Docket #: S17-095

Low-Power, Active Light Tuning via MEMS Optical Antenna

Stanford researchers have developed a simple optical device for low-power, active light tuning. The device tunes the color of light across the visible spectrum and at select wavelengths by electrical biasing an array of micron sized pixels or nanowires. Electric and magnetic-like optical modes can be simultaneously or separately excited. Light scattering can be enhanced or suppressed. By utilizing optically resonant structures, a larger range of spectral tunability as well as phase progression is possible compared to non-resonant or Fabry-Perot based devices. Due to the capacitive nature of the actuation mechanism, this device operates at lower powers than other technologies and is suited to a wide range of applications, including optical communications and low power, color displays.

Stage of Research

Researcher have built and tested a proof-of-concept device. Figures 1 and 2 show device schematic, and active tuning for the device.

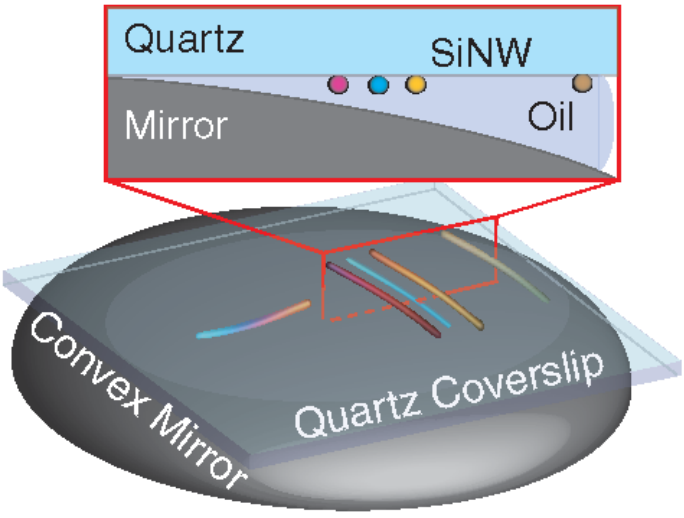


Fig. 1 Proof-of-concept device schematic with Si nanowire.

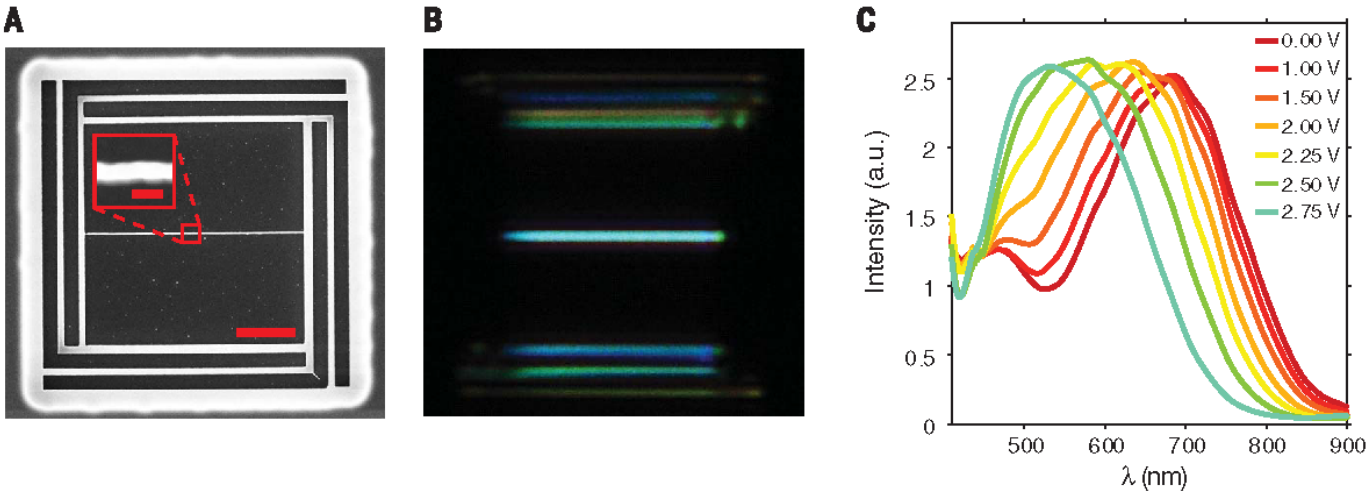


Fig. 2 Active tuning of light scattering with a nanoelectromechanical device. **A** Scanning electron micrograph of device with a suspended Si nanowire. Scale bars, 2 mm (main panel); 100 nm (inset) **B** Dark-field scattering image of the device. **C** Dark-field scattering spectra confocally collected from the Si nanowire under applied bias and TM polarization.

Applications

- Optical communications and optoelectronic devices:
  - Low-power optical information switching at moderate frequencies (MHz),
  - Reconfigurable phased array optics
  - Free-space optical data communication
  - Metasurface-based optics, such as photodetectors, solar cells, and light emitters
- LiDAR
- Adaptive optics
- Low-power color display technology
- MEMS-based sensing technologies/ sensors

Advantages

- Low-power, larger range broadband color tuning

Publications

- Holsteen, Aaron L., et al. "Purcell effect for active tuning of light scattering from semiconductor optical antennas." *Science* 358.6369 (2017): 1407-1410. DOI:zx10.1126/science.aao5371

Patents

- Published Application: 20180299743
- Issued: 10,795,234 (USA)

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