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Nonlinear kinetic description of Raman growth using an envelope code, and comparisons with Vlasov simulations DIDIER BENISTI, OLIVIER MORICE, LAURENT GREMILLET, EVANGELOS SIMINOS, CEA/DAM/DIF, DAVID STROZZI, LLNL — Using a nonlinear kinetic analysis, we provide a theoretical description for the nonlinear Landau damping rate, frequency, and group velocity of a slowly varying electron plasma wave (EPW). In particular, we show that the nonlinear group velocity of the EPW is not the derivative of its frequency with respect to its wave number, and we discuss previous results on the nonlinear Landau damping rate and on the nonlinear frequency shift of the EPW. Our theoretical predictions are moreover very carefully compared against results from Vlasov simulations of stimulated Raman scattering (SRS), and an excellent agreement is found between numerical and theoretical results. We use the previous analysis to derive envelope equations modeling SRS in the nonlinear kinetic regime. These equations provide very accurate predictions regarding threshold intensities for SRS and the growth time of SRS beyond threshold, provided that one uses the ansatz of self-optimization that we detail. Finally, we discuss saturation of SRS and, in particular, we derive growth rates for sidebands using a spectral method.

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