order to cause immense damage here on Earth. They have the potential to cost communication and electrical companies trillions of dollars’ worth of damage, as well as put the lives of astronauts aboard the International Space Station in danger.

It’s actually noted in the study that depending on the orbital variation of the cutoff rigidities, the astronauts aboard the space station at the time would have received a large dose of radiation during the burst.

Fortunately, enough for the planet, and for all of human life, the crack lasted only a few hours before the magnetic field was able to return to its original size. This could be a normal occurrence that the Earth has experienced several times during its orbit, but until now, something like this has never been recorded. However, it could happen again and most likely will.

What makes this phenomenon so scary is that it gives us some perspective in regards to how powerful our own star really is. There’s absolutely nothing we can do about random and violent bursts of energy that come from the sun.

All we can do is study in the hopes that we can be better prepared when the next one strikes.
Earth’s Magnetic Shield Almost Cracked by Massive Solar Storm

Arthur Dominic Villasanta | Nov 06, 2016 10:06 PM EST

GRAPES-3 detectors. (Photo : GRAPES-3 Experiment )

The Earth's magnetosphere or magnetic shield temporarily cracked and has weakened since being hit by a powerful solar storm on June 22, 2015. This penetration of the magnetic shield left us temporarily vulnerable and exposed to deadly cosmic radiation, said scientists in a new study.

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Scientists studying this fierce coronal mass ejection (CME) from the Sun came to this conclusion after carefully studying data from the GRAPES-3 Experiment's tracking muon telescope in the city of Ooty in India. GRAPES 3 is an acronym for "Gamma Ray Astronomy at PeV EnergyS 3rd establishment."

ADVERTISING

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The GRAPES-3 tracking muon telescope measures muon intensity at high cutoff rigidities (15 GV to 24 GV) along nine independent directions covering 2.3 sr. A muon is an unstable subatomic particle.

GRAPES-3 data also shows the magnetosphere came under such heavy CME bombardment in recent years that it weakening. But on June 22, 2015, a massive burst of galactic cosmic rays from a CME battered the magnetic shield for two hours.

Scientists discovered the weakening and cracking of the magnetosphere were caused by heavy bombardment of the Earth's magnetic field by high-energy cosmic rays after a massive CME.
The Sun unleashed a massive cloud of plasma associated with a surge of high-energy radiation that hit the magnetosphere at 2.5 million kilometers per hour. The impact also triggered a violent geomagnetic storm that generated a supercharged aurora borealis and widespread radio signal blackouts in North and South America.

The analysis, conducted by experts at the Tata Institute of Fundamental Research (TIFR), used data from GRAPES-3 to run multiple simulations of the impact of the cosmic ray bombardments on the magnetosphere.

The simulations revealed the radiation caused multiple small cracks in the magnetosphere that exposed the Earth to potentially harmful radiation. Scientists were also worried to discover the intense bombardment caused the magnetosphere to shrink from 11 times to four times the Earth's radius.

"The occurrence of this burst also implies a two-hour weakening of Earth's protective magnetic shield during this event," said the study. "It indicates a transient weakening of Earth's magnetic shield."

But the magnetosphere has since recovered from the damage and weakening after the bombardment subsided, scientists said.

Sufficiently powerful cosmic ray bombardments of the magnetosphere might "reconfigure" and disrupt the Earth's magnetic shield based on data analysis and simulations.

Scientists noted the results of their study have far-reaching implications because the Earth's magnetosphere is very vital to life on Earth since it shields the atmosphere from deadly cosmic rays.

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The Planet’s Magnetic Field Was Cracked Open By A Solar Storm

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This highly energetic ejection caused the entire magnetic field of the Earth to shrink from being 11 times the radius of the planet, to just four times larger. Not only did this trigger a geometric storm that added to the beauty of the famous Northern Lights, but it’s also responsible for bringing down radio networks for some time.

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What makes this phenomenon so scary is that it gives us some perspective in regards to how powerful our own star really is. There’s absolutely nothing we can do about random and violent bursts of energy that come from the sun.

All we can do is study in the hopes that we can be better prepared when the next one strikes.
Crack discovered in Earth's magnetic shield

November 3, 2016

The GRAPES-3 muon telescope recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015 lasting for two hours. The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometers per hour struck our planet, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth. It triggered a severe geomagnetic storm that generated aurora borealis, and radio signal blackouts in many high latitude countries.

Source: Crack discovered in Earth’s magnetic shield
Study: Solar flare caused a 'crack' in protective field around Earth

A news release by the Tata Institute of Fundamental Research in India reports that the two-hour event was spotted by the GRAPES-3 muon telescope on June 22, 2015.

The release goes on to state that "The burst occurred when a giant cloud of plasma ejected from the solar corona, and ... struck our planet, causing a severe compression of Earth's magnetosphere from 11 to 4 times the radius of Earth."

This area is considered to be a shield from strong radiation.

A geomagnetic storm is believed to have resulted from the activity, as The Wire reports, which "allowed an unusually high flux of cosmic ray particles to arrive on Earth."

According to the institute, consequent simulations indicated that "the Earth's magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere."

While such damage can't necessarily be avoided in the future, the team believes the research could help to enable "a better understanding of future superstorms."
A Solar Storm Put A Crack In Earth’s Magnetic Field

This is absolutely astounding...

By

thecoolestscience

Published on November 10, 2016

Earth’s magnetic field is partly responsible for a couple of things that all humans enjoy. Firstly, it conspires with the solar wind to create those beautiful, ephemeral aurorae. Secondly, by preventing so much damaging radiation making it to the surface, it stops us all dying – that, inarguably, is rather wonderful.

As a new study in Physical Review Letters has revealed, though, there was recently a “crack” in it.

Back in June 2015, the GRAPES-3 muon telescope based in India – one which is designed to pick up on highly energetic interactions – spotted an increase in the flow of galactic cosmic rays (GCRs) permeating through our atmosphere. This type of radiation originates from outside our Solar System, although in this case, its source appeared to be relatively close by in our stellar neighborhood.

A detailed analysis led by researchers at the Tata Institute of Fundamental Research (TIFR) found that the plasma cloud got through an unusual, temporary gap in Earth’s magnetic field.

This GCR invasion coincided with a coronal mass ejection moving at 2.5 million kilometers per hour (1.6 million miles per hour), one that was so energetic that it caused the entire planet’s magnetic field to shrink from being 11 times the radius of Earth to just four times that. As reported by Wired, this triggered a geomagnetic storm that both boosted the dramatic iridescence of the Northern Lights, but also brought down radio networks for some time.

This storm was ranked as a G4 on the National Oceanic and Atmospheric Administration (NOAA) scale, which means it was rated as “severe”. It is highly likely that this powerful storm caused the crack to appear.
A powerful coronal mass ejection seen emerging from the Sun on August 31, 2012. NASA

These storms have the potential to cause trillions of dollars of damage to communications networks and electrical grids, and even endanger the lives of astronauts onboard the International Space Station. In fact, the team note in their study that “depending on the orbital variation of the cutoff rigidities, the astronauts on the International Space Station would have received a high, and variable radiation dose during the burst.” This would have included NASA astronaut Scott Kelly, who spent 340 days in low-Earth orbit.

Fortunately, the crack lasted for just a few hours, and the magnetic field returned to its original size and strength shortly afterwards. There’s a good chance that this astrophysical injury would have occurred in Earth’s past, but this particular phenomenon just hasn’t been detected until now. Of course, it’s almost certain that it will happen again.

If anything, this study is a powerful reminder of how frighteningly energetic our local star actually is. There’s pretty much nothing we can do about its violent outbursts, but a better understanding of their behavior can allow us to prepare for future geomagnetic storms.
GRAPES-3 Indicates a Crack in Earth’s Magnetic Shield

The GRAPES-3 muon telescope located at Tata Institute of Fundamental Research’s (TIFR’s) Cosmic Ray Laboratory in Ooty recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015 lasting for two hours.

The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometers per hour struck our planet, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth. It triggered a severe geomagnetic storm that generated aurora borealis, and radio signal blackouts in many high latitude countries.

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor recorded a burst of galactic cosmic rays that indicated a crack in the Earth’s magnetic shield.

Credit: TIFR

Earth’s magnetosphere extends over a radius of a million kilometers, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations. Numerical simulations performed by the GRAPES-3 collaboration on this event indicate that the Earth’s magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.

Earth’s magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015. The data was analyzed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray Laboratory in Ooty.

This work has recently been published in Physical Review Letters.

Solar storms can cause major disruption to human civilization by crippling large electrical power grids, global
positioning systems (GPS), satellite operations and communications.

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor operating on Earth is playing a very significant role in the study of such events. This recent finding has generated widespread excitement in the international scientific community, as well as electronic and print media.

Contacts and sources:

Pravata K Mohanty

Tata Institute of Fundamental Research

Citation: Transient Weakening of Earth’s Magnetic Shield Probed by a Cosmic Ray Burst

Earth’s magnetic shield crack found

It’s pretty much common sense that Earth’s magnetic shield plays an important role in protecting the planet from bad things like solar winds and cosmic radiation, making it a habitable place, but while scientists were investigating one of the most powerful geomagnetic storms from the last times, have found out that our protective layer isn’t as safe as we previously thought.

While examining the data from the GRAPES-3 moun telescope in Ooty, India, in specific the galactic cosmic rays from 22 June 2015, they noticed that 40 hours before the event, a giant cloud of plasma was ejected from the Sun’s corona (Sun’s outer atmosphere), and struck the magnetosphere at speeds of about 2.5 million kilometers per hour, which we already knew about because of the massive radio signal blackouts in many high latitude countries. Just now, the researches have gotten a full picture of the consequences of that event, and have detected that the magnetosphere had been temporarily cracked, which lead to the problems in the radio systems.

Although this was only a temporary crack in the magnetosphere, it has proven that the magnetosphere can be cracked, which is bad, but at least now, will be more alert during this events.
India’s Telescope Detects Crack in the Earth’s Magnetic Shield

A crack has been detected in the Earth’s magnetic shield, which allowed deadly cosmic ray particles to seep through into the atmosphere.

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitoring system on Earth located at Tata Institute of Fundamental Research’s (TIFR) Cosmic Ray Laboratory in Ooty, India, had recorded (click on the title to see the full article).
Scientists have just detected a crack in Earth’s magnetic shield

czaal.com/scientists-have-just-detected-a-crack-in-earths-magnetic-shield/
czaal 11/4/2016

Experts have recently found that Earth’s magnetic shield cracked open due to a super-strong geomagnetic storm that managed to reconfigure our planet’s magnetic shield. Our planet's magnetosphere extends over a radius of a million kilometers, and acts as the ‘first line of defense’, protecting us from the continuous flow of solar and galactic cosmic rays.

The magnetosphere is a large area that encompasses our planet. Its presence alone protects the planet from charged particles of the solar wind and deflects them around Earth.

This enormous protective natural layer around our planet extends thousands of miles into space and its magnetism is so important and influential that it affects technology, life forms on the planet and weather patterns as well.

Scientists used the telescope and cosmic ray detector GRAPES-3 and published the analysis of a solar storm that occurred in June of 2015, leaving us without a magnetic shield for TWO hours.

The giant cloud of plasma -which originated in the Sun’s corona- ejected in June 2015 and eventually crashed into our planet magnetosphere at a speed of about 2.5 million kilometers per hour. The damage caused by the collision was of epic proportions.

As this occurred, it caused massive radio-signal blackouts in many high-latitude countries in North and south America. This supermassive storm also caused supercharged aurora borealis.

But over a year after the solar storm struck our magnetosphere, experts have been able to realize the extent of damage caused by the bombardment of solar rays.
According to experts from the Tata Institute of fundamental Research in India, after performing simulations based on data gathered by the GRAPES-3 satellite from that day, the magnetosphere of Earth cracked open, meaning that after all its not as secure as we thought it was.

