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# A STUDY OF AX Mon (HD 45910) KINEMATICAL PARAMETERS OF THE Fe II DENSITY REGIONS

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**Abstract.** The UV spectrum of AX Mon (HD 45910) presents a series of complex structure spectral lines, that present SACs or DACs. In this paper, using the GR model, we study the complex profile of Fe II spectral lines and we calculate the relation of some physical parameters with the excitation potential.

## 1. INTRODUCTION

Fleming (1898) was the first that noted that AX Mon (HD 45910=BD+5°, 1267=SAO 13974, a=$6^h$ $27^m$ $52^s$, $\delta$=+5°, 54′,1 (1950), V=6,59-6,88 mag) had bright hydrogen lines. Merrill (1923) and Plaskett (1923) noted a variability of the spectrum. The most pronounced changes discovered in photographic studies were the occasional appearance of a shell spectrum of ionized metals and variable hydrogen lines with one or more components.

Merrill (1952) discovered the binary nature of AX Mon. He derived an orbit for the late-type star with a period of 232 days. Cowley (1964) concluded that the system consists of a rapidly rotating B3nn star and a somewhat fainter K0 giant and that the rotational velocity of the early-type star is 345 km/s.

Danezis et al. (1991) studied a series of Fe II lines with classical method and indicated the existence of three satellite components with radial velocities of -75, -260 and +10 km/s. These values did not present any variation with the excitation potential.

| $\lambda_{lab}$ (Å) | Excitation Potential (eV) |
|---|---|
| 1558.542 | 0.35 |
| 1646.187 | 1.07 |
| 1673.462 | 1.96 |
| 1679.388 | 2.02 |
| 1720.042 | 1.72 |
| 1731.038 | 2.27 |
| 1880.976 | 2.57 |
| 2237.577 | 4.75 |
| 2445.559 | 2.69 |
| 2607.086 | 0.08 |
| 2767.500 | 3.23 |
| 2858.340 | 3.75 |

Table 1: The $\lambda_{lab}$ of the Fe II spectral lines and the respective excitation potential

In this paper we study a series of Fe II lines with GR model (Danezis et al. 2007), in order to verify the results found by Danezis et al. (1991), as well as the accuracy of GR model. Additionally, we present the radial, rotational and random velocities, the FWHM and the absorbed energy of a group of Fe II lines, as a function of their excitation potential between 0.08 and 4.75 eV.

## 2. OBSERVATIONAL DATA

In Table 1 we present the studied Fe II spectral lines, taken with IUE, and the respective excitation potential.

## 3. RESULTS AND DISCUSSION

In Figure 1, we give as an example the fit of the $\lambda$ 2607.086 Å Fe II spectral line. We can see that the observed complex structure can be explained with SACs phenomenon.

In Figure 2 we present the variation of the radial velocities of the studied group of Fe II lines as a function of the excitation potential (left). As we can see the radial velocities stay nearly constant as a function of I.P. We detected three levels of radial velocities. The first level has values about -260 km/s (circle), the second one has values about -125 km/s (open square) and the third one has values about -18 km/s (triangle). We compare our results with the results found by Danezis et al. (1991) (right). As we can see the results are almost the same. This fact verifies the previous results, as well as the accuracy of GR model. Specifically, we verify the number of satellite components, their radial velocities, and the relation between the radial velocities of the Fe II lines with their excitation potential.

In Figure 3 we present the variation of the rotational and the random velocities of the studied group of Fe II lines as a function of the excitation potential. As the radial velocities, the random velocities stay also nearly constant as a function of I.P. The values of the rotational velocities (left) for all SACs are between 20 and 60 km/s. We detected three levels of the random velocities of the ions (right). The first level has values about 115 km/s (open circle), the second one about 70 km/s (square) and the third one about 35 km/s (triangle).

In Figure 4 we present the variation of the Full Width at Half Maximum (FWHM in Å) of the studied group of Fe II lines as a function of the excitation potential. We also detected three levels of values of the FWHM. The first level has values about 2 Å, the second one about 1.3 Å and the third one about 0.6 Å.

Finally, in Figure 5 we present the variation of the absorbed energy (Ea in eV) of the studied group of Fe II lines as a function of the excitation potential. Also here we found three levels of absorbed energy. The first level has values about 1 eV, the second one about 0.4 eV and the third one about 0.14 eV.

