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Low-Diffracting Modes in Surface Plasmon Metamaterials SANDEEP INAMPUDI, Department of Physics and Applied Physics, University of Massachusetts Lowell, IGOR SMOLYNONOV, Department of Electrical and Computer Engineering, University of Maryland, VIKTOR PODOLSKIY, Department of Physics and Applied Physics, University of Massachusetts Lowell — Plasmonic structures, with periodic arrays of thin PMMA ridges on metal substrates have been shown experimentally to overcome the diffraction limit. Here we present a theoretical description of this phenomenon. We use mode matching technique to analyze the dynamics of the electromagnetic waves in the periodic systems, taking into account the extended 3D-geometry and the finite thickness of the PMMA ridges. Specifically, we focus on the behavior of plasmonic mode and its non-trivial coupling to the free space waves and to the other guided modes of the system. The eigen states of the periodic system dominated by the surface waves are identified and their dispersion is analyzed via generalization of mode-matching formalism and Bloch-periodic approach. An analytical approximation, adequately describing the behavior of the system is derived and is used to explain the suppression of diffraction in the system.

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