

## LABORATORY AND ASTRONOMICAL DETECTION OF THE NEGATIVE MOLECULAR ION $C_3N^-$

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The negative molecular ion  $C_3N^-$  has been detected at millimeter wavelengths in a low pressure laboratory discharge, and then with frequencies in hand in the molecular envelope of IRC+10216. Spectroscopic constants derived from laboratory measurements of 12 transitions between 97 and 378 GHz allow the rotational spectrum to be calculated well into the submillimeter-wave band. Four transitions of  $C_3N^-$  were detected in IRC+10216 with the IRAM 30 m telescope at precisely the frequencies calculated from the laboratory measurements. The column density of  $C_3N^-$  is 0.5% that of  $C_3N$ , or approximately 20 times greater than  $C_4H^-$  relative to  $C_4H$ . The  $C_3N^-$  abundance in IRC+10216 is compared with chemical model calculations,<sup>a</sup> and observations in TMC-1 with the NRAO 100 m Green Bank Telescope (GBT) are discussed. The fairly high concentration of  $C_3N^-$  achieved in the laboratory implies that other molecular anions containing the CN group may be within reach.

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<sup>a</sup>S. Petrie and E. Herbst, *Astrophys. J. Lett.* **491**, 210 (1997); E. Herbst and Y. Osamura, *Astrophys. J.*, in press (2008).