

Narrowband Spatial Light Modulator



AI Overview

A narrowband spatial light modulator (SLM) is a device that modulates the amplitude, phase, or polarization of light within a limited spectral range, enabling precise control of monochromatic or quasi-monochromatic light.

Overview A spatial light modulator (SLM) is an optical device that imposes a spatially varying modulation on a light beam, which can affect its intensity, phase, or polarization. Narrowband SLMs are specifically designed to operate over a restricted wavelength range, typically for applications requiring high spectral selectivity, such as laser beam shaping, holography, or quantum optics experiments. Unlike broadband SLMs, which can handle multiple wavelengths simultaneously, narrowband SLMs optimize phase stability and efficiency for a single or narrow set of wavelengths.

Working Principle Narrowband SLMs often use liquid crystal on silicon (LCOS) or digital micromirror devices (DMDs):

- LCOS SLMs:** Utilize the optical anisotropy of liquid crystals to modulate the phase of incident light. The liquid crystal molecules tilt in response to an applied voltage, changing the refractive index and thus the optical path length for a specific wavelength. Narrowband operation ensures that the phase modulation is optimized for the target wavelength, minimizing chromatic dispersion.
- DMD-based SLMs:** Use micromirrors that tilt to modulate light intensity. While typically used for amplitude modulation, narrowband DMDs can be combined with spectral filters to achieve wavelength-specific control.

Applications Narrowband SLMs are particularly useful in applications where spectral precision is critical:

- Laser beam shaping:** Creating flat-top or complex intensity profiles for material processing or optical trapping.
- Holography and 3D displays:** Generating computer-generated holograms with minimal chromatic aberration.
- Adaptive optics:** Correcting wavefront distortions in microscopy, retinal imaging, or free-space optical communications.
- Quantum optics and atomic physics:** Controlling optical traps, manipulating single...

Article Content

Spatial light modulators for industry and research

Spatial light modulators can concentrate broad light beams into strong laser spots. The 2-axis tilting mirrors redirect incident light into a large

Two-dimensional pixel-level addressable mid-infrared metasurface ...

A mid-infrared amplitude metasurface spatial light modulator using phase change materials is demonstrated in a scalable crossbar architecture on a silicon foundry platform, allowing for high ...

Recent Progress of Terahertz Spatial Light Modulators:

In this review, we summarize the recent progress of THz spatial light modulators from the perspective of functional materials and analyze their

Electrically programmable pixelated coherent mid-infrared thermal ...

Based on this spatial temperature modulation, we develop an integrated emissivity-temperature scheme to create an electrically programmable 2D-pixelated mid-infrared metasurface,

Efficient GHz electro-optical modulation with a nonlocal lithium ...

A lithium niobate nonlocal metasurface with high-Q (~ 8000) resonances demonstrates efficient GHz-rate reflectivity modulation (~ 0.1) and one order of magnitude second harmonic

External Modulation Optical Coherent Domain

Optical coherent domain reflectometry (OCDR) can achieve a high spatial resolution that is independent of the bandwidth of the receiver, but the

Metasurface-assisted spatial light modulation with a

This work proposes a hybrid control architecture that enhances scanning range and viewing angle without increasing system volume, where the

What Is a Spatial Light Modulator? Definition, Types & Uses

What Exactly Is a Spatial Light Modulator? A spatial light modulator is an electro-optical component that imposes spatially varying modulation on an incident light beam. In simpler terms: it's

Optical PSF obtained using PRPEL with both narrowband

Increase of Charge-Coupled Device Resolution limits using Spatial Light Modulator
Article Full-text available Oct 2016

Spatial light modulator via optically addressed metasurface

Emerging demands for dynamic wavefront modulation in holographic displays, augmented/virtual reality, and light detection and ranging require spatial light modulators (SLMs) with

Subvolt high-speed free-space modulator with electro

Specifically, transmissive intensity modulators, phase modulators and two-dimensional multi-pixel spatial light modulators should also be feasible

Short distance illumination of a spatial light modulator using a curved ...

U.S. Patent Application US20210080741A1 for a display device includes a light source, a spatial light modulator, and an optical assembly. The light source is configured to provide illumination light and

NED University of Engineering & Technology: Researchers Model

This level of precision was unattainable until now. NED University of Engineering & Technology carefully modelled quantum gate operations using a spatial light modulator, a device

Programmable Supercontinuum Laser Spectrum

Supercontinuum (SC) lasers combine a broadband light spectrum with the unique properties of single-mode lasers. In this work we present an optical

On-chip silicon electro-optical modulator with ultra-high extinction ...

On-chip optoelectronic devices are promising to build compact and efficient distributed acoustic sensing (DAS) systems. Here, the authors demonstrate an ultra-high extinction ratio electro

Achieving Narrowband and Stable Pure Blue Organic Light-Emitting

1 Introduction With remarkable advancements in display technology driven by organic light-emitting diodes (OLEDs), emitting materials with narrowband spectra have become

Liquid crystal based tunable terahertz metadevices

THz spatial light modulators (SLMs) have widespread applications, ranging from wireless communication and radar imaging to nondestructive sensing. The most universal SLMs can

Spatial Light Modulators

We develop custom spatial light modulators with segmented micromirror arrays and a high pixel count—tailored for demanding industrial applications. Our advanced

Polarization-insensitive narrowband reflective wavefront manipulation ...

Here, we numerically present a reflective all-dielectric metasurface platform achieving simultaneous local phase control and spectral filtering: it reshapes the wavefront at a specific

Large-field-of-view narrowband light collection enabled

We demonstrate that integrating gradient-phase metasurfaces with a narrowband filter significantly enhances angular tolerance and broadens the

Metasurface-Empowered Quantum Photonics

For exam-ple, Figure 5i shows a well-designed multiplexing metasurface intended for the measurement of single-photon OAM quantum states. Conventionally, the measurement of OAM quantum

Plasmonic metafibers electro-optic modulators | Light: Science

Electro-optic modulators (EOMs) are indispensable elements in the optical communication systems, which control the amplitude, phase and polarization of a light via external

RL-SLM-R1 Spatial Light Modulator

High Power Steady State IR Sources CW High Power IR Source for Spectroscopy, NDIR, FT-IR Extended Area Blackbodies Mid IR Narrowband LEDs & Photodiodes Infrared Pulsable Array for

Adaptive Optics-Enhanced Michelson Interferometer for Spectroscopy

Adaptive optics enables the deployment of interferometer-based spectroscopy without the need for moving parts necessary for scanning the interferometer arms. Here, we employ a Michelson

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