DETECTION OF TERRESTRIAL GAMMA-RAY FLASHES WITH THE RHESSI SPACECRAFT

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We report the detection of Terrestrial Gamma-ray Flashes (millisecond bursts of gamma-rays seen from space, dubbed TGFs) with the Reuven Ramaty High Energy Solar Spectroscopic Imager (RHESSI) satellite, the second instrument ever to observe this phenomenon. The first instrument to detect these events was the Burst and Transient Source Experiment (BATSE), launched on board the Compton Gamma-Ray Observatory (CGRO) in 1991. RHESSI has been in orbit since February 2002 . BATSE detected over 75 TGF events during its 9-year lifetime, here, we present 38 TGFs from 3 months of observations. RHESSI records every interaction in 1 microsecond time bins and into one of 9 germanium detectors. TGFs synthesize 30 single photon events, on average. We find over ten times as many events per month as BATSE, and find that single photon energies extend to greater than 10 MeV, a factor of 30 higher in energy than BATSE was capable of distinguishing, since its highest energy channel included everything from 300 keV and up. Duration for these events ranges from 195 to 3515 microseconds. The RHESSI TGFs, like BATSE's, are found to be concentrated above regions of high thunderstorm activity worldwide. Collaborations have been established with research groups worldwide to directly correlate TGF events with radio signatures of lightning storms, individual strokes, sferics, and optical phenomena, namely red sprites and blue jets. An exact TGFs production mechanism is yet unknown, however,they may be caused by electrical discharges in the upper atmosphere related to large lightning storms; there have been alternate models proposed. A relationship between TGFs and high-altitude optical phenomena has been considered due to the common correlation with thunderstorms.

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2. H - Waves in Plasma

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4. I - Invited Paper

5. No special instructions