# TWO NEW ALGOL-TYPE ECLIPSING BINARIES

WILLIAMS, DAVID B.

P. O. Box 58, Whitestown, IN 46075 USA, e-mail: dbwilyumz@aol.com

This report presents some results of a search for new variable stars conducted with the 25-cm photographic refractor ($f/6.3$ Cooke triplet) and blink comparator at Indiana University's Goethe Link Observatory, made available through a cooperative arrangement with the Indiana Astronomical Society. The blue-corrected astrograph recorded a field of $6.4 \times 8.0$ degrees on $20 \times 25$-cm Kodak SB-5 X-ray film (blue sensitive) and reached a limiting magnitude of 15.0 $B$ in a 30-minute exposure.

The two eclipsing variables listed below are not officially designated in the General Catalogue of Variable Stars or subsequent Name Lists. Following the detection of variability at Link, each star was investigated at the Harvard College Observatory plate collection to confirm variability and determine the type and period. Magnitudes of comparison star sequences were determined by eye estimates using photoelectric $B$ magnitudes of stars in nearby fields of the Guide Star Photometric Catalogue (Lasker et al. 1988).

**GSC 5409-1201 (Pup).** ($07^{\rm h}30^{\rm m}01^{\rm s}\!.7 \; -14°28'22''\!.8$ (B1950); type EA, $12.8-<15.0$ $m_{\rm ptg}$.) Discovery of variability was first mentioned briefly in Williams (1996). Observed on 543 Harvard plates. Depth of minimum remains uncertain, variable fainter than plate limit. Duration of primary minimum is about 0.09 $P$. Magnitude estimates were recorded for each of the first 119 plates. To save time, only observations fainter than maximum were recorded from the remaining 424 plates. These observations are listed electronically as 5084-t3.txt, available through the IBVS Web site. The following light elements were determined by least squares analysis of the 19 observations of the variable at least 1 magnitude below maximum, 13.8 $m_{\rm ptg}$ or fainter (Table 1):

$$\text{Min. I} = \text{HJD } 2432891.408 + 10^{\rm d}\!.984156 \times E.$$
$$\pm 0.061 \quad \pm 0.000075$$

The $O - C$ residuals in Table 1 and the light curve (Figure 1) are based on these elements. The period is just 20 minutes longer than 11 sidereal days.

