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Short-lived dispersive electron events in Saturn's magnetosphere: A thunderstorm-induced phenomenon?

G. H. Jones (1, 2), E. Roussos (1), N. Krupp (1), J. Woch (1), A. Lagg (1), S. M. Krimigis (3)

(1) Max-Planck-Institut fuer Sonnensystemforschung, 37191 Katlenburg-Lindau, Germany (2) Mullard Space Science Laboratory, University College London, Holmbury St. Mary, Surrey RH5 6NT, UK (3) Johns Hopkins University Applied Physics Laboratory, Laurel, Maryland, USA

On day 266 of 2005, the LEMMS section of Cassini's MIMI instrument detected at 3.1 Saturn Radii from the planet a pair of highly unusual electron bursts. Lasting several minutes each, these bursts showed a clear increase in electron energy with time over most of the instrument's energy range. Above 150 keV, a curious reversal in energy dispersion was observed during one of the events. These bursts were first reported by Jones et al. (2006), in a study proposing that spokes in Saturn's main rings were caused by electrons accelerated out of the planet's atmosphere above thunderstorms. It was suggested that electrons originating above thunderstorms that lie within certain latitude ranges may strike the planet's rings, causing the electrostatic charging of fine grains. Electrons that do not strike the rings could undergo pitch-angle scattering out of their loss cones before reaching the magnetig conjugate point of the thunderstorm. These electrons would then drift in longitude at rates dependent upon energy, forming electron "curtains", as suggestde by some to similarly occur in Earth's magnetosphere. Here, we explore the characteristics of the LEMMS-observed electron bursts, and compare them to those expected if originating at thunderstorms.

G. H. Jones et al., Formation of Saturn's ring spokes by lightning-induced electron beams, Geophys. Res. Lett. 33, L21202, doi: 10.1029/2006GL028146, 2006.