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,[a] 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.

[a] S. Petrie and E. Herbst, Astrophys. J. Lett. **491**, 210 (1997); E. Herbst and Y. Osamura, Astrophys. J., in press (2008).