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Reconfigurable Photonic Metamaterials driven by Coulomb, Lorentz and Optical Forces

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Abstract: Metamaterials offer a huge range of enhanced and novel functionalities that natural materials cannot provide. They promise applications in superresolution imaging, optical data storage, optical filters, polarization control, cloaking, fraud prevention and many more. However, their unique optical properties are often narrowband and usually fixed. Here we demonstrate how the mechanical rearrangement of metamaterial structures at the nanoscale provides a powerful platform for controlling metamaterial properties dynamically. Using thermal, electrical, magnetic and optical control signals we demonstrate large-range tuning, high-contrast switching and modulation of metamaterial optical properties at megahertz frequencies and beyond. Beyond the obvious benefit of adding tunability to known metamaterial functionalities, this unlocks many new opportunities in areas such as light modulation and highly nonlinear & bistable optical devices.