CONTINUOUS-WAVE OPTICAL PARAMETRIC OSCILLATORS: A NEW TOOL FOR MOLECULAR SPECTROSCOPY

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30 years since their first demonstration, continuous-wave optical parametric oscillators (OPOs) have finally reached a stage of development where they can be used for high-resolution spectroscopy. We have demonstrated, for the first time, photoacoustic trace gas detection using a highly stable OPO.

The compact OPO is pumped by a diode-pumped single-frequency Nd:YAG laser and uses a periodically poled lithium niobate multi-grating crystal [1]. The emission range spans 1.45 to 2.0 μm (at about 10 mW output power) and 2.3 to 4.0 μm (at up to 230 mW). The output is single-frequency (no mode-hops), with a linewidth less than 150 kHz, a frequency stability better than 30 MHz over an hour, and low intensity fluctuations.

Photoacoustic detection of ethane at 3.4 μm in an extra-cavity resonant cell has been performed [2]. In comparison to e.g. the CO overtone laser, it is possible to tune the OPO to the strongest molecular absorption line for maximum sensitivity. A detection limit of 0.5 ppb has been demonstrated. The compact dimensions and good efficiency of the OPO open the possibility of a portable system for field use.

[1] K. Schneider et al. Opt. Lett. **22**, 1293 (1997)
[2] F. Khnemann et al. Appl. Phys. B, submitted