Abstract Submitted
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Three-dimensional graphene photonic crystal DUANNI HUANG, Sandia National Labs, UC Santa Barbara, XIAOYIN XIAO, RONEN POLSKY, DAVID BRUCE BURCKEL, TING LUK, IGAL BRENER, Sandia National Labs, DANHONG HUANG, Kirtland AFRL, WEI PAN, Sandia National Labs — We perform finite element method (FEM) simulations on a three-dimensional, multi-layer graphene structure patterned by interferometric lithography. The structure shows periodicity and face centered cubic (fcc) symmetry and a lattice constant of 1.7 microns. Initial simulations predict a photonic bandgap centered on a wavelength of 2.5 microns for high dielectric contrast ($\varepsilon_r > 16$). Further simulations modeling graphene as a dispersive material find evidence of surface plasmon activity. We believe the structure shows promise as a 3-D photonic crystal with a tunable bandgap by utilizing the ability to modify the Fermi level and plasma frequency of the material. Such a device may have applications in quantum sensing. Current efforts on this topic focus on experimental verification of the bandgap as well as a deeper understanding of the interaction between electrical and photonic mechanisms within the structure.

Duanni Huang
Sandia National Labs, UC Santa Barbara

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