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Muon Contribution to Cathodoluminescence Tests?

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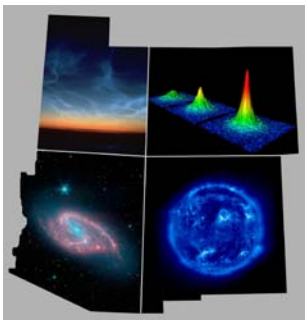

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Abstract

Tests of composites incorporating highly disordered insulating materials that were bombarded with low-flux keV electron beams exhibited three distinct forms of light emission: short-duration (<<1 s), high intensity luminous electrostatic discharges between the insulator and ground--termed "arcs"; intermediate-duration (10-100 s), intense surface emissions—termed "flares"; and lower intensity, continuous surface cathodoluminescent "glow". During long-duration experiments at temperatures <150 K, relatively intense flare events occurred at rates of ~2 per min. Rapid increase in photon emission and electron displacement current were observed, with long exponential decay times >1 min. We propose that the source of the flares is the interactions of high energy muons—of cosmic ray origin—with the highly-charged insulating components of the composite materials, which trigger avalanche electrostatic discharge and subsequent recharging along with concomitant light emission. We review evidence from the insulator conductivity at low temperatures, the rates and magnitude of surface charging, the flare frequency, and the magnitude and time-dependence of currents and light emission with regard to this muon hypothesis. Finally, a muon coincidence detection experiment using scintillation detectors is proposed to investigate the potential correlation between incident muons and the observed flares.