CORRELATIONS AMONG THE DIFFUSE INTERSTELLAR BANDS[a]

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Now that our long-term survey of the diffuse interstellar bands (DIBs) is complete, we have begun a systematic search for correlations among the DIBs in the hopes of shedding light on the nature of the DIB carriers. These carriers are assumed to be gas-phase molecules, and the DIBs themselves are assumed to be vibronic bands originating from the vibrational ground state. In searching for correlations, we implicitly assume that the low temperatures ($\sim$30 K) of diffuse clouds cause the DIB carriers to be found entirely in their ground states. [This assumption will break down if the molecules have extremely low frequency bending modes, or other low level splittings (e.g. spin-orbit).] In the framework of these assumptions, a vibronic progression of DIBs belonging to the same carrier could be identified as a set of DIBs whose intensities consistently vary in unison from sightline to sightline. In particular, if one generates a scatter plot of the intensity ("equivalent width") of one DIB against that of another, the correlation coefficient (r) should approach unity if the two DIBs belong to the same carrier molecule. Using our large database of DIB measurements, we find that very few pairs of strong DIBs exhibit nearly-perfect correlations. Among the DIBs whose lines have been measured in at least 20 sightlines, only 19 pairs of DIBs (out of over 2000 pairs) show correlation coefficients $r \geq 0.95$. We will discuss the distribution of the correlation coefficients, examine in detail some of the best correlations observed, and speculate on the implications for the DIB carriers.

[a]Based on observations from the APO 3.5-meter telescope, owned and operated by the Astrophysical Research Consortium.