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Collision-less Coupling between Explosive Debris Plasmas and Magnetized Background Plasmas ANTON BONDARENKO, DEREK SCHAEFFER, S. ERIC CLARK, ERIK EVERSON, BO RAM LEE, CARMEN CONSTANTIN, CHRISTOPH NIEMANN, Univ of California - Los Angeles — The explosive expansion of debris plasma into magnetized background plasma characterizes a variety of astrophysical and space environments, including supernova remnants, interplanetary coronal mass ejections, and ionospheric explosions. In these and other related phenomena, collision-less electro-magnetic processes rather than Coulomb collisions typically mediate the transfer of momentum and energy from the debris to the background. A unique experiment that jointly utilizes the Large Plasma Device (LAPD) and the Phoenix laser facility at UCLA has investigated the super-Alfvénic, quasi-perpendicular expansion of a laser-produced carbon (C) debris plasma through a preformed, magnetized helium (He) background plasma via a variety of diagnostics, including emission spectroscopy, wavelength-filtered imaging, and magnetic field probes. Collision-less coupling is directly observed via Doppler shifts in the He II 468.6 nm spectral line, which indicate that the He II ions are accelerated by the laminar electric field that develops due to the expanding C debris. By utilizing an early-time model of the C debris density and velocity, the laminar electric field is calculated and used in combination with the measured magnetic field to simulate He II ion trajectories and velocities. A synthetic Doppler-shifted wavelength spectrum of the He II 468.6 nm spectral line is generated from the simulated He II ion velocities and found to agree well with the measurements.

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