Multicolor Study of V1432 Aql in 2019

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Abstract. We present the results of VR photometric study of the eclipsing asynchronous polar V1432 Aquilae. The analysis made it possible to clarify the evolution of the white dwarf spin period in the V1432 Aql system. The groups of minima of self-eclipsed accretion columns were used to determine the spin period of the white dwarf as 0.140477(6). We also recorded a period of 0.140417(3), which differs from both the orbital and spin periods of the white dwarf, the nature of which is not clear. The color characteristics of the V1432 Aql minima have been determined.

Keywords: techniques: photometric; stars: cataclysmic variables: polars; stars: individual: V1432 Aql

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1 Introduction

V1432 Aql belongs to the unique subclass of variable stars – asynchronous polars. To date, there are totally 4 such objects known. The presence of eclipses in V1432 Aql allows a more precise photometric determination of the orbital period value, which is equal to 3.365 hours. Except for the common eclipses in V1432 Aql designated as "dips" (deep narrow drops in the light curve), the star undergoes self-eclipses of the accretion column with a lower depth and a higher width. Andronov et al. (2006) identified that accretion in the system occurs simultaneously at two poles, Rana et al. (2005) revealed in the X-rays three maxima during the white dwarf spin period.

2 Observations

Observations were carried out at the Crimean Astrophysical Observatory with the 38-cm telescope in V and R_c system. Thus, 5930 points were totally derived during 31 nights in 2019 from July 19 to November 7.

3 Results

3.1 Minima of V1432 Aql

The light curve shows minima associated with both an eclipse in the system and self-eclipses of accretion columns. We have determined 208 moments of minima with their errors.

All the minima we divided into several groups. These groups are supposed to be associated with the white dwarf eclipse or with a self-eclipse of the one of accretion columns.

3.2 White Dwarf Spin Period

To improve the variability associated with the white dwarf rotation in the system, we excluded time moments of eclipses from our observations and performed a periodogram analysis for non-eclipsed part. We used the multi-harmonic approximation within the MCV program (Andronov & Baklanov 2004).

The periodogram maxima correspond to 0.1405362(10) and 0.1405377(12) days in V and R_c, respectively.

We also determined the rotation periods of minima groups associated with self-eclipsing of accretion structures.

Of particular interest is the one group of minima. The period of this group is significantly different from others. Self-eclipses of this accretion structure occur with a shorter period.

This is likely due to the scrolling of accretion structure along the surface of the white dwarf (for example, along the magnetic equator), or the accretion structure is eclipsed at some distance from the surface of the white dwarf. This question can possibly be clarified if we obtain the observation during the full beat period of the orbital and spin periods of the white dwarf.

3.3 Color Characteristics of minima

We determined color characteristics for all groups of minima. One of group associated with a self-eclipse shown shorter period and lower color index $V - R$. It is possible caused by other physical process.

Bibliography

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