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Imaging Potential of a Negative Refractive Index Lens KEVIN WEBB, MING-CHUAN YANG, Purdue University, DAVID WARD, KEITH NELSON, Massachusetts Institute of Technology — Negative refractive index or left-handed (LH) material has been proposed as a perfect lens, whereby evanescent fields in a lossless LH slab would be amplified. Negative permittivity and permeability imply frequency dispersion and, through the Kramers-Kronig relations, loss. Expressing the fields in the object plane by plane wave expansion and assuming some degree of loss in the LH slab, the transfer function of the imaging system for each plane wave component can be obtained. We show that even minute loss has a drastic impact on the support of the plane wave transfer function. This means that for a realistic low-loss LH slab, achieving high resolution implies a near-field restriction, which in turn dictates the slab thickness. An imaging example considers a one-wavelength-thick LH slab, and an incident sub-wavelength transverse magnetic field which is a pulse in space. An approximate image forms in the center of the slab and at the image plane. In addition, the Poynting vector plot of the imaging system shows vortices forming at the surfaces of the LH material as well as at the image plane.

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