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Sensing atmospheric trace gases and aerosols with advanced laser absorption spectroscopy and photoacoustic spectroscopy

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Spectroscopy technique based on molecular absorption, such as optical multipass cell absorption spectroscopy, cavity enhanced absorption spectroscopy, photoacoustic spectroscopy and so on, is an effective tool for detection of atmospheric trace gases and aerosols, which allows a real time, selective, sensitive, and precise monitoring of gases. In this presentation, recent progress in laser absorption spectroscopy and photoacoustic spectroscopy techniques for sensing atmospheric trace gases and aerosols that developed in our laboratory will be presented. High sensitive measurement of CO_2 and CH_4 was achieved by using a newly developed, novel compact dense-pattern multipass cell with optical path length of 26.4 m and sample volume of only $\sim$250 cm^3[1]. Sub-ppb level, ultra-sensitive gas sensor, based on cavity enhanced absorption spectroscopy with efective optical path length of $\sim 10^4$m, was developed for monitoring of atmospheric background Greenhouse gases. An innovative multi-resonator photoacoustic spectroscopy (MR-PAS) technique was developed for multi-laser operation and multi-pollutants detection or multi-wavelength measurement of aerosol optical absorption [2]. In MR-PAS, a photoacoustic cell including three acoustic resonators operating at different resonant modes, but the photoacoustic signal in each resonator was listened by the same microphone. This significantly reduces the size of multi-laser based PAS sensor and expands its potential applications.

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Reference

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