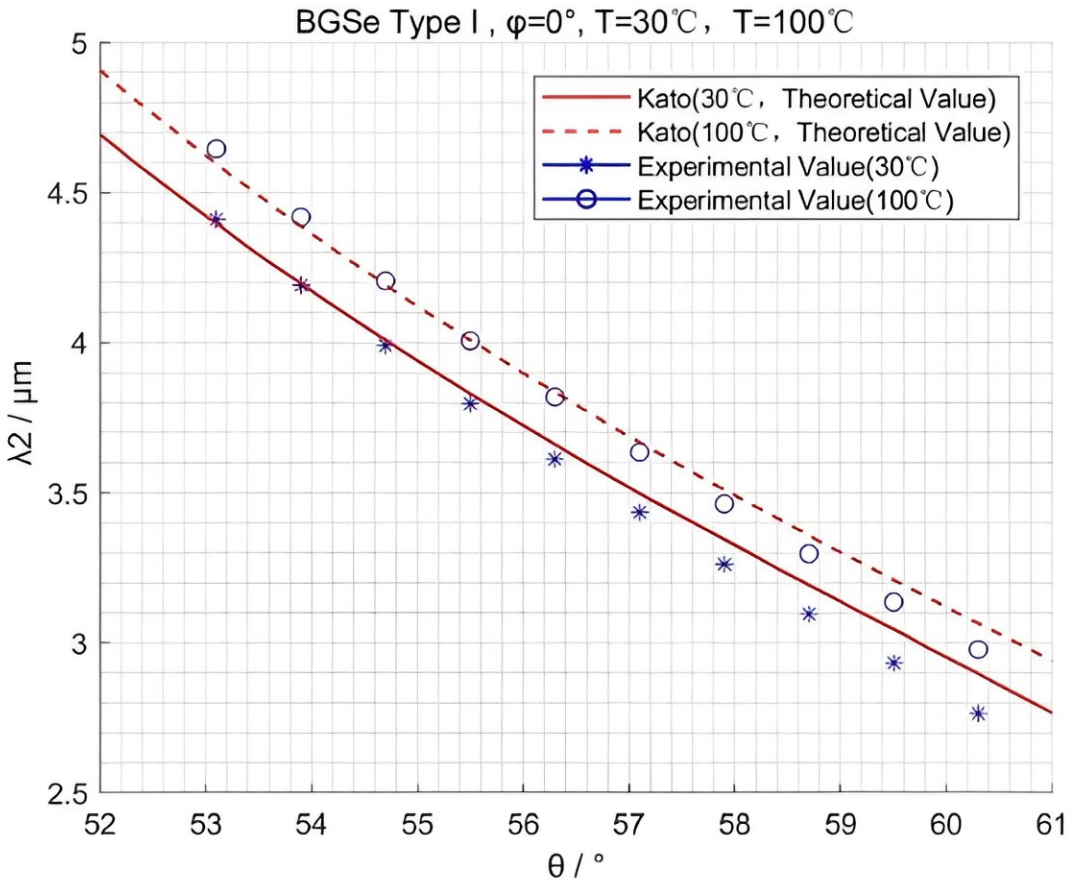
Widely tunable and high resolution mid-infrared laser based on optical parametric oscillator

October 18 2023



Relationship between output wavelength and angle and temperature. Credit: *Frontiers of Optoelectronics* (2023). DOI: 10.1007/s12200-023-00077-0

A widely tunable and high resolution mid-infrared radiation source operating in the 3–5 μm region has been applied to numerous frontier applications, including remote sensing, molecular spectroscopy, and atmosphere environmental monitoring.

Taking atmospheric monitoring as an example, due to the narrow absorption peak linewidth of atmospheric molecules, it is necessary to strictly align the output wavelength with the target wavelength, which requires high wavelength resolution. A larger wavelength tuning range can be obtained by controlling the angle of $BaGa_4Se_7$ (BGSe) or other nonlinear crystals, but the tuning resolution is not high.

To solve these problems, researchers have proposed tuning the temperature and angle of BGSe crystals simultaneously for the first time, placing BGSe crystals in a temperature-controlled furnace, and then placing the temperature-controlled furnace on an electric rotary platform. This scheme can achieve both wide-range wavelength tuning and high resolution wavelength tuning with stable output wavelength.

The work, titled "Widely tunable and high resolution mid-infrared laser based on BaGa4Se7 optical parametric oscillator," was published in *Frontiers of Optoelectronics*.

It also overcomes the problem that the output wavelength of BGSe OPO shifts with changes in ambient temperature. A peak wavelength of 3.6 μm with an angle tuning range of 2.76 μm–4.64 μm, was obtained by a 1.06 μm pumped laser. The wavelength tuning resolution was 0.3 nm, which is the narrowest reported resolution, and the output wavelength is stable.

In the future, the output wavelength range of high-resolution BGSe OPO can be expanded to 2.7 μm–17 μm by replacing the BGSe crystals.

More information: Qing Ye et al, Widely tunable and high resolution mid-infrared laser based on BaGa4Se7 optical parametric oscillator, *Frontiers of Optoelectronics* (2023). DOI: 10.1007/s12200-023-00077-0

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