THE PERFORMANCE OF A CONTINUOUS SUPERSONIC EXPANSION DISCHARGE SOURCE

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Production of cold molecular ions is an integral component in performing high resolution spectroscopy of astronomically important ions at temperatures comparable to the interstellar medium. Frequently, pulsed supersonic expansion discharge sources have been used to produce ions at these temperatures. Yet, pulsed sources impose a limit on the duty cycle of the spectroscopic technique. To circumvent this limitation, a continuous supersonic expansion discharge source has been designed for use in the high resolution technique that is currently being developed in our lab, SCRIBES (Sensitive, Cooled, Resolved Ion BEam Spectroscopy). In order to characterize and optimize the source design, the R(1,0), R(1,1)^u, and R(2,2)^l transitions within the $\nu_2 \leftarrow 0$ band of H_3^+ have been studied using continuous-wave cavity ringdown spectroscopy with a recently constructed difference frequency generation (DFG) laser. Temperature and ion column density were recorded as a function of discharge current. Observed temperatures were in the range of 50 to 110 K and the ion column densities between 8×10^{10} and 2×10^{12} cm^{-2}. The source was found to be robust; operation was sustained for a period of 200 hours. Future prospects to optimize this design using HN_2^+ will also be discussed.