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Long-Term Monitoring of Polars

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Abstract. We present long-term observations of magnetic cataclysmic variables AM Her, AN UMa, AR UMa, DP Leo, and V1309 Ori obtained with the ROTSEIIId telescope. All data have been analysed and preliminary results indicate periods of 170 days, 217 days, and 180 days for AM Her, AN UMa, and AR UMa, respectively.

Keywords. cataclysmic variables, stars: individual (AM Her, AN UMa, AR UMa, DP Leo, V1309 Ori

1. Introduction

Magnetic cataclysmic variables are important in stellar evolution studies because of their strong magnetic field intensities and their unpredictable mysterious behaviour. Light variations of polars are characterized by long and short term variations. Unlike the systems with discs, any modulation in mass accretion rate is generally attributed to the donor star (Warner 1988, Richman, Applegate & Patterson 1994). The characteristic time-scale of small amplitude, short period light variations are different for each polar (e.g. AM Her 4.2-4.7 minutes (Bonnet-Bidaud *et al.* 1991, Kalomeni *et al.* 2005) and V1309 Ori 10 minutes (Katajainen *et al.* 2003)). In the literature especially during the last decade long period observations of polars have been intensively studied (Hessman *et al.* 2000, Wu & Kiss 2008, Kalomeni & Yakut 2008, Kafka & Hoard 2009, Sanad 2010). Studies of the long term variations are especially important to reveal any characteristics based on stellar activity and/or mass transfer.

AM Her

Tapia (1976) discovered AM Her as a system showing large and variable polarization. The non-predictable behaviour of the system is apparent after more than 5 years, with 3349 data obtained in this study by using ROTSEIIId at the TÜBİTAK National Observatory (see for details Kalomeni 2011). The long term light curve of the system shows both single and double maxima during the high state.

AN UMa

Hearn & Marshall (1979) by using SAS3 detected AM Her-like properties of AN UMa. The light variation of AN UMa obtained in this study shows almost a sinusoidal variation. However, the system needs more observations to see if this pattern continues.

AR UMa

Wenzel (1993) by studying AR UMa's light variations extending 32 years concluded it to be a cataclysmic variable. Remillard *et al.* (1994) identified AR UMa as a soft X-ray source in the Einstein survey. From ellipsoidal variations they identified the orbital period as 1.932 hr. By using the spectral lines of the secondary star the authors classified its spectral type as ∼M6 and estimated the distance ∼88 pc. AR UMa was observed by

Szkody *et al.* (1999) in the low state with ASCA and in the high state simultaneously with EUVE, RXTE, and ground based optical telescopes. In this study, Fourier analysis of the system yields a period of 180 days.

DP Leo

DP Leo was the first eclipsing polar to be discovered (Biermann *et al.* 1985). DP Leo is an interesting and important polar since it is a member of the post-common envelope binaries group with known/suspected planet companions (Beuermann *et al.* 2011). Recently, Beuermann *et al.* (2011) found the physical parameters of the third body using mid-eclipse times of the WD obtained during the last 21 years. Since the system is faint and requires a long exposure time, we could not deduce an accurate long term light variation (see Kalomeni 2011).

V1309 Ori

V1309 Ori was discovered as a soft X ray source with ROSAT (Beuermann & Thomas 1993) and classified as a magnetic CV by Garnavich *et al.* (1994). V1309 Ori, with ∼8 hours orbital period, is the longest period polar detected so far. Its light variation was obtained with ROTSEIIId and with RTT150 at TUG during two nights in 2006.

2. Conclusions

We present a preliminary study of the long term light variations of the first detected polar AM Her, the next discovered polar AN UMa, the highest magnetic field polar AR UMa, the first discovered eclipsing polar DP Leo, and the longest period polar V1309 Ori. Our analysis yields periods of 170 days, 217 days, and 180 days for AM Her, AN UMa, and AR UMa. Those variations are probably due to the active secondary star. A more detailed study will be presented in Kalomeni (2011).

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