Docket #: S18-193

High-Efficiency Broad-Angle Dielectric Diffraction Grating

Researchers at Stanford have developed 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, this innovation utilizes low-refractive-index materials and is compatible with nano-imprint fabrication methods for low-cost, large-area manufacturing. The grating is optimized for incoming light to have very large glancing incident angles, providing an ultra-compact volume and beam magnification. The grating is further optimized for the desired output angle, which can be selected over a broad range. By varying the grating across the full surface, light can be arbitrarily redirected, performing functions such as beam expansion or focusing. By including a second diffraction grating in series, more operations can be achieved such as chromatic dispersion-compensation or 2-D functionality. Furthermore, the low profile grating can be made visibly transparent when fabricated on a narrow-band Bragg mirror.

Overall configuration (image credit: the inventors)

Related Technologies:
Stanford docket S17-078 - **Mechanically Tunable Metasurface for Optical Modulation, Beam Steering**
Describing a metasurface with high reflectance and large phase modulation for use as optical phase modulators or beam steering device (Lidar).

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 S18-495 - **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

- Folded optical systems e.g., telescopes, beam expanders
- Optical combiners for augmented reality, virtual reality, or light-field display system

Advantages

- High efficiency (near unity) for operation with large input angles over a broad range of output angles.
- Can provide optical magnification with large input angles and small output angles.
- Can perform arbitrary redirection of incident light over one dimension, such as lensing.
- Nonresonant architecture provides broad angular operation over the defined range.
- The low profile grating can provide high optical transparency when fabricated on a Bragg reflector.
- Chromatic dispersion can be compensated for with a second diffraction grating

Patents

- Published Application: 20200073031
- Issued: 11,747,528 (USA)

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