UCLA

Plasma Physics Seminar

Physics & Astronomy Building (PAB) Room 4-330

Via Zoom: https://ucla.zoom.us/j/92785449357?pwd=SVBTSko3bTdEUW03dzQwNks1Q2lKZz09

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11:30 AM Lunch will be served

High Repetition Rate Mapping of the Regimes of Laminar Collisionless Coupling

Bobby Dorst (UCLA)

The collective electro-magnetic effects that mediate the transfer of energy from an energetic, dense plasma species to a relatively tenuous, magnetized species have been observed to play an important role in a wide variety of environments from supernova remnants, planetary bow-shocks, and man-made ionospheric explosions to the laboratory scale. An abundance of *in-situ* space-craft and satellite data have been collected in order to examine such collisionless coupling, but these measurements carry numerous challenges due to the irreproducibility of these interactions, limited data sampling, and detangling of temporal and spatial features. Laboratory settings are able to replicate scaled-down, but qualitatively similar conditions in order to make contact with the *in-situ* measurements and help to validate theoretical and simulation efforts. Since there is not a single source term for creating these fields, studying the individual components can be extremely difficult in space-craft data. However, with the flexibility offered by laboratory settings we can more easily isolate and identify each source term for study in high detail. This well resolved data mandates the high-repetition rate acquisition of data in order for it to be feasible. The facilities at UCLA offer a unique platform for studying this behavior: combining the high repetition rate peening laser used to create the dense explosive plasma, the ambient magnetized plasma produced by the Large Plasma Device, and a variety of rep-rated diagnostics that allow for the thorough investigation of the large-scale, collision-less electromagnetic interactions in question.

In the experiments that will be detailed, we separated out the two primary drivers of the coupling: the magnetic structure feature and the Larmor feature. The first experiment we discuss is focused on the magnetic structure feature that dominates in the sub-Alfvénic ($M_A = v/v_A < 1$) regime, and therefore a lower intensity ablation beam created the energetic plasma species. The second experiment used a higher intensity laser to drive a super-Alfvénic, but relatively low-Mach number ($M_A \sim 2$) plasma. Therefore, both the magnetic structure as well as the Larmor term will be present and affect the dynamics. In order to spatially and temporally map the driver plasma velocity as it couples to the background, a novel laser induced fluorescence diagnostic was developed to measure such transient plasma features.