

The hyperfine structure of the hydrogen molecular ion

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The hydrogen molecular ion composed of two protons and one electron is the simplest molecule. The effective spin Hamiltonian arises from the various couplings of electron spin, nuclear spin, and nuclear rotation and the various spin coupling constants have to be averaged over the molecular wave functions, including nuclear vibrational motion. The corresponding hyperfine structure and spin rotation structure has only been measured accurately in a few spectroscopic experiments. Moreover because of the two-center nature of the system, theoretical descriptions of the various terms arising in evaluations of the spin coupling constants are still far from the accuracy that has been achieved for the (one electron) hydrogen atom.

I will review progress on high precision theory for the hydrogen molecular ion, its isotopologues, and discuss some future directions.

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