INVESTIGATION OF DIFFUSE INTERSTELLAR BANDS OF ORGANIC MOLECULES IN THE SPECTRA OF CEPHEID STARS

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ABSTRACT. We describe an effective method of investigation of the Diffuse Interstellar Bands (DIBs) in the spectra of Cepheid stars. DIBs are believed to originate from the absorption of such carriers as polycyclic aromatic hydrocarbons in the interstellar gaseous clouds located between an observer and the stars whose spectra were recorded. We performed a detailed consideration of the DIB at 6613 A in our sample of spectra for more than 250 stars. The quantitative characteristics of the DIB absorption features will be studied in connection with the interstellar absorption data, and after that, they will be used in the mapping of the Galactic disc.

Keywords: ISM: bands – variables: cepheids

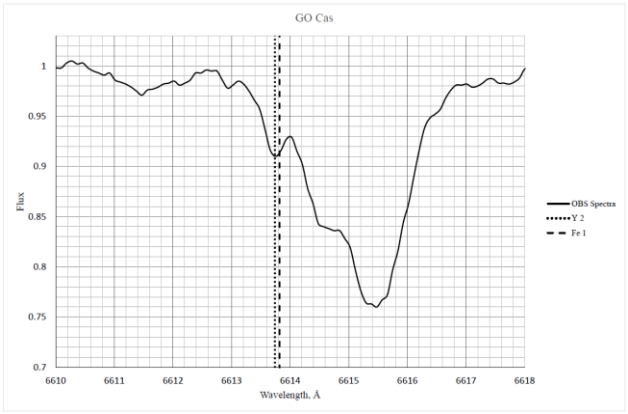

Figure 1: The DIB at 6613 Å in spectrum of GO Cas

1. Introduction

The Diffuse Interstellar Bands (DIBs) are observed in spectra of astronomical objects in ultraviolet, visible and infrared wavelengths. The central wavelengths of DIBs don't correspond to any known spectral lines of a chemical elements. This phenomena is one of the most difficult conundrums for astrophysics. However, presence the unknown bands in the spectra of stars confirms existence the inhomogeneous distribution of the interstellar medium. Therefore, we investigated in detail the one of the DIBs of organic molecules in the spectra of Cepheid stars for determining of some characteristics ISM.

2. Data

We used the spectra of Cepheid stars with resolution of 30000, which had been obtained by R. E. Luck with the Hobby–Eberly Telescope Spectrograph (McDonald Observatory, Texas, United States). Using spectra of the variable stars for investigation DIBs is unique. In our research, we analyzed 253 spectra.

3. The method

The object of the research was DIB at 6613 Å. As a rule it blend with two stellar spectral lines: Y II at 6613.73 Å and Fe I at 6613.82Å. But sometimes our band don't blend with any stellar spectral lines.

We had to neutralize the influence of these two lines on our DIB. For this purpose, we developed an effective method, which consists of the following stages:

1. Verifying oscillator strength for Y II at 6613.73 Å and Fe I at 6613.82Å. We used spectra of Sun with high resolution (Kurucz et al. 2004) and VALD (Vienna Atomic Line Database).
2. Creating synthetic spectra of Cepheid stars. For that, we used the basic atmospheric parameters stars, which are presented in the paper Luck & Lambert (1). The models of stellar atmospheres were generated with program ATLAS9 (Kurucz, 2004). The synthetic spectra were calculated with the SynthV program (Tsymbal, 1996). We also used the chemical structure database from the paper Luck et al. (2).
3. The observed spectra processing. All procedures of spectra processing were conducted in DECH20t (Galazutdinov).
4. The observed spectrum was divided by the synthetic and we received a «clean» profile of the DIB.

Our aims were to analyze the «clean» profiles of the DIB at 6613 Å and to make map of the distribution density of interstellar matter in the Galactic disc.

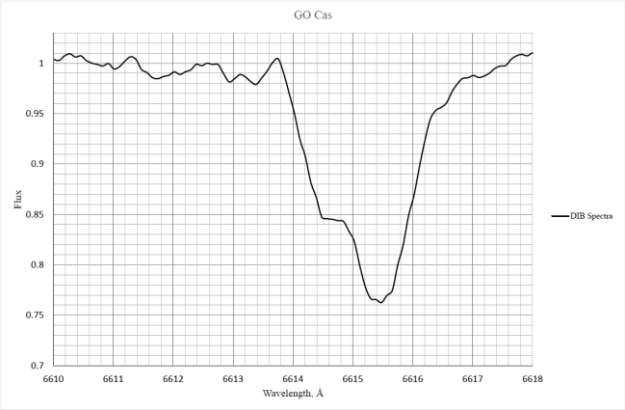

Figure 2: The «clean» profiles of the DIB at 6613 Å in spectrum of GO Cas

In our paper, we investigated the DIB of organic molecules at 6613 Å in the 253 spectra of Cepheid stars.

We «cleared» the chosen DIB's profiles of the stellar spectral lines Y II at 6613.73 Å and Fe I at 6613.82Å.

We defined the equivalent width of DIB at 6613 Å in 253 spectra.

Finally, we made map of the distribution density of interstellar matter in the Galactic disc. Our results were presented in tables and graphs.

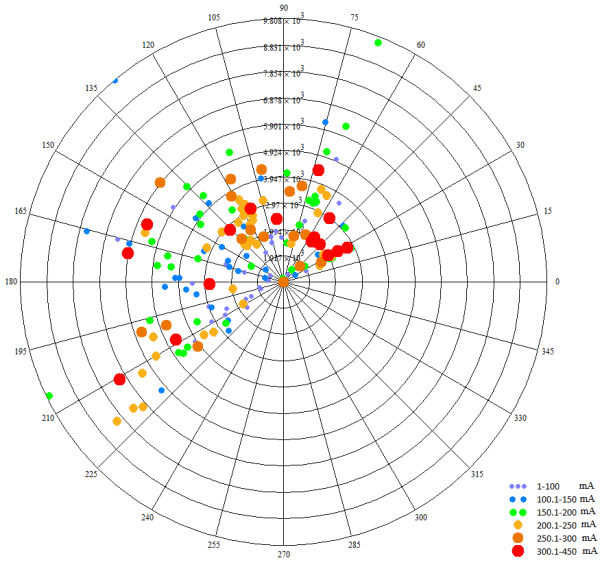

Figure 1: The Map of the Distribution Density of Interstellar Matter in the Galactic Disc

References

Luck, R.E., & Lambert, D. L. 1981, *ApJ*, 245, 1018.
Luck R.E. et al.: 2007, *ApJ*, **133**, 2464.