

EMERGING RESEARCH FRONTS - 2009

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David M. Smith talks with *ScienceWatch.com* and answers a few questions about this month's Emerging Research Front Paper in the field of Geosciences.



Article: Terrestrial gamma-ray flashes observed up to 20 MeV

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(addresses have been truncated.)

SW: Why do you think your paper is highly cited?

We were only the second group to observe this phenomenon (flashes of gamma-rays associated with lightning) and we found several things that the previous mission (NASA's Compton Gamma-ray Observatory) couldn't see.

SW: Does it describe a new discovery, methodology, or synthesis of knowledge?

The new things we discovered about terrestrial gamma-ray flashes (TGFs) were 1) the extremely high energies to which electrons are accelerated (over 20 MeV, or nearly a thousand times higher in energy than the x-rays used for medical imaging) and 2) the frequency with which they occur; they're not as rare as one might have concluded from the early data.

SW: Would you summarize the significance of your paper in layman's terms?

Earth's atmosphere is capable of accelerating particles to high energies in a way normally associated with more violent environments, like solar flares and the vicinity of black holes. These events might be the triggering process for lightning, which, surprisingly, is not known.

SW: How did you become involved in this research and were any particular problems encountered along the way?

We were looking for novel uses of the data from the Reuven Ramaty High Energy Solar Spectroscopic Imager (RHESSI) satellite, which was designed to look for solar flares. Because of the limitations of the previous data on TGFs, we mistakenly assumed that they would be rare and difficult to see. I assigned

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the project to an undergraduate student, [Liliana Lopez](#), and was amazed at the brightness, energy, and frequency of the events she eventually found. She ended up unexpectedly the star of a summer school in this discipline that I sent her to about the time she found the first TGFs in the RHESSI data.

SW: Where do you see your research leading in the future?

We are working toward detecting these flashes at the altitudes where they are formed (the tops of thunderstorms) instead of from a great distance away, in space. Instead of seeing about 20-100 gamma-rays from a flash, we will be able to see thousands or tens of thousands of gammas from close up, and therefore learn much more about each event.

SW: Do you foresee any social or political implications for your research?

We are looking carefully into the radiation dose that could be received by someone in an airplane above a thunderstorm. It would be a very rare event for someone in that position to be hit by a TGF, but it might result in a radiation dose higher than the recommended maximum exposures.

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