

## **Study proposes achromatic metalens with varifocal performance**

May 30 2023, by Liu Jia



The working principle of CVBAM operating in 1.8–2.2 THz with tunable focal length from 736.25  $\mu$ m (NA = 0.62) to 861.02  $\mu$ m (NA = 0.56). Credit: *Journal of Science: Advanced Materials and Devices* (2023). DOI: 10.1016/j.jsamd.2023.100560

Metalenses, comprising one of the most prominent applications of metasurfaces, demonstrate promising abilities to replace traditional lenses. By manipulating the phase distribution of metalenses composed of appropriately arranged meta-atoms, the wavefront of incidence can be arbitrarily controlled to achieve desired purposes.



Broadband achromatic metalenses (BAMs) that correct <u>chromatic</u> <u>aberration</u> in <u>broadband</u> applications have found practical applications. However, existing BAMs are limited to a single functionality, which impedes potential applications after fabrication. Producing continuously varifocal metalenses for broadband achromatic focusing is still a challenge.

To overcome this challenge, a research team led by Prof. Dr. Fan Wenhui from Xi'an Institute of Optics and Precision Mechanics (XIOPM) of the Chinese Academy of Sciences (CAS) proposed a metalens for designing tunable BAMs, a continuously varifocal and broadband achromatic metalens (CVBAM). The study was published in the *Journal of Science: Advanced Materials and Devices*.

The researchers selected the semiconductor material indium antimonide (InSb) with tunable responses to design meta-atoms for accomplishing phase compensation required by CVBAM with the operation frequency range of 1.8 to 2.2 THz.

The CVBAM was designed to converge the focal spots to a preset spatial location over the operation frequency range. By varying the external temperature, the focal length of the CVBAM can be dynamically tuned from 736.25  $\mu$ m to 861.02  $\mu$ m, while the achromatic focusing can be maintained, as well.

The proposed metalens can significantly enrich the capabilities and potential applications of current meta-devices, which may facilitate the development of THz near-field imaging and spectroscopy systems.

**More information:** Xiao-Qiang Jiang et al, Continuously varifocal metalens for broadband achromatic focusing of terahertz waves, *Journal of Science: Advanced Materials and Devices* (2023). DOI: 10.1016/j.jsamd.2023.100560



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