Scientists concluded that **the geomagnetic storm was so great that it actually managed to RECONFIGURE our magnetic shield.**

“This vulnerability can occur when magnetized plasma from the Sun deforms Earth’s magnetic field, stretching its shape at the poles and diminishing its ability to deflect charged particles,” Katherine Wright explains on the American Physical Society website. The research has been published in *Physical Review Letters.*

This is something we need to worry about. Experts say that the fact that this occurred means that our magnetic field is changing and even weakening in certain parts.

“The occurrence of this burst also implies a 2-hour weakening of Earth's protective magnetic shield during this event,” the researchers report.

“[This] indicates a transient weakening of Earth’s magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”

In previous articles we reported about how our planet's magnetic field is collapsing and our planet's poles are flipping. This could result in catastrophic events on our planet.

Scientists warn that in the last two centuries the magnetic field has weakened, suggesting that it could be a tell-tale sign that Earth’s poles are about the flip. While experts believe a flip is overdue, they still cannot tell when it might occur. According to researchers, the Earth’s magnetic field is in constant movement and every 2-3 hundred thousand years or so the polarity of our planet flips.

The post **Scientists have just detected a crack in Earth’s magnetic shield** appeared first on **EWAO.**
India’s Telescope Detects Crack in the Earth’s Magnetic Shield

A crack has been detected in the Earth’s magnetic shield, which allowed deadly cosmic ray particles to seep through into the atmosphere.

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitoring system on Earth located at Tata Institute of Fundamental Research’s (TIFR) Cosmic Ray Laboratory in Ooty, India, had recorded (click on the title to see the full article).

We’ve seen leaked images before, but now you can get your first proper look at Dan Stevens in action as Disney’s titular Beast in the live-action Beauty and the Beast remake. (Click on the title to see the full article).
Is Earth's protective shield cracking?

- Simulations indicate the Earth's magnetic shield temporarily cracked
- This was caused by magnetic reconnection of our magnetic field lines
- This allowed lower energy galactic cosmic rays to enter our atmosphere
- It could also be a sign our magnetic shield is weakening, researchers said
- This would cause widespread havoc on Earth including black outs and exposure to harmful UV radiation

By Abigail Beall For Mailonline

Published: 08:36 EDT, 3 November 2016 | Updated: 09:01 EDT, 3 November 2016

It might not be something you think about every day, but you should be grateful for the Earth's magnetic field.

It protects you from harmful radiation, charged particles and meteorites and causes the spectacular Northern Lights.

But a new study has indicated there was a temporary 'crack' in the magnetic field, that allowed dangerous galactic cosmic ray particles into our atmosphere.

A new study has indicated there was a temporary 'crack' in the magnetic field, that allowed dangerous galactic cosmic ray particles into our atmosphere. This was caused by the process of magnetic reconnection, which is visualised above.

The crack indicates that Earth's magnetic shield is weakening.

**MAGNETIC RECONNECTION**

Magnetic reconnection occurs wherever charged gases, called plasma, are present.
It's rare on Earth, but plasma makes up 99 per cent of the visible universe, fueling stars and filling the near-vacuum of space.

This plasma contains magnetic fields that affects the way charged particles it encounters move.

Under normal conditions, the magnetic field lines inside plasmas don't break or merge with other field lines.

But sometimes, as field lines get close to each other, the entire pattern changes and everything realign into a new configuration.

As they come together, the field lines will cancel and re-form, each performing a sort of U-turn and curving to move off in a perpendicular direction.

Magnetic reconnection taps into the stored energy of the magnetic field, converting it into heat and kinetic energy that sends particles streaming out along the field lines.

The amount of energy released can be formidable.

If this continues, it could cause widespread havoc on Earth including power black outs and exposure to harmful UV radiation

The GRAPES-3 muon telescope, at TIFR's Cosmic Ray Laboratory in Ooty, in India, recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015, lasting for two hours.

'The simultaneous occurrence of the burst in all nine directions suggests its origin close to Earth,' the authors wrote in the study, published in Physical Review Letters.

'It also indicates a transient weakening of Earth's magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.'

Numerical simulations indicate the Earth's magnetic shield temporarily cracked due to the occurrence of magnetic reconnection.

Magnetic reconnection can occur anywhere there are powerful magnetic fields, such as in the sun's magnetic environment.

As field lines get close to each other, the entire pattern changes and everything realign into a new configuration.

This allowed the lower energy galactic cosmic ray particles to enter our atmosphere.

The burst occurred when a giant cloud of plasma ejected from the solar corona, struck our planet at a speed of about 1.55 million miles (2.5 million kilometres) per hour.

This caused a severe compression of Earth's magnetosphere - the region around the planet which holds the magnetic field - from 11 to 4 times the radius of Earth.

Earth's magnetosphere extends over a radius of a million kilometres, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays and protecting life on our planet from these high intensity energetic radiation.

The magnetic field bent these particles about 180 degree, where they were detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015.
The GRAPES-3 muon telescope, pictured, is the largest and most sensitive cosmic ray monitor. In June last year it recorded a burst of galactic cosmic rays that indicated a crack in the Earth's magnetic shield.

Solar flares (pictured) and coronal mass ejections explode in the sun's atmosphere, the corona, sending light and high energy particles out into space, along with a stream of charged particles known as the solar wind. Solar wind is a plasma.
Views of the solar wind from NASA's STEREO spacecraft (left) and after computer processing (right). Scientists used an algorithm to dim the appearance of bright stars and dust in images of the faint solar wind.

There is a solar storm facing Earth at the moment. The severe geomagnetic storm has generated stunning displays of Northern Lights, like this one pictured on Skye, in Scotland, and radio signal blackouts in many high latitude countries.

**HOW THE SOLAR WIND IS FORMED**

The sun and its atmosphere are made of plasma – a mix of positively and negatively charged particles which have separated at extremely high temperatures, that both carries and travels along magnetic field lines.

Material from the corona streams out into space, filling the solar system with the solar wind.

But scientists found that as the plasma travels further away from the sun, things change. The sun begins to lose magnetic control, forming the boundary that defines the outer corona – the very edge of the sun.

The breakup of the rays is similar to the way water shoots out from a squirt gun.

First, the water is a smooth and unified stream, but it eventually breaks up into droplets, then smaller drops and eventually a fine, misty spray.

The images in a Nasa study capture the plasma at the same stage where a stream of water gradually disintegrates into droplets.

If charged particles from solar winds hit Earth’s magnetic field, this can cause problems for satellite and communication equipment.

The data was analysed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray Laboratory in Ooty.

Solar storms can cause major disruption to human civilization by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.
There is a solar storm facing Earth at the moment.

The severe geomagnetic storm has generated stunning displays of Northern Lights, and radio signal blackouts in many high latitude countries.

Geomagnetic storms are more disruptive now than in the past because of our greater dependence on technical systems that can be affected by electric currents.

The Earth’s magnetic field, so important to life on the planet, has weakened by 15 per cent over the last 200 years and this, scientists claim, could be a sign that the Earth’s poles are about to flip.

Experts believe we are currently overdue a flip, but they are unsure when this could occur.

If a switch happens, we would be exposed to solar winds capable of punching holes into the ozone layer.

The impact could be devastating for mankind, knocking out power grids, radically changing Earth’s climate and driving up rates of cancer.

‘This is serious business’, Richard Holme, Professor of Earth, Ocean and Ecological Sciences at Liverpool University told MailOnline.

‘Imagine for a moment your electrical power supply was knocked out for a few months – very little works without electricity these days.’

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**HOW DOES A LIQUID IRON CORE CREATE A MAGNETIC FIELD?**

Our planet’s magnetic field is believed to be generated deep down in the Earth’s core.

Nobody has ever journeyed to the centre of the Earth, but by studying shockwaves from earthquakes, physicists have been able to work out its likely structure.

At the heart of the Earth is a solid inner core, two thirds of the size of the moon, made mainly of iron.

At 5,700°C, this iron is as hot as the Sun’s surface, but the crushing pressure caused by gravity prevents it from becoming liquid.

Surrounding this is the outer core there is a 1,242 mile (2,000 km) thick layer of iron, nickel, and small quantities of other metals. The metal here is fluid, because of the lower pressure than the inner core.

Differences in temperature, pressure and composition in the outer core cause convection currents in the molten metal as cool, dense matter sinks and warm matter rises.

The 'Coriolis' force, caused by the Earth’s spin, also causes swirling whirlpools.

This flow of liquid iron generates electric currents, which in turn create magnetic fields.

Charged metals passing through these fields go on to create electric currents of their own, and so the cycle continues. This self-sustaining loop is known as the geodynamo.

The spiralling caused by the Coriolis force means the separate magnetic fields are roughly aligned in the same direction, their combined effect adding up to produce one vast magnetic field engulfing the planet.
At the heart of the Earth is a solid inner core, two thirds of the size of the moon, made mainly of iron. At 5,700°C, this iron is as hot as the sun’s surface, but the crushing pressure caused by gravity prevents it from becoming liquid.
Earth’s magnetic field is partly responsible for a couple of things that all humans enjoy. Firstly, it conspires with the solar wind to create those beautiful, ephemeral aurorae. Secondly, by preventing so much damaging radiation making it to the surface, it stops us all dying – that, inarguably, is rather wonderful.

As a new study in Physical Review Letters has revealed, though, there was recently a “crack” in it.

Back in June 2015, the GRAPES-3 muon telescope based in India – one which is designed to pick up on highly energetic interactions – spotted an increase in the flow of galactic cosmic rays (GCRs) permeating through our atmosphere. This type of radiation originates from outside our Solar System, although in this case, its source appeared to be relatively close by in our stellar neighborhood.

A detailed analysis led by researchers at the Tata Institute of Fundamental Research (TIFR) found that the plasma cloud got through an unusual, temporary gap in Earth’s magnetic field.

This GCR invasion coincided with a coronal mass ejection moving at 2.5 million kilometers per hour (1.6 million miles per hour), one that was so energetic that it caused the entire planet’s magnetic field to shrink from being 11 times the radius of Earth to just four times that. As reported by Wired, this triggered a geomagnetic storm that both boosted the dramatic iridescence of the Northern Lights, but also brought down radio networks for some time.

This storm was ranked as a G4 on the National Oceanic and Atmospheric Administration (NOAA) scale, which means it was rated as “severe”. It is highly likely that this powerful storm caused the crack to appear.
A powerful coronal mass ejection seen emerging from the Sun on August 31, 2012. NASA

These storms have the potential to cause trillions of dollars of damage to communications networks and electrical grids, and even endanger the lives of astronauts onboard the International Space Station. In fact, the team note in their study that “depending on the orbital variation of the cutoff rigidities, the astronauts on the International Space Station would have received a high, and variable radiation dose during the burst.” This would have included NASA astronaut Scott Kelly, who spent 340 days in low-Earth orbit.

Fortunately, the crack lasted for just a few hours, and the magnetic field returned to its original size and strength shortly afterwards. There’s a good chance that this astrophysical injury would have occurred in Earth’s past, but this particular phenomenon just hasn’t been detected until now. Of course, it’s almost certain that it will happen again.

If anything, this study is a powerful reminder of how frighteningly energetic our local star actually is. There’s pretty much nothing we can do about its violent outbursts, but a better understanding of their behavior can allow us to prepare for future geomagnetic storms.

文章轉載來源
Researchers Have Found Evidence of Cracking in the Magnetosphere

In Brief

- A team at the GRAPES-3 muon telescope in India has determined an unusually powerful burst from the Sun's corona in 2015 caused cracking in Earth's magnetosphere, allowing more radiation than normal to seep into Earth.
- The research underscores the need for spacecraft and aircraft makers to design better systems to accommodate rare occurrences like this.

