INTERNAL MOTION EFFECTS IN THE MICROWAVE SPECTRUM OF ARGON-*CIS*-1,2-DIFLUOROETHYLENE

HELEN O. LEUNG AND MARK D. MARSHALL, *Department of Chemistry, Amherst College, P.O. Box 5000, Amherst, MA 01002-5000*.

Using the results of Fourier transform microwave spectroscopy, we have recently completed a comprehensive study of protic acid-fluoroethylene complexes. The structures obtained for these species, specifically the length of the hydrogen bonding interaction, the deviation of this bond from linearity, and the contribution from a secondary interaction between the electron rich portion of the acid and a hydrogen contained in the fluoroethylene moiety, have been interpreted in terms of changes in the nucleophilicity of the fluorine atoms caused by an increasing degree of fluorine substitution. Our work included complexes with all the possible mono-, di-, and tri-substituted fluoroethylenes, with the exception of *cis*-1,2-difluoroethylene. In the course of seeking to observe the complex of this species with HF, a rich spectrum due to complexes with the argon carrier gas has been observed. Most notably, all *c*-type transitions observed for Ar-*cis*-1,2-difluoroethylene are doubled, while *a*-type lines are not and *b*-type lines are absent. This suggests that the complex is interconverting between two equivalent, non-planar, symmetric structures on the timescale of the experiment, a conclusion that is supported by *ab initio* calculations. Comparisons will be made with previously observed Ar-fluoroethylene complexes.