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Time domain structures in a colliding magnetic flux rope experiment[1] SHAWN WENJIE TANG, WALTER GEKELMAN, TIMOTHY DEHAAS, STEVE VINCENA, PATRICK PRIBYL, Univ of California - Los Angeles
— Electron phase-space holes, regions of positive potential on the scale of the Debye length, have been observed in auroras as well as in laboratory experiments. These potential structures, also known as Time Domain Structures (TDS), are packets of intense electric field spikes that have significant components parallel to the local magnetic field. In an ongoing investigation at UCLA, TDS were observed on the surface of two magnetized flux ropes produced within the Large Plasma Device (LAPD). A barium oxide (BaO) cathode was used to produce an 18 m long magnetized plasma column and a lanthanum hexaboride (LaB_6) source was used to create 11 m long kink unstable flux ropes. Using two probes capable of measuring the local electric and magnetic fields, correlation analysis was performed on tens of thousands of these structures and their propagation velocities, probability distribution function and spatial distribution were determined. The TDS became abundant as the flux ropes collided and appear to emanate from the reconnection region in between them. In addition, a preliminary analysis of the permutation entropy and statistical complexity of the data suggests that the TDS signals may be chaotic in nature.

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