COMPACT QUANTUM CASCADE LASER BASED $^{13}CO_2/^{12}CO_2$ ISOTOPIC RATIOMETER FOR FIELD MEASUREMENTS OF VOLCANIC GASES

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High precision measurements of $^{13}CO_2/^{12}CO_2$ are needed in a wide range of fields that include volcano emission studies [1-2], atmospheric chemistry, combustion diagnostics, medical diagnostics and biology. Currently we are developing a compact, field deployable quantum cascade laser based sensor to perform real time measurements with a precision of $\delta \sim 0.1^0/_{00}$, using absorption spectroscopy. The initial design of this analyser will target the prediction of potential volcano activities, but can be useful in other trace gas sensing applications.

A thermoelectrically cooled, pulsed, single frequency quantum cascade laser will be employed as spectroscopic source, which is required for field deployment. The laser is designed to operate at 4.33 μm, where the P-branch of $^{12}CO_2$ overlaps the R-branch of $^{13}CO_2$ of the 00^01-00^00 transition.. To reach a high precision delta value, the influences of temperature and pressure stabilities must be taken into account, as well as the water vapor collision broadening.

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[2] D. Richter, M. Erdelyi, R. F. Curl, F. K. Tittel, C. Oppenheimer, H. J. Duffell, and M. Burton, "Fields measurements of volcanic gases using tunable diode laser based mid-infrared and Fourier transform infrared spectrometers", Optics and Lasers in Engineering, **37** , 171-186 (2002).