Breaching Defenses

One of the main things space organizations consider in making spacecraft is resilience against the harshness of space weather. Solar winds and interstellar radiation bombard satellites and probes with large amounts of biologically toxic radiation and plasma.

Luckily, Earth's magnetic shield does a good job of protecting us from these dangers. But we may not be as insulated from harmful interstellar radiation as we previously thought.

Researchers from India and Japan have concluded an unusually large solar storm cracked the magnetosphere, allowing space radiation to pass through, according to a new paper published in Physical Review Letters.

Back in June 2015, a burst of galactic cosmic rays born from a giant cloud of plasma on the Sun's corona struck Earth's magnetic field at 2.5 million kph pounded for two hours. This produced radio signal blackouts at high altitude areas and created an unusually pronounced aurora borealis.

The GRAPES-3 muon telescope, located in the Tata Institute in India, has determined those cosmic rays actually cracked the magnetosphere, warping its size and allowing additional radiation to pass through.

The bombardment was able to compress the magnetosphere, from 11 to 4 times the radius of Earth. The telescope also detected that these cracks allowed lower energy galactic cosmic ray particles to enter our atmosphere.

Freaky Weather

Solar storms and space weather are a major concern for space flight, having a myriad of dangerous effects. Any spacecraft has to be built to withstand these bursts of cosmic particles, so astronauts only reach permissible radiation levels when these storms occur.
Here on Earth, space weather has a large effect on modern electronics. They can disrupt power grids and hamper GPS navigation and high-frequency radio communications. In fact, during certain space weather events, airplanes traveling through the poles need to use different routes to avoid communications problems.

That’s why these kinds of findings on the magnetosphere are important in designing better devices and aircraft that can handle these space weather events. Just like any other adverse weather occurrence, preparedness is key when it comes to interstellar radiation.
Cosmic-ray detector finds possible crack in Earth’s magnetic shield

Geomagnetic storms can trigger incredible light shows. Here, charged particles can be seen exciting the gas in the upper atmosphere of the northern hemisphere. Photo by NASA/UPI

MUMBAI, Nov. 3 (UPI) — The world’s largest, most sensitive cosmic-ray detector has identified a potential crack in Earth’s magnetic field.

The weakness was revealed by a burst of galactic cosmic rays, detected by GRAPES-3 during a severe geomagnetic storm in June 2015. The storm was triggered by a plasma cloud ejected from the sun’s corona.

It was one of the largest geomagnetic storms in recent history, generating an intense aurora borealis and thwarting radio communication systems among the most northern latitudes. The storm was strong enough to compress Earth’s magnetosphere for several hours.

The GRAPES-3 muon telescope is a massive array situated in southern India, a joint effort among scientific institutes in Japan and India. Data revealing the cosmic ray breach were analyzed by scientists at Tata Institute of Fundamental Research in Mumbai.

Researchers published their analysis of the potential magnetosphere crack this week in the journal Physical Review Letters.

Life itself has Earth’s magnetosphere to thank. Its ability to block out the harmful rays and particles flying through space allowed life to flourish. But as the latest research suggests, it’s not a fail-safe shield. High-intensity storms can reveal stress fractures, so to speak. Researchers suggest the 2015 storm triggered a phenomenon called magnetic reconnection, whereby magnetic energy is simultaneously converted into kinetic energy, thermal energy and particle acceleration.
In this instance, the process was powerful enough to open a crack through which a burst of cosmic rays slipped through.

Scientists hope their continued work with GRAPES-3 will offer an improved understanding of the stresses put on the magnetosphere by intense storms, to better predict vulnerabilities in the future.
The magnetic field that protects Earth from deadly cosmic radiation may be more vulnerable than previously thought.

**A crack in the shield caused by a solar flare which exposed the planet to a bombardment of radiation has been detected.**

Researchers from the Tata Institute of Fundamental Research in India made the discovery when analyzing a galactic cosmic ray burst that caused radio blackouts across North and South America and a supercharged aurora borealis in 2015.

The cosmic ray source was a giant solar plasma cloud that traveled 40 hours from our sun to reach Earth, where the researchers believe it caused a transient “weakening of Earth’s magnetic shield”, according to their findings published in the journal Physical Review Letters. [RT]

Earth’s magnetosphere extends over a radius of a million kilometers, which acts as the first line of defense, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations.

Solar storms can cause major disruption to human civilization by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor operating on Earth is playing a very significant role in the study of such events. This recent finding has generated widespread excitement in the international scientific community, as well as electronic and print media. [INDIATIMES]
GRAPES-3 indicates a crack in Earth’s magnetic shield

The GRAPES-3 muon telescope located at TIFR’s Cosmic Ray Laboratory in Ooty recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015 lasting for two hours.

The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometers per hour struck our planet, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth. It triggered a severe geomagnetic storm that generated aurora borealis, and radio signal blackouts in many high latitude countries.

Earth’s magnetosphere extends over a radius of a million kilometers, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations. Numerical simulations performed by the GRAPES-3 collaboration on this event indicate that the Earth’s magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere. Earth’s magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015. The data was analyzed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray Laboratory in Ooty.

This work has recently been published in Physical Review Letters

Solar storms can cause major disruption to human civilization by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

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Links to articles


Earth’s Magnetic Shield Weakened, Develops a Crack, Indian telescope GRAPES-3 Detected

By Dipannita Nov 08, 2016 05:36 AM EST

In a startling finding, Indian telescope GRAPES-3 has detected a crack in the magnetic shield of Earth.

The detailed study and the findings have been published in the Physical Reviews Letters.

The said crack may prove harmful as it has allowed deadly cosmic ray particles to enter the atmosphere of the Earth. This rupture in the magnetic shield was detected by GRAPES-3, which is also the largest and the most sensitive cosmic ray monitoring system on Earth. It is located in Ooty, India, at the Tata Institute of Fundamental Research's (TIFR) Cosmic Ray Laboratory.
Scientists found that the telescope had recorded a two-hour burst of galactic cosmic rays of around 20 GeV on 22 June 2015. The reason for the burst was attributed to the ejection of a huge cloud of plasma from the Sun's corona, reports Nature World News. This cloudburst struck Earth at a super high speed of 2.5 million kilometers per hour, leading to a severe compression of Earth's magnetosphere.

The strong impact caused an intense geomagnetic storm, resulting in aurora and radio signal blackouts in many countries, situated at high latitude. After the burst, the GRAPES-3 collaboration that includes scientists from India and Japan did a detailed study and performed numerical simulations. The simulations revealed that the magnetic shield of Earth had weakened temporarily and it allowed the lower energy cosmic rays to enter the atmosphere of Earth.

The shield bent the particles about 180 degrees and from the day-side to the night-side of the Earth. Using the 1280-core computing farm, developed by the team at GRAPES-3, the scientists analyzed the data gathered by the telescope and concluded that the simultaneous occurrence of the burst in all nine directions indicates that its origin was close to Earth.

It also indicated a temporary weakening of the magnetosphere but it holds great potential. It could hold clues about predicting future superstorms that can lead to massive loss of lives and technological infrastructure on Earth.

It is worth mentioning here that the magnetosphere protects Earth from high-intensity radiations and the continuous flow of solar and galactic cosmic rays.

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Thru world's largest and most sensitive cosmic ray monitor, located in India, Scientists detect crack in Earth's magnetic shield

The GRAPES-3 muon telescope, located in Ooty, recorded a burst of galactic cosmic rays that indicated a crack in the Earth’s magnetic shield

The world’s largest and most sensitive cosmic ray monitor, located in India, has recorded a burst of galactic cosmic rays that indicates a crack in the Earth’s magnetic shield, according to scientists. The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth’s magnetosphere and triggering a severe geomagnetic storm.

The GRAPES-3 muon telescope located at the Tata Institute of Fundamental Research’s Cosmic Ray Laboratory in Ooty recorded a burst of galactic cosmic rays last year lasting for two hours.

The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million km per hour struck our planet, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth. It triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries, according to the study published in the journal Physical Review Letters this week.

Earth’s magnetosphere extends over a radius of a million kilometres, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations.

Numerical simulations performed by the GRAPES-3 researchers, including Pravata K Mohanty, indicate that the Earth’s magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.

Earth’s magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the telescope around midnight on June 22, 2015.PTI

The data was analysed and interpreted through extensive simulation over several weeks by using the 1280core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray Laboratory in Ooty.

Solar storms can cause major disruption to human civilisation by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

Indian scientists detect crack in Earth’s magnetic shield
India’s Telescope Detects Crack in the Earth’s Magnetic Shield
Crack Found In Earth’s Magnetic Shield

As we speak the Earth may be vulnerable to dangerous matter from outer space. It seems the Earth magnetic shield may have cracked. The shield is the Earth’s first line of defense against outer space radiation.

Don't Miss: Black Friday 2016 Deals on Sale Now

How did we come to this conclusion of colossal proportions? We can credit the GRAPES-3 experiment with this new proposition. The GRAPES-3 experiment is a study of different rays which affect the Earth.

The study consists of a Cosmic Ray Laboratory (CRL) in Ooty, India. The lab contains two components; an array of 400 plastic scintillator detectors along with a large area muon telescope.

The GRAPES-3 experiment is led by Professor Sunil K.Gupta, who oversees a team of 30 scientists from 7 different universities from all over India, and 5 members are even from Japan.

According to the GRAPES-3 team the muon telescope observed a burst of galactic cosmic rays on the 22nd of June in 2015. The rays which recorded for about 20 GeV lasted for two hours.

The rays were shot from a giant cloud of plasma ejected from the Sun. The cloud originated from within the solar corona and moved with a speed of about 2.5 million km/hours.

The cloud of rays was then recorded to have struck the Earth. The collision resulted in a severe compression of Earth’s magnetosphere. The magnetosphere was cracked to such an extent its size went from 11 to 4 times the radius of Earth.

Subsequently a severe geomagnetic storm around the earth’s shield was triggered which led to an aurora borealis, which can be credited for radio signal blackouts in high latitude countries.

Basically the Earth’s magnetic shield temporarily cracked and allowed lower energy galactic cosmic ray particles to enter.

This study has recently been published in Physical Review Letters.
GRAPES-3 Indicates a Crack in Earth’s Magnetic Shield

The GRAPES-3 muon telescope located at Tata Institute of Fundamental Research’s (TIFR's) Cosmic Ray Laboratory in Ooty recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015 lasting for two hours.

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The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor recorded a burst of galactic cosmic rays that indicated a crack in the Earth's magnetic shield

Credit: TIFR

Earth's magnetosphere extends over a radius of a million kilometers, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations. Numerical simulations performed by the GRAPES-3 collaboration on this event indicate that the Earth's magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.

Earth's magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015. The data was analyzed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray
Laboratory in Ooty.

This work has recently been published in Physical Review Letters

Solar storms can cause major disruption to human civilization by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor operating on Earth is playing a very significant role in the study of such events. This recent finding has generated widespread excitement in the international scientific community, as well as electronic and print media.

Contacts and sources:
Pravata K Mohanty
Tata Institute of Fundamental Research

Citation: Transient Weakening of Earth’s Magnetic Shield Probed by a Cosmic Ray Burst
Phys. Rev. Lett. 117, 171101 – Published 20 October 2016APS Physics highlight:

A recent powerful geomagnetic storm cracked and shrunk the Earth’s magnetic field, leaving human populations vulnerable and exposed to deadly cosmic radiations, scientists have revealed in a new study.

The recent transient cracking and weakening of the Earth’s magnetosphere were discovered in a new analysis of data from the GRAPES-3 muon telescope in Ooty, India.

