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**Instability of an electron-plasma shear layer in a strain flow.**[1]

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The $E \times B$ shear instability of a two-dimensional ($2D$) filament (i.e., a thin, rectangular strip) of a magnetized pure electron plasma is studied in the presence of an externally imposed strain flow.[3] Experiments are conducted using a specially designed Penning-Malmberg trap in which such flows can be imposed in $2D$ by biasing segmented electrodes surrounding the plasma. Electron density, which is the analog of fluid vorticity, is measured directly with a CCD camera. The situation studied corresponds to the Rayleigh instability of a finite-width shear layer in a $2D$ incompressible fluid. Theory predicts that neutrally stable traveling waves on opposite surfaces of the filament will phase lock and go unstable. The experimentally observed phase locking and the time-evolution of the wavenumber spectrum are in quantitative agreement with a linear model[4] that extends Rayleigh's work to account for the imposed strain flow. For weak strain, the system maintains a phase relationship that corresponds to an instantaneous (though evolving) Rayleigh eigenmode. A nonlinear regime is observed at later times that includes wave breaking, vortex formation, a vortex-pairing instability, and vorticity transport perpendicular to the filament. This evolution is suppressed, but not quenched as the strain rate is increased. Remaining open questions will be discussed.

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[2]Work done in collaboration with N. C. Hurst, D. H. E. Dubin, and C. M. Surko.

[3]N. C. Hurst, J. R. Danielson, D. H. E. Dubin, and C. M. Surko, *Phys. Plasmas* **27**, 042101 (2020).

[4]D. G. Dritschel, P. H. Haynes, M. N. Juckes, and T. G. Shepherd, *J. Fluid Mech.* **230**, 647 (1991).