

UU Aqr: Overview of Recent Observational Work at Bosscha Observatory

Janette Suherli,¹ and Hakim L. Malasan^{1,2}

¹*Bosscha Observatory, Lembang Indonesia*

²*Astronomy Study Program, Bandung Institute of Technology*

Abstract. UU Aqr is a nova-like cataclysmic variable whose variability was found spectroscopically by Volkov et al. (1985). Since its discovery, UU Aqr shows various activities yet cannot be explained. In this paper we present an overview of the system's uniqueness and recent results of its photometric observations carried out at Bosscha Observatory (Lembang, Indonesia).

1. Introduction

Nova-like variables are a very heterogeneous class which are recognized to have eruptions that show similarity to those of novae. Even though the eruptions in those systems resemble those in novae, they are structurally unrelated to true novae. There are a lot of systems that fall into this variable type, but yet none of them are well-explained.

UU Aqr was first catalogued as a semiregular variable with period of 66.2 days by Kholopov et al. (1985). Then, Stephenson (1986) in his survey study categorized UU Aqr as a new Ha emission star. Volkov, Shugarov, & Seregina (1986) had observed the system and established that UU Aqr instead is a 13.5^h magnitude eclipsing cataclysmic variable with ephemeris:

$$HJD_{Min.I} = 2446347.2667 + 0.1635806^d \times E \quad (1)$$

Dawnes & Keyes (1987) obtained the low-resolution spectra of UU Aqr and confirmed that it is a cataclysmic variable with H, weak HeI and HeII emissions. Haefner (1989) found that the line shape from its spectra is variable and indicates several sources of emission within the system. The spectroscopic measurements showed semiamplitude of 160 km s⁻¹ for the primary which implies a low-mass white dwarf (0.4-0.5 $M_{\odot}$) for orbital inclination of 70° – 90°.

Diaz & Steiner (1991) suggested UU Aqr to be classified as a novelike system. They also implied that the mass of the primary is 0.9 $M_{\odot}$ with mass ratio is about 0.4, which later improved to be $q=0.3$ (Patterson et al. 2005). Later, Baptista et al. (1994) revised the ephemeris:

$$HJD_{Min.I} = 2446347.26657 + 0.163580429^d \times E \quad (2)$$

Their data also showed that UU Aqr presents long-term brightness variations of 0.3 magnitude on timescales of 4 years. Also, it is a high mass transfer novelike system with a relatively bright and optically thick accretion disk. Later investigations showed that UU Aqr system stunted outbursts which last for several days (Honeycutt et al. 1998) as well as 0.3 mag brightness modulations of every few years (Baptista & Bortoletto, 2008). The system has a bright disk that accreting matter onto the 0.67 $M_{\odot}$ white dwarf (Baptista et al. 1996).

2. Observation and Data Reduction

The CCD photometric observations were carried out at Bosscha Observatory, Lembang, Indonesia which is located at 107°37.0' East and 6°49.5' South at an altitude of 1300 meters above sea

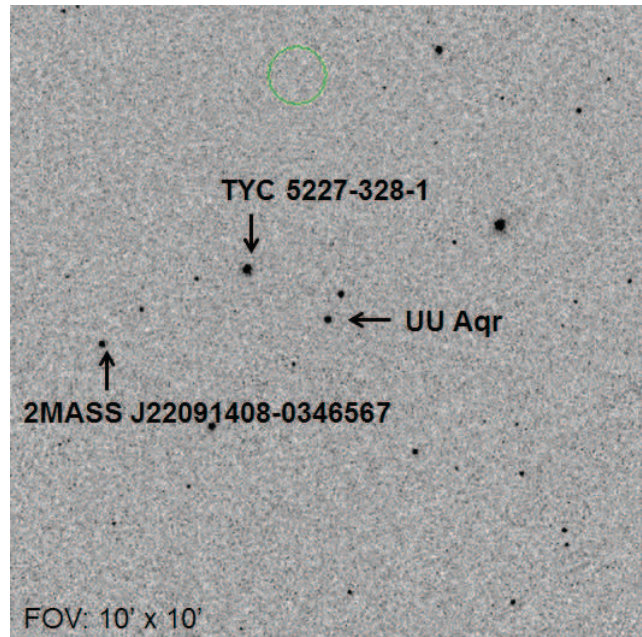


Figure 1. Image of UU Aqr, comparison star, and check star in V filter which obtained at the observatory, with 60 seconds exposure time.

level. The data was collected in five nights through July to October 2012 with typical exposure time for each frame is 40 to 120 seconds. We used the SBIG ST-9 CCD Camera attached to the 8-inch f/10 Schmidt-Cassegrain telescope at GAO-ITB RTS (Gunma Astronomical Observatory Institut Teknologi Bandung Remote Telescope System) building. TYC 5227-328-1 and 2MASS J22091408-0346567 was selected as the comparison star and check star respectively, as they are described in AAVSO database. The comparison star that Goldader & Garnavich (1989) used in their paper turns out is a double system (SAO 145900) which may hinder the brightness.

