A COMPARISON OF THE NEAR-ULTRAVIOLET CONTINUUM AND CHROMOSPHERIC EMISSION LINE FLUXES OF THE LATE-TYPE GIANT STARS

KÂMURAN AVCIOĞLU, M. TÜRKER ÖZKAN, and H. HÜSEYIN MENTEŞE

Department of Astronomy and Space Sciences, Faculty of Science, University of Istanbul, Turkey

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Abstract. We investigate the near-ultraviolet high-resolution LWR spectra of the stars α Cas, β And, α Tau, β Gem, γ Cru, α Boo, and β Peg, obtained with the aid of the International Ultraviolet Explorer Satellite. We have given here a list of the strongest and most prevalent emission lines in the near-ultraviolet spectra of α Boo, K1 III, and β Peg, M2.5 II–III which have the same luminosity class and different spectral type. The near-ultraviolet continuum flux measurements and integrated emission line fluxes of these stars for the 2500–3200 Å region are presented in order to compare the variations in the appearance of the near-ultraviolet flux distribution with the temperature structure of their chromospheres for K and M giant stars. We also discuss differences between observed and calculated fluxes found from the Planck function.

1. Introduction

With the advent of ultraviolet high-resolution spectroscopy from space instruments, the near-ultraviolet flux, the chromospheric h and k emission cores of Mg II resonance doublet at 2795–2803 Å has become the subject of study for an increasingly large number of researchers. The cool stars emit only a tiny fraction of their radiation in the ultraviolet portion of the spectrum. Both the observed ultraviolet continuum fluxes and the emission line profiles of the resonance doublet of singly-ionized Mg of cool stars give us large amount of astrophysical information. The International Ultraviolet Explorer (IUE) satellite is an effective tool for studying the near-ultraviolet spectra of late-type stars. The IUE cameras have proved to be sufficiently sensitive to do useful research on cool stars at high resolution. Bogges et al. (1978) have published a description of the IUE spectrographs and data acquisition system. High-resolution spectra in the long-wavelength region at 1900–3200 Å, have been obtained for many late-type stars to study the temperature structure of their chromospheres and transition region (Dupree, 1980; Linsky, 1980).

In this paper, we study spectra of seven late-type stars α Cas, β And, α Tau, β Gem, γ Cru, α Boo, and β Peg by using the Atlas of High-Resolution IUE Spectra of Late-Type Stars prepared by Wing et al. (1983). In particular, by giving the line identification of α Boo and β Peg we derive the fluxes in these lines. Additionally, continuum fluxes of all stars considered are compared among themselves as well as with those found from the Planck function.

2. Surveyed Stars

In this section we briefly review some of the previous studies on the recent spectral appearance of the stars studied in this work from ground-based, BUSS, Copernicus, and IUE observations.

\( \alpha \) Cas, K0IIIa

Recently, Keenan and Pitts (1980) have investigated \( \alpha \) Cas, and assigned a more refined classification K0IIIa. Shedir seems to be a normal K0 giant.

\( \beta \) And, M0IIIIE

Mirach has been classified by Morgan et al. (1943) as an MK standard of type M0III. Morgan and Keenan (1973) have more recently classified this star as M0IIIa, and Wing (1978a) as M0.5III.

\( \alpha \) Tau, K5III

Aldebaran has a controversial spectral classification. It has been believed that this star is prototype of spectral class K5III, and there is no published revision of this type recently. The TiO bands of Aldebaran are abnormally strong for this classification. They are as strong as M0III. Wing (1978a) reports this star as belonging to K5.7III from narrow-band photometry. According to Morgan and Keenan (1973) it would be classified as K7III or perhaps M0III for its TiO strength. \( \alpha \) Tau has the MgII lines in emission by balloon (Kondo et al., 1975) and by the Copernicus satellite (McClintock et al., 1975). Van der Hucht et al. (1979) have also observed the spectrum of Aldebaran by balloon flight at high resolution down to 2800 Å.

\( \beta \) Gem, K0IIIIE

This star has been studied by Keenan (1963) and found to belong to the K0IIIb classification. He reported that Pollux is slightly less luminous than the average K0 giant. Earlier observations from Copernicus (McClintock et al., 1975) and BUSS (Kondo et al., 1976) have shown that strong MgII emission lines from \( \beta \) Gem are narrower than in any other giant or supergiant observed by IUE (Wing et al., 1983). Griffin (1976) has reported that this star has solar abundances.

\( \gamma \) Cru, M4III

Gacrux has been classified as an ordinary giant of type M3.5III by Keenan and Pitts (1980). Measurements of its narrow-band photometry give M3.5III (Wing, 1978a). The narrow MgII emission lines of this star would appear to confirm that the luminosity is no brighter than class III. The first high-resolution spectrum of the star \( \gamma \) Cru has been taken with IUE, and described by Wing and Carpenter (1978) and Wing (1978b). Its emission lines identified in the chromospheric spectrum are listed by Wing et al. (1983).