Invisibility cloaking using thin all-dielectric multilayer coatings

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During the past decade there has been a strong interest in metamaterials, artificial media with exotic electromagnetic properties, mainly for applications in cloaking. Usually, the invisibility cloaks are designed using transformation optics concept and involve metamaterials with anisotropic, magnetic, and extreme material parameters. Due to the artificial nature of these media an experimental implementation of cloaking is non-trivial, especially for operation at optical frequencies. Hence, there are some recent efforts to achieve cloaking using isotropic dielectric materials readily available in nature. Cloaking devices made of a single dielectric material arranged into complicated geometry obtained through numerical optimization has been achieved. This approach is convenient for cloaking of large objects with diameter more than operating wavelength, but it is more appropriate for special cases where cloaking is required only for certain directions of incident wave. An alternative approach is based on using several dielectric materials in multilayer shell geometry. The permittivities of the layers can be optimized using a genetic algorithm. This kind of cloak is spherically symmetric and thus operates independently on incidence direction. In this talk we will discuss the state of the art in the field of cloaking, emphasizing the advantages of using all-dielectric multilayer coatings.