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Engineering of Plasmonic Anisotropic Nanopatch-Based Metasurfaces

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Hyperbolic metasurfaces are known for their dispersion and polarization properties, such as negative refraction, hyperlensing, enhanced spontaneous emission, etc [1]. The surface waves localized at hyperbolic metasurfaces are called hyperbolic plasmon-polaritons and exhibit a lot of potential applications for planar technologies [2].
In this work, we analyze the dependencies of the spectral positions of the resonances and spectral bandwidth of hyperbolic regime for the metasurfaces based on square arrays of the nanodisks [3] and rectangular nanopatches. Namely, we study the resonant characteristics of metasurfaces by varying the size of the nanoparticles, the degree of stretching (anisotropy) and the period of the metasurface from the isotropic to extreme anisotropic cases. As a result, we defined the quadratic dependence of the spectral bandwidth for one of the resonances on the anisotropy degree, when the electric field is oriented along the stretching direction. Besides, we demonstrate the plasmon canalization, which is characterized by a flat isofrequency contour and the self-collimated unidirectional propagation of surface wave. The canalization takes place in the vicinity of one of the resonances highlighting the relevance of the metasurface engineering for the in-plane optical signal transferring.
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References
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