JET SPECTROSCOPY OF THE $2\nu_8$ BAND OF HYDROGEN FLUORIDE TRIMER IN THE 750 CM^{-1} REGION

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Theory predicts a planar ring, oblate symmetric top structure (C_{3h}) for hydrogen fluoride trimer. This ground state structure has been confirmed experimentally for deuterium fluoride trimer by Suhm, et al.[a] and for hydrogen fluoride trimer by Michael and Lisy.[b] Both of these experiments involved examining intramolecular stretching modes in the cluster. We have recorded what we believe to be the first rotationally resolved spectra of an intermolecular mode: the first overtone of the ν_8 (e'') out-of-plane torsion, which was predicted by Kolenbrander, et al.[c] This spectrum was produced by expanding a 4% HF-in-helium mixture through a pulsed, slit-jet source and interrogating the jet with the output of a lead salt diode laser spectrometer. A pressure and concentration study showed that most transitions (FWHM 45 MHz) in the 750 cm^{-1} region belong to the same oligimer. Groupings of intense lines are spaced by about 0.284 cm^{-1} suggesting a B value of 0.142 cm^{-1} which is close to the predicted value of 0.13 cm^{-1}. The appearance of the spectrum is, however, far more complicated than that predicted for a perpendicular band of a semi-rigid oblate symmetric top.

[a] Martin A. Suhm, John T. Farell, Jr., Stephen H. Ashworth, David J. Nesbitt, J. Chem. Phys. 98, 5985 (1993).
[b] Daniel W. Michael, James M. Lisy, J. Chem. Phys. 85, 2528 (1986).
[c] Kirk D. Kolenbrander, Clifford E. Dykstra, James M. Lisy, J. Chem. Phys. 88, 5995 (1988).