COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS
Number 4767

Konkoly Observatory
Budapest
7 September 1999
HU ISSN 0374 – 0676

CCD PHOTOMETRY OF THE 1998 DECEMBER OUTBURST OF AQ Eri

T. KATO, K. MATSUMOTO

Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan,
e-mail: tkato@kusastro.kyoto-u.ac.jp, katsura@kusastro.kyoto-u.ac.jp

AQ Eri is an SU UMa-type dwarf nova (Kato 1991), whose superhump period was reported to be $0^{\mathrm{d}}\!.06225$. Thorstensen et al. (1996) yield a spectroscopic orbital period of $0^{\mathrm{d}}\!.06093$, which places AQ Eri among short orbital period systems. The relatively short orbital period and the relative low frequency of outbursts make AQ Eri a candidate for an intermediate system between usual SU UMa-type dwarf novae and WZ Sge-type stars (cf. Nogami et al. 1996 for the discussion of CT Hya).

The outburst was detected by Hers (1998) on 1998 December 18.332 at $m_{\mathrm{v}} = 13.5$. The lack of detected superoutburst since 1995 and the brightness of the outburst prompted our time-series CCD observations.

The observations were done using an unfiltered ST-7 camera attached to the Meade 25-cm Schmidt-Cassegrain telescope. The exposure time was 30 s. The images were dark-subtracted, flat-fielded, and analyzed using the Java$^{\mathrm{TM}}$-based PSF photometry package developed by one of the authors (TK). The magnitudes of the variable was measured relative to GSC 4758.784 (Tycho $V = 10.79$, $B - V = +0.62$), whose constancy was confirmed by comparison with GSC 4758.334 ($V = 10.93$, $B - V = +1.24$). Table 1 summarizes the observations.

Figure 1 illustrates the overall light curve of the present observation. Nightly averaged relative magnitudes and estimates of errors are plotted for the last two nights. The light curve shows a steep decline characteristic of a normal outburst. The data of the first two nights, when the variable was in outburst, were analyzed, after subtracting the linear declining trend, using the Phase Dispersion Minimization (PDM) method (Stellingwerf 1978). The result gave no very convincing periodicity, but seemed to have a weak signal around the reported orbital period, and not around the superhump period.

In order to more closely examine the potential orbital modulation, the data of the first two nights were phase-averaged using the reported period of 0.06093 d. The result is shown in Figure 2, which shows the existence of a double-wave modulation in one orbital cycle. The amplitude of the modulation was $\sim$0.10 mag. The data on December 21 (the third night) were analyzed in the same way, giving the upper limit of the orbital modulation of $\sim$0.05 mag, indicating that the modulation during outburst decayed as the system faded. It is noteworthy that similar doubly humped (orbital) modulations during early outburst have been observed in the early stage of WZ Sge-type outbursts, and are considered as one of defining characteristics of WZ Sge-type phenomenon (e.g. Matsumoto

