Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Semiconductor-based mid-IR metamaterials: experimental and theoretical studies ANDREY SEMICHAEVSKY, CHRISTIAN HARRIS, Lincoln University (PA), DONGXIA WEI, STEPHANIE LAW, University of Delaware — All-semiconductor (III-V) metamaterials (MTM) for the infrared (IR) can be applied to superlensing and optical cloaking [1]. 1-D metallic-semiconductor superlattices can be designed to have hyperbolic dispersion due to the choice of their effective permittivity tensor components. In this paper we go beyond the effective-medium theories and provide a detailed analysis of how the choice of doping levels and layer thicknesses in the InAs - InAs:Si will affect the reflectance of the MTM superlattice in the IR. In order to do that, four metamaterial samples with various doping profiles were grown by MBE and characterized using FTIR. For the same samples we performed full-wave calculations of the wavelength- and angle-resolved reflectance. Our numerical model is suitable for 1-D inhomogeneous lossy dispersive media and is capable of accounting for an arbitrary doping profile and the quantum mechanical tunneling of electrons in the heterostructure. Experimental and theoretical results for the reflectance of IR metamaterial structures are compared. [1] S. Law, C. Roberts, T. Kilpatrick, L. Yu, T. Ribaudo, E. A. Shaner, V. Podolskiy, and D. Wasserman, *Phys Rev. Letters*, **112**, 017401, 2014.

Andrey Semichaevsky
Lincoln University (PA)

Date submitted: 28 Oct 2015 Electronic form version 1.4