LEAK-OUT SPECTROSCOPY OF PROTONATED WATER DIMER II: SPIN STATISTICAL WEIGHTS

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It is widely believed that in the protonated water dimer the central proton is equally shared between the two water molecules (Zundel structure). This complex is subject to large amplitude motions and tunneling. It is an interesting question which motions are feasible and the answer to this question is tightly related to the underlying molecular symmetry group. For a semi-rigid complex the symmetry group is $G_{16}^{(2)}$. But when all five protons can swap places the underlying group is G_{240}. For these two situations the nuclear spin statistical weights are different. In a trap experiment where a finite ensemble of cold and mass selected ions is stored, it is now possible to determine the fractions of nuclear spin species by kicking out all ions belonging to one nuclear spin configuration using leak-out spectoscopy (LOS). Results from these measurements are much more reliable than comparing line intensities, which is a traditional approach to determine those fractions. This is because the fractions are directly determined from the temporal evolution of the number of ions in the trap. In this contribution we will present results for such LOS depletion experiments for the protonated water dimer. From a detailed analysis of our findings we infer information on the mobility of the central proton of this fundamental complex.