Diffuse Interstellar Band at 5850 as a Member of 5797 Spectroscopic Family

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Abstract.
The carriers of diffuse interstellar bands are still mysterious species. There exist many arguments that diffuse bands at 5797 and 5850 angstroms have the same carrier. Using high-resolution spectra of few dozens of reddened stars we have searched mutual correlation between intensities of considered bands. Results of our analysis indicate that 5797 and 5850 really tend to have the same carrier.

1. Introduction

Diffuse interstellar bands (DIBs) are mysterious absorption structures of interstellar origin observed in spectra of reddened stars of early spectral types. The detection of the first two DIBs was described by Heger in 1922. These structures, as we know them today, are scattered within the whole region of visible light and in the near infrared (see e.g. Herbig 1995). Individual DIBs differ between themselves in intensity, line width and profile shapes.

There are many arguments that 5797 and 5850 DIBs have the same carrier. Almost all procedures isolating DIBs’ families indicate that 5797 and 5850 bands tend to belong to the same family (e.g. Chlewicki et al. 1986, Josafatson and Snow 1987, Krelowski and Walker 1987, Wszołek and Godłowski 2003). Wszołek and Godłowski (2003) additionally confirmed the status of 5850 band as a member of 5797 spectroscopic family, that means that both these DIBs have probably the same carrier. They composed sequences of spectrograms, of different target stars, in such a way that equivalent width (EW) of 5797 was substantially changing from one case to the other. They realized that the depth of 5850 band regularly follows the depth of 5797 band.

To check how good candidate to 5797 spectroscopic family is the DIB at 5850 angstroms, we carried out measurements of EWs for both DIBs in spectra of 74 target stars. We also carried out the analysis of mutual correlation between them.
2. Observational Data

All the spectra analyzed for the purpose of this contribution were taken from the archives of Professor Jacek Krelowski (Astronomical Centre, Nicolaus Copernicus University, Toruń, Poland). We used spectra taken with the Canada-France-Hawaii Telescope and spectra acquired at the McDonald Observatory with an echelle spectrograph fed with the 2.1-m telescope. Considered DIBs were present always in the same order of the spectra. Spectra are of quite good quality, as far as resolution and signal/noise are concerned.

3. Correlation Analysis

Using spectra of 74 target stars we have measured EWs for DIBs at 5797 and 5850 angstroms. That was done with the help of software package REWIA v. 1.4, written by Jerzy Borkowski (Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences, Toruń, Poland). We calculated correlation coefficient for measured values. We drew correlation diagram, which is exposed in figure 1. On the figure one may notice small dispersion of points around the straight line. It is most probably caused by errors in observation and in data reduction. Correlation coefficient r=0.9 was counted and it is very high. In practice, there exist no other pair of DIBs with such good correlation as 5797 and 5850 ones.

4. Concluding Remarks

5850 band lies in the spectra very close to 5797 DIB. Although 5850 is substantially weaker than 5797, it is still a relatively strong DIB. That means that for very reddened stars EW(5850) measurement errors are not too big. Furthermore, 5850 morphologically resembles very much the 5797 band. All groupings of DIBs into families, known from literature, show that 5850 and 5797 belong to the same morphological family. Correlation diagram for large number of target stars, exposed in the figure 1, and counted coefficient of correlation strengthen very much the hypothesis that 5797 and 5850 DIBs have the same carrier.

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References

Chlewicki G., van der Zwet G.P., van Ijzendoorn L.J., Greenberg J.M.: 1986, ApJ., 305, p.455;
Heger M.L.: 1922, Lick. Obs. Bull., 10, p.146;
Herbig G.H.: 1995, ARA&A, 33, p.19;
Josafatson K., Snow T.P.: 1987, ApJ., 319, p.436;
Krelowski J., Walker G.A.H.: 1987, ApJ., 312, p.860;
Figure 1. Correlation diagram between EW(5850) and EW(5797) for 74 target stars. EWs are given in milliangstroms.
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Wszełek B., Godłowski W.: 2003, MNRAS, 338, p.990;