

TGF afterglows: a new radiation mechanism from thunderstorms

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Thunderstorms emit energetic radiation of different types, physically distinguishable based on duration. On the one hand, terrestrial gamma-ray flashes (TGFs) are microsecond-long bursts of photons, and on the other hand, gamma-ray glows last much longer, for seconds to minutes or even hours. Whereas TGFs are the result of the developing lightning discharge, lightning is observed to terminate the usual gamma-ray glows.

In the published work [1] we predict a new intermediate thunderstorm radiation mechanism, which we call a TGF afterglow, as it is caused by the capture of photonuclear neutrons produced by a TGF. TGF afterglows are milliseconds to seconds long; this duration is caused by the thermalization time of the intermediate neutrons. Recently, the work of [2,3] experimentally confirmed this phenomenon, and [3] probably also detected the corresponding beta+ decay from the positron annihilation peak.

Although sometimes overlapping in duration, TGF afterglows are fundamentally different than gamma-ray glows. There may be gamma-ray observations from thunderstorms which are actually TGF afterglows. We have derived discriminators to search for TGF afterglows and we invite other researches to look for their signatures in their millisecond resolution gamma-ray measurements.

References:

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