According to research scientists, the weakening and cracking of the magnetosphere were caused by heavy bombardment of the Earth’s magnetic field by high-energy cosmic rays following a massive coronal mass ejection (CME) from the Sun.

The Sun released a massive cloud of plasma associated with a surge of high-energy radiation that hit the magnetosphere at 2.5 million kilometers per hour, causing a dramatic compression of the Earth’s magnetic shield from about 11 to four times the radius of Earth.

The impact triggered a violent geomagnetic storm that generated a supercharged aurora borealis and widespread radio signal blackouts in North and South America.
The Earth’s magnetic shield cracked temporarily, exposing the Earth’s atmosphere to deadly cosmic radiation.

The GRAPE-3 muon telescope at the Tata Institute of Fundamental Research (TIFR) in Ooty, India, recorded the burst of galactic cosmic rays of about 20 GeV associated with the coronal mass ejection (CME) from the Sun on June 22, 2015, according to Phys.org.

The storm was so powerful that it caused widespread radio signal blackouts in high latitude countries and North and South America. The Earth’s magnetosphere reeled under the force of the assault and multiple cracks appeared in the magnetic shield.

Scientists were able to obtain a precise estimation of the full extent of the weakening and damage to the magnetosphere caused by the heavy cosmic ray bombardment after a recent analysis of data collected using the GRAPE-3 muon telescope in Ooty, India.

The GRAPE-3 muon telescope is the largest and most sensitive cosmic ray monitor, according to Phys.org. Analysis of data obtained from the telescope showed that the burst of cosmic rays disrupted the Earth’s magnetic shield.

The analysis, conducted by experts at the Tata Institute of Fundamental Research (TIFR), involved using data collected from the telescope to run multiple simulations of the impact of the cosmic ray bombardments on the magnetosphere.
The simulations revealed that the radiation caused multiple small cracks in the magnetosphere that exposed the Earth to potentially harmful radiation. Scientists were also worried to discover that the intense bombardment caused the magnetosphere to shrink from 11 times to four times the Earth’s radius.

But the magnetosphere recovered from the damage and weakening after the bombardment subsided, the scientists said.

According to the researchers in a paper published in the Physical Review Letters, data analysis and simulations showed that sufficiently intense cosmic ray bombardment of the magnetosphere could “reconfigure” and disrupt the Earth’s magnetic shield.

The scientists noted that the results of their study have far-reaching implications because the Earth’s magnetosphere is very vital to life on Earth as it shields the atmosphere from deadly cosmic rays.

An artist’s depiction of the Earth’s magnetosphere deflecting solar wind and radiation [Image by Koya979/Shutterstock]

The study reveals that the Earth’s magnetosphere is more vulnerable than previously thought, the researchers said.

“The occurrence of this burst also implies a two-hour weakening of Earth’s protective magnetic shield during this event,” the study said. “It indicates a transient weakening of Earth’s magnetic shield.”

Powerful solar storms can cause widespread disruption of modern civilization by tripping electrical power grids, global positioning systems, and satellite communications.

Scientists fear that sustained intense bombardment of the magnetosphere could damage it permanently and expose Earth to powerful high-energy radiation that could strip Earth of its protective atmosphere and end life on Earth.

Although there is nothing that modern science and technology can do to help in the event of such catastrophe, scientists said the results of the new study and the knowledge obtained could “hold clues for a better
understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”

Astronauts on deep space missions outside the Earth’s protective magnetosphere — such as during a trip to Mars — are particularly vulnerable to the effect of high-energy cosmic radiation.

[Featured Image by Aaron Rutten/Shutterstock]
The Earth's magnetic field which protects our planet from cosmic radiation has been breached and scientists are investigating how severe the crack was. A massive galactic cosmic burst in India was recorded last June 22 in India by the GRAPES-3 muon telescope, the largest cosmic ray monitoring system.

The recorded crack in the Earth's magnetic field occurred for two hours with highly energized energy particles broke through the magnetosphere travelling close to the speed of light. These rays are very strong and can easily penetrate the hulls of space ships, posing a danger to spacemen.

Reviewing the events leading to this incident in India, scientists discovered that a cloud of oversized plasma exploded from the Sun's outer layer called the corona and sent cosmic rays to the Earth at the speed of 2.5 kilometers per hour. This is a normal occurrence and such radiation waves are usually prevented by the Earth's magnetic field from penetrating the atmosphere of the planet.

In the event in India, the cosmic radiation cause geometric storm that cause radio signal outage in polar countries in North and South America. The storm caused the formation of aurora borealis in the atmosphere, which may indicate a breach in the Earth's magnetic field.

Scientists made laboratory simulation of the conditions in the July 22 India incident and concluded that the Earth's magnetic field has been breached causing radio signals to behave erratically haywire in areas near the poles. The Earth's magnetosphere may have been temporarily reshaped by the powerful rays and that there are now cracks or weakened spots in the Earth's protective layer.

Scientists continue to be on the lookout for similar occurrences since the latest crack in the Earth's magnetic field means that magnetic rays can breach and reshape the protective layer that surrounds the Earth. Only research can provide the data that can provide a solution to the problem.
Did a Solar Storm Damage Earth's Magnetic Field?

In the Summer of 2015, a solar storm reportedly wreaked havoc on the Earth's magnetic field. During the freak event, which reportedly lasted just a couple of hours, the Earth's magnetosphere reportedly shrunk from 11 times the Earth's radius to just four.

The Earth's magnetic field is supposed to protect the planet from stellar radiation, including solar wind.

*Image Credit: NASA*

The solar storm was so strong that not only did it get passed Earth's natural defense against cosmic radiation, but it also impacted technology in certain regions of the world, particularly in the Northern hemisphere.

Although it put on a spectacular Northern Lights (Aurora Borealis) show, it may have also left a considerable dent in the Earth's magnetic field permanently.

Despite happening more than a year ago, a study has just popped up in *Physical Review Letters* that actually shows just how scary this kind of thing really is.

Powerful solar winds capable of breaking through the Earth's magnetic field could have dire consequences, as the magnetic field is the Earth's only real defense against them. They have the potential to knock out various kinds of technology because they act a lot like electromagnetic pulses (EMPs).
But aside from that, these solar winds carry harmful radiation that could harm life on Earth, or even the astronauts orbiting Earth.

Humans in particular are sensitive to the Sun’s radiation, but if more radiation is allowed through the magnetic field, which normally deflects most of the harmful particles away from us, then skin cancers of all kinds could easily become far more widespread in the affected areas.

The study referenced suggests that we must continue to be mindful of our magnetic field, because it allows our planet to be the beautiful planet it is today. Magnetic storms like this one could further damage the Earth’s magnetic field, eventually turning it into an ineffective means of protection against radiation from space.

If this happened, we have an idea of what could happen to our planet already. You can turn your attention to Mars, a planet that was once thought to have a thriving magnetic field, but seems to have a very weak one today. Mars, which once had flowing water and possibly even life, is now a barren wasteland of sand and rock.

It'll probably be a very long, long, longgggg time before Earth's magnetic field is ever ineffective, since it has lasted this long already, but space can be unpredictable. Fortunately, experts in the field have all kinds of observation equipment to keep track of this sort of thing.

Source: Wired
Cosmic rays leaking into earth’s atmosphere; High intensity event may cause unexpected damage

By Qudsia Ibrahim staff@latinoshealth.com

Nov 08, 2016 04:42 AM EST

The cosmic rays originated from the Sun's surface (Photo : Getty / NASA)

A crack has taken place in earth's magnetic shield. The news of this crack did not surface until India's GRAPES-3 muon telescope released data.

The telescope recorded increased level of cosmic rays in earth's atmosphere back in June, 2015. This indicated that earth's magnetic field may have been damaged or cracked.

According to reports published on "Wired", a cloud of speedy plasma entered the earth's atmosphere. The cloud was comprised of particles created from the surface of the sun that were moving in the space with a speed of 2.5 million kilometers per hour.

The fast-moving cloud of plasma damaged earth's magnetosphere. The solar winds entered our atmosphere and triggered severe magnetic storms that damaged radio signals and the northern part of the world witnessed clear northern lights.

The area of earth containing the planet's magnetic field shrank in its radius from 11 times to four times from the high-speed attack.

Solar winds contain ultraviolet radiation. The earth's magnetic field deflects the radiation. The decrease in the size of magnetic field or its damage can increase the penetration of ultraviolet radiation into the earth.

This radiation makes out skin tan and is also responsible of causing cancer. The crack in the earth's magnetic field was for a short while during which the galactic cosmic rays penetrated earth's atmosphere.

Though the leaked cosmic rays were little in amount yet they sparked huge geomagnetic storms. According to a
study reported by *Physical Review Letters* strong cosmic activity can weaken earth's magnetic shield.

Further study of the sudden event may disclose clues of upcoming mega-storms that would cripple the infrastructure of our modern technology.

Apart from crippling the technological infrastructure, the health risks are also looming. What we need to prepare for is the security of human advancement and life on the planet earth.
Is Earth's protective shield cracking? Bursts of deadly cosmic rays raises fears that our planet's magnetic field is disappearing

Simulations indicate the Earth's magnetic shield temporarily cracked. This was caused by magnetic reconnection of our magnetic field lines. This allowed lower energy galactic cosmic rays to enter our atmosphere. It could also be a sign our magnetic shield is weakening, researchers said. This would cause widespread havoc on Earth including blackouts and exposure to harmful UV radiation.

By Abigail Beall For Mailonline

Published: 08:36 EDT, 3 November 2016
| Updated: 08:40 EDT, 3 November 2016

It might not be something you think about every day, but you should be grateful for the Earth's magnetic field.

It protects you from harmful radiation, charged particles and meteorites and causes the spectacular Northern Lights.

But a new study has indicated there was a temporary 'crack' in the magnetic field, that allowed dangerous galactic cosmic ray particles into our atmosphere.

Scroll down for video

A new study has indicated there was a temporary 'crack' in the magnetic field, that allowed dangerous galactic cosmic ray particles into our atmosphere. This was caused by the process of magnetic reconnection, which is visualised above.

The crack indicates that Earth's magnetic shield is weakening.

**MAGNETIC RECONNECTION**

Magnetic reconnection occurs wherever charged gases, called plasma, are present.

It's rare on Earth, but plasma makes up 99 per cent of the visible universe, fueling stars and filling the near-vacuum of space.

This plasma contains magnetic fields that affects the way charged particles it encounters move.

Under normal conditions, the magnetic field lines inside plasmas don't break or merge with other field lines.

But sometimes, as field lines get close to each other, the entire pattern changes and everything realign into a new configuration.

As they come together, the field lines will cancel and re-form, each performing a sort of U-turn and curving to move off in a perpendicular direction.

Magnetic reconnection taps into the stored energy of the magnetic field, converting it into heat and kinetic energy that sends particles streaming out along the field lines.
The amount of energy released can be formidable.

If this continues, it could cause widespread havoc on Earth including power black outs and exposure to harmful UV radiation

The GRAPES-3 muon telescope, at TIFR's Cosmic Ray Laboratory in Ooty, in India, recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015, lasting for two hours.

'The simultaneous occurrence of the burst in all nine directions suggests its origin close to Earth,' the authors wrote in the study, published in Physical Review Letters.

'It also indicates a transient weakening of Earth's magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.'

Numerical simulations indicate the Earth's magnetic shield temporarily cracked due to the occurrence of magnetic reconnection.

Magnetic reconnection can occur anywhere there are powerful magnetic fields, such as in the sun's magnetic environment.

As field lines get close to each other, the entire pattern changes and everything realign into a new configuration.

This allowed the lower energy galactic cosmic ray particles to enter our atmosphere.

