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Hyperbolic Metasurfaces Based on Gold Nanodisks

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Metasurface is a periodic subwavelength array of scatterers that provides effective beam shaping, phase and polarization manipulation of electromagnetic waves. In contrast to bulk metamaterials, metasurfaces allow eliminating volumetric losses, simplifying the manufacturing process, and ensuring full integration into optical planar devices. They can serve as various optical devices including polarization converters, antennas, perfect absorbers, sensors, frequency selectors, etc. In addition, the miniaturization and planarization of optical components requires the in-plane control of the optical signal by means of surface electromagnetic waves. Surface waves are characterized by the spatial distribution of field profiles and the speed of propagation. Hyperbolic propagation regime is one of the most practically important. It may be applied for the spontaneous emission enhancement, planar hyperlensing, sensing, enhanced spin-orbit interactions of light and the in-plane electromagnetic signal transmission. In this work, we provide a practical guide of the hyperbolic metasurfaces engineering. First, we retrieve the surface conductivity of a metasurface consisting of gold nanodisks from the reflectance spectrum. Then, we analyze the dependence of the resonant wavelengths and the spectral width of hyperbolic regime on the period of metasurface and size of nanodisks. The results obtained may be used to design a hyperbolic metasurface based on gold nanoparticles for any relevant purpose on demand.

Topics

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