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Yields of electronically excited product states in the dissociative recombination of N_2H^+, HCO^+, HOC^+, and HNC^+ RAINER JOHNSEN, University of Pittsburgh, RICHARD ROSATI, Smithsonian Astrophysical Observatory, DAPHNE PAPPAS, Army Research Laboratory, MIREK SKRZYPKOWSKI, Prometheus Energy Company, MICHAEL GOLDE, University of Pittsburgh —
We have determined branching fractions of radiating products of the dissociative electron-ion recombination (DR) of the astrophysically important ions N_2H^+, HCO^+, HOC^+, and HNC^+, using the flowing-afterglow technique and absolute spectroscopy. State-specific yields were derived by fitting spatially resolved emission band intensities to model calculations. We find that DR of N_2H^+ results in $N_2(B^3\Pi_g$, v'$\geq$1), with a yield of (19$\pm$8)%. DR of HCO^+ forms the long-lived $CO(a^3\Pi)$ state with a yield of (23 $\pm$ 12)%, but DR of its isomeric form, HOC^+,favors formation of the triplet states $CO(a' \ ^3\Sigma^+)$ and $CO(d \ ^3\Delta)$ with a combined yield of greater than 40%. The yield of CN(B) from DR of HNC^+ was found to be (22$\pm$8)%, while that of CN(A) is (14$\pm$5)%. The vibrational distributions of the product electronic states do not follow a simple pattern. In some cases, the distributions are close to those predicted by Bates' impulse model but we also find partially inverted distributions, and some that extend to very high vibrational quantum numbers.

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