PHOTOIONIZATION SPECTROSCOPY OF Ga-RARE GAS COMPLEXES

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New electronic states, $F^2\Delta_{3/2}, G^2\Delta_{5/2}, H^2\Pi_{1/2}, and\ I^2\Pi_{3/2}$ are investigated for the complexes GaAr, GaKr and GaXe with resonant two-photon photoionization spectroscopy. These excited states correlate to the ^{2}D $\leftarrow$ ^{2}P $(4d \leftarrow 4p)$ atomic transition of gallium. Vibronic structure in these spectra are used to obtain vibrational constants, and extrapolated progressions are used to determine dissociation energies. The upper $^2\Delta$ states are more than twice as strongly bound as the corresponding $^2\Pi$ states. Excited state values of dissociation energies are used in energetic cycles to determine ground state dissociation energies for GaAr, GaKr and GaXe. In all three cases, the values obtained are significantly lower than previous estimates. The ground state of GaAr is extremely weakly bound, with $D_0'' = 20 \pm 20$, cm $^{-1}$, while the corresponding value for GaKr is only 35 ± 20 cm $^{-1}$. Analysis suggests the pre sence of a barrier in the long range potential of the excited states of the $B^2\Sigma^+$ Ga-RG complexes.