DIFFUSE INTERSTELLAR BANDS CORRELATED WITH CARBON MOLECULES C_2 and C_3

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Our survey of diffuse interstellar bands (DIBs) toward 53 stars with color excesses $0.11 \leq$ E(B-V) ≤ 1.99 has revealed "the C_2 DIBs", a class of about a dozen weak and narrow DIBs whose intensities correlate well with column densities of carbon molecules C_2 and C_3 with the correlation coefficient r = $0.85 \sim 0.50$[a]. They are strongest toward HD 204827, the star whose sightline contains by far the highest C_2 and C_3 column densities,[b] and weak or undetectable toward Herbig's classic DIB star HD 183143, although the two stars have comparable color excess of 1.11 and 1.27, respectively. The C_2 DIBs have high correlation among them (r = $0.94 \sim 0.54$, mostly $\geq$ 0.75) suggesting that their carriers are several molecules with similar chemical properties that exist abundantly in the diffuse interstellar medium where carbon molecules abound. We note among the C_2 DIBs 4 pairs of doublet lines with very close spacings of $20.9 \sim 19.1$ cm^{-1}. High correlations between the components of a doublet suggest that they are due to the same molecule. The magnitude of the splitting and the relative intensities of the doublets of $4 \sim 2$ suggest that they are spin-orbit split levels of linear molecules.

[a] J. A. Thorburn, L. M. Hobbs, B. J. McCall, T. Oka, D. E. Welty, S. D. Friedman, T. P. Snow, P. Sonnentrucker and D. G. York, *ApJ* **584**, 339 (2003)
[b] T. Oka, J. A. Thorburn, B. J. McCall, S. D. Friedman, L. M. Hobbs, P. Sonnentrucker, D. E. Welty, and D. G. York, *ApJ* **582**, 823 (2003)