

PRESS RELEASE

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Fraunhofer IPMS presents latest Spatial Light Modulators at Photonix Japan

High-Resolution Phase Modulation for Holography, Quantum Computing and Adaptive Optics

The Fraunhofer Institute for Photonic Microsystems IPMS is one of the world's leading research institutions in the field of spatial light modulators. Its technologies enable light to be controlled and shaped with high precision. This opens up new possibilities in semiconductor manufacturing, medical technology, and precision optics. At Photonix Japan 2026, Fraunhofer IPMS will present its latest research findings. The institute will also demonstrate how its spatial light modulators can be further developed into customized solutions for demanding photonic applications.

Spatial light modulators (SLMs) enable high-precision, high-speed modulation of both the amplitude and phase of light at the microscopic level. As a key technology for modern optical applications, they provide the foundation for advances in microlithography, microscopy, adaptive optics, holographic image and pattern generation, and quantum computing. The institute develops SLMs based on microelectromechanical systems (MEMS). These SLMs provide a versatile technology platform for wavelengths ranging from deep ultraviolet (DUV) to near-infrared. Building on this platform, Fraunhofer IPMS develops application-specific solutions tailored to the requirements of its partners.

New Applications for SLM Technologies

Recent advances in spatial light modulation are expanding the range of potential applications.

In **microscopy**, precisely controlled single-axis tilting mirrors can be used to illuminate samples selectively and at high resolution. In the **semiconductor industry**, modulation techniques in the UV and DUV spectral ranges help optimize lithography processes. The technology also offers potential for **materials processing**: two-axis tilting mirrors can redistribute light with low optical loss, thereby increasing processing efficiency. For **3D holography**, precise phase modulation enables the generation of true three-dimensional representations. Unlike 2D representations that merely simulate a sense of depth, this produces a genuinely three-dimensional hologram.

SLMs developed by Fraunhofer IPMS can precisely control light intensity. The amplitude modulation opens up applications, including **laser beam shaping**, **optical signal processing**, and advanced **display technologies**.

Editor

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FRAUNHOFER INSTITUTE FOR PHOTONIC MICROSYSTEMS IPMS

In **quantum computing**, SLMs use holographic techniques to shape laser beams. The resulting focused spots of light act as optical tweezers that trap individual neutral atoms. This allows large numbers of atoms to be controlled simultaneously in flexible configurations. The light patterns can be dynamically adapted to different quantum operations. Operating the SLMs at ultraviolet wavelengths also supports the necessary excitation of the atoms.

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Evaluation Kits for Versatile Spatial Light Modulators

To enable interested companies to test spatial light modulators, Fraunhofer IPMS offers evaluation kits. A single kit allows different mirror architectures to be tested on the same platform. Depending on the actuator used, the micromirrors can either be tilted or displaced vertically.

The “DIFFRACTIVE MEMS KIT” is based on an array of analog tilting micromirrors and enables high-speed, high-resolution control of optical amplitude. Alternatively, the kit is available with an analog piston mirror array for phase modulation.

“A diffractive optical element does not merely reflect light like a conventional mirror. Its specially designed structure diffracts the light, sending it in specific directions,” explains Dr. Michael Wagner, Head of the Spatial Light Modulators Business Unit at Fraunhofer IPMS. “Our diffractive MEMS device features 256×256 individually addressable tilting mirror elements, each with an edge length of 16 micrometers. Each mirror element can be moved independently through an almost continuous range between its initial position and a defined tilted position. This allows light to be steered precisely in different directions. The device is suitable for both DUV light and longer wavelengths.”

In addition to the micromirror chip, the kit includes a complete control electronics system, quick-start software, and a flexible PC interface library.

Potential applications range from 3D displays and mirror-based adaptive optics to quantum computing with neutral atoms. At Photonix Japan, Patrick Recknagel will present the technology and explain its key principles, performance characteristics, and use cases for industry and research. The technology could therefore help drive innovative industrial solutions and scientific advances, including in astronomy and quantum computing.

Cooperation Opportunities: From Proof of Concept to Custom Development

Fraunhofer IPMS offers companies and research institutions a range of collaboration models. “Our evaluation kits enable users to validate SLM technology in their own application environment. For specific requirements, we develop custom SLMs—from the initial feasibility analysis to pilot production. Our expertise spans design, process development, and system integration,” says Wagner.

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Fraunhofer IPMS will participate in Photonix Japan for the eleventh time. This underscores the institute's long-standing commitment to the Japanese photonics market. The trade show will take place from September 30 to October 2, 2026, in Makuhari, Chiba. At Booth 49-39 in Hall 8, the institute will present the evaluation kit and a portfolio of high-performance spatial light modulators. Visitors will also have the opportunity to examine components embedded in acrylic glass up close. Appointments for personal discussions with the researchers can be arranged in advance via the institute's website. A Japanese-English interpreter will be available on site.

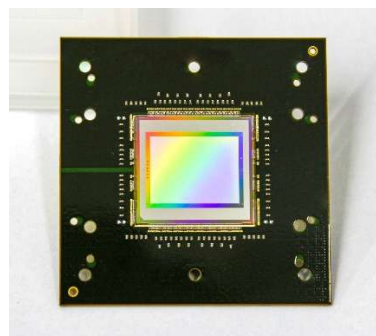
About Fraunhofer IPMS

Fraunhofer IPMS is a leading international provider of research and development services for electronic and photonic microsystems. Our technologies are used in industrial applications, mobility, biotechnology, and medical technology. We also focus on key future areas such as quantum technologies and neuromorphic computing. Through our research into green microelectronics, we contribute to a resource-efficient and sustainable world.

Images

Customer Evaluation Kit with control electronics, connection cable, and 256 x 256 mirror device.

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REALHOLO Chip developed by Fraunhofer IPMS

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