

# Switchable Photonics with Soft-lattice Perovskites

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## ABSTRACT

Researchers at the University of California, Davis have developed a technology that enables rapid, reversible, and opposite-direction optical switching in the mid-infrared range using single crystalline halide perovskite materials activated by either light or heat.

## FULL DESCRIPTION

This technology utilizes single crystal cesium lead bromide (CsPbBr<sub>3</sub>) halide perovskites to enable fast, reversible, and diametrically opposite optical switching of mid-infrared (MIR) transmission. Optical excitation with above-bandgap light reduces transmission via polaron-like lattice distortion, while thermal excitation near 80°C increases transmission due to lattice expansion and the material's negative thermo-optic coefficient. The switching achieves modulation greater than 10% in under 1 millisecond, making this a promising platform for reconfigurable photonics driven by intrinsic soft lattice properties.

## APPLICATIONS

- ▶ Mid-infrared photonic devices for sensing and communications.
- ▶ Reconfigurable optical filters and modulators.
- ▶ Dynamic tunable lenses and beam steering components.
- ▶ Infrared imaging and spectroscopy systems.
- ▶ High-speed optical switching in integrated photonicst.

## FEATURES/BENEFITS

- ▶ Reversible switching with opposite polarity via independent optical or thermal control.
- ▶ Fast modulation times below 1 millisecond. Significant tunable changes in mid-infrared transmission (>10%).
- ▶ Utilizes robust inorganic single crystalline halide perovskite material.
- ▶ Low power optical excitation (e.g., 40 mW laser at 532 nm).
- ▶ Non-reliant on phase-change materials, reducing degradation.
- ▶ Eliminates losses and delay associated with electronic circuit-based light modulation.
- ▶ Overcomes limited switching states and high power requirements of phase-change materials.
- ▶ Addresses degradation issues of existing phase-change optical switches.
- ▶ Expands optical switching capability into the mid-infrared spectrum.
- ▶ Offers dynamic and tunable control without compositional changes or mechanical strain.

## PATENT STATUS

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## OTHER INFORMATION

### KEYWORDS

cesium lead bromide,  
halide perovskite, mid-  
infrared, optical  
switching, polaron lattice  
distortion, reconfigurable  
photonics, reversible  
transmission, single  
crystal, thermal  
excitation, tunable  
absorption

### CATEGORIZED AS

- ▶ **Optics and Photonics**
- ▶ All Optics and Photonics

### RELATED CASES

2024-521-0

Patent Pending

## ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ [Mechanical Power Generation Through Passive Radiative Cooling](#)
- ▶ [Methods and Systems for Determining Optical Properties of Materials Using Casimir Interactions](#)
- ▶ [Thin Film Thermophotovoltaic Cells](#)

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