THE QUINTET OF HF DIMER: VIBRATIONAL OVERTONES OF THE HF STRETCHES AT N = 4

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The vibrational overtones of HF dimer at N = $v_1 + v_2 = 4$ is a quintet: (4, 0), (3, 1), (2, 2), (1, 3), and (0, 4), in the visible region. The K = 0 and 1 sublevels of the (4, 0) mode has been observed near 14,700 $cm^{-1}$ by the high-resolution molecular beam intra-cavity laser induced fluorescence. The band origin $\nu_0$ = 14700.458(7) $cm^{-1}$ and rotational constant (B + C)/2 = 0.22278(31) $cm^{-1}$ are determined for K = 0 with the centrifugal distorsion constant $D_J$ fixed to $2 \times 10^{-6}$ $cm^{-1}$. The spectral constants A = 24.3 $cm^{-1}$, (B + C)/2 = 0.22296(20) $cm^{-1}$, and (B - C) = 4.5(2) $\times 10^{-3}$ $cm^{-1}$ are also obtained for K = 1. The hydrogen interchange tunneling is essentially quenched at both K = 0 and 1 levels, consistent with the theoretical prediction from a phenomenological model.[a] The predissociation linewidths are 470(30) MHz with no apparent rotational dependence for both levels. To further verify the integrity of our model, we are extending our experimental studies to the (3, 1) and (2, 2) modes.

[a] H. -C. Chang and William Klemperer, J. Chem. Phys. 104, 7830(1996).