TIME DEPENDENT MEASUREMENTS OF NITROUS OXIDE - FOREIGN GAS COLLISIONAL RELAXATION PROCESSES USING A FREQUENCY DOWN-CHIRPED 7.84 MICRONS QUANTUM CASCADE LASER

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Intra-pulse quantum cascade laser (QCL) spectrometers are able to produce both saturation and molecular alignment of the gas sample. This is due to the rapid sweep of the radiation through the absorption features. The intra-pulse time domain spectra closely resemble those recorded in coherent optical nutation experiments. In this presentation the frequency down-chirped technique is employed to investigate nitrous oxide - foreign gas collisions. We have demonstrated that the measurements may be characterised by the induced polarization dominated and collision dominated measurement limits. The first of these is directly related to the time dependence of the long range collision cross sections. Among the collisional partners considered, carbon dioxide shows a very unusual behaviour of rapid polarization damping, resulting in the production of symmetrical line shapes at very low gas buffer pressures. The carbon dioxide absorptions are modelled by solving the coupled Maxwell - Bloch equations and the role played by the low transition dipole moment of the $^{16}O^{12}C^{18}O$ isotopomer is discussed.