

## MULTIPLEXED CHIRPED PULSE QUANTUM CASCADE LASER MEASUREMENTS OF AMMONIA AND OTHER SMALL MOLECULES

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Spectrometers based on Quantum Cascade (QC) lasers can be run in either continuous or pulsed operation. Although the instrumentation based upon the most recent versions of continuously operating QC lasers can have higher resolution than chirped lasers, using chirped pulse QC lasers can give an advantage when rapid changes in gas composition occur. For example, when jet engines are being tested, a variety of temperature dependent effects on the trace gas concentrations of the plume may be observed. Most pulsed QC lasers are operated in the down chirped mode, in which the chirp rate slows during the pulse. In our spectrometer the changes in frequency are recorded using two Ge etalons, one with a free spectral range of  $0.0495 \text{ cm}^{-1}$ , and the other with a fringe spacing of  $0.0195 \text{ cm}^{-1}$ . They can also be deployed in multiplex schemes in which two or more down-chirped lasers are used.

In this paper we wish to show examples of the use of multiplexed chirped pulse lasers to allow overlapping spectra to be recorded. The examples of multiplex methods used are taken partly from measurements of  $^{14}\text{NH}_3$  and  $^{15}\text{NH}_3$  in the region from  $1630$  to  $1622 \text{ cm}^{-1}$ , and partly from the use of other chirped pulse lasers operating in the  $8 \mu\text{m}$  region. Among the effects seen are rapid passage effects caused by the rapid down-chirp, and the use of gases such as nitrogen to cause variation in the shape of the collisional broadened absorption lines.