MICROWAVE TRANSITIONS IN Na_3 DETECTED BY RESONANT TWO-PHOTON IONIZATION

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The direct measurement of hyperfine and fine structure as well as tunneling splittings in small clusters can provide information on the localization of electrons and an electron-nuclear coupling mechanism. The ground state of the sodium trimer is split by Jahn-Teller interaction. Energy minima of the potential surface for the nuclei are found corresponding to an isosceles triangle geometry with 80 degree apex angle. The Jahn-Teller distortion gives rise to a small electric dipole moment. Using our new resonant two-photon ionization detection scheme for the absorption of microwaves, we measured rotational transitions in the 12 to 17 GHz region. From intensity measurements, an extremely small electric dipole moment on the order of 0.01 D can be concluded. The detection scheme involves as intermediate steps the optical excitation into various excited electronic states for which the symmetries of rotational levels had previously been assigned. Through careful studies of several rotational states, we found that in some ground state levels, the tunneling splitting is so small that hyperfine mixing forbids any clear assignment of A and E symmetries. In the paper which follows this presentation, Laurent Coudert will introduce an effective hyperfine Hamiltonian taking these effects into account.