OBSERVATION OF INFRARED FREE INDUCTION DECAY AND OPTICAL NUTATION SIGNALS FROM NITROUS OXIDE USING A VOLTAGE MODULATED QUANTUM CASCADE LASER

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Free induction decay, FID, and rapid passage, RP, signals in nitrous oxide, under both optically thin and optically thick conditions, have been observed used using a pulse modulated quantum cascade laser operating at 7.97 μm. The variation in optical depth was achieved by increasing the pressure of nitrous oxide in a long path length multipass absorption cell. This allows the variation of optical depth to be achieved over a range of low gas pressures. Since, even at the highest gas pressure used in the cell, the sweep rate of the QC laser is faster than the collisional reorientation time of the molecules, there is minimal collisional damping allowing a large macroscopic polarisation to develop. The resultant FID signals are enhanced owing to the constructive interference between the field within the gas generated by the pump laser, and the probe laser signal generated by pulse modulation of the continuously operating QC laser. The FID signals obtained at large optical depth have not been observed previously in the mid infrared regions, and unusual oscillatory signals have been observed at the highest gas pressures used.