The Most Likely Magnetic Period of AX CVn (HD 110066)

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Abstract. As a result of magnetic monitoring of the AX CVn AR star, SrCrEu type was found rotation period of 6.4769 days instead of the previously assumed "long" a period of 4900 days. Basic parameters of inclined rotator model defined describing the magnetic behavior of this star.

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1 Photometric Period

Adelman (1981) based on spectrophotometric measurements and literature data estimated the likely variable period of AX CVn 4900 days (13.4 years). At the same time, Adelman (1981) mentions that the possible amplitude of photometric variability is at the measurement accuracy level.

2 Magnetic Field AX CVn

For the first time, the magnetic field of the star was HD110066 measured in 1955-1957 by Babcock (1958) photographic by method. But these estimates have extremely low accuracy (about 300 G), which prevents the use of these estimates in this study. Modern high-precision measurements were carried out by Mathys (2017); Romanyuk et al. (2014, 2017) But these authors obtained only 6 measurements. According to these measurements longitudinal magnetic field B_l lies in the range from -80 to -220 G. We measured the magnetic field of this star on the 1st telescope of the SAO RAS using the Zeeman spectra obtained in the focus of kude and equipped with a circular polarization analyzer (Bychkov 2008).Polarization Instrumental effects were investigated in the works (Bychkov et al. 1998, 2000) Measurements were carried out in the interval 01.04.2018 -

08.04.2020 (a little over 2 years). Total received 21 magnetic field estimates that always have a negative sign and show variability within -40 to -330 G. To check correct operation measurements of magnetic standards were performed during observations, mainly $\alpha^2\ CVn$ and 53 Cam. Figure 1 shows the average magnetic phase curve for star $\alpha^2\ CVn$ obtained by high-precision estimates taken from the work of Silvester et al. (2012) which on the 1-m telescope. As can be seen from the figure, the obtained estimate coincides well with the average phase curve. Using the data we obtained and the measurements from the literature an attempt was made to find a probable period of variability. The methods used were the same, as in the work of Bychkov et al. (2016). The most probable period was found $P = 6.4769 \pm 0.0011$ day. If the found period is right, then this star has a small tilt angle rotation axes to a sight beam in the investigation of what we constantly see a "negative" pole magnetic field on a visible surface. Parameters of magnetic variability: $B_l = B_0 + B_1 * cos(\phi)$; $P = 6.4769 \pm 0.0011$; $T0 = 49826.738 \pm 0.104$; $B_0 = -194 \pm 8$; $B_1 = 102 \pm 11$

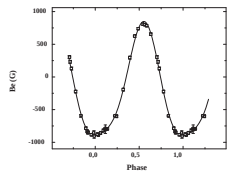

Fig. 1. Magnetic standard $\alpha^2\ CVn$.

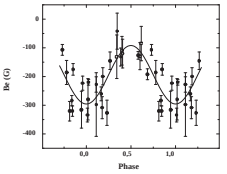

Fig. 2. Magnetic curve by B_l with short period.

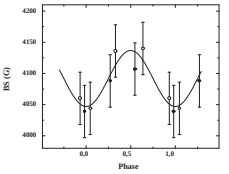

Fig. 3. Magnetic curve by BS with short period.

Using $V_e * sin(i) = 3.3 \pm 0.3\ km/s$ and star radius from Romanovskaya et al. (2020) $R/R_\odot = 2.68 \pm 0.01$ we get $V_e = 20.93 \pm 0.08\ km/s$. From this it follows that angle i is equal to 99.1 ± 0.9 degrees. Using the expression from the work of Preston (1971) developed for the inclined rotator model, we obtain an estimate of the inclination angle of the magnetic field axis to the rotation axis β . From this we get the angle $\beta = 72\overset{\circ}{.}5^{+2.4}_{-1.3}$. The surface magnetic field BS was measured by Mathys et al. (1997); Mathys (2017).The accuracy of the estimates obtained is about 50 G . All these estimates were obtained over a time interval of 5.9 years. The values of the estimates are close to each other (lie within from 4039 to 4140 G) and on average the surface magnetic field is based on these measurements $BS_{mean} = 4092 \pm 16$ G.

3 Conclusion

As a result of the study, an estimated "short" period was found duration $P = 6.4769 \pm 0.0011$ day. Axis of rotation is inclined to beam angle i not more than

106.7 degrees. Assuming that the magnetic field structure strictly dipole tilt of dipole axis to rotation axis near 73°. I.e. this star is oriented towards us with a negative pole, the axis of rotation is close to the ray of vision and therefore expect in this situation a great variability of the magnetic field or no glitter. Critical for verification of found period and proposed models are polarimetric measurements that will make it possible to clearly conclude about the rotation period of this star according to Leroy et al. (1994).

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