UBVRI Photometry of AE Aquarii in July-August 1994

Nina Beskrovnaya[1], *Nazar Ikhsanov*[1], *Albert Bruch*[2]
Nikolaj Shakhovskoy[3]

[1] Pulkovo Observatory, 196140 St. Petersburg, Russia
[2] Astronomisches Institut, Wilhelm–Klemm–Straße 10, D-48159, Münster, FRG
[3] Crimean Astrophysical Observatory, 334413 Nauchnyi, Crimea, Ukraine

The most striking feature of the close binary system AE Aqr is its unique photometric behaviour – irregular alternations of quiet and active phases without noticeable transition periods. Although extensive photometric observations of AE Aqr have been carried out for more than forty years (see Bruch 1991 and references therein), the mechanism of its flaring activity is still poorly understood and the star – although generally classified as a cataclysmic variable – does not fit well into any of the subclasses.

According to us, much insight into this peculiar object can be gained by an investigation of the connections between the flaring activity of AE Aqr and the strictly periodic oscillations at 33^s, identified as the spin period of the primary. The latter have been seen in optical (Patterson 1979) and UV light (Eracleous et al. 1994), in X-rays (Patterson et al. 1980) and in TeV γ rays (Meintjes et al. 1992). There are contradictory reports about the relation between their amplitude and the flaring activity in AE Aqr : Patterson (1979) noted that the amplitude of the pulsations increases during active phases, while Eracleous et al. (1994) observed that their characteristics are not strongly affected by the flares.

During July–August 1993 the oscillations in AE Aqr vanished below a detectable limit (Bruch et al. 1994), but neither brightness and colour of the system nor its flaring activity showed any dramatic peculiarities. In this contribution we present a preliminary report on results of five-channel time resolved photometry of AE Aqr in 1994, performed to study further the optical oscillations and the flaring behaviour of the system.

AE Aqr was observed during four nights in July–August 1994 with the photometer-polarimeter of Helsinki University (Piirola 1987) at the 1.25 m telescope of the Crimean Astrophysical Observatory. In the photometry mode the instrument provides simultaneous observations of the star and the sky background in five broad passbands close to the standard *UBVRI* system. A new version of the photometer control and signal recording system based on CAMAC modules and a PC AT-286 was used (Kalmin & D. Shakhovskoy 1995).

An integration time of 5^s was chosen. The variable star was monitored continuously for $\sim 30^m$ (with the use of offset guiding) through a $10''$ diaphragm. Between these series of integrations a comparison star (situated $10'$ to the west form AE Aqr) was observed. The measurements were tied into the *UBVRI* sys-

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tem by observations of the nearby photometric standard HD 196395 (Barnes & Moffet 1979).

Power spectra of all light curves were calculated. Only in one night (July 10) could the 33^s oscillations confidently be detected in the U, B and V bands. On July 9 some quasi-periodic oscillations close to the frequency of the 33^s signal are possibly seen in the B band. However, this detection is marginal. The first harmonic of the 33^s oscillations, often appearing strongly in power spectra of AE Aqr, remains undetectable in our data. In order to assess the reliability of our non-detections we added tracer signals of various amplitudes to the data: an oscillation with an amplitude of a few millimagnitudes would have been easily detected (except in the U band). Possible reasons for the cessation of the 33^s oscillations in AE Aqr were discussed by Beskrovnaya et al. (1995).

While the coherent signal was thus largely absent during our observations the irregular activity was quite normal. AE Aqr showed a strong flaring behaviour interspersed with shorter periods of relative calmness. The time scale of the large outbursts and the rise time of rapid flares is of the order of 1 hour. This is much longer than the characteristic time scale ($\sim 100^s$) for the rise of flares in the model of magnetospheric gating (Van Paradijs et al. 1989). However, the observed time scales are comparable with the free-fall time of the matter flowing from the secondary star to the compact primay. It may thus be suggested, that the origin of the large flares is connected with variations of the secondary mass loss rather than with variations of the accretion rate in the vicinity of the primary. This idea is supported by the fact, that the amplitude of the 33^s oscillations is not affected by the large flares (Eracleous et al. 1994). A corresponding physical model is currently being worked out by one of us (N. Ikhsanov).

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