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Application of Quantum Cascade Lasers to trace gas analysis

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Quantum cascade (QC) lasers are virtually ideal IR sources for trace gas monitoring with their only significant limitation being a tuning range that is currently limited to about 100 cm^{-1}. They can be fabricated to operate at any of a very wide range of wavelengths from about 80 μm to about 3 μm. Seizing the opportunity presented by the mid-IR QC lasers, several groups are actively applying them to trace gas sensing [1](to list a few). In our laboratory we have explored the use of several methods for carrying out absorption spectroscopy with these sources: multipass absorption spectroscopy [2], cavity ring down spectroscopy [3], integrated cavity output spectroscopy (ICOS) [4], and quartz-enhanced photoacoustic spectroscopy (QEPAS) [5]. Practical applications from our laboratory include: monitoring of formaldehyde in the Houston atmosphere [6], monitoring of NO in the human breath [7], monitoring NH_3 in NASA bioreactor [8] and detection of traces of CO in propylene [9]. There is a website [10] with a complete listing of publications on trace gas sensing at Rice.

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