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Structure of an Exploding Laser-Produced Plasma

ANDREW COLLETTE, University of Colorado

The behavior of expanding dense plasmas has long been a topic of interest in space plasma research, particularly in the case of expansion within a magnetized background plasma. Expansion perpendicular to B causes a wide range of effects, including a "diamagnetic bubble" or localized reduction of the background field, as well as visible periodic structures on the expanding plasma surface. A recent series of experiments at the UCLA Large Plasma Device (LaPD) studied these phenomena via a laser-produced plasma immersed in a large magnetized background plasma. The structure of the expanding plasma is diagnosed in three dimensions via a high-resolution ($\Delta L/L_{\text{plasma}} \sim 0.03$) in-plasma probe drive. Currents within the expanding plasma are found to have complex structure in three dimensions; in particular, an unexpected current system along the background field was discovered at the cavity surface. In addition to measurement of the plasma structure, the time behavior of large-scale ($L \sim L_{\text{plasma}}$) periodic structures on the plasma surface was investigated via two-probe correlation analysis, revealing that the structures are static and translate with the bubble across the background field.