SPECTROSCOPY OF CaH IN A MAGNETIC TRAP

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Trap spectroscopy is not only vital for the understanding of the processes that take place within the confines of a trapping field but benefits the elucidation of the structure of the trapped species themselves.In a recent experiment we magnetically trapped 10^8 ground-state calcium monohydride molecules, CaH($X^2\Sigma, v'' = 0, J'' = 0$). The molecules were prepared by laser ablation of a solid sample of CaH_2 and loaded via thermalization with a cold (< 1 K) ^{3}He buffer gas. The magnetic trap was formed by superconducting coils arranged in the anti-Helmholtz configuration. The observed loss of the molecules from the trap was mainly due to evaporation over the edge of the trap (where the the molecules stick to the walls). The detection was done by laser fluorescence spectroscopy excited at 635 nm (in the $B^2\Sigma, v' = 0 - X^2\Sigma, v'' = 0$ band) and detected at 692 nm (within the $B, v' = 0 - X, v'' = 1$ band). Due to the thermalization of molecular rotation, only a transition from the lowest rotational state could be detected at zero field, $N' = 1, J' = 3/2 \leftarrow N'' = 0, J'' = 1/2$. In the magnetic field this rotational transition splits into two features. The measured shifts are linear in field strength and indicate a small difference (0.02 μ_B) in the magnetic moments between the ground and excited states. We identified the observed magnetic shifts as arising from a rotational perturbation of the $B^2\Sigma, v' = 0$ state by a close-lying $A^2\Pi, v' = 1$ state that lends the B state some of its A character and found that the Hamiltonian can be well approximated by a 3×3 matrix built out of elements that connect states from within the Σ-doublet and the $^2\Pi_{3/2}$ manifolds.