Table 1: Plate minima, GSC 5409-1201

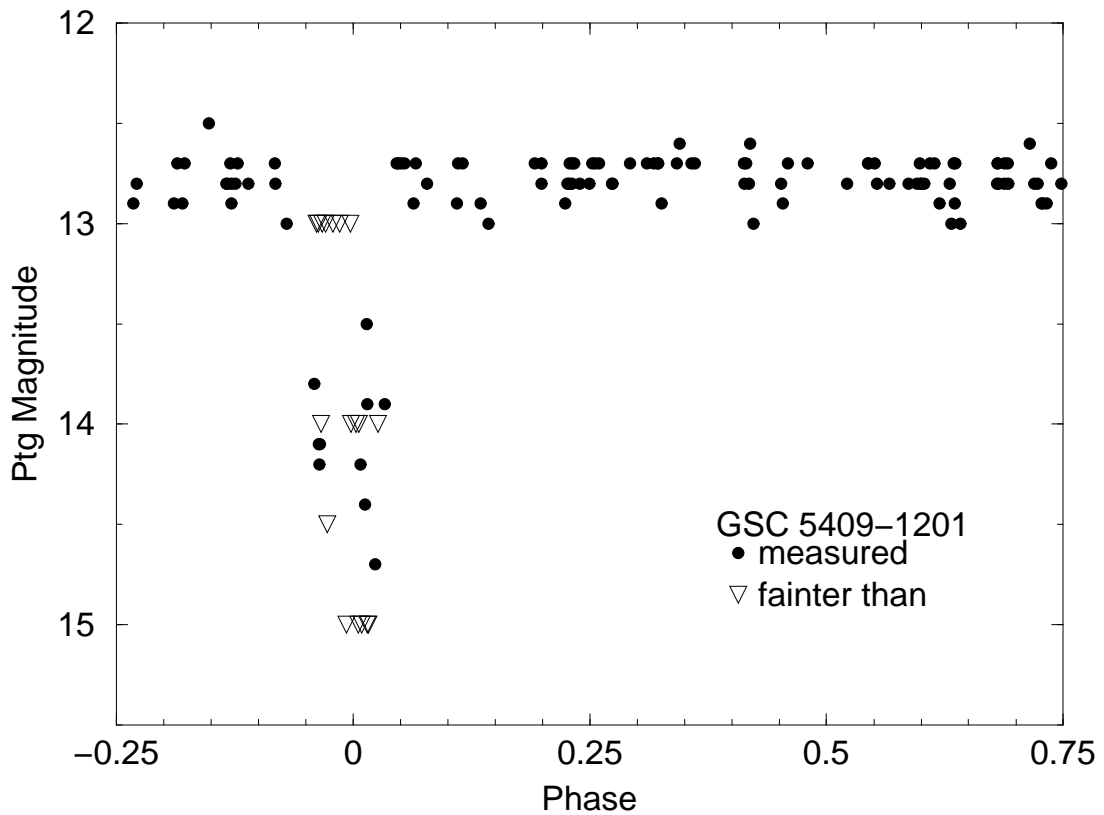| HJD 2400000 + | Mag (ptg) | Epoch | $O - C$ (days) |
|---|---|---|---|
| 25619.516 | 14.1 | −662 | −0.381 |
| 25982.473 | <15.0 | −629 | +0.099 |
| 26762.318 | <14.0 | −558 | +0.069 |
| 28596.530 | <15.0 | −391 | −0.073 |
| 28596.577 | <14.0 | −391 | −0.026 |
| 28837.861 | 14.1 | −369 | −0.394 |
| 28848.849 | 14.2 | −368 | −0.390 |
| 28937.401 | <14.0 | −360 | +0.289 |
| 29585.435 | 14.7 | −301 | +0.258 |
| 29717.359 | 13.9 | −289 | +0.372 |
| 32891.575 | <15.0 | 0 | +0.167 |
| 32891.587 | <15.0 | 0 | +0.179 |
| 42447.658 | <14.0 | 870 | +0.035 |
| 45753.942 | 14.2 | 1171 | +0.088 |
| 46115.961 | <14.0 | 1204 | −0.370 |
| 46116.032 | <14.5 | 1204 | −0.299 |
| 46446.025 | 13.9 | 1234 | +0.169 |
| 47258.823 | 14.4 | 1308 | +0.139 |
| 49389.671 | <15.0 | 1502 | +0.061 |



