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New observation of outer well levels of the $B"\overline{B}^1\Sigma_u^+$ state of molecular hydrogen R.C. EKEY, A. MARKS, E.F. MCCORMACK, Bryn Mawr College — Double well states in the *ungerade* manifold of molecular hydrogen are challenging to observe due to poor Franck-Condon overlap with the ground state. The large internuclear separation (R $>$ 7 a.u.) of the outer well, $\overline{B}^1\Sigma_u^+$ state, in particular, must be excited in step-wise fashion to obtain appreciable excitation. The results reported here were achieved via two-color laser excitation through the double-well $E, F^1\Sigma_g^+(v = 6, J)$ state. Levels were observed by detecting both molecular and atomic ion production as a function of laser wavelength using a time-of-flight mass spectrometer. Lineshapes in the molecular ion channel appear as window resonances, while in the atomic ion channel they appear as resonant peaks. Rovibrational energies of the outer well levels were measured, many for the first time. The newly observed levels were assigned using theoretical energy calculations incorporating the latest potential curves. In this energy region, the $B"\overline{B}$, $^1\Sigma_u^+$ state crosses the ionization threshold and should provide an interesting test for *ab initio* and MQDT calculations of this fundamental system in a region of bound and continuum states.

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