

## MID-INFRARED QUANTUM CASCADE LASER SENSORS FOR GAS ANALYSIS AND MEDICAL DIAGNOSTICS

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This talk will focus on the development of compact trace gas sensors based quantum cascade lasers for the detection, quantification, and monitoring of several key trace gas species in ambient air addressing important analytical instrumentation needs in atmospheric chemistry, industrial and medical applications. The architecture and performance of several sensitive, selective and real-time gas sensors based on mid-infrared cw and pulsed QC-DFB lasers will be described. To date we have detected 11 gases (CH<sub>4</sub>, N<sub>2</sub>O, CO<sub>2</sub>, CO, NO, H<sub>2</sub>O, NH<sub>3</sub>, C<sub>2</sub>H<sub>4</sub>, OCS, C<sub>2</sub>H<sub>4</sub> and C<sub>2</sub>H<sub>5</sub>OH) including isotopic signatures of carbon and oxygen at the ppm to the ppt level [1-3]. This requires different sensitivity enhancement schemes such as multipass gas absorption cells, cavity ringdown and photo-acoustic absorption spectroscopy which can realize minimum detectable absorbances in the range from 10<sup>-4</sup> to 10<sup>-6</sup> in several real world applications.

### References:

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- [3] Rice University Laser Science Group website: <http://ece.rice.edu/lasersci/>