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Spectroscopic Measurement of High-Frequency Electric Fields in the Interaction of Explosive Debris Plasma with Ambient, Magnetized Background Plasma ANTON BONDARENKO, DEREK SCHAEFFER, ERIK EVERSON, ERIC CLARK, STEPHEN VINCENA, BART VAN COMPERNOLLE, SHREEKRISHNA TRIPATHI, CARMEN CONSTANTIN, CHRIS NIEMANN, UCLA — The explosive expansion of dense, high-beta debris plasma into relatively tenuous, magnetized background plasma is relevant to a wide variety of astrophysical and space environments. Electric fields play a fundamental role in the coupling of momentum and energy from debris to background, and emission spectroscopy provides a powerful diagnostic for assessing electric fields via the Stark effect. A recent experiment utilizing a unique experimental platform at UCLA that combines the Large Plasma Device and the Raptor laser facility has investigated the super-Alfvénic, quasi-perpendicular expansion of a laser-produced carbon (C) debris plasma through a preformed, ambient, magnetized helium (He) background plasma via emission spectroscopy. Spectral profiles of the He II 468.6 nm line have been analyzed via single-mode and multi-mode time-dependent Stark broadening models for hydrogen-like ions, yielding large magnitude ($\sim$100 kV/cm), high-frequency ($\sim$100 GHz) electric fields. The measurements suggest the development of an electron beam-plasma instability, and a simple instability saturation model demonstrates that the measured electric field magnitudes are feasible under the experimental conditions.

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