Different Cloaks for Different Folks

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An electromagnetic cloak defined by Pendry et al. (Science, 312, 1780–1782, 2006) consists of either a two-dimensional or three-dimensional, arbitrarily shaped annulus of linear, passive anisotropic material with free space inside and outside the annulus. The anisotropic material is chosen to produce zero scattered fields outside the cloak and zero total fields within the free-space cavity of the cloak for all incident fields originating outside the cloak. Several alternative methods for reducing total scattering cross section have also been described as cloaking. Miller (Opt. Express, 14, 12457–12466, 2006) proposed the use of sensors and active sources near a surface to cloak the region inside the surface. Kildal et al. (IEEE Trans. Antennas Propagat., 44, 1509–1520, 1996) used dielectric-filled parallel-plate waveguides and "hard surfaces" to reduce the scattering from cylinders. Kerker (J. Opt. Soc. Am., 65, 376–379, 1975) and, more recently, Alu and Engheta (Phys. Rev. E, 72, 016623, 2005) have found layered ellipsoids and spheres, respectively, with practically zero dipolar scattering. Milton et al. (Proc. Roy. Soc. A, 462, 3027–3059, 2006) show that the scattering vanishes from a fixed distribution of a finite number of polarizable dipoles within the divergent-field region of "superlenses." Alitalo et al. (arXive, 0706.4376, June 2007) show that an array of small inclusions can be made undetectable by placing them within a transmission-line network that simulates free-space propagation.

In this talk we shall review these alternative forms of cloaking, comparing and contrasting them to the cloaking of Pendry et al.