The burst occurred when a giant cloud of plasma ejected from the solar corona, struck our planet at a speed of about 1.55 million miles (2.5 million kilometres) per hour.

This caused a severe compression of Earth's magnetosphere - the region around the planet which holds the magnetic field - from 11 to 4 times the radius of Earth.

Earth's magnetosphere extends over a radius of a million kilometres, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays and protecting life on our planet from these high intensity energetic radiation.

The magnetic field bent these particles about 180 degree, where they were detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015.

The GRAPES-3 muon telescope, pictured, is the largest and most sensitive cosmic ray monitor. In June last year it recorded a burst of galactic cosmic rays that indicated a crack in the Earth's magnetic shield

Solar flares (pictured) and coronal mass ejections explode in the sun's atmosphere, the corona, sending light and high energy particles out into space, along with a stream of charged particles known as the solar wind. Solar wind is a plasma

Views of the solar wind from NASA's STEREO spacecraft (left) and after computer processing (right). Scientists used an algorithm to dim the appearance of bright stars and dust in images of the faint solar wind

There is a solar storm facing Earth at the moment, The severe geomagnetic storm has generated stunning displays of Northern Lights, like this one pictured on Skye, in Scotland, and radio signal blackouts in many high latitude countries

HOW THE SOLAR WIND IS FORMED

The sun and its atmosphere are made of plasma – a mix of positively and negatively charged particles which have separated at extremely high temperatures, that both carries and travels along magnetic field lines.

Material from the corona streams out into space, filling the solar system with the solar wind.
But scientists found that as the plasma travels further away from the sun, things change. The sun begins to lose magnetic control, forming the boundary that defines the outer corona – the very edge of the sun.

The breakup of the rays is similar to the way water shoots out from a squirt gun.

First, the water is a smooth and unified stream, but it eventually breaks up into droplets, then smaller drops and eventually a fine, misty spray.

The images in a Nasa study capture the plasma at the same stage where a stream of water gradually disintegrates into droplets.

If charged particles from solar winds hit Earth’s magnetic field, this can cause problems for satellite and communication equipment.

The data was analysed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray Laboratory in Ooty.

Solar storms can cause major disruption to human civilization by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

There is a solar storm facing Earth at the moment.

The severe geomagnetic storm has generated stunning displays of Northern Lights, and radio signal blackouts in many high latitude countries.

Geomagnetic storms are more disruptive now than in the past because of our greater dependence on technical systems that can be affected by electric currents.

The Earth's magnetic field, so important to life on the planet, has weakened by 15 per cent over the last 200 years and this, scientists claim, could be a sign that the Earth’s poles are about to flip.

Experts believe we are currently overdue a flip, but they are unsure when this could occur.

If a switch happens, we would be exposed to solar winds capable of punching holes into the ozone layer.

The impact could be devastating for mankind, knocking out power grids, radically changing Earth’s climate and driving up rates of cancer.

‘This is serious business’, Richard Holme, Professor of Earth, Ocean and Ecological Sciences at Liverpool University told MailOnline.

‘Imagine for a moment your electrical power supply was knocked out for a few months – very little works without electricity these days.’

**HOW DOES A LIQUID IRON CORE CREATE A MAGNETIC FIELD?**

Our planet’s magnetic field is believed to be generated deep down in the Earth’s core.

Nobody has ever journeyed to the centre of the Earth, but by studying shockwaves from earthquakes, physicists have been able to work out its likely structure.

At the heart of the Earth is a solid inner core, two thirds of the size of the moon, made mainly of iron.

At 5,700°C, this iron is as hot as the Sun's surface, but the crushing pressure caused by gravity prevents it from becoming liquid.

Surrounding this is the outer core there is a 1,242 mile (2,000 km) thick layer of iron, nickel, and small quantities of other metals. The metal here is fluid, because of the lower pressure than the inner core.
Differences in temperature, pressure and composition in the outer core cause convection currents in the molten metal as cool, dense matter sinks and warm matter rises.

The 'Coriolis' force, caused by the Earth’s spin, also causes swirling whirlpools.

This flow of liquid iron generates electric currents, which in turn create magnetic fields.

Charged metals passing through these fields go on to create electric currents of their own, and so the cycle continues. This self-sustaining loop is known as the geodynamo.

The spiralling caused by the Coriolis force means the separate magnetic fields are roughly aligned in the same direction, their combined effect adding up to produce one vast magnetic field engulfing the planet.

At the heart of the Earth is a solid inner core, two thirds of the size of the moon, made mainly of iron. At 5,700°C, this iron is as hot as the sun's surface, but the crushing pressure caused by gravity prevents it from becoming liquid.

Read more:
Earth’s Magnetic Shield Vital for Humanity Cracks, Indian Researchers Discover

According to scientists, the world's largest and one of the most sensitive cosmic ray monitors, located in India recorded a burst of galactic cosmic rays

By

NewsDesk2

November 6, 2016

83

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November 6, 2016: According to scientists, the world’s largest and one of the most sensitive cosmic ray monitors, located in India recorded a burst of galactic cosmic rays which indicates a crack in the magnetic shield of the earth.

According to PTI report, “The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth’s magnetosphere and triggering a severe geomagnetic storm.”

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A burst of galactic cosmic rays was recorded last year, of about 20 GeV that lasted for two hours. It was recorded by the GRAPES-3 muon telescope located at Tata Institute of Fundamental Research’s Cosmic Ray
Laboratory in Tamil Nadu.

When a huge cloud of plasma moving with a speed of 2.5 million kilometres per hour ejected from the solar corona and struck our planet, the burst took place, causing a severe compression of Earth’s magnetosphere.

“It triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries, according to the study published in the journal Physical Review Letters this week.”

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The magnetosphere of the Earth extends over a radius of a million kilometres, which acts as a shield—the first line of defence, protecting us from the continuous flow of solar and galactic cosmic rays and guarding our planet from all these energetic radiations of high intensity.

Numerical simulations performed by the GRAPES-3 researchers, including Pravata K Mohanty indicates, “The Earth’s magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.”

“Earth’s magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015.”

Through extensive simulation, the data was interpreted and analysed at the Cosmic Ray Laboratory in Ooty.

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Solar storms can disrupt human civilisation to a large extent by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

by NewsGram team with PTI inputs

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The GRAPES-3 muon telescope located at TIFR’s Cosmic Ray Laboratory in Ooty recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015 lasting for two hours.

The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometers per hour struck our planet, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth. It triggered a severe geomagnetic storm that generated aurora borealis, and radio signal blackouts in many high latitude countries.

Earth’s magnetosphere extends over a radius of a million kilometers, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations. Numerical simulations performed by the GRAPES-3 collaboration on this event indicate that the Earth’s magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere. Earth’s magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around mid-night on 22 June 2015. The data was analyzed and interpreted through extensive simulation over several weeks by using the 1280-core computing farm that was built in-house by the GRAPES-3 team of physicists and engineers at the Cosmic Ray Laboratory in Ooty.

This work has recently been published in Physical Review Letters.

Solar storms can cause major disruption to human civilization by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor operating on Earth is playing a very significant role in the study of such events. This recent finding has generated widespread excitement in the international scientific community, as well as electronic and print media.

Story Source:

Materials provided by Tata Institute of Fundamental Research. Note: Content may be edited for style and length.

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Crack In Earth's Magnetic Shield Greater Than Expected

Analysis of a cosmic event from Jun. 2015 revealed Earth's magnetic shield cracked, allowing cosmic rays to leak into the atmosphere and causing geomagnetic storms in the Northern Hemisphere.

The GRAPES-3 muon telescope in Ooty, India, detected a spike in cosmic ray levels in Jun. 2015, but the severity of the event wasn’t revealed until Nov. 2016 through a study published in the scientific journal Physical Review Letters.

The study reports for two hours on Jun. 22, 2015, particles from a giant cloud of fast-moving plasma penetrated the Earth’s atmosphere at approximately 1.6 million mph. The particles, originating from the surface of the sun, caused the Earth’s magnetosphere to shrink from 11 times to 4 times the earth’s radius -- allowing harmful solar winds to breach the Earth’s surface.

Earth’s magnetosphere acts as the first line of defense between the Earth and the flow of galactic cosmic rays, which shield life on the planet from harmful ultraviolet radiation. It has a radius of over 620,000 miles, according to Wired.

Numerical simulations of the event performed by the GRAPES-3 collaboration propose that the Earth’s magnetic shield cracked due to magnetic reconnection, allowing low-energy galactic cosmic ray particles to enter the atmosphere.

"This vulnerability can occur when magnetized plasma from the Sun deforms Earth’s magnetic field, stretching its shape at the poles and diminishing its ability to deflect charged particles," Katherine Wright explains on the American Physical Society's website.

The solar wind triggered a severe geomagnetic storm at the time of the event, generating vivid aurora borealis -- also known as "northern lights" -- and radio signal blackouts in many high-altitude countries.

The study reports the surge in cosmic activity indicates “transient weakening of Earth’s magnetic shield.”

The study authors remain optimistic for Earth geomagnetic future, saying the research may “hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth.”

Sources: Physical Review Letters, Wired, American Physical Society / Photo credit: NASA via Science Alert
Scientists detect crack in Earth’s magnetic field, here is why you should care

#Earth #Mars – Scientists detect crack in Earth’s magnetic field, here is why you should care: A breach in the protective magnetic shield of the earth has been observed by the largest and the most sensitive cosmic ray monitor in the world, the GRAPES -3 muon telescope located in Ooty. The telescope detected a burst of the galactic cosmic radiation, which indicated a crack in the planet’s magnetic shield. The break happened when a massive blast of a giant cloud of plasma which has been ejected by solar corona struck Earth at a very high speed.

This resulted in the compression of the magnetic field of Earth and caused a massive geomagnetic storm. The breach in the magnetic field was detected by Tata Institute of Fundamental Research Cosmic Ray Laboratory in Ooty and lasted for two hours. The giant plasma plume ejected by the sun’s corona raced at more than 2.5 million kilometres miles per hour and struck the planet precipitating a massive geomagnetic storm causing radio blackouts in countries situated in the high altitudes..

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Cosmic-Ray Detector Finds Possible Crack in Earth’s Magnetic Shield

The world's largest, most sensitive cosmic-ray detector has identified a potential crack in Earth's magnetic field.

The weakness was revealed by a burst of galactic cosmic rays, detected by GRAPES-3 during a severe geomagnetic storm in June 2015. The storm as triggered by a plasma cloud ejected from the sun's corona.

It was one of the largest geomagnetic storms in recent history, generating an intense aura borealis and thwarting radio communication systems among the most northern latitudes. The storm was strong enough to compress Earth's magnetosphere for several hours.

The GRAPES-3 muon telescope is a massive array situated in southern India, a joint effort among scientific institutes in Japan and India. Data revealing the cosmic ray breach were analyzed by scientists at Tata Institute of Fundamental Research in Mumbai.

Researchers published their analysis of the potential magnetosphere crack this week in the journal Physical Review Letters.

Life itself has Earth's magnetosphere to thank. Its ability to block out the harmful rays and particles flying through space allowed life to flourish. But as the latest research suggests, it's not a fail-safe shield.

High-intensity storms can reveal stress fractures, so to speak. Researchers suggest the 2015 storm triggered a phenomenon called magnetic reconnection, whereby magnetic energy is simultaneously converted into kinetic energy, thermal energy and particle acceleration.

In this instance, the process was powerful enough to open a crack through which a burst of cosmic rays slipped through.

Scientists hope their continued work with GRAPES-3 will offer an improved understanding of the stresses put on the magnetosphere by intense storms, to better predict vulnerabilities in the future.
Solar flare radiation burst ‘cracked’ Earth’s magnetic field, caused radio blackouts

The magnetic field that protects Earth from deadly cosmic radiation may be more vulnerable than previously thought. A crack in the shield caused by a solar flare which exposed the planet to a bombardment of radiation has been detected.

