Energetic Electrons Accompanying Terrestrial Gamma-Ray Flashes

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Terrestrial gamma-ray flashes (TGFs) are brief ($\approx$ 1 ms), intense flashes of energetic gamma-rays detected by satellites above thunderstorms in coincidence with lightning. Such gamma-rays escaping the atmosphere will likely be accompanied by energetic electrons as a result of Compton scattering by TGF photons. Also possible is the direct escape of energetic electrons from the processes involved in TGF photon emission.

After escape, these electrons will be trapped along the geomagnetic field lines before quickly precipitating and thus will constitute a brief pulse of energetic electrons deep in the loss cone. It has been speculated that such electrons may be responsible for some anomalous "TGF" observations by the RHESSI and BATSE satellites in regions where thunderstorms and lightning are known not to occur or when lightning is known not to have occurred in coincidence with the TGF observation. If the satellite happens to intersect the electron emissions, a signature similar to a TGF may indeed be detected.

Such a brief pulse of energetic electrons emitted from deep in the atmosphere should be similarly detectable by the SAMPEX satellite's HILT instrument if the satellite happens to intersect the trapped electron emissions.

We present predictions of possible electron emissions on the basis of prior TGF models, existing TGF measurements, and Monte Carlo simulations of photon emission and escape. These electron emissions are used to predict the signatures of possible SAMPEX measurements. Together with estimates of TGF occurrence frequency, we predict the results of a search for these signatures in SAMPEX data. We then present the results of such a search of actual SAMPEX data, both in coincidence with RHESSI or BATSE TGF detections and in known thunderstorm flyovers.