STATE-OF-THE-ART ELECTRONICS FOR LASER-BASED DETECTION OF $^{14}CO_2$

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Combining advanced electronics for controlling semiconductor Quantum Cascade Lasers (QCLs)[1] with the most recent spectroscopy techniques allows to get ideal metrological probes to measure extremely low concentrations of rare molecules. The best results have been obtained in the last few years with saturated-absorption cavity ring-down (SCAR)[2], a nonlinear cavity ring-down technique, to detect the very elusive $^{14}CO_2$. Indeed, this radioactive molecule amounts only to about 1 part in 10^{12}, as compared to the overall CO_2 in the biosphere. Therefore, the sensitivity achieved by SCAR, of a few parts in 10^{15}, provides a wide dynamic range for radiocarbon dioxide detection, challenging the best results provided by Accelerator Mass Spectrometry (AMS)[3].

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