C_7^- AND THE DIFFUSE INTERSTELLAR BANDS

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The diffuse interstellar bands (DIBs) are a set of absorption features appearing in the visible spectra of stars whose lines of sight traverse interstellar dust and gas. The identification of the carriers of these bands has eluded astronomers and laboratory spectroscopists for over half a century. Many promising suggestions have been made, only to be negated on observational or spectroscopic grounds. The hypothesis that the DIBs are caused by long-chain carbon molecules[b] remains one of the most attractive alternatives.

The recent measurement[c] of the electronic spectrum of C_7^- in the gas phase lends new support to this hypothesis, since the five strongest $A^2\Pi_u \leftarrow X^2\Pi_g$ transitions of C_7^- roughly match diffuse interstellar bands both in wavelength (within ~ 2.8 Å) and in relative intensity. The remaining two $A^2\Pi_u \leftarrow X^2\Pi_g$ transitions, and five $B^2\Pi_u \leftarrow X^2\Pi_g$ transitions (which are broadened by internal conversion), have not yet been observed in astronomical spectra containing the diffuse interstellar bands.

In order to test the hypothesis that C_7^- is a carrier of the diffuse interstellar bands and to search for other carbon molecules, we have obtained medium ($\Delta\lambda/\lambda \sim 2000$) and high ($\Delta\lambda/\lambda \sim 40000$) resolution visible spectra of reddened stars using the Double Imaging Spectrograph (DIS) and the echelle spectrometer at Apache Point Observatory. We will present the results of these observations and critically evaluate the viability of the C_7^- DIB hypothesis.

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[b] A.E. Douglas, *Nature* 269, 130, (1977), W.H. Smith, T.P. Snow, and D.G. York, *Astrophys. J.* 218, 124 (1977)

[c] M. Tulej, D.A. Kirkwood, M. Pachkov, and J.P. Maier, *Astrophys. J.* 506, L69 (1998)