All of the observed images are dark subtracted and flat-fielded in a usual manner. We used IRAF to do all the standard data reduction and obtained the instrumental magnitude from the photometric data. We applied the aperture photometry method using IRAFs apphot package. Later on, we used the ephemeris provided by Baptista et al. (1994) to compute the phase and build the light curve.

3. Results and Discussion

Using the ephemeris derived by Baptista et al. (1994), we build the light curve from the photometric data. A good coverage of light curve has been attained in three out of five nights.

The observed primary minimum exhibits shift in phase. The flickering phenomenon apparently co-exists in the observed light curve, especially outside the minimum light. From the last observations, we can see the asymmetry in the primary minimum.

4. Remarks

From 5-nights observations at Bosscha Observatory, we found that the light curve of UU Aqr shows complexity (flickering outside eclipse) and sign of period variation. UU Aqr is indeed a

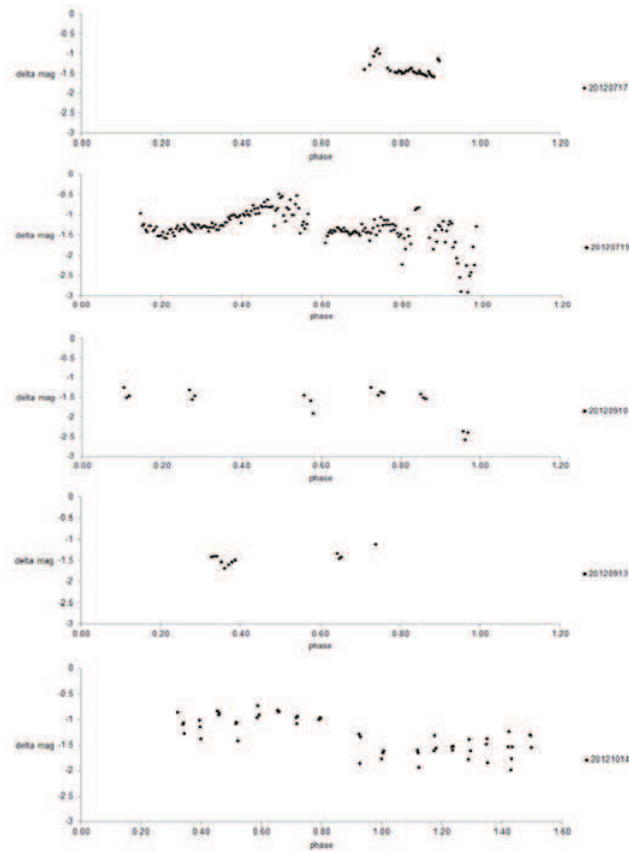


Figure 2. Light curve of UU Aqr in V filter from 5 nights of observation.

very intriguing object to observe with a fast-changing nature. New photometric data with more precision are needed, especially those which cover the primary eclipse timings.

Acknowledgments. HLM would like to deeply thank the Hitachi Scholarship Foundation for the support that has enabled him to attend the 10th PRCSA. This research made use the simbad database, operated at Centre de Données Astronomiques de Strasbourg (CDS), Strasbourg, France.

References

- Baptista, R. et al. 1994, ASPC, 105, 127.
 Baptista, R., J. E. Steiner, and K. Horne. 1996, MNRAS, 282, 99.
 Baptista, R. and A. Bortoletto. 2008, ApJ, 676, 1240.
 Diaz, M. P. and J. E. Steiner. 1991, AJ, 102, 1417.
 Haefner, R. 1989, Inf. Bull. Var. Stars, 3361.
 Honeycutt, R. K., J. W. Robertson, and G. W. Turner. 1998, AJ, 115, 2527.
 Kholopov, P.N. (ed). 1985, "The General Catalogue of Variable Stars" 4th edition, vol.1, Moscow, NAUKA.
 Patterson, J et al. 2005, PASP, 117, 1204.
 Volkov, I. V., S. Yu Shugarov, and T. M. Seregina. 1986, Astronomicheskij Tsirkulyar, 1418, 3.