Contribution ID: **61** Type: **Original Talk**

COMPARISON OF GLE EVENT OF 11 MAY 2024 AND MAGNETOSPHERIC EFFECT 5 NOVEMBER 20-23

Relativistic Runaway Electron Avalanches (RREA) are central to understanding a spectrum of high-energy atmospheric phenomena, including Terrestrial Gamma-ray Flashes (TGFs), Thunderstorm Ground Enhancements (TGEs), and gamma-ray glows. Despite their common physical origin, these events are often treated separately due to differences in detection methods, duration, and altitude. In this work, we present a unified conceptual and observational framework that reinterprets these radiation bursts as manifestations of the same runaway processes occurring in distinct atmospheric depths. Integrating recent results from satellite (ASIM), aircraft (ALOFT), balloon (HELEN), and ground-based (SEVAN) experiments, we demonstrate consistent spectral and temporal behavior across scales. We propose a rational revision of current terminology and challenge longstanding models that attribute TGFs to lightning leader dynamics. This study resolves key contradictions in the field, establishes new classification criteria based on physics rather than detector location, and reshapes our understanding of particle acceleration in thunderstorms.

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Session Classification: Cosmo- and geophysical aspects of cosmic rays at the ground level

Track Classification: Cosmo- and geophysical aspects of cosmic rays at the ground level