PHYSICS BEAT

Lightning Unleashes Antimatter Storms

THE POWERFUL BLASTS OF PARTICLES and light energy known as gamma-ray bursts come from violent cosmic events in deep space, such as stellar explosions and black hole collisions. But smaller-scale bursts called terrestrial gamma-ray flashes (TGFs) can occur much closer to home, erupting thousands of times a year in association with lightning strikes during storms in Earth's atmosphere. Two satellites originally designed to observe gamma rays from space recently caught the atmospheric flares in action, revealing that they emit far more energy than previously thought and release streams of antimatter particles, which bear a charge opposite that of their normal counterparts.

In a study of 130 TGFs recorded by the AGILE satellite, Italian Space Agency physicist Marco Tavani and colleagues report that the most energetic particles released carry four times as much energy as previous measurements detected, and hundreds of times as much as those produced by normal lightning strikes. In fact, Tavani describes a storm hurling photons into AGILE's detectors as basically a giant particle accelerator in the sky. "It's the equivalent of the Large Hadron Collider acting in the atmosphere for a fraction of a second," he says. Next, Tavani plans to evaluate how TGFs might affect aircraft flying nearby.

Researchers working on another mission, NASA's Fermi Gamma-ray Space Telescope, announced in January that about 10 percent of the particles fired off by TGFs consist of positrons—the positively charged antimatter twins of electrons. Because gamma rays can convert into electrons and positrons, physicists had predicted the antiparticles' presence in the bursts, but until now they had never been directly observed. Astrophysicist Michael Briggs, a Fermi team member based at the University of Alabama in Huntsville, hopes such findings will aid in modeling how TGFs form. Currently, he says, scientists do not understand why some lightning strikes produce such mayhem while others do not.

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Some high-powered lightning strikes produce unusual forms of matter.