COLLINEAR TWO-COLOR SATURATION SPECTROSCOPY IN CN A-X (1-0) AND (2-0) BANDS

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Hyperfine-resolved saturation spectra were measured for a selection of low and medium J rotational lines in the $A^2\Pi$–$X^2\Sigma^+$ system of CN using two copropagating laser beams tuned to transitions in the (2–0) and (1–0) bands. A bleach laser was amplitude modulated and fixed in frequency near the center of a rotational line of the (2–0) vibrational band, while a probe laser was frequency-modulated and scanned across selected lines of the (1–0) vibrational band, sharing a common lower state with the bleach laser. Locking the probe laser with a tunable radio frequency offset to a cavity that tracks the slowly drifting bleach laser greatly improved the quality of the double-resonance saturation signals, by stabilizing the relative frequency of the two beams. The sub-Doppler resonances were fit with Lorentzian line shapes having a typical full-width at half maximum of 2–3 MHz. The hyperfine spectra observed depend on the hyperfine structure within both rovibronic transitions excited, permitting the determination of hyperfine molecular constants in the $\nu = 2$ state and the refinement of previously published values in the $\nu = 1$ state. Four nuclear magnetic dipole and two electric quadrupole hyperfine constants were determined for each of the upper states from a fit with a weighted root mean squared error of 0.5 MHz. The vibrational dependence of these constants is weak or negligible.

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