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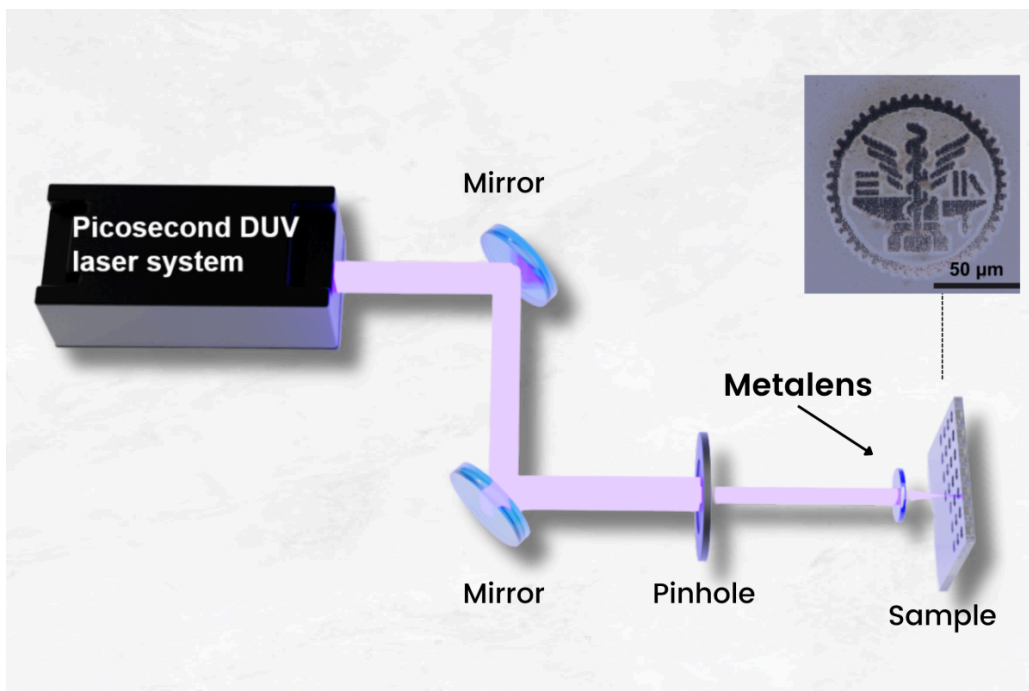
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Research Highlights

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NYCU Develops Deep-Ultraviolet Metalens for Advanced Imaging and Micro-Nano Processing

*Deep-ultraviolet (DUV) precision laser processing*

Translated by Szu-Yung

Huang

Edited by Chance Lai

Researchers from the
Institute of Electronics at

Metasurfaces: Shaping the
Next Generation of Optical
Innovation

National Yang Ming Chiao Tung University (NYCU) have developed innovative deep-ultraviolet metalens, significantly advancing compact, lightweight optical components. This cutting-edge lens, boasting a thickness of just 380 nanometers—less than a human hair—delivers exceptional performance by focusing deep-ultraviolet (DUV) light with unparalleled precision.

Featured as the cover story in *Nano Letters* under the title '[Deep-Ultraviolet AIN Metalens with Imaging and Ultrafast Laser Microfabrication Applications](#)' this breakthrough opens new doors in fields ranging from semiconductor manufacturing to biomedical imaging and diagnostics.

Advancing DUV Technology: A Metalens Innovation

Deep-ultraviolet light, with a wavelength shorter than UVA and UVB, has long been integral to semiconductor processing and advanced imaging applications. However, the high costs and complexities of DUV

Metasurfaces, made of custom-designed nanostructures, allow engineers to manipulate light in ways conventional optics cannot. The DUV metalens functions like a traditional lens, yet it delivers enhanced capabilities, making it ideal for high-accuracy and efficiency applications.

In recent years, such metasurfaces have been helpful in full-color imaging, quantum optics, and biomedical diagnostics. There are rumors that major tech companies like Apple may incorporate this novel optical technology into next-generation devices.

Tseng's team is optimistic about the metalens' potential for mass production and commercialization. The lens's compact size, versatility, and high performance position it as a game-changer in key areas such as silicon photonic device fabrication, biomedical imaging, and semiconductor inspection.

As the field of metasurface technology evolves, its ability

components have limited their widespread use.

The NYCU Institute of Electronics team's metalens addresses these challenges and achieves a remarkable milestone in DUV optical control. The lens demonstrates extraordinary capabilities by employing aluminum nitride—a material known for its high thermal resistance, chemical stability, and transparency to DUV light. For instance, it can produce nanoscale images and perform ultrafast laser engraving, both firsts in the field.

Assistant Professor Ming-Lun Tseng, who has dedicated years to developing metalens technology, highlights the transformative potential of this invention. "Deep-ultraviolet technologies are vital to basic research and industrial applications," Tseng explains.

"Traditional DUV lenses used for precision laser machining can cost millions of NT dollars. Our approach using metasurfaces—consisting of intricately engineered semiconductor nanoantennas—enables

to bridge scientific innovation and industrial application continues to grow, offering unprecedented opportunities for research and industry alike.



Assistant Professor Ming-Lun Tseng (center) led the team in developing the deep-ultraviolet metalens.

precise light manipulation at a fraction of the cost, paving the way for broader adoption.”

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NYCU NATIONAL
YANG MING CHIAO TUNG
UNIVERSITY

Contact Us



Yangming Campus

 Address :

No. 155, Sec. 2, Linong St. Beitou Dist., Taipei City 112304, Taiwan [↗](#)

 Phone : +886-2-2826-7000

Chiaotung Campus

 Address : No. 1001, Daxue Rd. East Dist., Hsinchu City 300093, Taiwan [↗](#)

 Phone : +886-3-5712121

