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Spectroscopic Measurements of Collision-less Coupling Between Explosive Debris Plasmas and Ambient, Magnetized Background Plasmas ANTON BONDARENKO, DEREK SCHAEFFER, ERIK EVERSON, STEPHEN VINCENA, BART VAN COMPERNOLLE, CARMEN CONSTANTIN, ERIC CLARK, CHRISTOPH NIEMANN, UCLA — Emission spectroscopy is currently being utilized in order to assess collision-less momentum and energy coupling between explosive debris plasmas and ambient, magnetized background plasmas of astrophysical relevance. In recent campaigns on the Large Plasma Device (LAPD) ($n_{elec} = 10^{12} - 10^{13}$ cm^{-3}, $T_{elec} \approx 5$ eV, $B_0 = 200 - 400$ G) utilizing the new Raptor laser facility (1053 nm, 100 J per pulse, 25 ns FWHM), laser-ablated carbon debris plasmas were generated within ambient, magnetized helium background plasmas and prominent spectral lines of carbon and helium ions were studied in high spectral (0.01 nm) and temporal (50 ns) resolution. Time-resolved velocity components extracted from Doppler shift measurements of the C^{+4} 227.1 nm spectral line along two perpendicular axes reveal significant deceleration as the ions stream and gyrate within the helium background plasma, indicating collision-less momentum coupling. The He^{+1} 320.3 nm and 468.6 nm spectral lines of the helium background plasma are observed to broaden and intensify in response to the carbon debris plasma, indicative of strong electric fields (Stark broadening) and energetic electrons. The experimental results are compared to 2D hybrid code simulations.

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