OFF-AXIS CAVITY RING DOWN SPECTROSCOPY BASED ON A CONTINUOUS-WAVE OPTICAL PARAMETRIC OSCILLATOR

JARI PELTOLA, MIKAEL SILTANEN and LAURI HALONEN, *Laboratory of Physical Chemistry, Department of Chemistry, P.O. BOX 55 (A.I. Virtasen aukio 1), FI-00014 University of Helsinki, Finland*; MARKKU VAINIO, *Laboratory of Physical Chemistry, Department of Chemistry, P.O. BOX 55 (A.I. Virtasen aukio 1), FI-00014 University of Helsinki, Finland and Centre for Metrology and Accreditation, P.O. Box 9, FIN-02151 Espoo, Finland*.

Continuous-wave cavity ring down spectroscopy (cw-CRDS) is a sensitive absorption technique for trace gas analysis. Although it is highly sensitivity and relatively fast, ring down repetition rate and spectral resolution are limited by the cavity free spectral range (FSR). Normally, the injected beam is mode matched to the lowest transverse electro-magnetic mode (TEM_{00}) of the cavity. Light is coupled into the cavity only when standing wave condition is fulfilled. Scanning of the laser without variation of the cavity length leads to transmission comb where recorded ring down times are separated in frequency by the FSR.
Recently Romanini[a] *et. al.* reported an off-axis (OA) CRDS spectrometer operating in the 766 nm region where the FSR of the cavity was reduced by $N = 4$ times from the original. In this re-entrant condition the cavity length is chosen to provide degeneracy of transverse modes. If the injection is adequately off-axis the beam returns to the starting point after N round trips. This divides the FSR to N group of degenerated modes which are equally frequency-spaced. We present an OA-CRDS spectrometer ($N = 4$) based on a continuous-wave optical parametric oscillator (cw-OPO) operating in the mid-infrared region (2.75 - 3.45 μm). The measurement of formaldehyde (H_2CO) using an OA-CRDS spectrometer will be presented.

[a] J. Courtois, A. K. Mohamed and D. Romanini *Opt. Express* **18**(5), 1 March 2010.