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Observations of the $4\ ^1\Sigma_u^+$ state of H_2 ALEXANDER CHARTRAND, Bryn Mawr College, ROBERT EKEY, University of Mount Union, ELIZABETH MCCORMACK, Bryn Mawr College — Resonantly-enhanced multiphoton ionization via the $EF\ ^1\Sigma_g^+$, $v' = 6$ double-well state has been used to probe the energy region of the high vibrational levels of the $4\ ^1\Sigma_u^+$ state of H_2. Theoretical *ab initio* potential energy curves[1] for this state predict a deep inner-well and shallow outer well due to an avoided crossing with the $B''\bar{B}\ ^1\Sigma_u^+$ curve. Transitions to the $4\ ^1\Sigma_u^+$ state have not been assigned previously because absorption from the $(1s\sigma)^2$ ground state is forbidden due to the f character of the inner well. However, transitions from the $EF\ ^1\Sigma_g^+$ state with inner well s character and combined doubly-excited and d character outer well are allowed. The high vibrational levels converging on the third dissociation limit should exhibit rotational constant values dependent on the varying amounts of inner and outer-well character for a given v. We report experimental energies for the $v = 8 - 12$ levels and compare favorably to the predicted adiabatic rovibrational energies[1]. The $v = 9$ level is the exception since it lies just above the avoided crossing, which makes predicting its energy difficult.

[1]G. Staszewska and L. Wolniewicz, *J. Mol. Spectrosc.* **212**, 208–212 (2002)

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