Researchers from the Tata Institute of Fundamental Research in India made the discovery when analyzing a galactic cosmic ray burst that caused radio blackouts across North and South America and a supercharged aurora borealis in 2015.

The cosmic ray source was a giant solar plasma cloud that travelled 40 hours from our sun to reach Earth, where the researchers believe it caused a transient "weakening of Earth’s magnetic shield", according to their findings published in the journal Physical Review Letters.

The magnetic field shrank dramatically as well as cracking. © NASA

The sun’s flare was so intense the team claim it would have shrunk the magnetic field from 11 times the radius of Earth to four times its radius before it eased, allowing the shield to recover.

Researchers used data from the GRAPES-3 muon telescope in Ooty, India, to simulate the burst. Results indicated the effect on Earth would have required a crack in the magnetic field that lasted approx. two hours.

Unfortunately not a lot can be done to protect Earth from any future cracks in the shield, which could leave the planet under constant exposure to radiation and could potentially lead to the eradication of our atmosphere.

The team were optimistic the knowledge gained would have positive results though, claiming it could “hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”

Astronauts onboard the International Space Station (ISS) fall within the field’s 56,000km extension around Earth but future voyagers to Mars would likely be exposed to the rays for long periods.
Crack Detected in Earth’s Magnetic Shield, Causing Supercharged Aurora Borealis, Radio Signal Blackouts In High Latitude Countries

The GRAPES-3 moun telescope located at the Cosmic Ray Laboratory (CRL) in Ooty, India recorded a massive burst of galactic cosmic rays about 20 GeV, on 22 June 2015 lasting for 2 hours. Report says the burst temporarily caused a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth, and it triggered a severe geomagnetic storm that supercharged aurora borealis, and radio signal blackouts in many high latitude countries in North and South America.

The source of the cosmic ray burst was a giant cloud of plasma ejected from the solar corona, which traveled at a speed of about 2.5 million kilometers per hour and eventually struck the planet’s magnetosphere. Magnetosphere is what makes the earth a habitable place, and if its magnetic field becomes ineffective, it would mark the end of the world. This vast region surrounding the planet extends over a radius of a million kilometers and it protects us from high intensity energetic radiations such as solar winds and galactic cosmic rays.

The data the team from the Tata Institute of Fundamental Research in India obtained by performing numerical simulations based on the GRAPES-3 data indicated that the Earth’s magnetic shield temporarily cracked due to the occurrence of magnetic reconnection.

Magnetic reconnection can occur in any place where ionized gas called plasma are present. The plasma contains magnetic field lines which under normal circumstances don’t break or merge with other field lines. However, the geomagnetic storm that was taken place was so powerful that it forced the fields lines to get

11/6/2016
close to each other, causing reconfiguration of our magnetic shield and eventually allowing the lower energy galactic cosmic ray particles to slip through our atmosphere. The magnetic field then bent these particles about 180 degree from the day-side to the night-side of the Earth where it was detected as a burst at the midnight of 22 June 2015.

REFERENCE:
Transient Weakening of Earth’s Magnetic Shield Probed by a Cosmic Ray Burst – Physical Review Letters

ABSTRACT:
The GRAPES-3 tracking muon telescope in Ooty, India measures muon intensity at high cutoff rigidities (15–24 GV) along nine independent directions covering 2.3 sr. The arrival of a coronal mass ejection on 22 June 2015 18:40 UT had triggered a severe G4-class geomagnetic storm (storm). Starting 19:00 UT, the GRAPES-3 muon telescope recorded a 2 h high-energy (~20 GeV) burst of galactic cosmic rays (GCRs) that was strongly correlated with a 40 nT surge in the interplanetary magnetic field (IMF). Simulations have shown that a large (17×) compression of the IMF to 680 nT, followed by reconnection with the geomagnetic field (GMF) leading to lower cutoff rigidities could generate this burst. Here, 680 nT represents a short-term change in GMF around Earth, averaged over 7 times its volume. The GCRs, due to lowering of cutoff rigidities, were deflected from Earth’s day side by ~210° in longitude, offering a natural explanation of its night-time detection by the GRAPES3. The simultaneous occurrence of the burst in all nine directions suggests its origin close to Earth. It also indicates a transient weakening of Earth’s magnetic shield, and may hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.
Cosmic Burst Cracked Earth's Magnetic Field Wide Open

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Our magnetic field may not be all it's cracked up to be.

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Lola Gayle, STEAM Register

On June 22, 2015, a burst of galactic cosmic rays was recorded by the GRAPES-3 muon telescope located at TIFR's Cosmic Ray Laboratory in Ooty.

That burst of rays occurred when the sun let loose a giant cloud of plasma that struck our planet at a speed of roughly 2.5 million kilometers per hour, causing a severe compression of Earth's magnetosphere from 11 to 4 times the radius of Earth.

As you can imagine, the cosmic bombardment triggered a severe geomagnetic storm that generated aurora borealis and radio signal blackouts in many high latitude countries.

Thankfully, we are protected by the Earth's magnetic field. This shield extends over a radius of a million kilometers and is our first line of defense against the continuous flow of solar and galactic cosmic radiation.

Note: Earth's magnetic field, also known as the geomagnetic field, is the magnetic field that extends from the Earth's interior out into space, where it meets the solar wind, a stream of charged particles emanating from the Sun.
See Also: Our Sun Could One Day Unleash A Deadly Superflare

If something should go wrong, we're really in for it. And during this particular two-hour 20 GeV blast, it almost did.

According to a statement from the Tata Institute of Fundamental Research, "Numerical simulations performed by the GRAPES-3 collaboration on this event indicate that the Earth's magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere. Earth's magnetic field bent these particles about 180 degree, from the day-side to the night-side of the Earth where it was detected as a burst by the GRAPES-3 muon telescope around midnight on June 22, 2015."
Phew! A near miss this time. But thankfully the GRAPES-3 muon team is keeping an eye to the sky.

Results of this work are published in the journal *Physical Review Letters*.

See Also: The Changing Shape of the Van Allen Belts

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A recent cosmic burst cracked the Earth’s magnetic field wide open

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Crack in Earth's magnetic shield detected

Solar storms have weakened the magnetosphere

The Earth's magnetic field which protects our planet from cosmic radiation has been breached and scientists are investigating how severe the crack was.

A team of Indian scientists in the southern Indian state of Tamil Nadu recorded an explosion of galactic cosmic rays indicating a crack in the Earth's magnetic shield. However, a newly discovered crack by a telescope in India, have scientists anxious about its implications. This shield is what allowed life to flourish on Earth for millions of years.

At the time, India's GRAPES-3 muon telescope, the world's most sensitive cosmic-ray monitoring system, recorded a powerful blast of solar energy that lasted for more than two hours. It is created to study cosmic rays with an array of air shower detectors and a large area muon detector; and it is the largest and most sensitive cosmic ray monitor operating on Earth.

Scientists hope their continued work with GRAPES-3 will offer an improved understanding of the stresses put on the magnetosphere by intense storms, to better predict vulnerabilities in the future.

The Sun released a massive cloud of plasma associated with a surge of high-energy radiation that hit the magnetosphere at 2.5 million kilometers per hour, causing a dramatic compression of the Earth's magnetic shield from about 11 to four times the radius of Earth. The impact triggered a strong geomagnetic storm that resulted in aurora borealis and radio signal blackouts in many high-latitude countries.
But now researchers have finally realised the full extent of that relentless bombardment of cosmic rays. 

According to the researchers, the Earth's magnetic field bent the particles about 180 degrees, from the day-side to the night-side of the Earth, where it was detected as a burst by the GRAPES-3 muon telescope.

An in-house team of physicists and engineers at the laboratory in Ooty analysed and interpreted the data through extensive simulation over several weeks.

This research can help us understand how future superstorms of cosmic rays could affect the planet and our technological infrastructure, and even endanger the wellbeing of astronauts living on the International Space Station.

What do you think about the Earth's magnetic shield being temporarily weakened?
Solar flare radiation burst ‘cracked’ Earth’s magnetic field, caused radio blackouts

TomAbigal

The magnetic field that protects Earth from deadly cosmic radiation may be more vulnerable than previously thought. A crack in the shield caused by a solar flare which exposed the planet to a bombardment of radiation has been detected.

Researchers from the Tata Institute of Fundamental Research in India made the discovery when analyzing a galactic cosmic ray burst that caused radio blackouts across North and South America and a supercharged aurora borealis in 2015.

The cosmic ray source was a giant solar plasma cloud that travelled 40 hours from our sun to reach Earth, where the researchers believe it caused a transient "weakening of Earth’s magnetic shield”, according to their findings published in the journal Physical Review Letters.

The sun’s flare was so intense the team claim it would have shrunk the magnetic field from 11 times the radius of Earth to four times its radius before it eased, allowing the shield to recover.

Researchers used data from the GRAPES-3 muon telescope in Ooty, India, to simulate the burst. Results indicated the effect on Earth would have required a crack in the magnetic field that lasted approximately two hours.

Unfortunately not a lot can be done to protect Earth from any future cracks in the shield, which could leave the planet under constant exposure to radiation and could potentially lead to the eradication of our atmosphere.

The team were optimistic the knowledge gained would have positive results though, claiming it could “hold clues for a better understanding of future superstorms that could cripple modern technological infrastructure on Earth, and endanger the lives of the astronauts in space.”

Astronauts onboard the International Space Station (ISS) fall within the field’s 56,000km extension around Earth but future voyagers to Mars would likely be exposed to the rays for long periods.
GRAPES-3 Indicates a Crack in Earth's Magnetic Shield

Posted 11 days ago
by Tata Institute of Fundamental Research

The GRAPES-3 muon telescope located at TIFR's Cosmic Ray Laboratory in Ooty recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015 lasting for two hours.

The burst occurred when a giant cloud of plasma ejected from the solar corona, and moving with a speed of about 2.5 million kilometers per hour struck our planet, causing a severe compression of Earth's magnetosphere from 11 to 4 times the radius of Earth. It triggered a severe geomagnetic storm that generated aurora borealis, and radio signal blackouts in many high latitude countries.

Earth's magnetosphere extends over a radius of a million kilometers, which acts as the first line of defence, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations. Numerical simulations performed by the GRAPES-3 collaboration on this event indicate that the Earth's magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower
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This work has recently been published in Physical Review Letters

Solar storms can cause major disruption to human civilization by crippling large electrical power grids, global positioning systems (GPS), satellite operations and communications.

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor operating on Earth is playing a very significant role in the study of such events. This recent finding has generated widespread excitement in the international scientific community, as well as electronic and print media.

This story provided by ScienceNewsline, the daily online science and technology news portal. The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the ScienceNewsline or Technobahn.com.
GRAPES-3 muon telescope indicates a crack in Earth’s magnetic shield

Nov. 3, 2016 – The GRAPES-3 muon telescope located at TIFR’s Cosmic Ray Laboratory in Ooty recorded a burst of galactic cosmic rays of about 20 GeV, on 22 June 2015 lasting for two hours.

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Links to articles


Solar storms can weaken Earth’s magnetic field

By Steven Andrian 10/31/2016

Gupta and his team collected data from a telescope in India that measures the number of charged particles called muons that are created as byproducts when cosmic rays hit Earth’s atmosphere.

Looking at data from 22 June 2015, they found a statistically significant spike in the number of muons that day. This result was consistent with a weakening of Earth’s magnetic field that allowed cosmic rays to stream more freely through Earth’s magnetosphere and into the atmosphere without being deflected.

