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Electromechanical control of flat optical devices TAPASHREE ROY, Argonne National Lab, SHUYAN ZHANG, John A. Paulson School of Engineering and Applied Sciences, Harvard University, IL WOONG JUNG, Argonne National Lab, FEDERICO CAPASSO, John A. Paulson School of Engineering and Applied Sciences, Harvard University, DANIEL LOPEZ, Argonne National Lab —
In the recent times flat optical elements, like lenses and beam deflectors, have come to the forefront of scientific research. These devices, also referred to as metasurfaces, use metal or dielectric resonators, arbitrarily spaced with subwavelength resolution on a two dimensional plane, to mimic the phase profile of any conventional bulk optical device and beyond. Such metasurface-based planar devices are compact and lightweight compared to their conventional bulky counterparts. However, most of these nanostructured devices have so far been passive. In this work we introduce an important concept of actively controlling these flat optical devices. A prototype: an electromechanically controlled plasmonic flat lens focusing mid infrared signal in reflection will be presented. The lens is fabricated on a 2.8 micron thin membrane following photolithography processes and integrated with a micro electromechanical system (MEMS) device. When electrostatically actuated, the MEMS platform controls the mechanical tilt angle of the lens along two orthogonal axes by about 16 degrees that in turn controls the scanning of the focal spot. Such actively controlled miniaturized optical devices promise to provide faster, more efficient and often enhanced functionalities.

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