**Figure 1.** Photographic phased light curve, GSC 5409-1201

Table 2: Plate minima, GSC 3002-0454

| HJD 2400000 + | Mag (ptg) | Epoch | $O - C$ (days) |
|---|---|---|---|
| 25290.813 | <14.2 | −4732 | +0.119 |
| 27092.797 | 14.2 | −3761 | +0.015 |
| 27374.884 | <14.8 | −3609 | +0.003 |
| 27532.588 | 14.7 | −3524 | −0.045 |
| 28961.655 | 14.6 | −2754 | −0.029 |
| 29429.655 | 14.4 | −1963 | −0.054 |
| 31084.864 | <14.5 | −1610 | +0.019 |
| 34072.774 | 14.5 | 0 | −0.086 |
| 42485.727 | 14.4 | 4533 | +0.027 |
| 44996.764 | <14.5 | 5886 | +0.018 |
| 45289.892 | 14.2 | 6044 | −0.088 |
| 45757.717 | 14.2 | 6296 | +0.048 |
| 46438.810 | <14.2 | 6663 | +0.022 |
| 46492.646 | <14.5 | 6692 | +0.036 |
| 46878.712 | 14.1 | 6900 | +0.073 |
| 47264.629 | <14.5 | 7108 | −0.039 |
| 49801.651 | <15.0 | 8475 | −0.046 |
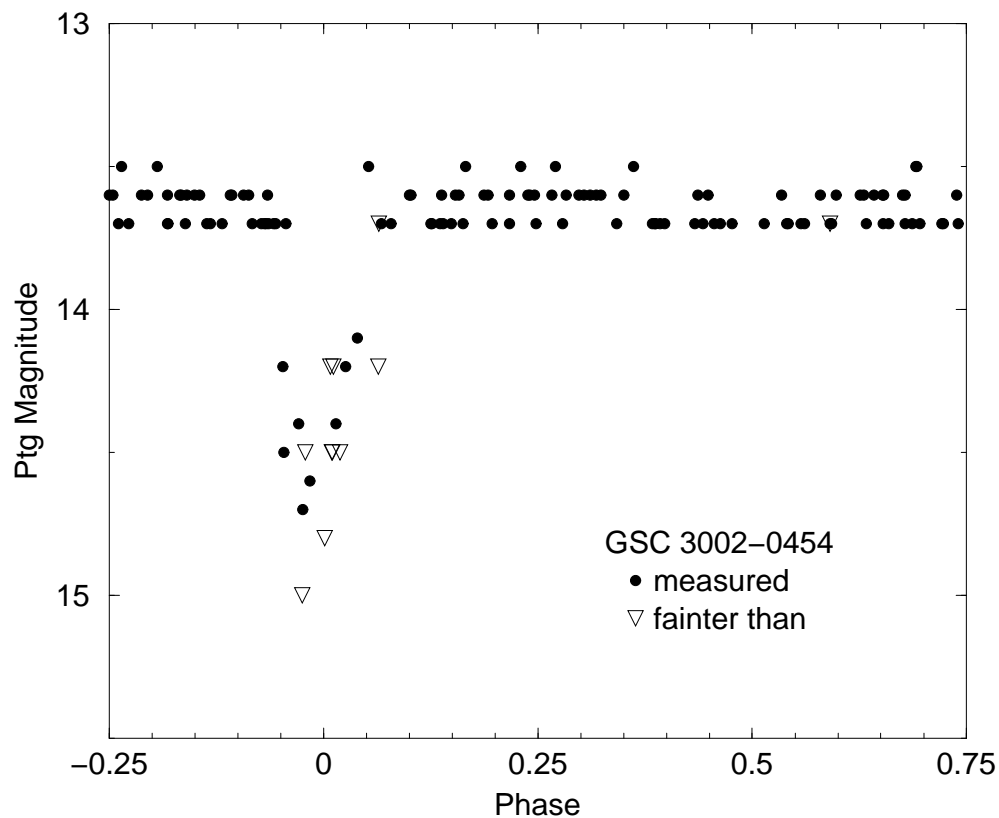


**Figure 2.** Photographic phased light curve, GSC 3002-0454

**GSC 3002-0454 (UMa).** ($10^\mathrm{h}26^\mathrm{m}56\overset{\mathrm{s}}{.}4$, $+40°11'51''\!.0$ (B1950); type EA, 13.6–<15.0 $m_\mathrm{ptg}$.) Observed on 142 Harvard plates (magnitude estimates available electronically as 5084-t4.txt through the IBVS Web site). Faint or invisible on 17 plates, but these observations do not define the times of mid-eclipse very well because the minima are much deeper than the faint limit on the patrol plates. As a result, attempts to find the period were frustrated by sidereal day aliases. Visual monitoring by M. E. Baldwin and P. R. Guilbault revealed that the period is close to $1\overset{\mathrm{d}}{.}856$. The following light elements were determined by least squares analysis of the 17 times when GSC 3002-0454 was fainter than maximum (Table 2):

$$\text{Min. I} = \text{HJD } 2434072.860 + 1\overset{\mathrm{d}}{.}8559010 \times E.$$
$$\pm 0.015 \pm 0.0000003$$

The $O - C$ residuals in Table 2 and the light curve (Figure 2) are based on these elements. New visual and CCD times of minima, $BVRI$ photometry, and light curve parameters will appear in Baldwin et al. (2001).

I wish to thank the Indiana University Astronomy Department for use of the Link Observatory facilities. I am also grateful to Martha Hazen for extensive use of the Harvard plates, to M. E. Baldwin and P. R. Guilbault for finding the period of GSC 3002-0454, and to Guilbault and G. W. Billings for preparing this report for publication.

References:

Baldwin, M. E., Guilbault, P. R., Henden, A. A., Kaiser, D. H., Lubcke, G. C., Samolyk, G., and Williams, D. B., 2001, *Journ. Amer. Assoc. Var. Star Obs.*, Vol. 29, No. 2, in press

Lasker, B., Sturch, C., Conrad, R., et al., 1988, *Astrophys. Journ. Suppl.*, **68**, 1 (Guide Star Photometric Catalogue)

Williams, D. B., 1996, *Journ. Amer. Assoc. Var. Star Obs.*, **25**, 30