Abstract

The Superrotor Model for the Rovibrational Motion of CH_{5}^{+}, an Extremely Flexible Molecule †

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† Presented at Symmetry 2017—The First International Conference on Symmetry, Barcelona, Spain, 16–18 October 2017.
Published: 3 January 2018

We discuss here the low-energy rotation-vibration problem in CH_{5}^{+}, an extremely flexible molecule lacking a well-defined structure. Using SO(5) symmetry we determine zeroth order energies, and complete nuclear permutation S_{5} symmetries, using a five-dimensional model involving rotation and two vibrations (which one might imagine as internal rotations of a 2-proton-moiety relative to a 3-proton-moiety). These two vibrations are presumed to be unhindered by the molecular potential function and their analytical form is not determined. The other ten vibrational degrees of freedom are presumed to be “rigid” (or averaged over). The general energy expression for this “rigid superrotor” is relatively simple and contains one parameter only, the rotational constant B, together with two non-negative integers defining the irreducible representations of SO(5). The superrotor predictions agree favourably with the available experimental data.

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