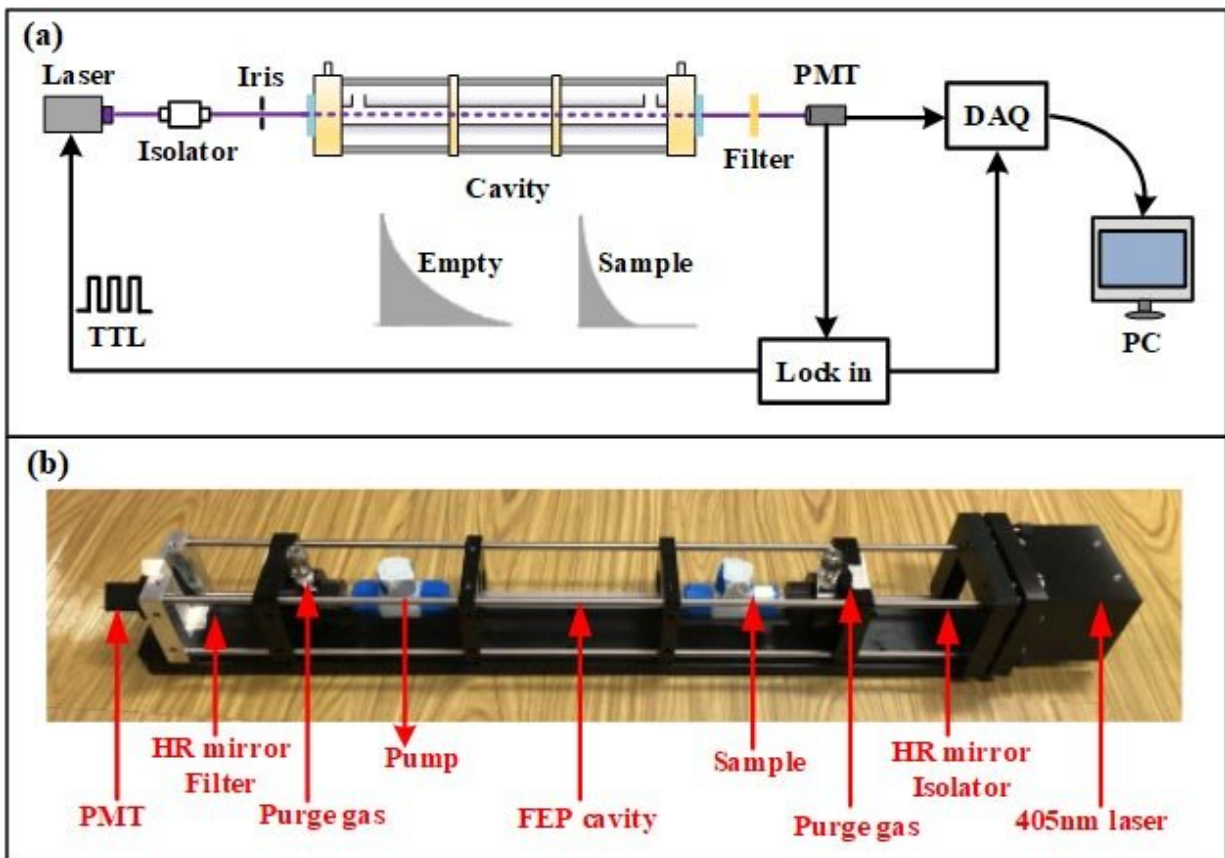


High sensitive detector developed for nitrogen dioxide detection

February 21 2022, by Zhang Nannan



Schematic diagram of the experimental setup of the AM-CEAS instrument.
Credit: Zhou Jiacheng

A research team led by Prof. Zhang Weijun at the Hefei Institutes of Physical Science of the Chinese Academy of Sciences has developed a

