RECENT RESULTS ON HYDROGEN PEROXIDE AND NITRIC ACID

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Because of their atmospheric interest, hydrogen peroxide (H_2O_2) and nitric acid (HNO_3) have been the subject of numerous studies in the microwave, far-infrared, and infrared spectral ranges. Improved line positions and line intensities are indeed needed for reliable retrieval of atmospheric concentration profiles. Furthermore, these two molecules are of theoretical interest. The purpose of this paper is to compare the effect of a large amplitude motion for these two molecules which both exhibit a two-fold torsional motion but for which the description of the torsion is actually very different: for H_2O_2, the motion is the torsion of the two "equal halves" O–H rotors around the O–O bond, while for HNO_3, we are dealing with the torsional motion of the O-H bond relative to the much heavier NO_2 radical. In fact, even if the expression of the torsional potential is similar (we are dealing with only one two-fold motion) the symmetry considerations are very different, and the effects of the torsional motion, which increase with increasing energies, differ for these two molecules:

- For H_2O_2 the torsional motion induces both a splitting of the levels (tunneling through the trans-barrier) and a staggering (tunneling through the cis-barrier) of the already split levels.
- For HNO_3, the torsional motion induces a splitting of the levels: in fact for the main $HN^{(16)}O_3$ isotopic species only a shift can be observed for some lines because of spin statistics reasons (the $^{(16)}O$ oxygen nucleus has a zero spin).

Finally, it is clear that both for H_2O_2 and HNO_3 these torsional effects become more complicated in the excited vibrational states due to the existence of numerous vibration-torsion resonances.