Unusual Relative Strengths of the Diffuse Interstellar Bands in Some Interstellar Dust Clouds

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We find that some of the diffuse interstellar features (DIB) in the spectra of certain stars at high galactic latitudes (1 > 15°) are unusually weak or absent while others have the strength expected for their color excess. In some cases the stars are probably reddened by single interstellar clouds. There appear to be three families of DIB where:

(i)   4430, 4882 and 6180 are absent.

(ii)   5362, 5449, 5487, 5508, 5780, 6196, 6203, 6269, 6284 are about one third of their expected strength,

(iii)   the 2200 feature and 4763, 4780, 5494, 5535, 5545, 5797, 5850, 6376, 6379, 6614 are of approximately normal strength for the color excess.

The effect for families (ii) and (iii) is demonstrated in Figure 1 for a number of lines. The high signal to noise Reticon spectrograms in the region 5760 to 5860A are of (A) HD 91316 E(B-V) = 0.03, (B) 40111 E(B-V) = 0.16 (C) 24398 E(B-V) = 0.29, (D) 2905 E(B-V) = 0.31, (E) 42087 E(B-V) = 0.34. The diffuse features are identified and, from more extensive observations we consider HD2905 to have normal relative DIB strengths. 5780 is obviously significantly weaker in C, the star at high galactic latitude.

In the galactic plane we find that 4430 is significantly weaker for stars which have values of E(15-18) > 0.2. This effect is also correlated with certain regions in galactic longitude. In Perseus for example 4430 is significantly weaker than in Cepheus where E(15-18) is < 0.2. This suggests that the behavior of family (i) is related to the presence or absence of the fine particle component or some other component of the interstellar dust which causes the enhanced UV extinction.

The existance of the three families implies that at least three agents cause the DIB and that the proportions of the agents or the physical conditions giving rise to the DIB can vary from cloud to cloud.
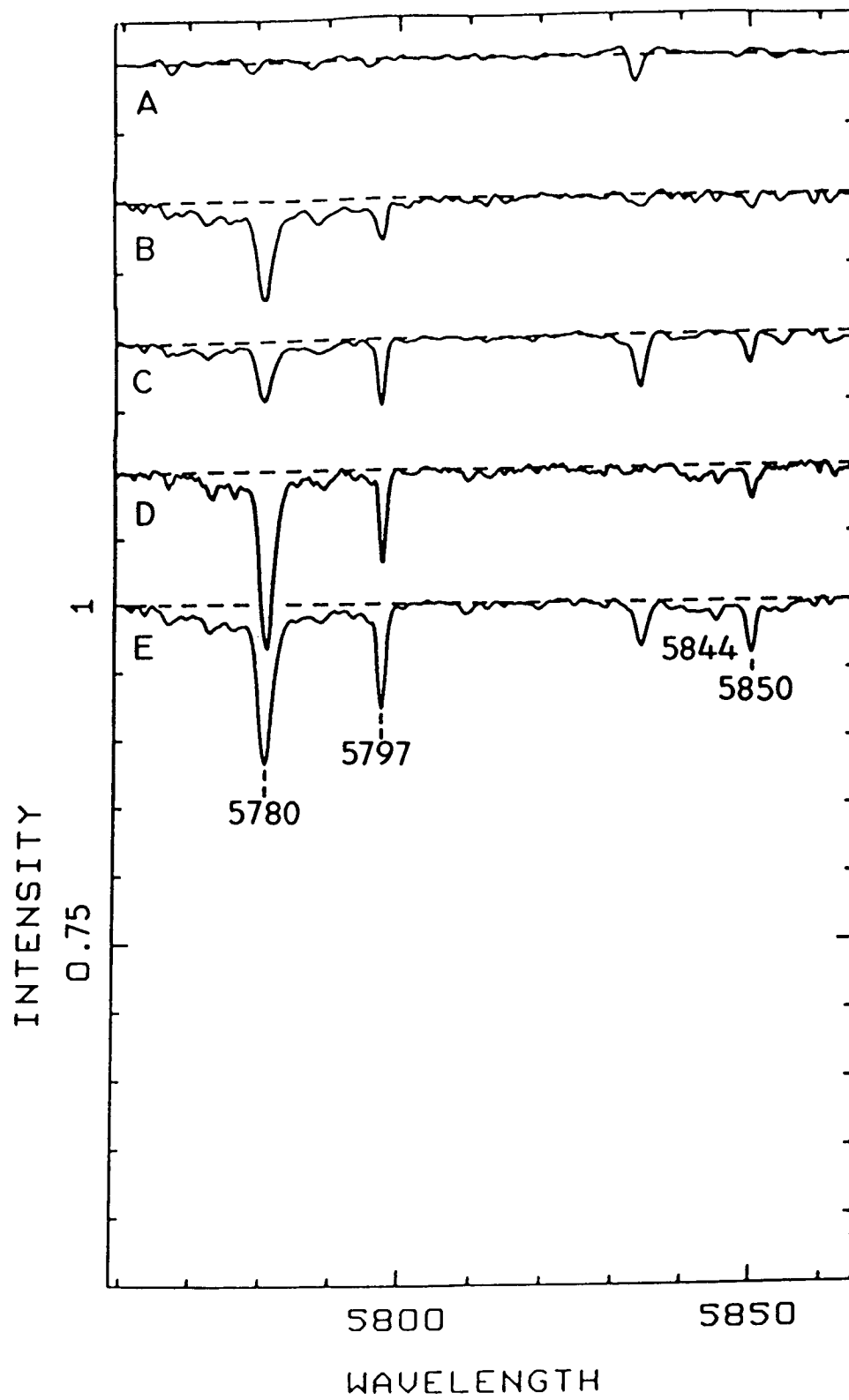
FIGURE 1.