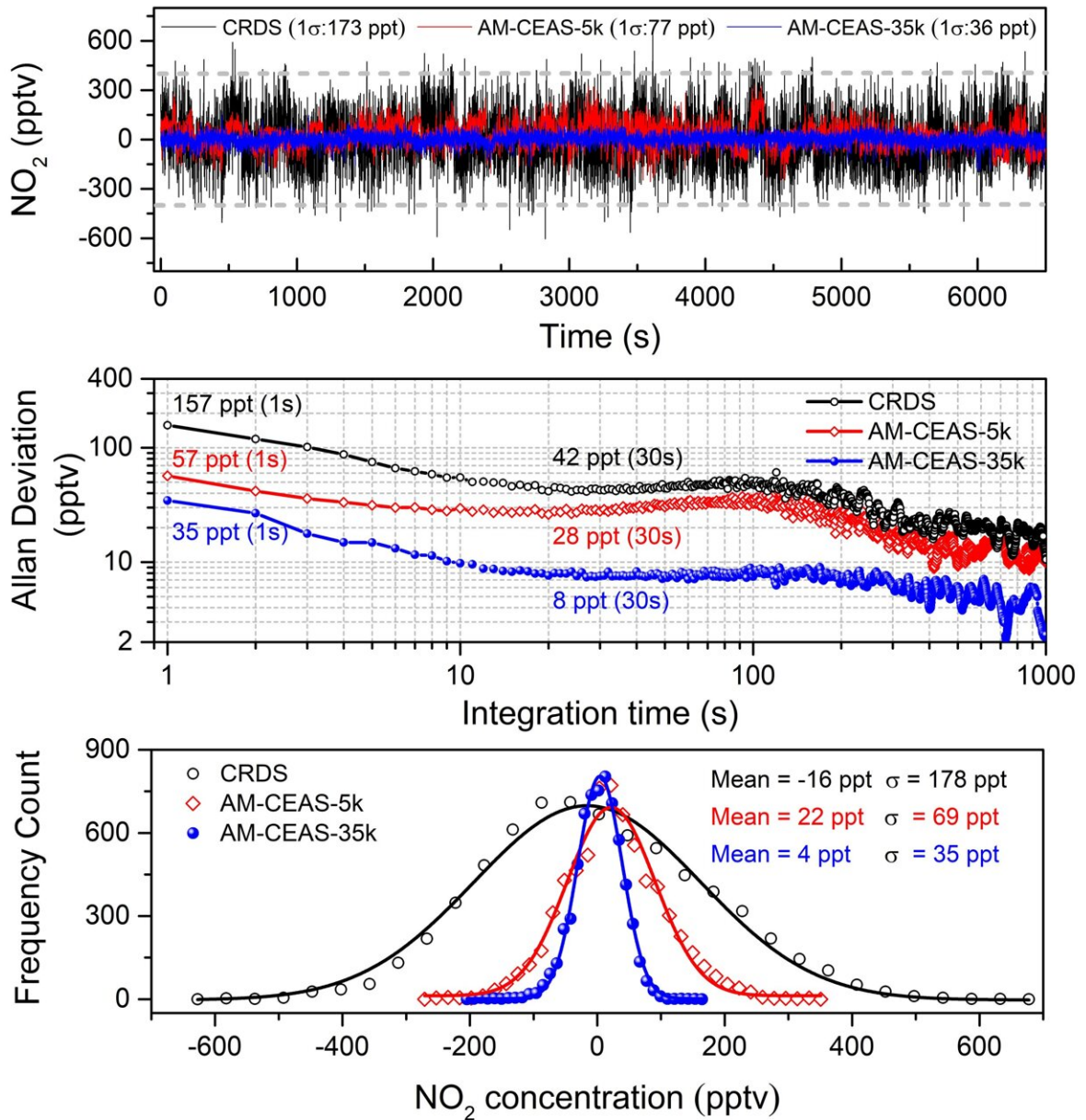
new detection technology that enables rapid and sensitive detection of nitrogen dioxide (NO_2). Relevant results were published in *Analytical Chemistry*.

NO_2 is a major pollutant affecting air quality, highly sensitive and accurate measurement of NO_2 is of great significance to atmospheric chemistry research and air pollution prevention and control.

In this research, the researchers applied amplitude modulation technique to a multimode diode laser for the first time, and developed an amplitude modulated multimode-diode-laser-based Cavity Enhanced Absorption Spectroscopy (AM-CEAS) system for extremely sensitive NO_2 detection.

The new instrument uses phase-sensitive detection for ultra-sensitive absorption measurement. Its accuracy is over four times lower than that of the cavity ring-down spectroscopy (CRDS) method using the same instrument during one second and 30 seconds of data acquisition time.

Combined with ring-down time measurement, the AM-CEAS method eliminates the calibration process of mirror reflectivity and achieves the measurement of absolute concentration of NO_2 . It also has the advantages of high injection efficiency, low cavity-mode noise and phase-sensitive detection of modulation spectroscopy.



Performance evaluation of the AM-CEAS method and comparison with CRDS measurements. Credit: Zhou Jiacheng

The AM-CEAS instrument is a simple, reliable, low-cost, self-

calibration tool suitable for long-term stability and low maintenance requirements, with good prospects for [scientific research](#) and business applications.

Currently, the newly developed instrument is being used for comprehensive field observation in Beijing to measure total reactive nitrogen in the atmosphere during the Beijing 2022 Winter Olympics.

More information: Jiacheng Zhou et al, Amplitude-Modulated Cavity-Enhanced Absorption Spectroscopy with Phase-Sensitive Detection: A New Approach Applied to the Fast and Sensitive Detection of NO₂, *Analytical Chemistry* (2022). [DOI: 10.1021/acs.analchem.1c05484](https://doi.org/10.1021/acs.analchem.1c05484)

Provided by Chinese Academy of Sciences

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