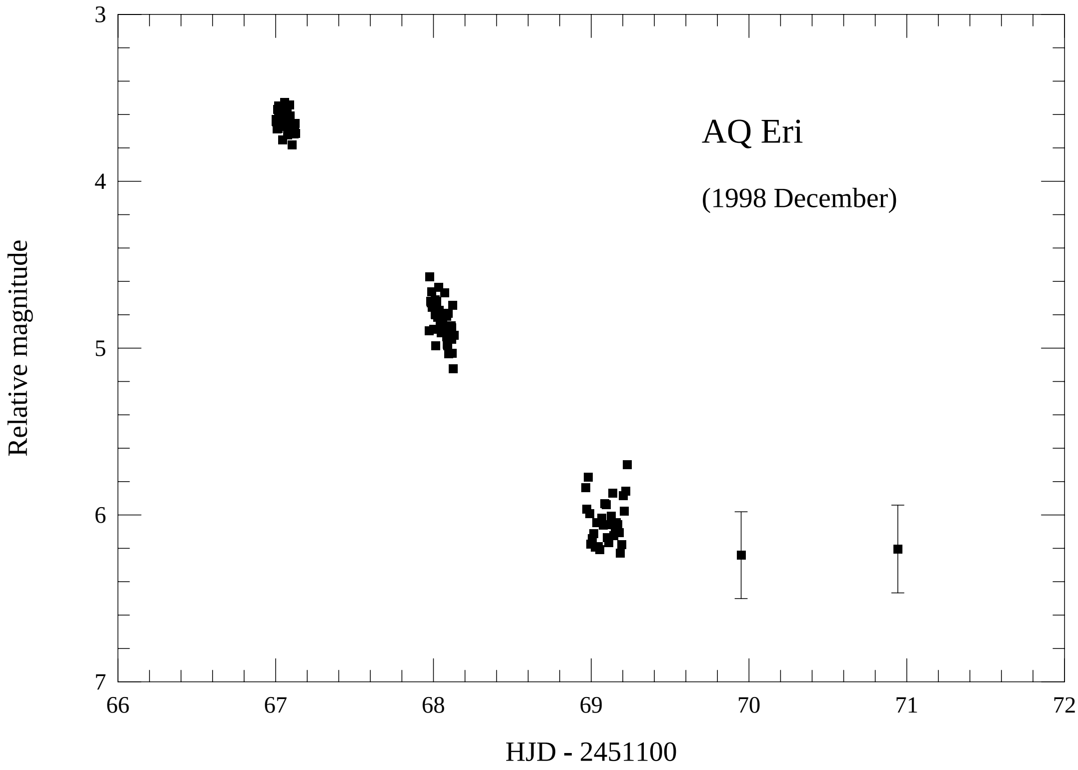

Figure 1. Overall light curve of AQ Eri

Table 1: Summary of observations

JD start[a]	JD end[a]	N[b]
51167.001	51167.130	247
51167.970	51168.121	244
51168.960	51169.238	635
51169.923	51169.969	95
51170.942	51170.944	5

[a] JD − 2400000
[b] Number of frames

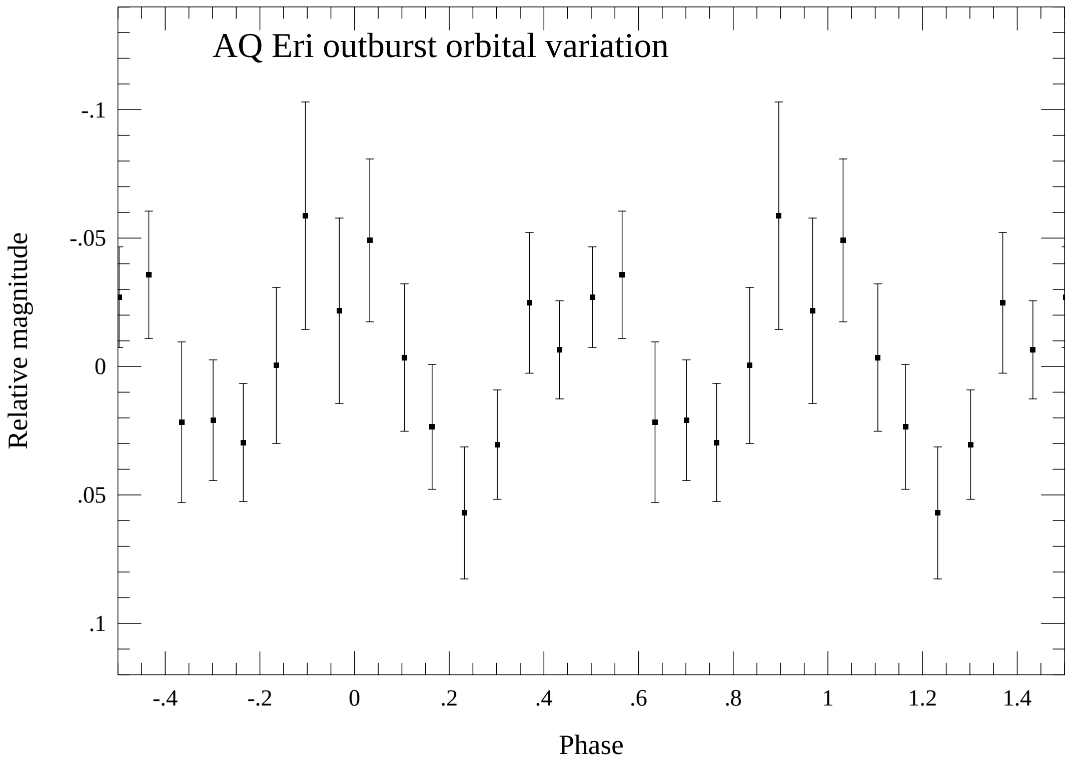

Figure 2. Hump profile of AQ Eri

et al. 1998). The present outburst of AQ Eri may have been followed the similar course of WZ Sge-type outburst, but failed to trigger a superoutburst. More extensive studies of outbursts, of similar systems with infrequent outbursts, are thus encouraged.

This work is partly supported by the Grant-in-Aid for Scientific Research (10740095) of the Japanese Ministry of Education, Science, Culture, and Sports (TK). Part of this work is supported by a Research Fellowship of the Japan Society for the Promotion of Science for Young Scientists (KM).

References:

Hers, J., 1998, *VSNET alert circulation*, No. 2458 (also available from http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet-alert/msg02458.html).
Kato, T., 1991, *IBVS*, No. 3671
Matsumoto, K., Nogami, D., Kato, T., Baba, H., 1998, *PASJ*, **50**, 405
Nogami, D., Kato, T., Hirata, R., 1996, *PASJ*, **48**, 607
Stellingwerf, R. F., 1978, *ApJ*, **224**, 953
Thorstensen, J. R., Patterson, J., Shambrook, A., Thomas, G., 1996, *PASP*, **108**, 73