THE ELECTRONIC SPECTRUM OF THE GALLIUM DIMER

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A study of the electronic spectrum of the gallium dimer in the $33600 - 36800\ cm^{-1}$ spectral range is presented. The dimer was prepared in a pulsed, free-jet supersonic beam and detected by laser fluorescence excitation and depletion spectroscopy. All observed excited vibronic levels predissociate, and the transitions were detected by observation of Ga $5s \rightarrow 4p$ atomic emission. Four excited-state progressions were observed, and it was possible to assign the excited-state vibrational quantum numbers based on observed isotope shifts for two of the four progressions. Through comparison of the results with available quantum chemical calculations, these two progressions were assigned as electronic transitions to the $3^3\Pi_g$ and $2^1\Pi_g$ states from the ground $X^3\Pi_u$ state. A Franck-Condon analysis was performed to determine the equilibrium internuclear separation of the $3^3\Pi_g$ state. An upper limit for the Ga_2 dissociation energy, $De'' < 8891\ cm^{-1}$, was derived. This bound is consistent with previous experimental and computational estimates of the dissociation energy.