

## Experimental study of MHD instabilities

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Plasma acceleration by magnetic fields occurs in a variety of instances, from supernova explosions to the interaction of stellar winds with planetary magnetospheres. The instabilities formed at the plasma-field boundary affect the plasma dynamics, leading, in the extreme case, to plasma penetration across the magnetic field. Experiments at the Nevada Terawatt Facility focused on the investigation of the instability development at the boundary of plasma flows decelerated by external magnetic field. The Rayleigh-Taylor instability (RTI) was actuated in several distinct regimes including the usual magneto-RTI ( $k\rho_i \ll 1$ ), and the large-Larmor-radius-RTI ( $k\rho_i \gg 1$ ), where  $k$  is the wavenumber and  $\rho_i$  is the ion Larmor radius. The RTI evolution in the nonlinear stage led to plasma expansion across the magnetic field with practically unchanged velocity over several ion Larmor radii. This observation can be explained if the plasma motion across the magnetic field leads to charge separation. The ensuing electric field transverse to both the plasma velocity and the magnetic field promotes a steady plasma expansion by  $\mathbf{E} \times \mathbf{B}$  drift. This work was supported by the DOE/NNSA grant DE-FC52-06NA27616.