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Driven Plasma Waves Relevant to Stimulated Raman Scattering
JAY FAHLEN, BENJAMIN WINJUM, JOHN TONGE, F.S. TSUNG, VIKTOR DECYK, WARREN MORI, University of California, Los Angeles — In fully self-consistent particle-in-cell (PIC) simulations the saturation of Stimulated Raman Scattering (SRS) is quite complicated. To better understand possible saturation mechanisms of SRS, we study the excitation of plasma waves by imposing an external ponderomotive force in 1D electrostatic PIC simulations. By varying the phase velocity and the drive frequency (detuning) with respect to the linear frequency, several saturation mechanisms are explored, including fluid and kinetic nonlinear frequency shifts, sideband generation, and particle trapping. The simulations indicate that simple frequency shift models are inadequate in describing the wave saturation. Wave harmonics are also observed and these can contribute to the non-linear frequency shift. A theory for harmonic-generated frequency shifts in the absence of particle trapping is presented along with corroborating simulation data. Further, the simulations are used to understand the effects necessary for developing a consistent harmonic, kinetic theory. Work supported by DOE under DE-FG52-06NA26195 and NSF under NSF-Phy-0321345. Simulations performed on the DAWSON Cluster.

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