THE *GERADE* RYDBERG STATES OF MOLECULAR HYDROGEN: HYPERFINE-RESOLVED VUV SPECTROSCOPY AND MQDT ANALYSIS

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The Rydberg states of *gerade* electronic symmetry of molecular hydrogen have posed a serious challenge to Multichannel Quantum Defect Theory (MQDT) because of their strong interactions with doubly excited configurations. A rovibronic MQDT calculation has been performed using quantum defect curves predicted by a new R-matrix method[a] which provides for the first time an assignment of all observed Rydberg states in the vicinity of the vibronic ground state of H_2^+. The results of this calculation are used to assign new hyperfine-resolved spectra (180 MHz) of bound Rydberg states of ortho-H_2 (n=35-65) recorded following double-resonance excitation via selected levels of the B state. The spectra reveal the details of angular momentum recoupling between the two electron and nuclear spins and strong interactions with vibrationally excited interlopers of low principal quantum numbers. Highly accurate quantum defect curves for both the singlet and the triplet manifold are derived from this analysis which provide a global spin-rovibronic description of highly excited states of the hydrogen molecule and will allow for an analysis of the role of nuclear spin in molecular photoionization.

[a]M. Telimini and Ch. Jungen, *Phys. Rev. A* **68**, 062704 (2003)