Metasurface-Driven Mid-Infrared Detection and Imaging

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Thermal imaging holds broad application prospects in industrial process monitoring, building inspection, smart home appliances, the Internet of Things (IoT), health, and safety. Meanwhile, miniaturized imaging systems are critical for advancing on-chip integrated optical devices. However, lenses in the mid-infrared spectrum are typically fabricated from bulky materials (e.g., germanium) with large physical footprints, resulting in bulky and costly thermal imaging systems. In this presentation, I will demonstrate how metamaterial technology addresses this challenge. To this end, we developed an 8-mm-diameter all-silicon planar metalens operating in the long-wave infrared (LWIR) range (8–15 μm). By integrating this metalens with a two-dimensional infrared detector array [1], we achieved a chip-scale thermal imaging device. This device reliably reconstructs the temperature profiles of macroscopic objects. Such wafer-scale all-silicon metalenses can be mass-produced via CMOS-compatible processes, offering significant potential for cost reduction and miniaturization of thermal imaging systems [2, 3].

References

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