FURTHER STUDIES OF λ 5797.1 DIFFUSE INTERSTELLAR BAND

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The λ 5797.1 DIB is unique with its sharp central feature.[a] We simulated the spectrum based on three premises: (1) Its carrier molecule is polar as concluded from the anomalous spectrum toward the star Herschel 36.[b] (2) The central feature is Q-branch of a parallel band of a prolate top. (3) The radiative temperature of the environment is T_r = 2.73 K. A comparison with observed spectrum indicated that the carrier contains 5-7 heavy atoms.[c]

To further strengthen this hypothesis, we have looked for vibronic satellites of the λ 5797.1 DIB. Since its anomaly toward Her 36 was ascribed to the lengthening of bonds upon the electronic excitation, vibronic satellites involving stretch vibrations are expected. Among the 73 DIBs observed toward HD 183143 to the blue of 5797.1 Å, two DIBs, λ 5545.1 and λ 5494.2 stand out as highly correlated with λ 5797.1 DIB. Their correlation coefficients 0.941 and 0.943, respectively, are not sufficiently high to establish the vibronic relation by themselves but can be explained as due to high uncertainties due to their weakness and their stellar blends. They are above the λ 5797.1 DIB by 784.0 cm^{-1} and 951.2 cm^{-1}, respectively, approximately expected for stretching vibrations.

Another observations which may possibly be explained by our hypothesis is the emission at 5800 Å from the Red Rectangle Nebula called RR 5800.[d] Our analysis suggests that λ 5797.1 DIB and RR 5800 are consistently explained as caused by the same molecule.

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[a] T.H. Kerr, R.E. Hibbins, S.J. Fossey, J.R. Miles, P.J. Sarre, ApJ 495, 941 (1998)
[b] T. Oka, D.E. Welty, S. Johnson, D.G. York, J. Dahlstrom, L.M. Hobbs, ApJ 773, 42 (2013)
[c] J. Huang, T. Oka, Mol. Phys. J.P. Maier Special Issue in press.
[d] G.D. Schmidt, A.N. Witt, ApJ 383, 698 (1991)