THE ELECTRONIC SPECTRUM AND MOLECULAR GEOMETRY OF THE JET-COOLED STIBINO (SbH_2) FREE RADICAL

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The jet-cooled stibino (SbH_2) free radical has been detected for the first time. This highly reactive species was produced in an electric discharge through a precursor mixture of stibine (SbH_3) diluted in high pressure argon. Stibine was synthesized by the low-temperature reduction of $SbCl_3$ with $LiAlH_4$ and stored and handled at -85 ^{o}C to avoid decomposition. Low-resolution LIF scans revealed a single band of SbH_2 with complex rotational structure in the 514.9 - 511.0 nm region. We find that the fluorescence lifetimes of the rotational transitions in this band are very short, of the order of 50-75 ns, suggesting an upper state dissociative process. The spectrum is assigned to the $\tilde{A}^2A_1$ - $\tilde{X}^2B_1$ electronic transition by analogy with the known spectra of NH_2, PH_2 and AsH_2 and in accord with a recent high level *ab initio* study. Emission spectra obtained after laser excitation of single rotational lines in the 0-0 band show a ground state bending frequency of approx. 820 cm^{-1}, consistent with theoretical predictions. The rotationally resolved spectrum of the 0-0 band, which spans some 150 cm^{-1}, was recorded at a resolution of 0.08 $\mathrm{cm}^{-1}$and analyzed in detail. The spectrum is complicated by large spin splittings and Sb hyperfine effects. The molecular constants were used to determine the geometry of SbH_2 in both states.