

Laboratory study of avalanches in a magnetized plasma

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Results of a basic heat transport experiment involving an off-axis heat source are presented. Experiments are performed in the Large Plasma Device (LAPD) at UCLA. A ring-shaped electron beam source injects low energy electrons (below ionization energy) along a strong magnetic field into a preexisting, large and cold plasma. The injected electrons are thermalized by Coulomb collisions within a short distance and provide an off-axis heat source that results in a long, hollow, cylindrical region of elevated plasma pressure embedded in a colder plasma, and far from the machine walls.

The off-axis source is active for a period long compared to the density decay time, i.e. as time progresses the power per particle increases. Two distinct regimes are observed to take place, an initial regime dominated by avalanches and a second regime dominated by sustained drift-Alfvén wave activity.

The avalanches are identified as sudden rearrangements of the pressure profile following the growth of fluctuations from ambient noise. The intermittent collapses of the plasma pressure profile are associated with unstable drift-Alfvén waves and exhibit both radial and poloidal dynamics. After each collapse the plasma enters a quiescent phase in which the pressure profile slowly recovers and steepens until a threshold is exceeded, and the process repeats.

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