'Dark Lightning' Zaps Airline Passengers with Radiation

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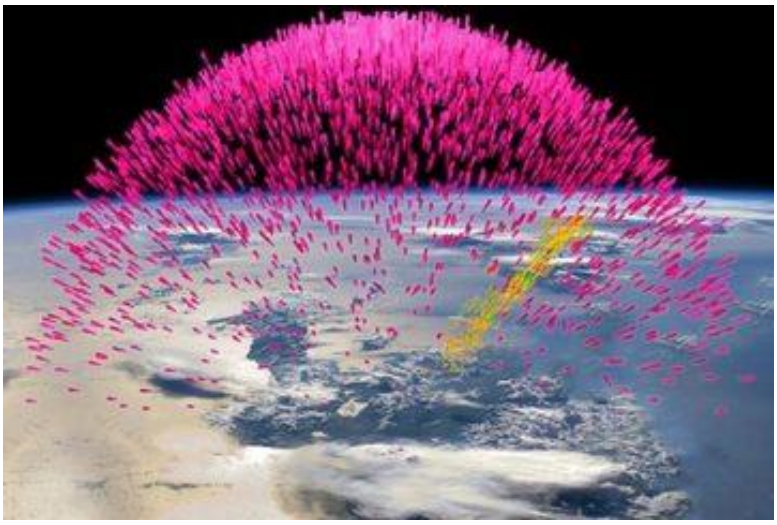

Artist impression of a terrestrial gamma-ray flash, called "dark lightning," originating from a thunderstorm. The gamma rays (pink), in turn, generate electrons and positrons (yellow and green), their antimatter counterparts, which get blasted into space.
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"Dark lightning" that is almost invisible within clouds may regularly blast airline passengers with large numbers of gamma rays, scientists find.

However, these outbursts do not seem to reach truly dangerous levels, researchers added.

More than a decade ago, researchers unexpectedly discovered thunderstorms could generate brief but powerful bursts of gamma rays, the highest-energy form of light. These so-calledterrestrial gamma-ray flashesare so bright that they are able to blind sensors on satellites many hundreds of miles away.

Worryingly, terrestrial gamma-ray flashes can occur near the same altitudes at which commercial aircraft regularly fly. Attempts to discover whether these flashes pose a radiation hazard to airline passengers have been hampered by a poor understanding of the cause of these flashes. Past research has also found these flashes hurl beams of antimatter into space. [The 5 Real Hazards of Air Travel]

"We know in detail how black holes work at the centers of distant galaxies, but we don't really understand what is going on inside thunderclouds just a few miles over our heads,"

said researcher Joseph Dwyer, a physicist at the Florida Institute of Technology.

Extreme lightning

Now computer models suggest the flashes are caused by an extreme form of lightning. Although they may blast out large numbers of gamma rays, they generate very little visible light, leading scientists to call the phenomenon "dark lightning."

"I find it amazing that it took us two-and-a half centuries after Ben Franklin to find out that there is another kind of lightning inside thunderstorms," Dwyer told LiveScience.

Normal lightning involves slow electrons that carry electric current to the ground or within clouds. In contrast, dark lightning involves high-energy electrons. These electrons slam into air molecules, producing gamma rays. In turn, these gamma rays generate electrons and their antimatter counterparts, known as positrons. These high-energy particles collide into still more air molecules, generating more gamma rays, ultimately explaining many of the properties of the gamma-ray flashes that scientists have detected from thunderstorms.

Ordinary lightning arcs from one spot to another to reduce the voltage growing within clouds. Dark lightning does so as well, and since much higher energy particles are involved, it reduces voltage far more quickly, so the electric fields within them "can collapse in a few tens of microseconds," Dwyer said.

Dark lightning and radiation

Armed with a model that potentially explains these gamma-ray flashes, Dwyer and his colleagues analyzed how much radiation airline passengers might receive from them. Near the tops of thunderstorms, at about 40,000 feet (12,200 meters) in altitude, the scientists calculated that radiation doses are comparable to about 10 chest X-rays, or about the same dose people receive from natural background sources of radiation over the course of a year. [Infographic: Earth's Atmosphere Top to Bottom]

However, near the middle of the storms, at about 16,000 feet (4,900 meters) in altitude, "the radiation dose could be about 10 times larger, comparable to some of the largest doses received during medical procedures and roughly equal to a full-body CT scan," Dwyer said.

Although airline pilots already do their best to avoid thunderstorms, "occasionally aircraft do end up inside electrified storms, exposing passengers to terrestrial gamma-ray flashes," Dwyer said. "On rare occasions, according to the model calculations, it may be possible that hundreds of people, without knowing it, may be simultaneously receiving a sizable dose of radiation from dark lightning."

The average cruising altitude of a passenger jet ranges from about 30,000 to 40,000 feet (9,150 to 12,200 m). This means that commercial airliners may pass through the potentially dangerous altitude of 16,000 feet (4,900 m) twice per flight.

Still, Dwyer noted the radiation risk posed by these flashes is minimal. Pilots already avoid thunderstorms. In addition, the flashes behind the biggest doses of radiation are probably

much less common than normal lightning. Moreover, the plane would have to be in exactly the wrong place at the wrong time to see such high doses.

"Doses never seem to reach truly dangerous levels," Dwyer noted. "The radiation from dark lightning is not something that people need to be frightened about, and it is not a reason to avoid flying. I would have no problem getting on a plane with my kids."

Dwyer and his colleagues Ningyu Liu and Hamid Rassoul detailed their findings April 10 at a meeting of the European Geosciences Union in Vienna.

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