POLARIZATION DEPENDENT CAVITY RINGDOWN SPECTROSCOPY

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We here theoretically outline and experimentally demonstrate that Polarization Spectroscopy can be combined with Cavity RingDown (CRD) spectroscopy, thereby retaining the specific advantages of both techniques. The $b^1\Sigma_g^+$ (v'=2) $\leftarrow$ $X^3\Sigma_g^-$ (v''=0) transition of molecular oxygen around 628 nm is used to demonstrate the possibility to selectively measure either the polarization dependent absorption or the resonant magneto-optical rotation of gas-phase molecules in the appropriate set-up. Just as in CRD absorption spectroscopy, where the *rate* of absorption is measured, in the here presented Polarization Dependent CRD (PD-CRD) detection scheme the *rate* of polarization rotation is measured, which enables the polarization rotation to be quantitatively determined. Apart from studying electro-optic and magneto-optic phenomena on gas phase species, the PD-CRD detection scheme is demonstrated to be applicable to the study of magneto-optical rotation in transparent solid samples as well.
Rotationally resolved spectra of the $b^1\Sigma_g^+$ (v'=0) $\leftarrow$ $X^3\Sigma_g^-$ (v''=0) band of molecular oxygen are recorded by CRD spectroscopy in magnetic fields up to 20 Tesla. Measurements are performed in a short cavity, placed in the homogeneous field region inside a Bitter magnet. CRD absorption spectra are measured with linearly and circularly polarized light, leading to different ΔM selection rules in the molecular transition, thereby aiding in the assignment of the spectra. Frequencies and intensities of the rotational transitions of the oxygen A band in a magnetic field are calculated, and all observed spectral features are well reproduced. A discussion on the alignment of the oxygen molecules in the magnetic field is given.