SYMMETRY, DEGENERACY, AND STATISTICAL WEIGHTS OF H_3^+

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High resolution spectroscopy of H_3^+ is used to probe a variety of physical phenomena, from temperatures, densities, and ionization rates of interstellar clouds to the fundamental chemical physics of chemical reactions involving identical particles. Throughout the literature surrounding these applications, various assumptions, often implicit and sometimes contradictory, are made concerning the degeneracies and statistical weights of the *ortho* and *para* nuclear spin modifications of H_3^+, and it is often difficult to account for their origins and applicability. In this talk, the symmetry properties of the nuclear spin and rovibrational wavefunctions of H_3^+ are discussed in detail, as well as the selection rules that determine their combinations. The findings from this close examination are presented in the context of the applications of H_3^+ spectroscopy, with the aim of explicitly identifying the degeneracies of individual rovibrational states. Finally, it is suggested that the nuclear spin wavefunctions of *para*-H_3^+ directly reveal branching fractions for the nuclear spin modifications of H_2 formed in proton transfer reactions of the form p-H_3^+ + X $\rightarrow$ H_2 + HX^+.