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Nonlinear Landau damping, and nonlinear envelope equation, for a driven plasma wave DIDIER BENISTI, OLIVIER MORICE, LAURENT GREMILLET, CEA/DAM/DIF, DAVID STROZZI, Lawrence Livermore National Laboratory — A nonlinear envelope equation for a laser-driven electron plasma wave (EPW) is derived in a 3-D geometry, starting from first principles. This equation accounts the nonlinear variations of the EPW Landau damping rate, frequency, and group velocity, as well as for the nonlinear variations of the coupling of the EPW to the electromagnetic waves. All these quantities are moreover shown to be nonlocal because of nonlocal variations of the electron distribution function. Each piece of our model is carefully tested against Vlasov simulations of stimulated Raman scattering (SRS), and very good agreement is found between the numerical and theoretical results. Our envelope equations for both, the electrostatic and electromagnetic waves, are solved numerically, and comparisons with Vlasov simulations regarding the growth of SRS are provided. Finally, from our theory we can straightforwardly deduce a nonlinear gain factor which provides an alternate, simpler and faster method to quantify the SRS reflectivity. First results using this method will be shown.

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