LABORATORY AND ASTRONOMICAL DETECTION OF THE LARGE MOLECULAR ANION C_6H^-

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The importance of negative ions (anions) in astronomy was demonstrated in 1939 by Rupert Wildt who showed that H^- is the major source of optical opacity in the solar atmosphere, and therefore the material which one mainly sees when looking at the sun and similar stars. It is remarkable that in the many years since, during which nearly 130 neutral molecules and 14 positive molecular ions have been found in astronomical sources, no molecular anion has been identified. During the same period of time, more than 1000 molecular anions have now been studied in the laboratory at low resolution, but for only two diatomics, OH^- and SH^-, have rotational spectra been obtained. On the basis of recent experiments, a third negative molecular ion has been detected in the radio band in the laboratory, and, for the first time, in two well-known astronomical sources as well: the molecular envelope of IRC+10216 and in the dense molecular cloud TMC-1. The new anion is a surprising molecule — the hexatriyne anion, C_6H^-, a carbon chain which is larger than nearly all the neutral molecules that have been found, and larger than all the cations. Following this work several other molecular anions have now been detected in our laboratory, and the results will be presented at this meeting. The present work suggests that a variety of other molecular anions may now be detectable in the laboratory and in space, and that some of these may be considerably easier to detect than one might suppose.

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