AN OPTIMAL DATA ACQUISITION SCHEME FOR A PULSED CAVITY RING-DOWN EXPERIMENT

ALEXANDER A. KACHANOV, *Université J. Fourier/CNRS Grenoble Laboratoire de Spectrométrie Physique BP 87, 38402 Saint Martin d'Hères – France*; SERGEY I. PANOV, ILIA DUBINSKY, LEAH M. RUSLEN, MICHELLE L. SILVA, and ROBERT W. FIELD, *Department of Chemistry, Massachusetts Institute of Technology, Cambridge, MA 02139*.

In a pulsed ring-down experiment, where the mirror reflectivity is high and consequently the ring-down time is long ($\approx 10 \times 10^{-6}$s) the time constant of the photo-detector is usually chosen to be long enough, such that ripples due to the round trips in the cavity are filtered out, yet short enough to avoid a distortion of the decay curve. In the UV or mid-IR, where very high reflectivity mirrors are not available, the periodic structure of the decay curve cannot be filtered out. Fitting such a curve with a pronounced substructure to an exponential results in large decay constant fluctuations as the fitted time interval is changed. These fluctuations can be one or even more orders of magnitude larger than fluctuations due to shot noise. This becomes a serious limiting factor even if a detection system could operate at the shot noise limit. We are going to demonstrate an optimal data processing scheme capable of reducing significantly this non-statistical component of the noise with the goal of achieving shot noise limited detection.
Presently, a detection limit of $2 \times 10^{-8}\mathrm{cm}^{-1}$ is experimentally achieved in a two meter long cavity with $\approx 1.5\mu s$ decay time at $\lambda = 240nm$.