“The weakening of Earth’s magnetic field opens up floodgates for low-energy solar plasma to pour into the atmosphere,” says Gupta, whose team reports its findings this month in Physical Review Letters.

Overall, the team showed that Earth’s magnetic field is susceptible to temporary damage, rendering our planet’s atmosphere the last line of defense against energetic particles from space. Without Earth’s magnetic field, astronauts above the atmosphere are exposed to particles that can rip through human bodies and damage DNA, potentially causing cancer.

The new results also suggest a possible method to detect impending geomagnetic storms. A successful early warning system is key to reducing the economic impact of such storms, which has been estimated by the National Academy of Sciences to be several trillion dollars in the most severe cases.

Even with only a few hours of advance warning, power grids could redistribute currents to reduce their vulnerability to currents traveling through Earth and airplanes flying polar routes could be rerouted to avoid losing radio contact with controllers, for example.
The GRAPES-3 muon telescope, the world’s largest and most sensitive cosmic ray monitor recorded a burst of galactic cosmic rays. These indicated a crack in the Earth’s magnetic shield.

(TIFR)

The Gamma Ray Astronomy PeV EnergieS 3rd establishment (GRAPES-3) muon telescope, the largest cosmic ray monitor, has observed a burst of galactic cosmic rays suggesting a crack in Earth's magnetic shield.

The burst took place when a very large cloud of plasma erupted from the solar corona and collided with our planet, causing a significant compressions of the Earth’s magnetosphere. The collision also triggered an acute geomagnetic storm.

The telescope is currently located at Tata Institute of Fundamental Research (TIFR)'s Cosmic Ray Laboratory in Ooty, and the galactic cosmic rays it observed were approximately 20 GeV. The event took place on June 22, 2015, and went on for about two hours.

The blast happened as the cloud formation of plasma distanced from the solar corona, moving with a speed of roughly 2.5 million kilometers per hour, touched Earth. As a result of this event, a compression of the magnetosphere from 11 to 4 times the radius of our planet was created. The geomagnetic storm created aurora borealis, as well as radio signal interference at the level of various countries around the globe being located in high altitudes.

Effects On The Magnetosphere

The magnetosphere of our planet is stretched over 600,000 miles, its most important purpose is that it acts as a line of defense, protecting the planet from galactic and solar cosmic rays, along with the lives and environment. The high-intensity radiations contain harmful energetic fields, which could significantly endanger our planet's forms of life.

Simulations were carried out by the GRAPES-3 collaboration, in this respect, show that our planet's magnetic shield is cracked for the moment because of the magnetic reconnection and its effects, which permits to the cosmic ray particles of lower energy to enter our atmosphere.

The magnetic field of our planet bent the particles roughly 180 degree; therefore, the effects shifted from the day-side to the night zones of Earth.

The data observed that night was carefully analyzed and interpreted, through the means of expanded simulations, during the following weeks. The machine was designed in-house by the GRAPES-3 team of engineers and physicists. The place where the instrument was built, just like the telescope, was at the research facility in Ooty.

The GRAPE-3 telescope is an Indian-located project consisting of cosmic ray study, through the air shower
detector array, as well as large muon detectors. The purpose of this project is to comprehend nuclear composition of the cosmic rays, as well as high-energy gamma-ray astronomy or modulation of solar activity.

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The world’s largest, most sensitive cosmic-ray detector has identified a potential crack in Earth’s magnetic field. The weakness was revealed by a burst of galactic cosmic rays, detected by GRAPES-3 during a severe geomagnetic storm in June 2015. The storm was triggered by a plasma cloud ejected from the sun’s corona.

It was one of the largest geomagnetic storms in recent history, generating an intense aurora borealis and thwarting radio communication systems among the most northern latitudes. The storm was strong enough to compress Earth’s magnetosphere for several hours.

The GRAPES-3 muon telescope is a massive array situated in southern India, a joint effort among scientific institutes in Japan and India. Data revealing the cosmic ray breach were analyzed by scientists at Tata Institute of Fundamental Research in Mumbai.

Researchers published their analysis of the potential magnetosphere crack this week in the journal Physical Review Letters.

Life itself has Earth’s magnetosphere to thank. Its ability to block out the harmful rays and particles flying through space allowed life to flourish. But as the latest research suggests, it’s not a fail-safe shield.

High-intensity storms can reveal stress fractures, so to speak. Researchers suggest the 2015 storm triggered a phenomenon called magnetic reconnection, whereby magnetic energy is simultaneously converted into kinetic energy, thermal energy and particle acceleration.

In this instance, the process was powerful enough to open a crack through which a burst of cosmic rays slipped through.

Scientists hope their continued work with GRAPES-3 will offer an improved understanding of the stresses put on the magnetosphere by intense storms, to better predict vulnerabilities in the future.
India’s Telescope Detects Crack in the Earth’s Magnetic Shield

Short resume:

space
90%
telescope
90%
cosmic
80%
grapes
60%

Observations from India’s GRAPES-3 cosmic-ray telescope indicated a crack in the Earth’s magnetic shield, which was weakened by a geomagnetic storm in 2015.

Source Nature World News
– Read More…
Earth’s Magnetic Shield Weakened, Develops a Crack, Indian telescope GRAPES-3 Detected

Short resume:

- shield
  - 80%
- grapes
  - 70%
- magnetic
  - 70%
- rumors
  - 60%

In a startling finding, Indian telescope GRAPES-3 has detected a crack in the magnetic shield of Earth. The detailed study and the findings have been published in the Physical Reviews Letters.
Source Headlines & Global News

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Study: Solar Flare Caused A ‘Crack’ In Protective Field Around Earth

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A new study led by a team out of India has found that Earth’s protective magnetic field cracked after an intense geomagnetic storm observed by the GRAPES-3 muon telescope on June 22, 2015. A team of scientists suspects that Earth’s magnetic field temporarily cracked due to a solar flare, reports RT. A news release by the Tata Institute of Fundamental Research in India reports that the two-hour event was spotted by the GRAPES-3 muon telescope on June 22, 2015. The release goes on to state that “The burst occurred when a giant cloud of plasma ejected from the solar corona, and...struck our planet, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth.” This area is considered to be a shield from strong radiation. A geomagnetic storm is believed to have resulted from the activity, as The Wire reports, which “allowed an unusually high flux of cosmic ray particles to arrive on Earth.” According to the institute, consequent simulations indicated that “the Earth's magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.” While such damage can't necessarily be avoided in the future, the team believes the research could help to enable “a better understanding of future superstorms.”
Indian Scientists Have Detected a Crack in Earth’s Magnetic Shield

A team of scientists from Tata Institute of Fundamental Research’s Cosmic Ray Laboratory in India detected a crack in Earth’s magnetic shield which allowed galactic cosmic rays to leak into the Earth’s atmosphere and caused huge geomagnetic storms.

The world’s largest and most sensitive cosmic ray monitor, GRAPES-3 muon telescope, located in Ooty (India), has recorded a burst of galactic cosmic rays. As per scientists, this burst of galactic cosmic rays indicates a crack in the Earth’s magnetic shield.

This telescope has recorded a burst of about 20 GeV, on 22 June 2015. This bombardment lasted for 2 hours and emitted immensely high-energy radiation. This burst took place when a giant cloud of plasma ejected from a solar corona, and traveled through space at about 2.5 million kilometers per hour and struck Earth.

This all resulted in triggering of severe geomagnetic storms that generated aurora borealis, and radio signal blackouts in many high-latitude countries in North and South America.

From that very day, researchers at Tata Institute of Fundamental Research in India have performed various simulations based on the data they received from GRAPES-3, by using the 1280-core computing farm, developed by the GRAPES-3 team.

Their results indicate that the magnetosphere (the area containing the planet’s magnetic field) had been temporarily cracked. The team explained that this high-speed strike was relentless; it resulted in severe compression of the magnetosphere, forcing it to shrink from 11 to 4 times the radius of Earth.

Nidhi Goyal

Nidhi is a gold medalist Post Graduate in Atmospheric and Oceanic Sciences. You can also find Nidhi on Google+.
Giant Coronal Mass Ejection Created A Crack In Earth’s Magnetic Shield

MessageToEagle.com – Scientists have discovered that a giant plasma cloud ejected from the solar corona, moving with a speed of about 2.5 million kilometers per hour struck our planet, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth.

A coronal mass ejection (or CME) is a giant cloud of solar plasma drenched with magnetic field lines that are blown away from the Sun during strong, long-duration solar flares and filament eruptions.

Earth is enveloped in a protective magnetic envelope called the magnetosphere, extending over a radius of a million kilometers.

It can change shape in response to the Sun’s effects, causing various types of space weather on Earth.

Earth’s magnetic field is our planet’s first line of defense – a shield – against the bombardment of the solar wind. This stream of plasma is launched by the Sun and travels across the Solar System, carrying its own magnetic field with it.

Our magnetosphere is the first line of defense, shielding us from the continuous flow of solar and galactic cosmic rays, thus protecting life on our planet from these high intensity energetic radiations. Without it there would be no life on our planet.

Scientists have previously warned that Earth’s magnetic shielding has been “severely compromised and it may be in danger.”
On 22 June 2015, the GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor operating on Earth located at TIFR’s Cosmic Ray Laboratory in Ooty recorded a burst of galactic cosmic rays of about 20 GeV lasting for two hours. It triggered a severe geomagnetic storm that generated Aurora Borealis, and radio signal blackouts in many high latitude countries.
Physicists and engineers at the Cosmic Ray Laboratory have conducted multiple simulations and analyzed the effects of the giant plasma cloud hitting our planet. The results show the Earth’s magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere. Earth’s magnetic field bent these particles about 180 degrees, from the day-side to the night-side of the Earth.

This temporary ‘crack’ in the magnetic field, that allowed dangerous galactic cosmic ray particles into our atmosphere.

“The occurrence of this burst also implies a two-hour weakening of Earth’s protective magnetic shield during this event,” the study said. “It indicates a transient weakening of Earth’s magnetic shield.” The research has been published in Physical Review Letters.
TH-SUNDAY - GRAPES-3 facility - first to detect effect of solar storms on earth's magnetic field, gets an upgrade:
Hole found in Earth’s magnetic field – humanity at risk of cosmic radiation

A huge hole has been detected in the Earth’s magnetic shield, leaving millions of human beings vulnerable to deadly cosmic radiation, scientists have warned. From analysing data from the GRAPES-3 muon telescope in Ooty, India, experts have concluded that the magnetosphere has come under such heavy bombardment in recent years that it weakening.

On June 22, 2015, there was a massive burst of galactic cosmic rays which traumatised the Earth’s magnetic shield for two hours. Roughly 40 hours before the Earth was bombarded by cosmic rays, the sun ejected a giant cloud of plasma which caused high energy radiation to strike the Earth’s magnetosphere at 2.5 million kilometres per hour.
A telescope known as the GRAPES-3 muon recorded a burst of cosmic rays. These rays were about 20 GeV. This occurred on June 22nd of 2015.

The burst lasted 2 hours and happened due to a solar corona. It was moving at about 2.5 million kph when it hit our planet. The hit caused a geomagnetic storm that was responsible for an impressive display of the aurora borealis. It also triggered blackouts in radio signals.

Running simulations have indicated that the planets magnetic shield cracked temporarily during that event. This was because of magnetic re-connection. This allowed for low energy cosmic ray particles to enter the atmosphere.

The Cosmic Ray Laboratory spent many weeks and crafted many simulations on the event and have finally put it together piece by piece as to better understand how this event took place and why.