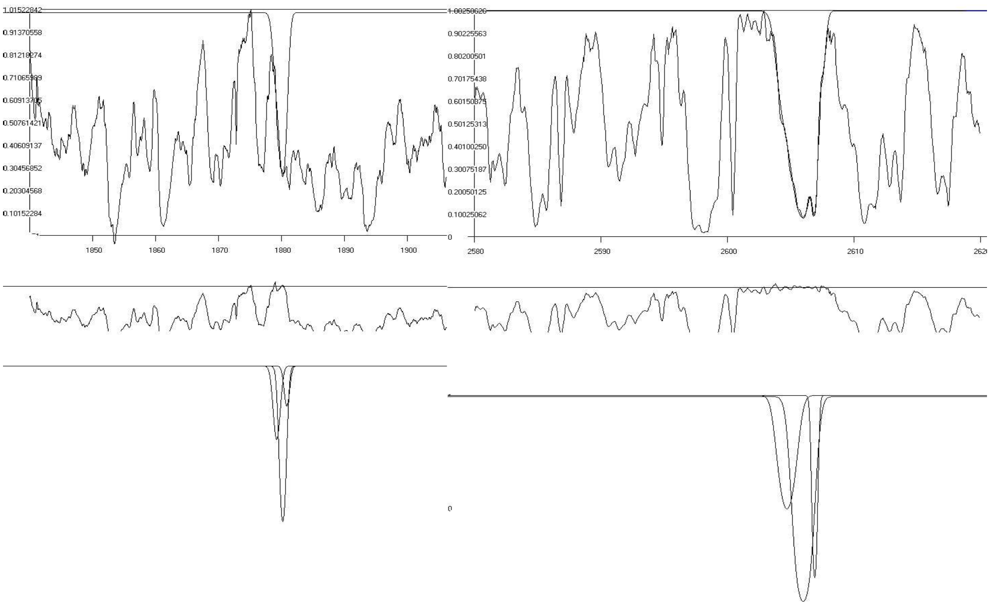


Figure 1: Best fit of the $\lambda$ 1880.976 Å (left) and $\lambda$ 2607.086 Å Fe II (right) spectral line. We can explain the complex structure of these lines as a DACs or SACs phenomenon. Below the fit one can see the analysis (GR model) of the observed profile to its SACs.

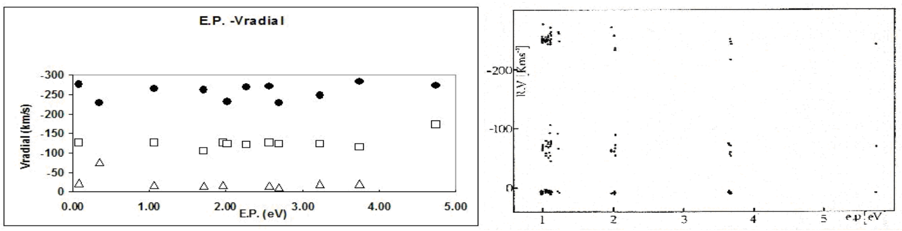


Figure 2: Radial velocities of the studied group of Fe II spectral line as a function of the excitation potential (E.P.) that result from this study (left), compared with the results deriving from the study of Danezis et al. (1991) (right).

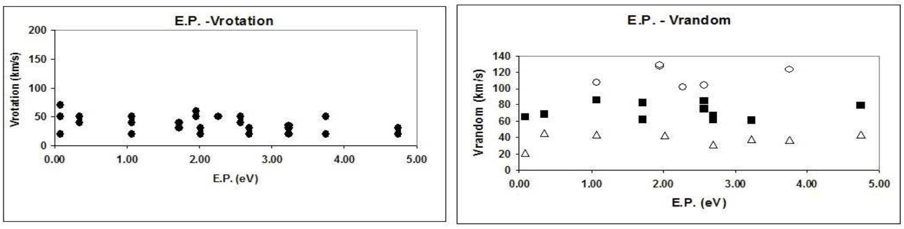


Figure 3: Rotational (left) and random (right) velocities of the studied group of Fe II spectral line as a function of the excitation potential (E.P.).

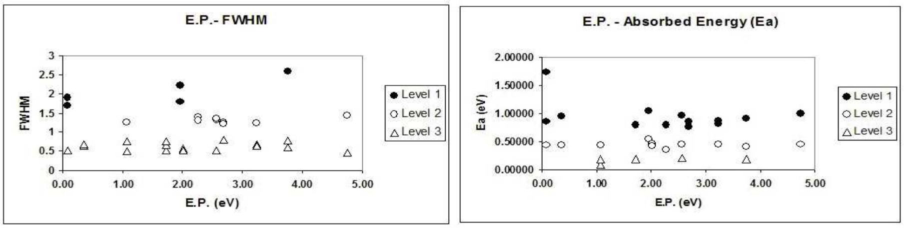


Figure 4: Full Width at Half Maximum (FWHM) and Absorbed Energy (Ea in eV) of the studied group of Fe II spectral line as a function of the excitation potential (E.P.).

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