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Characteristic Dynamics of a Non-Linear Flux Rope[1] TIMOTHY DEHAAS, WALTER GEKELMAN, BART VAN COMPERNOLLE, UCLA — A magnetic flux rope is a tube-like, current carrying plasma embedded in an external magnetic field. Commonly observed on the solar surface extending into the solar atmosphere, flux ropes are naturally occurring and have been observed by satellites in the near earth and often recreated in laboratory environments. In a series of experiments, a single flux rope of varying cross-section and length was formed in the cylindrical, magnetized plasma of the Large Plasma Device (LaPD, L = 2200 cm, r = 30 cm, $\mathrm{n_o} = 10^{12}\ \mathrm{cm}^{-3}$, $\mathrm{T_e} = 4$ eV, He). The flux rope was generated via a DC discharge between a cathode and anode with a fixed-free boundary condition. Upon the initiation of the kink instability ($\mathrm{I_{Kink}} > \pi \mathrm{r}^2 \mathrm{B_z c}/2\mathrm{L}$), the displacement of the flux rope saturates, commencing complex motion. The flux ropes exhibit two types of motion, common to all cases of varying Alfven speeds, injection currents, lengths, and cross-sections. The first motion is characterized by a circular path in the transverse plane, whose displacement depends on the input power and whose frequency varies with injection current. The second motion is characterized by random Lorentzian pulses in the magnetic signals. The polarity of these pulses align with the transverse magnetic field and manifest with greater frequency with increases in magnetic field and injection current.

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Timothy DeHaas
UCLA

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