INFRARED SPECTROSCOPIC EVIDENCE FOR NeHF$^+$ AND HFFH$^+$ TRAPPED IN SOLID NEON

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When a Ne:HF mixture is subjected to Penning ionization and/or photoionization by neon atoms in their first excited states, between 16.6 eV and 16.85 eV, and the products are rapidly frozen at approximately 5 K, the infrared spectrum of the resulting deposit includes absorptions assigned to NeHF$^+$ and HFFH$^+$. Evidence is presented suggesting that neon-matrix shifts may be anomalously large for protonated molecules which are derived from species with proton affinities near or below 550 kJ/mol. The results of earlier \textit{ab initio} studies, as well as those of the present experimental and \textit{ab initio} studies, indicate that the NeHF$^+$ complex is quite strongly bound. The $\nu_3$ absorptions of NeHF$^+$ and NeDF$^+$ are identified, and the $\nu_2 + \nu_3$ absorption of NeHF$^+$ is tentatively identified. An absorption at 3064.7 cm$^{-1}$ has isotopic substitution behavior appropriate for its assignment to HFFH$^+$. Density functional and more elaborate \textit{ab initio} calculations support this assignment.