

## SPIE Student Seminar Series



**Nathaniel Kinsey**

**(Virginia Commonwealth University)**

### **Epsilon-Near-Zero Materials - Making Photons Talk**

**Tuesday, February 16th, 2021**

**11:00 am ~ 12:00 pm (CST)**

**ZOOM ID: 980 4617 4137**

**Abstract:** Controlling the phase, amplitude, and frequency of photons in unique ways is a fundamental goal of optics. Among the wide range of techniques available, nonlinear optics offer unique advantages allowing frequency conversion, ultrafast switching, and temporal pulse shaping just to name a few. Unfortunately, many of the nonlinear processes are weak and require large intensities to utilize. Towards this end, epsilon-near-zero (ENZ) and near-zero-index (NZI) materials have recently come onto the scene as promising nonlinear materials. They have experimentally demonstrated near-unity-order refractive index tuning, enhanced harmonic generation, and nearly perfect frequency shifting among others. Here, we will contextualize these advances by laying out the foundations of nonlinear interactions in ENZ and NZI materials. We will review some of the unique nonlinear experiments they have enabled in recent years, and discuss their general strengths/weakness when compared to the large library of other nonlinear materials. While certainly not the solution for all challenges in the field, ENZ materials provide several unique benefits that ensure they will remain a key area of research in the years to come.

**Bio:** Nate received his bachelors degree in Electrical Engineering from the University of Missouri – Columbia in 2011, graduating Magna Cum Laude. He followed with his Masters of Science from the University of Missouri in 2012 where he researched optically activated solid-state switches for high energy RF systems. Following, Nate moved to Purdue University to pursue his PhD where he researched nonlinear optics, integrated nanophotonics, and plasmonics. During his time at Purdue Nate received several awards for his research contributions including the Meissner Fellowship, the Bilsland Dissertation Fellowship, and the College of Engineering Outstanding Graduate Research Award. In the fall of 2016 Nate joined Virginia Commonwealth University as an Assistant Professor of Electrical and Computer Engineering where he continues his studies of light-matter interactions.

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