SUBMILLIMETER-WAVE ROTATIONAL SPECTROSCOPY OF H_2F^+

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Five pure rotational transitions of H_2F^+ were observed in the 473-774 GHz range with a backward-wave oscillator based submillimeter-wave spectrometer[a]. The H_2F^+ ion was generated in an extended negative glow discharge in a gas mixture of hydrogen fluoride generated by heating potassium hydrogen fluoride (HF_2K) granular powder at 150°C-160°C and hydrogen in an argon buffer. A simultaneous analysis of the rotational lines with 120 combination differences for the ground state derived from the infrared spectra obtained by Schäfer and Saykally[b] and Fujimori et al.[c] was carried out to determine the precise molecular constants for the ground state. The rotational transition frequencies that lie below 2 THz were calculated, together with their estimated uncertainties, to facilitate future astronomical identifications. Recently H_2Cl^+ was detected in NGC 6334I and Sgr B2 with the Heterodyne Instrument for Far-Infrared (HIFI) on board the Herschel Space Observatory[d], and HF was also detected in a wide variety of interstellar clouds with the same facility[e]. The proton affinity of HF is smaller than those of N_2 and CO, so the abundance of H_2F^+ is likely to be low in dense molecular clouds. We will discuss abundances of H_2F^+ in diffuse molecular clouds, considering various chemical reaction rates.

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