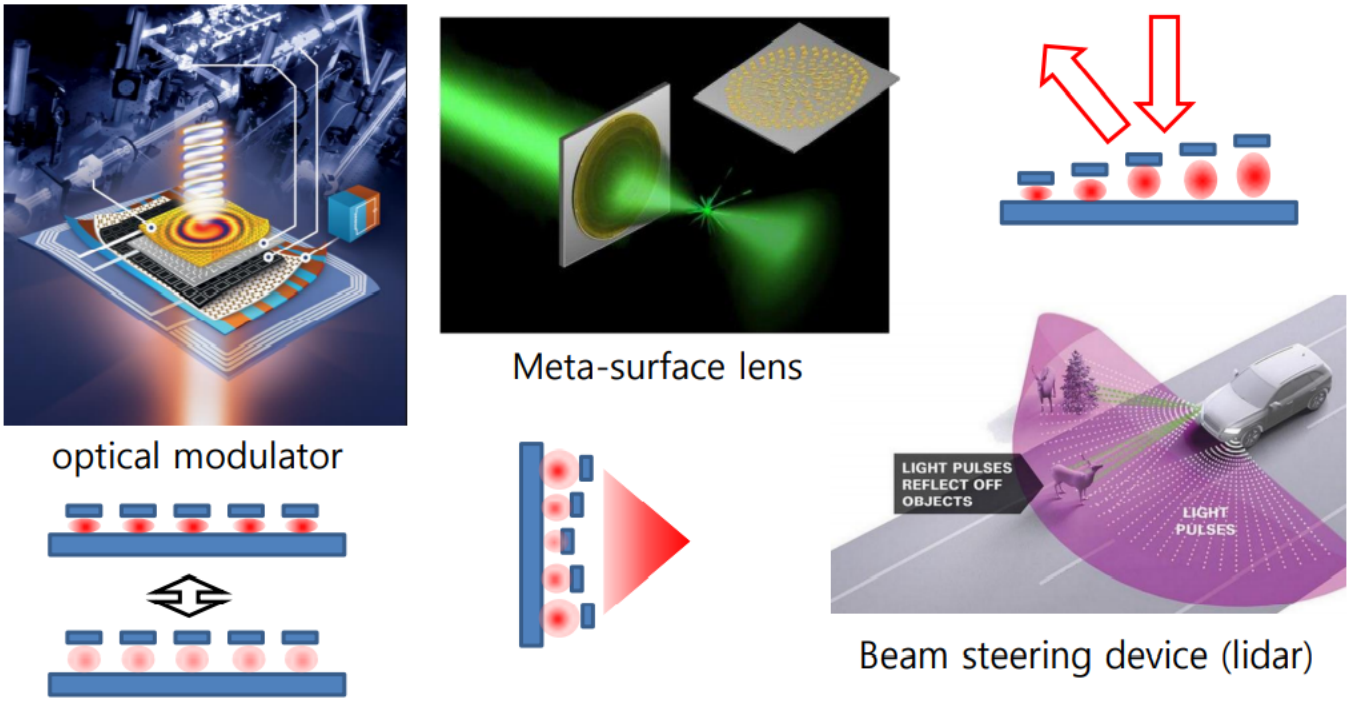
**Docket #:** S17-078

# Mechanically Tunable Metasurface for Optical Modulation, Beam Steering

Researchers at Stanford have developed a tunable metasurface with high reflectance and large phase modulation for use as optical phase modulators or beam steering device (Lidar). Currently, the large size of beam steering devices is a critical problem. Tunable metasurfaces are promising candidates for on-chip (compact) beam steering, but low efficiency (reflectance) has been a problem. The new design can provide much higher reflectance compared to previous ITO-based tunable metasurfaces. It comprises a metal reflector and multiple metal nano-beams with an **adjustable air gap** in between. By adjusting the gap distance between metal antenna and reflector, resonance behavior of the antenna can be dramatically changed, resulting in the large phase (or amplitude) modulation of the beam reflected from the metasurface.




Applications of the novel metasurface technology (image credit: the inventors)

**Related Technologies**

Stanford docket S17-079 - **Multi-Wavelength Laser with Perpendicular Polarization**

Describing a multi-wavelength laser with perpendicular polarization, which supports easy and independent measurement in various optical sensors for improved accuracy and speed.

Stanford docket S17-263 - **Holographic Beam Steering Device**

Describing a highly efficient (>90%) holographic beam steering method for obtaining distance information of objects nearby, with applications from autonomous vehicles to home appliances.

Stanford docket S17-487 - **Metasurface Micro-Cavity for OLED Color Purity**

Describing a simpler and low-cost micro-cavity design for color tuning of organic light emitting devices (OLEDs) for display applications.

Stanford docket S18-193 - **High-Efficiency Broad-Angle Dielectric Diffraction Grating**

Describing a dielectric diffraction grating that provides high (near-unity) diffraction efficiencies in an ultra-compact volume. With applications in a variety of optical systems such as telescopes and VR.

Stanford docket S18-495 - **Metasurface Display for Augmented and Virtual Reality**

Describing a near-eye display enabling both Augmented Reality (AR) and Virtual Reality (VR) modes with dynamically controlled contrast.

## Applications

- Metasurface based optical modulator (absorption or phase)
- Tunable metasurface lens
- Beam steering device (Lidar)

## Advantages

- Can provide higher reflectance compared to previous ITO-based metasurfaces
- In real device applications, low reflectance can cause serious problems such as unnecessary heat-up during operation and low energy efficiency

## Patents

- Published Application: 20180314130
- Issued: 10,649,303 (USA)

## Innovators

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