OBSERVATION OF HIGH LYING LEVELS OF THE $1_g - 1^1\Pi_g$ STATE OF K_2

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Very high-lying vibrational levels $87 \leq$ v"$\leq$ 138 of the $1_g - 1^1\Pi_g$ electronic state of K_2 have been observed in a photoassociation experiment performed in Connecticut, using ionization detection. Photoassociation of ultracold potassium atoms furnishes accurate binding energies for $J \leq 4$ in these levels. These binding energies have been treated with laser induced fluorescence data covering the levels $0 \leq$ v"$\leq$105 at high J (infrared $C\,^1\Pi_u \rightarrow 1\,^1\Pi_g$ transitions recorded by Fourier transform spectrometry) to construct an accurate potential curve for this electronic state.

Because several vibrational levels were observed both in photoassociation and in fluorescence, an experimental dissociation energy can be deduced from the sum of binding energies (measured in photoassociation) and vibrational energies established with respect to the potential minimum (from fluorescence data), giving D_e = 1230.297 $\pm$ 0.002 cm^{-1}. Applying asymptotic models for the interactions between K(4s) + K(4p) atoms to the molecular potential energy curve, a slightly lower value, 1230.292 $\pm$ 0.002 cm^{-1} is obtained. This is considered to be the best available value for the dissociation energy of the $1\,^1\Pi_g$ electronic state into K(4s) + K(4p)$^2P_{3/2}$ atoms.