we have

$$\langle 0|\langle 10|\langle v|\sum_i s_{1-1}(i)\delta(r_{i1})|0\rangle|11\rangle|v\rangle = (2)^{-1}[\langle \sigma s(i)|\delta(r_{i1})|\sigma s(i)\rangle + \langle \sigma p_0(i)|\delta(r_{i1})|\sigma p_0(i)\rangle]. \quad (22)$$

FIG. 10. Simulated hyperfine spectra of the c $X\,^1\Sigma^+(v=0, J)$ transition $[^RQ(J)]$ and th F_1)–$X\,^1\Sigma^+(v=0, J)$ transition $[^PQ(J)]$. Th energy separation are calculated from the eig obtained by diagonalizing the matrix of H_0 - for all perturbing states, whose molecular cor The linewidth (fullwidth at half-maximum) o is assumed to be 20 MHz.

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$|\sigma p_0\rangle = c|3p_z^{Na}\rangle + d|4p_z^K\rangle$, where $|\chi^n\rangle$ represents χ^n atomic orbitals of nucleus n, and a, b, c, and d are the coefficients, we have

$$K_1 = (8\pi/3)\zeta(1)[a^2\langle 3s^{Na}|\delta(r_1)|3s^{Na}\rangle + 2ab\langle 3s^{Na}|\delta(r_1)|4s^K\rangle + b^2\langle 4s^K|\delta(r_1)|4s^K\rangle + c^2\langle 3p_z^{Na}|\delta(r_1)|3p_z^{Na}\rangle + 2cd\langle 3p_z^{Na}|\delta(r_1)|4p_z^K\rangle + d^2\langle 4p_z^K|\delta(r_1)|4p_z^K\rangle]/2. \quad (25)$$

The hyperfine constant of the $c\,^3\Sigma^+$ state induced by the Fermi contact interaction between the ^{23}Na nuclear moment and the electron spin is then expressed by neglecting small terms as

$$K_{Na}(c\,^3\Sigma^+) = (8\pi/3)\zeta(Na)a^2\langle 3s^{Na}|\delta(r_{Na})|3s^{Na}\rangle/2. \quad (26)$$

The hyperfine structure of the $Na(3s\,^2S_{1/2})$ atom arises from the Fermi contact interaction and the value of $K_{Na}(3s\,^2S_{1/2}) = (8\pi/3)\zeta(Na)\langle 3s^{Na}|\delta(r_{Na})|3s^{Na}\rangle$ is reported to be 2.95×10^{-2} cm^{-1}.[18] From the observed hyperfine splitting, we determined the value of $K_{Na}(c\,^3\Sigma^+)$ to be

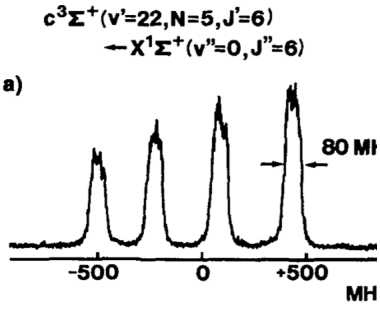

FIG. 11. (a) Observed hyperfine spectrum of F_1)–$X\,^1\Sigma^+(v''=0, J''=6)$ transition $[^PQ(6)]$ the $c\,^3\Sigma^+(v'=22,\ N=25,\ F_2$)–$X\,^1\Sigma^+(v''$ $[^RR(24)]$, which shows that our spectral resol

electric quadrupole interaction of th much smaller than the magnetic dipol