

Abstract Submitted
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Analysis of Downward Terrestrial Gamma-Ray Flashes at Telescope Array¹ JACKSON REMINGTON, Department of Physics and Astronomy, University of Utah, TELESCOPE ARRAY SCIENTIFIC COLLABORATION COLLABORATION, LANGMUIR LABORATORY FOR ATMOSPHERIC RESEARCH COLLABORATION — The Telescope Array cosmic ray observatory in central Utah reports the first close, high-resolution observations of downward-directed TGFs. The array consists of 512 3 m² thin scintillator detector units on a grid covering 700 km², and is overlooked by a broadband VHF interferometer, Lightning Mapping Array, and fast electric field change sensors. This unique collection of detectors provides high-resolution measurements of lightning activity alongside particle data at ground level. Four TGF-producing lightning flashes from 2018 were analyzed in this study with currents between -21 and -37 kA. The particle data can resolve individual particles and place lower limits on their energies — this study finds unambiguous evidence of gamma photons with energy of at least 6.4 MeV. These TGFs occurred in the first couple milliseconds of lightning activity during strong, complex initial breakdown pulses. The precision timing analyses are able to further correlate the TGFs to individual sub-pulses in the streamer-based fast negative breakdown, implying the existence of impulsive, spark-like events. These events may shed light on many poorly-understood processes involved in negative lightning development and TGF production in general.

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