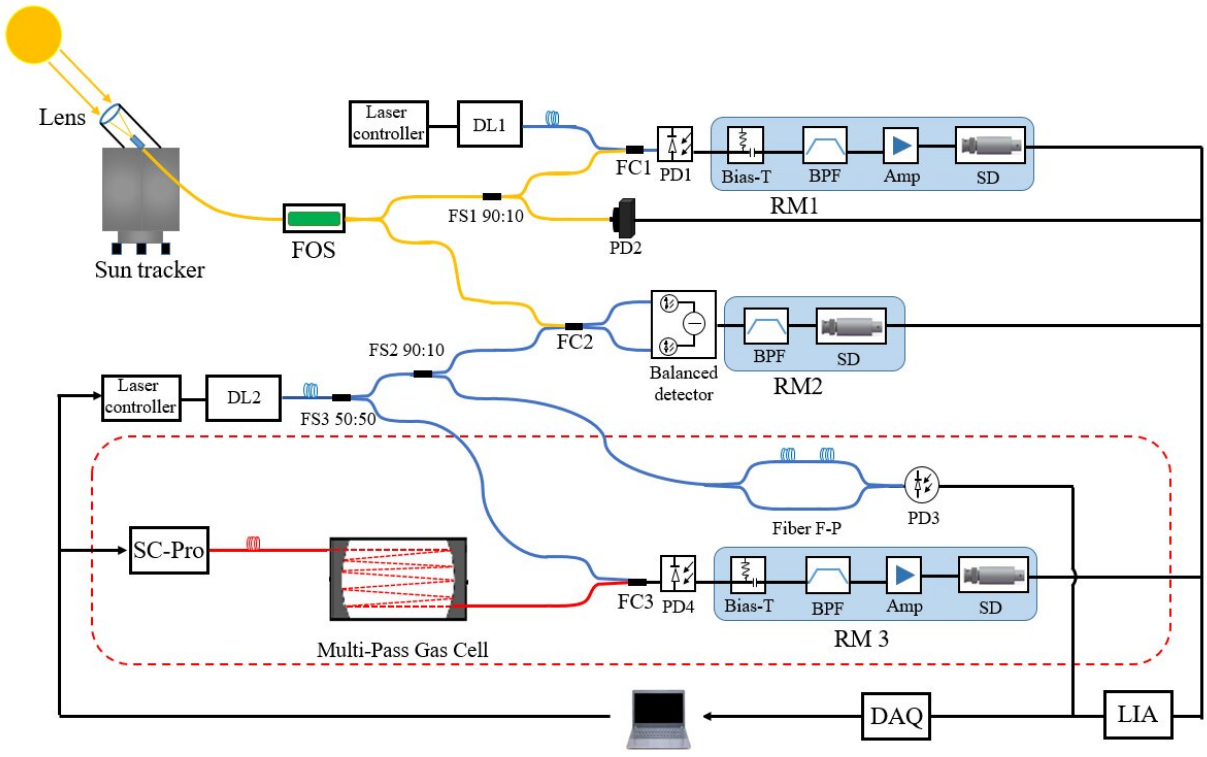
# Researchers develop high-resolution laser heterodyne spectroscopy for wind field detection

March 2 2023, by Zhang Nannan




Schematic diagram of near-infrared laser heterodyne radiometer. Credit: Li Jun

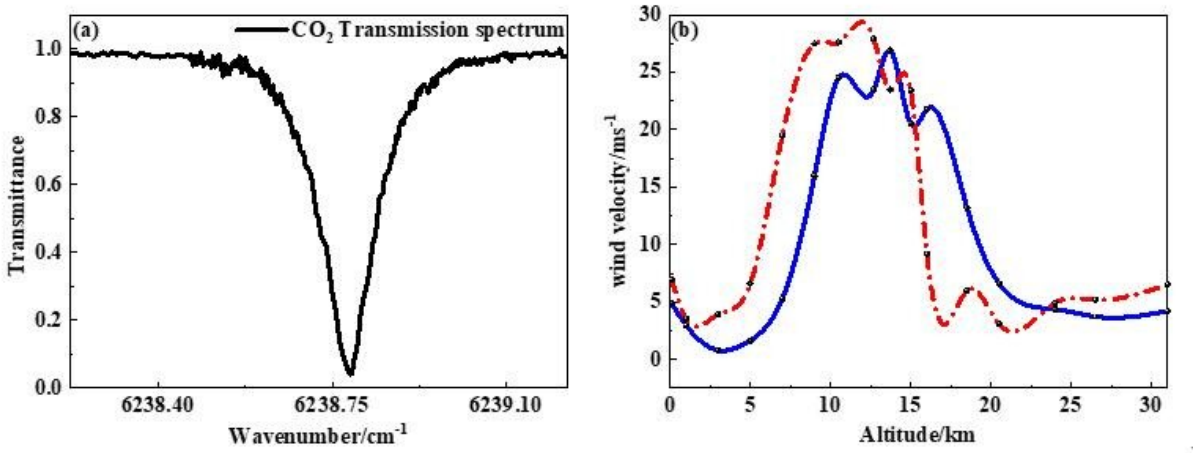
A research team led by Prof. Gao Xiaoming from the Hefei Institutes of Physical Science of the Chinese Academy of Sciences has developed a near-infrared dual-channel oxygen-corrected laser heterodyne

radiometer (LHR) in the ground-based solar occultation mode, which was used to measure the vertical profile of the wind field in the troposphere and lower stratosphere.

The results were published in *Optics Express*.

LHR has a high spectral resolution that can effectively detect small Doppler frequency shifts caused by the wind field. Combined with the atmospheric transmission spectrum, LHR can obtain vertical profiles of horizontal winds and atmospheric column concentrations along the line of sight through spectral inversion.

In this study, the researchers designed a near-infrared laser heterodyne spectrometer based on oxygen correction, and measured the atmospheric $O_2$ and $CO_2$ transmission spectra.




(a) The measured atmospheric transmission spectrum; (b) The prior wind profile (blue curve) and the inverted wind profile (red dotted line). Credit: Li Jun

Using the constrained Nelder-Mead simplex method based on the atmospheric $O_2$ transmission spectrum, they corrected the atmospheric temperature and pressure distribution, and combined the optimal estimation algorithm to invert the vertical profile of the atmospheric wind field with an accuracy of about ±2.5 m/s.

The results show that the oxygen-corrected LHR, as a portable and miniaturized measuring instrument, has broad application potential in wind field detection.

**More information:** Jun Li et al, High-resolution oxygen-corrected laser heterodyne radiometer (LHR) for stratospheric and tropospheric wind field detection, *Optics Express* (2023). DOI: 10.1364/OE.483123

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