Antimonide-based infrared detectors and focal plane arrays

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Infrared imaging (3–25 μm) has been an important technological tool for the past 60 years since the first report of infrared detectors in 1950's. There has been a dramatic progress in the development of antimonide-based detectors and low-power electronic devices in the past decade, with new materials like InAsSb, InAs/GaSb superlattices and InAs/InAsSb superlattices demonstrating very good performance. One of the unique aspects of the 6.1A family of semiconductors (InAs, GaSb, and AlSb) is the ability to engineer the bandstructure to obtain designer band-offsets. Our group investigates fundamental challenges in antimonide based infrared detectors and explores new avenues for next-generation infrared detectors, arrays, and imagers.

In this presentation, I will describe the material science and device physics of the antimonide systems. I will also discuss the challenges in these systems including the identification of defects that limit the performance of the detector. The use of "unipolar barrier engineering" to realize high-performance infrared detectors and focal plane arrays will be discussed. I will also explore the possibility of realizing fourth-generation infrared imaging systems. Using the concept of a bio-inspired infrared retina, I will make a case for an enhanced functionality in the pixel. The key idea is to engineer the pixel such that it not only has the *ability* to sense multimodal data, such as color, polarization, dynamic range and phase, but also the *intelligence* to transmit a reduced data set to the central processing unit.