The Beams and Applications Seminar Series

Reduced Kinetic Description of Raman Backscatter in a Plasma

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Bldg. 401, Rm. B2100
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Host: Kwang-Je Kim, ASD

Raman backscatter is an important instability in plasma, in which incident laser light can be scattered into a downshifted laser and a plasma oscillation. Recently, it has been extensively studied both in the context of inertial confinement fusion, where it is a deleterious instability that can decrease laser energy on target, and as a mechanism for compressing a long, low intensity pump laser into a short, high intensity seed. While kinetic effects are important to properly model and understand this interaction, they are too time-intensive for parameter scans in realistic geometries. To address this, we have developed a reduced model of kinetic effects in Langmuir wave dynamics using a nonlinear distribution function that includes particle separatrix crossing and self-consistent electrostatic evolution. This asymptotic, phase-mixed distribution function yields a nonlinear frequency shift of the Langmuir wave that agrees well with Vlasov simulations. Furthermore, the incoherent energy required to develop this asymptotic state is used to determine a simplified model of nonlinear Landau damping. The resulting nonlinear, dynamic frequency shift and damping can be used in an extended three-wave type model of driven Langmuir waves, and we discuss comparisons of this model to Vlasov simulations in the context of backward Raman scattering.

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