Depletion spectroscopy of ultracold $\nu_x = 0$ $^{85}\text{Rb}_2$ molecules trapped in a crossed optical dipole trap

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In this work, we have loaded $\nu_x = 0$ $^{85}\text{Rb}_2$ ultracold molecules into a crossed optical dipole trap from a standard magneto optical trap using a single light beam. Such beam is composed of a single frequency coherent light source, which is responsible for short range PA of cold rubidium atoms, and an incoherent broadband light source which transfers the molecules in different vibrational levels ($v_x$) of the singlet-ground-state $X$, into $\nu_x = 0$, through optical pumping. The molecules were observed, by REMPI technique, through 11 transitions from the $\nu_x = 0$ $X^1\Sigma_g^+$ ground state to the $2^1\Sigma_u^+$ excited state in the 20853-20985 cm$^{-1}$ energy range. Due to the bandwidth of the REMPI laser we were unable to resolve the rotational distribution of the $\nu_x = 0$. Therefore, we have performed depletion spectroscopy in the $\nu_x = 0$ trapped molecules using a diode laser at 682 nm to drive transitions from $v_X = 0$ to $v = 0$ of the $b^1\Pi_u$ potential. The pulsed dye laser frequency was set at the largest peak at 20966.9 cm$^{-1}$. The experimental depletion spectrum, which is in good agreement with theoretical predictions, allows us to determine that 75% the $\nu_x = 0$ molecules are in $J = 0$, 1 and 2 rotational states.

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