MAR16-2016-020825

Abstract for an Invited Paper
for the MAR16 Meeting of
the American Physical Society

Field confinement using metasurfaces for increased-efficiency III-V infrared detectors

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Field concentration using metallic metasurfaces directly integrated with InAsSb infrared detectors allows us to fundamentally change the detector architecture. Expected advantages of this new architecture are lower dark current and crosstalk while maintaining or improving the MTF and external quantum efficiency. The metasurface is used in conjunction with a metallic backplane to form a resonant cavity around the detector material. This leads to the incoming optical field concentrated in a small volume, allowing for a much thinner absorber layer while maintaining complete field absorption. The metasurface also offers an antireflection surface with angular insensitivity. This geometry required the development of new processing steps and allows for different material compositions. The modeling, fabrication, and characterization of first-generation structures will be discussed. I acknowledge the contributions of Jin Kim, Anna Tauke-Pedretti, Michael Goldflam, and Joel Wendt to this work.