Without the GRAPE-3 muon the burst might not have been detected at all. Thanks to this telescope and the ability for the simulations; should any other cosmic bursts happen we will have the ability to know about them, recreate the event, and study it. This allows us greater insight to the workings of our universe.
From Wikipedia, the free encyclopedia

GRAPES-3 Air Shower Array

The GRAPES-3 experiment (or Gamma Ray Astronomy PeV EnergieS phase-3) located at Ooty in India started as a collaboration of the Indian Tata Institute of Fundamental Research and the Japanese Osaka City University, and now also includes the Japanese Nagoya Women's University.

GRAPES-3 is designed to study cosmic rays with an array of air shower detectors and a large area muon detector. It aims to probe acceleration of cosmic rays in the following four astrophysical settings. These include acceleration of particles to, (i) \( \sim 100 \text{ MeV} \) in atmospheric electric fields through muons, (ii) \( \sim 10 \text{ GeV} \) in the Solar System through muons, (iii) \( \sim 1 \text{ PeV} \) in our galaxy, (iv) \( \sim 100 \text{ EeV} \) in the nearby universe through measurement of diffuse gamma ray flux.

The GRAPES-3 is located at N11.4°, E76.7°, 2200m above mean sea level. The observations began with 217 plastic scintillators and a 560 m\(^2\) area muon detector in 2000. The scintillators detect charged particles contained in extensive air showers produced by interaction of high energy cosmic rays in the atmosphere. At present the array is operating with \( \sim 400 \) scintillators that are spread over an area of 25,000 m\(^2\). The energy threshold of muon detectors is 1 GeV.

Objectives

Study of

1. The origin, acceleration and propagation of \( >10^{14} \) eV cosmic rays in the galaxy and beyond.
2. Existence of “Knee” in the energy spectrum of cosmic rays.
3. Production and/or acceleration of highest energy \( \sim 10^{20} \) eV cosmic rays in the universe.
4. Astronomy of multi-TeV \( \gamma \)-rays from neutron stars and other compact object.
5. Sun the closest astrophysical object, accelerator of energetic particles and its effects on the Earth.

Overview

The first cosmic ray experiment was started in 1955 by B. V. Sreekantan by setting up cloud chambers that heralded the beginning of research at the Cosmic Ray Laboratory (CRL) in Ooty.[citation needed] The next decade witnessed a variety of experiments involving high energy interactions and extensive air shower studies in this laboratory. The world’s largest multiplate cloud chamber was operated here[citation needed] as part of an air shower array and significant results[which?] on the high energy nuclear interactions and cores of extensive air showers were obtained. A triple set-up comprising an air Čerenkov counter, a multiplate cloud chamber and a total absorption spectrometer was operated in the early seventies to study the differences in the characteristics of interactions with nuclei of protons and pions in the energy range 10-40 GeV.[citation needed] This enabled the time structure study of nuclear active components of air showers and led to the discovery that the nucleon-antinucleon production cross-section considerably increases with energy.[citation needed]

In continuation of the work on cosmic ray research at CRL, GRAPES-1 experiment was upgraded in various stages to GRAPES-2. However, due to the technical and administrative problem in its further expansion, a new experiment was set up at the RAC[clarification needed] site 8 km from the old site which is called GRAPES-3. The GRAPES-3 experiment at present is operating with \( \sim 400 \) (each 1 m\(^2\)) plastic scintillator detectors with a
separation of 8 meters, to record the density and arrival time of particles in cosmic ray showers, and in continuous operation. At present, GRAPES-3 array is the highest density conventional EAS array in the world, and also, this experiment associated with a huge 560 m² area tracking muon detector, is also the largest area tracking detector anywhere.

Results

Several results have recently been obtained from the GRAPES-3 experiment on a variety of topics, a few of which are listed below.

- Measurement of primary composition in the energy 50 TeV - 1 PeV overlapping with direct measurements
- Precision measurements of Forbush decrease events including rigidity dependence of its amplitude
- Measurement of turbulent magnetic field in the shock-sheath region in the Coronal mass ejections (CMEs) by using multi-rigidity muon data
- Precision measurement of the solar diurnal anisotropy and its higher harmonics including its rigidity dependence
- Precision measurement of the density gradient of cosmic rays in the solar system by probing Swinson flow
- Precision measurement of the anti-correlation between changes in solar wind velocity and cosmic ray intensity

Publications

External links

Categories
How India uses recycled pipes to detect ferocious solar storms

What does a sensational scientific discovery about a solar storm in the Earth’s magnetic field have to do with old, recycled steel pipes which lay buried for more than a decade under a now-defunct gold mine in India? Almost everything.

More than 3,700 such pipes are actually at the heart of a most significant scientific finding. A team of Indian and Japanese scientists recently published an internationally-feted paper which recorded the events that unfolded after a breach in the Earth’s magnetic shield.

Using the GRAPES-3 muon (a sub-atomic particle) telescope – the world’s largest of its kind – at the Cosmic Ray Laboratory in Ooty, a hill station in the southern state of Tamil Nadu, the scientists recorded a two-hour burst of galactic cosmic rays that invaded the atmosphere on 22 June 2015.

The magnetic field breach was the result of charged particles from the Sun striking the Earth at high speed. Solar storms of such high magnitudes can knock out satellites and aircraft autopilots, cause catastrophic power outages, and take us, according to one of the scientists leading the research, Dr Sunil Gupta, “back to the Stone Age”.

Grey line
Solar storms
The sudden release of magnetic energy stored in the Sun’s atmosphere can cause a bright flare
This can also release bursts of charged particles into space
These solar “eruptions” are known as coronal mass ejections or CMEs
When headed in our direction, the charged gas collides with the magnetic “sheath” around Earth
The subsequent disturbances in the Earth’s magnetic envelope are called solar storms
They can interfere with technology: satellites, electrical grids and communications systems
They can also cause aurorae – Northern and Southern Lights – to be seen at lower latitudes
The largest such solar storm in recorded history took place in 1859 and disrupted a robust and new communication system involving telegraph lines
Scientists record breach in magnetic field
Grey line
Low-cost telescope
The world’s largest and most sensitive cosmic ray telescope located in Ooty is made up of four-decades old recycled zinc-coated steel pipes.
“Necessity is the mother of invention. When you don’t have the money to buy new, expensive stuff, you look within the system to find out your own solutions to reduce costs. India’s scientists have mastered the art of recycling and coming up with their own inexpensive solutions," Pallava Bagla, India correspondent for Science magazine, told me.

A notable example: India’s 2014 operation mission to Mars, cost the exchequer 4.5bn rupees ($67m;£54m), almost 10 times less than the American Maven orbiter. (This prompted Prime Minister Narendra Modi to quip that India’s real-life Martian adventure cost less than Hollywood film Gravity.) The Ooty laboratory’s annual budget is about $375,000.

The 6m (19.65 ft) long pipes, which acted as sensors in the telescope, lay in underground caverns below the centuries-old Kolar Gold Fields in southern Karnataka state, home to one of the world’s deepest gold mines, for nearly two-decades.
The pipes were imported from Japan – where they are normally used at building construction sites – to help a team of Indian and Japanese scientists examine neutrinos, sub-atomic particles produced in high energy interactions in the galaxy and beyond. The scientists had laid them 2km (1.24 miles) below the earth for their experiment.

Highly sensitive
When gold prices fell to unprofitable levels and the fields began shutting down in the early 1990s, authorities planned to remove the pipes and dispose them off as scrap. “We said we want to re-use them for our
experiments,” Dr Gupta told me.
Eventually, some 7,500 of the pipes were transported by truck to a hilly 100-acre campus that the laboratory shares with a radio astronomy centre. The place skirts a forest populated by deer, bison, tigers and wild boars. Recently, CCTV cameras captured a tiger strolling past the sensors at night.
Work on recording cosmic rays in Ooty began in right earnest in 1998, when the scientists began making muon sensors from the discarded pipes to research high energy cosmic rays.
Today, 3,712 steel tubes, stacked up against layers of concrete, are housed across 560 sq m in four squat brown-and-white colour buildings, home to the world’s largest such muon telescope. There are a couple of dozen such telescopes in the world, but none as powerful as the one in Ooty.
At the laboratory, a small group of scientists and assorted helpers – local gardeners and carpenters, for example – continue to recycle the old pipes, so that they can be used as cosmic ray detectors.
Making the sensors
To do this, they open the pipes and clean them with high pressure water jets. They insert a 100 micron – as thick as a strand of human hair – tungsten wire into the pipe and anchor it at both ends with hermetic seals. The pipes are then filled with a gas comprising methane and argon and an electric potential run through it to enable it to become an effective sensor.
Finally, they are laid out in rows – below two metres of concrete, which act as absorbers – to become a muon telescope.
The fabled jugaad – an Indian colloquial word that means ingenious improvisation in the face of scarce resources – extends to using the pipes as sensors.
When the scientists at the laboratory wanted to make doubly sure that the old pipes were not leaking, they modified a helium spray gun by attaching a 7-cent injection syringe needle to the nozzle of the gas jet to help them to carry out the precise leak tests.
“Every day, we make 10 such recycled pipes ready for our experiments. The plan was to make very sensitive sensors to detect the weakest of signals. We wanted to measure cosmic rays with higher sensitivity than ever done before”, says Atul Jain, a scientist at the facility.
Home grown
The laboratory itself is a shining example of home-grown innovation. The majority of the electronic equipment is designed, assembled and manufactured in-house. The software for the computer programmes is locally made.
The 40GB of raw data from cosmic rays that it generates every day is stored and processed by a cluster of computers which has been largely assembled in-house, cutting costs and saving hefty maintenance fees. Old computers are stripped for parts. A locally developed cooling system using fans saves electricity and protects the computers.
At the moment, the scientists plan to pore over 17 years of data on cosmic rays recorded by the lab’s sensors to find out whether they offer more clues about forecasting space weather and advance warnings about solar flares. They say there have been some 38 severe solar storms in the past 17 years.
“We should be able to sift through our data to find out more about them. For us, they are a gift from the Sun, because they add to our knowledge on space weather,” says Dr Gupta.
A huge hole has been detected in the Earth’s magnetic shield, leaving millions of human beings vulnerable to deadly cosmic radiation, scientists have warned. From analysing data from the GRAPES-3 muon telescope in Ooty, India, experts have concluded that the magnetosphere has come under such heavy bombardment in recent years that it weakening.

Hole found in Earth’s magnetic field – humanity at risk of cosmic radiation

Oh special, and I think this has been around for a little while, but either way add this to Fukushima and all this radiation and aren't we living in a great environment.
GRAPES-3 indicates a crack in Earth's magnetic shield

5 months ago | Phys

The GRAPES-3 muon telescope, the largest and most sensitive cosmic ray monitor recorded a burst of galactic cosmic rays that indicated a crack in the Earth's magnetic shield. The burst occurred when a giant cloud of plasma ejected from the solar corona struck Earth at a very high speed causing massive compression of the Earth's magnetosphere and triggering a severe geomagnetic storm.
A team of scientists suspects that Earth’s magnetic field cracked due to a solar flare.

A news release by the Tata Institute of Fundamental Research in India reports that the two-hour event was spotted by the GRAPES-3 muon telescope on June 22, 2015.

The release goes on to state that “The burst occurred when a giant cloud of plasma ejected from the solar corona, and...struck our planet, causing a severe compression of Earth’s magnetosphere from 11 to 4 times the radius of Earth.”

This area is considered to be a shield from strong radiation. A geomagnetic storm is believed to have resulted from the activity, as The Wire reports, which “allowed an unusually high flux of cosmic ray particles to arrive on Earth.”

According to the institute, consequent simulations indicated that “the Earth’s magnetic shield temporarily cracked due to the occurrence of magnetic reconnection, allowing the lower energy galactic cosmic ray particles to enter our atmosphere.”

While such damage can’t necessarily be avoided in the future, the team believes the research could help to enable “a better understanding of future superstorms.”