
Nonlocal equations for nonlinear electromagnetic surface waves

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Abstract

Surface plasmon polaritons (SPPs) are electromagnetic surface waves that propagate on an interface between a conductor and an insulator and decay exponentially away from the interface. In the quasi-static, high-wave number limit, these waves have constant linearized frequency and nonlinear effects lead to complex spatial dynamics. We derive asymptotic equations for quasi-static SPPs on a planar interface between isotropic materials with a cubic Kerr nonlinearity. The asymptotic equations are Hamiltonian and couple the projections of the electric field on the interface onto its positive and negative wavenumber components. We discuss the nonlinear dynamics of these nonlocal equations, including the formation of singularities.

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