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Double Resonance Spectroscopy of the $D^1\Pi_u^+$ and $B''\bar{B}^1\Sigma_u^+$ States Near the Third Dissociation Threshold of H_2 WENQI DUAN, ALEXANDER CHARTRAND, ELIZABETH MCCORMACK, Bryn Mawr College — Double-resonance laser spectroscopy via the $E, F\,^1\Sigma_g^+, v' = 6, J'$ state was used to probe the energy region below the third dissociation limit of molecular hydrogen. Resonantly-enhanced multi-photon ionization spectra were recorded by detecting ion production as a function of energy using a time of flight mass spectrometer. Energies and line widths for the $v = 14-17$ levels of the $D^1\Pi_u^+$ state of H_2 are reported and compared to experimental data obtained by using VUV synchrotron light excitation and fully ab initio non-adiabatic calculations of $D^1\Pi_u^+$ state energies and line widths. Several high vibrational levels of the $B''\bar{B}\,^1\Sigma_u^+$ state were also observed in this region. Term energies and rotational constants for the $v = 67-69$ vibrational levels are reported and compared to highly accurate ro-vibrational energy level predictions from fully ab initio non-adiabatic calculations of the first six $^1\Sigma_u^+$ levels of H_2. While additional observed transitions can be assigned to other other states, several unassigned features in the spectra highlight the need for a fully integrated theoretical treatment of dissociation and ionization in this energy region.

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