An antenna can be cloaked to either render it invisible to a “bad guy” or to reduce the effects of scattering and coupling to nearby objects.

This implies a “dual band” mode of operation because the cloak must be transparent to the radiation frequency of the antenna.

Metamaterials used to realize cloaks are inherently narrowband which is an advantage for this application.
Electromagnetic Cloaking of Antennas (2 of 2)

Antenna $A_1$ transmits at frequency $f_1$.
Antenna $A_2$ transmits at frequency $f_2$.
Cloak of $A_1$ must be transparent to $f_1$.
Cloak of $A_2$ must be transparent to $f_2$.

Reshaping the Scattering of Objects

Scattering of an elliptical shaped object.
Rectangular object embedded in an anisotropic medium designed by TEM to scatter like the elliptical object.

Polarization Splitter

Device is made uniform in the $z$ direction.

Maxwell’s equations split into two independent modes.

Each mode can be independently controlled.

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Polarization Rotator

Figure 13. The coordinate transformation employed to design a beam-polarization rotator: (a) the original coordinate system, (b) the transformed coordinate system. The entire circular cylindrical lattice is transformed, but only the cylindrical shell is displayed for clarity of illustration.

Figure 14. Snapshots of the total electric field distribution at the $z$ and the $y-z$ planes (78) (a) $E_x$, (b) $E_y$. An $E$-polarized Gaussian beam impinged upon the device from the $-z$ direction.
Wave Collimator

Figure 16. Snapshots of the $\hat{z}$-polarized total electric-field distribution due to an electric line source located at the coordinate origin: (a) with the line source radiating in free space, (b) with the line source embedded in the wave collimator.

Flat Lenses

Figure 17. The coordinate transformation for a two-dimensional far-zone focusing lens design: (a) the original coordinate system, (b) the transformed coordinate system.

Figure 18. Snapshots of the total electric field for a line source radiating at the coordinate origin: (a) for the line source radiating in free space, (b) for the line source radiating in the presence of the far-zone focusing lens.
Beam Benders

Figure 28. The coordinate transformation for the two-dimensional right-angle bend: (a) the original coordinate system, (b) the transformed coordinate system.

Figure 29. The performance of a right-angle beam bender: (a) a snapshot of the total electric field for a two-dimensional Gaussian beam dispersion from the y direction at a right angle, (b) the magnitude distribution of the electric field.