

Negative refraction and subwavelength focusing using left-handed composite metamaterials

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We report the transmission characteristics of split-ring resonator and left-handed metamaterials (LHM) at the microwave frequency regime. A left-handed transmission band is observed at the frequencies where both dielectric permittivity and magnetic permeability are negative. The two-dimensional LHM structure is verified to have a negative refractive index. We employed three different methods to observe negative refraction; beam shift method, refraction through wedge-shaped negative-index metamaterial, and phase shift experiments. We demonstrated an impedance-matched, low loss negative-index metamaterial superlens that is capable of resolving subwavelength features of a point source with a 0.13λ resolution. By separating two point sources with a distance of $\lambda/8$, we were able to detect two distinct peaks. We also verified that the thickness of the superlens is important to obtain high resolution from a superlens.