Variability in an AX And Comparison Star, GSC 3295-1514

Mark J. Munkacsy
184 Sherwood Terrace, Portsmouth, RI 02871

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Abstract While establishing an ensemble of comparison stars to support CCD photometry of AX And, large statistical scatter was found in the photometry of one comparison star, GSC 3295-1514. Subsequent monitoring of this star shows distinct variability, with a range of about 0.7 magnitude and a period of about 82 days.

1. Background

Initial attempts to perform CCD *V*-band photometry on AX And (0226+46) using the preliminary AAVSO f-scale chart were frustrated by a poor match between comparison star magnitudes from the chart and measured photometry. I generally perform differential photometry using an ensemble of three to eight comparison stars, selecting a zero point that minimizes the differences between the charted and measured magnitudes of the stars in the comparison ensemble. However, experience has shown that photometry repeatability suffers when the ensemble is a poor fit to measurement. For AX And, an initial ensemble of comparison stars from the AAVSO chart was selected; the RMS error of the ensemble's fit was 0.4 magnitude.

2. Selection of the comparison star ensemble

Not being comfortable with a zero point based upon this ensemble because of its poor fit, two alternatives were considered: use of a single comparison star, and creation of a new ensemble sequence specifically chosen to match one of the chart's comparison stars. Because of the opportunity to reduce measurement noise by using a multiple-star ensemble, the latter approach was chosen.

A 7-star ensemble was chosen using the stars listed in the first column of Table 1. These stars are identified by their catalog numbers from the Space Telescope Science Institute's *Guide Star Catalog* (GSC; 1992) or from the US Naval Observatory's *A2.0* catalog (Monet, *et al.* 1998). All were selected from the sequence on the AAVSO (f) chart. The magnitude 12.7 comparison star was selected as the reference for the ensemble, since its photometry had generally been consistent with the average of all the other comparison stars. Charted magnitudes for all other stars in the ensemble were then ignored, and a new magnitude for each ensemble star was calculated using a linear least squares fit based upon all photometry obtained to date on this field (a total of 60 images on 6 dates between JD 2452612 and JD 2452679). In addition to the best-fit ensemble magnitude in column 3 of Table 1, the standard deviation of the fit (across all 60 images) was calculated and is provided in column 4 of that table.

Table 1. Selected ensemble stars.

Star	Chart Magnitude	Ensemble Magnitude	Standard Deviation of Ensemble Fit
GSC3295-1745	14.0	13.313	0.033
GSC3295-1559	12.9	13.121	0.055
GSC3295-1408	12.7	12.700	0.045
GSC3295-1514	13.0	12.985	0.226
GSC3295-1691	9.1	9.403	0.054
USNO1350-02439716	13.3	13.342	0.033
GSC3295-1296	13.7	13.393	0.041

GSC 3295-1514 stands out because of its poor fit, hinting at an inconsistent magnitude across these images. Figure 1 shows the central portion of the AAVSO AX And (f) chart, showing both AX And and GSC 3295-1514 (the 13.0 comparison star). Experience defining other ensembles has shown typical ensemble fit values of 0.02 magnitude, an order of magnitude better than was seen for this particular star.

GSC 3295-1514 was then deleted from the ensemble, and the resulting 6-star ensemble was re-calculated with an excelled overall fit. This 6-star ensemble was used to set the differential photometry zero point for all subsequent photometry of the field.

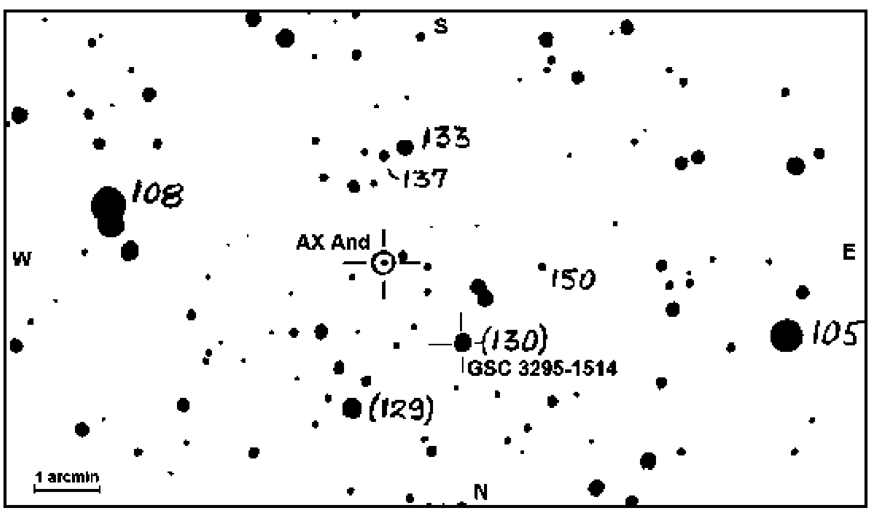

Figure 1. AAVSO (f) Chart for AX And showing GSC 3295-1514.

3. Analysis of GSC 3295-1514

The images already obtained were reanalyzed to calculate photometry for GSC 3295-1514, with additional images being obtained roughly weekly over the past year. The resulting light curve is shown in Figure 2. Analysis was performed with the computer program TS, developed by the American Association of Variable Star Observers. Fourier analysis suggests an overall period of 81.9 days, and the fluctuation range is approximately 0.7 magnitude. Although not conclusive, the general shape of the light curve suggests SRb.

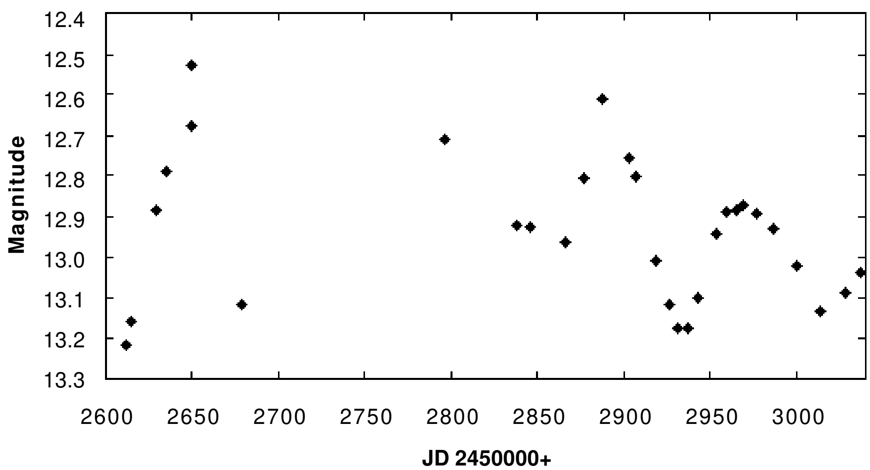

Figure 2. GSC 3295-1514 light curve.

4. References

Monet, D., Bird, A., Canzian, B., Dahn, C., Guetter, H., Harris, H., Henden, A., Levine, S., Luginbuhl, C., Monet, A. K. B., Rhodes, A., Riepe, B., Sell, S., Stone, R., Vrba, F., and Walker, R. 1998, *USNO-A V2.0 Catalog of Astrometric Standards*, U. S. Naval Obsrevatory, Flagstaff, AZ.

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