STUDIES OF COHERENT POPULATION TRAPPING IN DIATOMIC MOLECULES

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Whereas studies of nonlinear magneto-optical effects in atomic vapours have resulted in multiple technical innovations, it seems that the potential of these effects in other media still needs to be explored.

We present the results of an experimental as well as theoretical study of coherent population trapping (CPT) in potassium diatomic molecules in the ground electronic state with an extremely large angular momentum for a rotational quantum number on the order of J = 100. At zero magnetic field, the $\Delta J = 0, \pm 1$ absorption transitions are suppressed because of population trapping in the ground (***J***") state due to Zeeman coherences between magnetic sublevels of this state. The destruction of such coherences in an external magnetic field was used to study the CPT phenomenon in this work.

The K_2 molecules were formed in a glass cell containing potassium metal at a temperature above 150 °C. The cell was placed in an oven and was located in a homogeneous magnetic field ***B***, which was scanned from zero to 0.9 Tesla. The Q-type and R-type transitions were excited with a tunable single-mode diode laser at a wavelength of 660 nm. CPT was observed via the intensities of linearly polarised laser-induced fluorescence whose polarization vectors were parallel ($\boldsymbol{I}_{par}$) and orthogonal ($\boldsymbol{I}_{ort}$) to the exciting laser radiation polarization vector, which was orthogonal to **B**. The well pronounced CPT signals in the plots of the relative intensities $\boldsymbol{I}_{par}$ versus the magnetic field at different temperatures are depicted in Fig. 1 where they are compared with numerical simulations (dashed lines).

The intensities and degrees of polarization of the LIF were registered for different experimental parameters, such as laser power density and vapour temperature, in order to compare them with numerical simulations that were based on the optical Bloch equations for the density matrix [1]. We report good agreement of our measurements with numerical simulations.

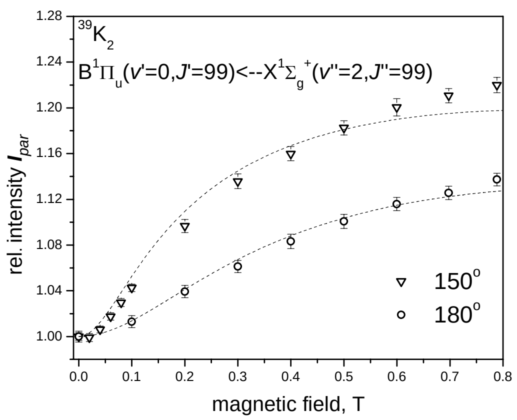

Fig. 1.

[1] K. Blush and M. Auzins, Phys. Rev. A **69**, 063806 (2004).

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