Spectroscopy of the BATSE TGFs with the LADs

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Terrestrial gamma-ray flashes (TGFs) are millisecond-long bursts of energetic radiation that have been associated with lightning strikes. These flashes of x-rays and gamma-rays have been observed by the Large Area Detectors (LADs) of the Burst and Transient Source Experiment (BATSE) on the Compton Gamma Ray Observatory (CGRO) and by the Reuven Ramaty High Energy Solar Spectroscopic Imager (RHESSI) satellite. A detailed spectroscopic analysis of the RHESSI data has indicated that the TGFs originate from deep in the atmosphere, near the tops of thunderstorms. Such a deep source results in a ionization losses of x-rays and gamma-rays in the large mass of air between the source and the satellites. Even so, it has recently been shown that when the TGFs reach the satellites they can still produce such high count rates that the readout electronics of both the BATSE LADs and the RHESSI satellite become saturated. This instrumental deadtime has been shown to be important in understanding the time evolution of the BATSE TGF lightcurves. We investigate the possible impact of this deadtime on spectroscopic analyses of the BATSE LAD data.

The BATSE data are only stored in four relatively coarse energy channels (nominally 30-60, 60-110, 110-300, and ¿ 300 keV), so a substantial change in any one of these channels can dramatically effect the results of any spectroscopic fitting. We use Monte Carlo simulations of the relativistic runaway process, believed to produce the TGFs, and the atmospheric scattering that influences the resulting energetic radiation to constrain the possible source altitude of the TGF with the BATSE data once the instrumental deadtime has been considered.