CAVITY RING-DOWN SPECTROSCOPY OF THE $1^2B_1 - \tilde{X}^2A_1$ TRANSITION OF THE PHENYL RADICAL

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In hydrocarbon combustion chemistry, the phenyl radical is believed to be a key intermediate in processes that lead to the formation of polycyclic aromatic hydrocarbons (PAH's) and soot. The radical is also of significance in atmospheric chemistry, interstellar chemistry, and environmental health. The detection and characterization of this highly reactive intermediate species in PAH formation reactions can help with the elucidation of mechanisms. However, the low concentrations associated with these radicals require special techniques to study them. This study combines an electrical discharge to produce radicals, a jet expansion to cool them immediately after production, and cavity ring-down spectroscopy (CRDS) for detection. We report absorption spectra for the $1^2B_1 - \tilde{X}^2A_1$ transition of the phenyl radical at a rotational temperature near 15 K. Rotational constants and vibrational frequencies for the 0_0^0, 9_0^1, and 10_0^1 bands are reported. Homogeneous line broadening was evident with a width indicative of an excited state lifetime of 80 ps. These results show the effectiveness of our system for studying relatively large reactive intermediates.