Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Nonlinear Propagation in Fishnet Metamaterials HAIM SUCHOWSKI, KEVIN O'BRIEN, ZI JING WONG, XIAOBO YIN, XIANG ZHANG, NSF Nano-scale Science and Engineering Center (NSEC), University of California, Berkeley, California 94720, USA — We present experimental and theoretical investigations of four-wave mixing in negative index metamaterials at optical frequencies with the goal of demonstrating a phase matched backward wave. The nonlinear propagation in thick fishnet structures are examined, in order to show an experimental observation of backward nonlinear optical generation in negative refractive index materials. We have fabricated a fishnet metamaterial with a negative refractive index in the near infrared and have measured its index using spectrally and spatially resolved interferometry. An infrared four wave mixing process was chosen to ensure that the linear properties of the fishnet can be treated with effective medium theory. The signal and idler are obtained from two optical parametric oscillators driven by synchronized femtosecond lasers. We find that with a counter-propagating pump and signal one can obtain perfect phase matching for the backward propagating idler and a large enough phase mismatch to suppress the forward propagating idler. Our efforts towards an experimental demonstration of nonlinear phase matching in negative index optical metamaterials will be discussed.

Haim Suchowski
NSF Nano-scale Science and Engineering Center (NSEC),
University of California, Berkeley, California 94720, USA

Date submitted: 20 Dec 2012 Electronic form version 1.4