2:00 PM *A12.2

Detectors at the Intersection of Photons and Electromagnetic Fields or, Where Einstein Meets Maxwell. Blake Eliasson[2] and Garret Moddel[1,2]; [1]Electrical & Computer Engineering, University of Colorado, Boulder, Colorado; [2]Phiar Corporation, Boulder, Colorado.

For standard visible and near-infrared light detectors, the detection is generally described using photon energies and numbers. For radio frequency waves picked up using an antenna and diode, i.e., a radio receiver, classical electromagnetics is fully adequate to describe the detection. But neither approach works when an antenna and diode are used to detect higher energy radiation in what is generally thought of as the domain of photons. We describe the operation and design of a detector comprising a micro-antenna and an ultra-high-speed metal-insulator tunneling diode. When the photon energy is on the order of or larger than the scale of the diode nonlinearity, we describe the detection using a semiclassical approach. The detector can pick up radiation from gigahertz to infrared (carrier) frequencies, and detect signals at up to terabit/second rates. By incorporating a double-insulator quantum well we provide a highly-nonlinear diode for efficient detection. This crystal radio for photons is a practical, integratable thin-film detector for a wide range of applications from broadband communications, through terahertz imaging, to ultra-high-speed infrared detection.