UCLA

Plasma Physics Seminar

Location: BaPSF Auditorium (Rehab Building Room 15-70)
Wednesday June 12, 2019
3:30PM

Investigations of Fundamental Plasma Physics in LAPD: Alfvén Wave Parametric Instabilities / Plasma and Radio Wave Generation by Electron Beams

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From solar radio bursts and the evolution of the solar wind to the loss of fusion alphas in tokamaks, plasma physics phenomena are key to many unsolved problems in both space and fusion plasmas. Investigation of fundamental plasma physics common to all these systems holds keys to unlocking important mysteries. I will focus on two examples: Alfvén wave parametric instabilities and plasma and radio wave generation by electron beams.

Alfvén waves are fundamental modes of a plasma with a magnetic field. The non-linear behavior of these waves may be key in contexts such as the heating of the solar corona and solar wind turbulence. One important non-linear process with a long history of theoretical and simulation studies is a class of parametric instabilities in which a large amplitude Alfvén wave produces various daughter modes. I will show results from experiments at the Large Plasma Device (LAPD) at UCLA which represent the first observation of this type of instability in the laboratory.

The interaction between relativistic electron beams and a magnetized plasma is a fundamental problem relevant to the operation of space-based beams for radiation belt remediation as well as type II/III solar radio bursts. Ongoing LAPD experiments aim to answer key questions about the nature of the generated waves, the wave emission mechanism, and the dependence on plasma parameters. Initial experiments using a 20 keV electron gun show strong emission and radiation between the plasma and upper hybrid frequencies, wave generation by a Landau resonance process, and signatures of both Cherenkov emission and non-linear interactions. Comparisons with simulations and planning for 1 MeV experiments are underway.