

Photonic Metamaterials: Artificial Magnetism, Negative Refractive Index, and Circular Dichroism at Optical Frequencies

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We review some of our recent results on photonic metamaterials operating at optical frequencies. In a series of interferometric pulse propagation experiments on a negative index metamaterial, we have demonstrated simultaneous negative phase and group velocity of light at 1.5 μm wavelength [1]. By optimizing the structure parameters and utilizing silver instead of gold, we have significantly reduced the losses of the negative index metamaterial [2]. Further downscaling of the lattice constant has brought the negative refractive index to the red end of the visible spectrum [3]. Oblique incidence spectroscopic experiments have led to the observation of magnetization waves in negative index metamaterials [4]. Very recently, we have also fabricated negative index metamaterial with up to three functional layers [5] and demonstrated circular dichroism in a layered chiral metamaterial [6].

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[3] G. Dolling, M. Wegener, C. M. Soukoulis, S. Linden, *Opt. Lett.*, Doc Id. 74376.

[4] G. Dolling, M. Wegener, A. Schädle, S. Burger, S. Linden, *Appl. Phys. Lett.*, in press.

[5] G. Dolling, M. Wegener, S. Linden, submitted to *Opt. Lett.*.

[6] M. Decker, M. Wegener, S. Linden, *unpublished*.