Search for superresolution in a metamaterial solid immersion lens - DTU Orbit (11/08/2019)

Superresolution is an important feature needed for modern optical microscopy. It can be achieved by using the transmission of evanescent waves in hyperbolic metamaterials. However, such devices suffer from material losses. Here we investigate a recently proposed metamaterial solid immersion lens—an assembly of dielectric nanoparticles. Using the multiple-scattering theory we reveal conversion of evanescent to propagating waves under conditions of coherent scattering. However, efficiency of the conversion is rather low as confirmed by the transmission of the fields of a couple of point sources. Comparing the scattering of light of a spherical cluster of nanospheres with that of a solid sphere of the same radius we find the same far fields in both cases. Generally, our conclusion is that material in the form of the assembly of nanoparticles behaves like an effective medium and does not demonstrate the superresolution in the far field. We believe that the resolution of the metamaterial solid immersion lens has the same origin as that of the conventional solid immersion lens.

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