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Nonlinear Surface Plasmon Polariton Propagation and Third Harmonic Generation at a Planar Metal/Dielectric Interface YAN GUO, MIRIAM DEUTSCH, Department of Physics, University of Oregon — Surface plasmon polaritons (SPPs) are electromagnetic (EM) waves guided at the interface between a metal and a dielectric. The confinement of EM fields to practically two dimensions leads to extremely high energy densities at the interface. We consider here the interaction of such optical fields with noble metals possessing large third order hyperpolarizabilities. We present analytical solutions to the nonlinear Maxwell equations with third order optical susceptibility. Surface electric dipoles induced at the metal/dielectric interface induce a third harmonic EM wave whose frequency lies above the plasma edge of the metal. The induced field thus becomes a leaky mode, guided at the air-side of the interface while freely propagating into the metal. Various necessary approximations, their limitations and implications are also discussed.

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