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Negative Refraction in a Raman Chiral System Using Rare-earth Atoms DANIEL SIKES, DENIZ YAVUZ, University of Wisconsin-Madison — We propose a new scheme to achieve negative refraction in an atomic system using laser-induced magnetoelectric cross-coupling. Our scheme uses a combination of one photon and far-off-resonant Raman transitions to coherently drive the electric and magnetic responses for a probe beam according to a chiral approach for negative refraction. The key idea of a chiral cross-coupling is that the medium's electric polarization is additionally coupled to the magnetic field of the wave and the medium's magnetization is coupled to the electric field. Under such conditions, a negative refractive index can be achieved with a fraction of the density required by non-cross-coupled systems. The energy level structure of this scheme has an advantage over other proposed schemes in that it does not require the existence of electric and magnetic dipole transitions at the same resonant frequency. By allowing a separation of electric and magnetic transition wavelengths we hope to apply this scheme toward realizable experiments with rare-earth atoms such as dysprosium.

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