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Observation of the Origin of Downward Terrestrial Gamma-Ray Flashes[1] JACKSON REMINGTON, JOHN BELZ, University of Utah, PAUL KREHBIEL, MARK STANLEY, New Mexico Institute of Mining and Technology, RASHA ABBASI, Loyola University Chicago, RYAN LEVON, University of Utah, WILLIAM RISON, DANIEL RODEHEFFER, New Mexico Institute of Mining and Technology, TELESCOPE ARRAY SCIENTIFIC COLLABORATION COLLABORATION — Terrestrial gamma flashes (TGFs) are bursts of intense gamma radiation produced during lightning, lasting up to a few milliseconds. High-fluence TGFs were originally seen from orbiting gamma detectors and were later linked to the early leader stage of upward intracloud lightning. As predicted, the effect has also been seen from the ground, apparently produced during the same (downward) process. The Telescope Array Surface Detector (TASD) in western Utah is a 700 km^2 array comprised of over 500 plastic scintillator detectors on a 1.2 km square grid and is designed for the measurement of Ultra-High-Energy Cosmic Rays (UHECRs). After reporting low-fluence gamma showers produced in the initial stages of lightning, TASD has upgraded its lightning mapping capabilities and become one of the world's leading instruments for ground-level detection of TGFs. A new broadband interferometer (INTF) installed in 2018 uses VHF signals collected from three antennas to more accurately pinpoint the timing and direction of lightning activity over TASD, while the fast sferic sensor is better tuned to record the rapid changes in a storm's electric field. Here we present new results, which for the first time clearly tie downward TGFs to energetic leader-stage processes at the submicrosecond level.

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