2003: The Journal of Astronomical Data 9, 2.

UBV Photometry of 56 Ari: 1990–1994

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Received 23 November 2002 ; accepted 4 July 2003

Abstract

We report on five seasons of UBV photometry of 56 Ari obtained with the 0.4-m telescope of the Braeside Observatory starting in the fall of 1990. These observations were part of the data used by Adelman et al. (2001) to find the very slow decrease in the main period of this magnetic CP star and the secondary period of approximately 5 years. Comparison of the light curves obtained in different seasons even with the same telescope tend to show slight discrepancies.

1 Introduction

Adelman et al. (2001) used extensive multiyear sets of UBV and $uvby$ photometric and high dispersion spectroscopic data to investigate the optical region light and equivalent width variations of the magnetic CP star 56 Ari (HD 19832, HR 954, HD spectral type A0p). Its main period of photometric variability, which is interpreted as the rotational period, of approximately 0.7279 days increases about 2 seconds per century. Further they attribute a second period of length about 5 years to the precession of the rotational axis about the magnetic field axis. The photometric analysis utilized the photometric phases, but not the small changes in the amplitudes seen in the various photometric filters.

2 The UBV Photometry

This paper provides the UBV photometry of 56 Ari from five observing seasons beginning with the fall of 1990. The first two years were discussed by Adelman & Fried (1993) who showed how they differ from the previous UBV observations of Hardie & Schroeder (1963) and Blanco & Catalano (1970). Other published photometric data of 56 Ari on or close to the UBV system are by Provin (1953), Rakosch (1963), Hildebrandt et al. (1985), and Ziznovsky et al. (2000), who provided three years of more recent UBV photometry which began three years after the observations reported in this note ended.

As Adelman & Fried (1993) did not list their UBV photometry, these values are given in Tables 1 (JD 2448167–2448234) and 2 (JD 2448561–2448646). An additional three seasons of photometry was later obtained in the same manner. Our comparison star HD 19600 (HR 945, spectral type A0 V) and our check star HD 19548 (HR 944, spectral type B8 III) have been used for most of the published differential measurements of 56 Ari. Tables 3, 4, and 5, respectively, contain the data for the observing periods JD 2448917–2448979, 2449298–2449329, and 2449655–2449696 with 294 sets of UBV values, 317 U and 417 B and V values, and 236 sets of UBV values, respectively. Tables 1–5 are available as ASCII files `table1, table2, table3, table4, table5`.

The Braeside Observatory 0.4-m Cassegrain f/16 telescope made these measurements. At the time of these observations, a Hamamatsu R 1463-01 multialkali, extended-red photomultiplier in a cooled housing was used as a detector. Red blocking filters were employed to permit tranformation to the Johnson System. The pulse amplifier was of the design by Taylor (1972). The dead time was 75 ns. The photometer and the telescope were computer controlled from a separated control building 30 m away. Seasonal extinction coefficients were used in the reductions and transformation coefficients were found from observations of many Johnson and Landolt standard stars (Huang et al. 1994, Percy et al. 1994). Additional details are contained in Fried (1990, 1991, 1992).

Figures 1, 2 and 3, respectively, show the U, B, and V light curves with data from year 3 shown as open squares, from year 4 as crosses, and from year 5 as closed diamonds. The standard deviations of good comparison-check star values for U, B, and V are 0.012 mag., 0.008 mag., and 0.007 mag., respectively, which are reflected in the scatter seen in the v-c data for all three colors. The ephemeris used is the same as that by Adelman & Fried (1993)

$$\mathrm{HJD(lightminumum)} = 2439797.586 + 0.727902E$$

The year 3 data lack values for phases approximately 0.2 to 0.5. For U, the mean values of the data from years 3 and 4 mostly agree. The year 5 data is brighter on the whole by about 0.01 mag. If we make it fainter by this amount, the agreement is much better, but there are still differences especially near secondary maximum and minimum. For B the overall agreement is good with the major discrepancy being that for year 3 the stars is brighter near phases 0.0 to 0.1. For V the overall agreement is generally acceptable. These are the same type of discrepancies noted by Adelman & Fried (1992).

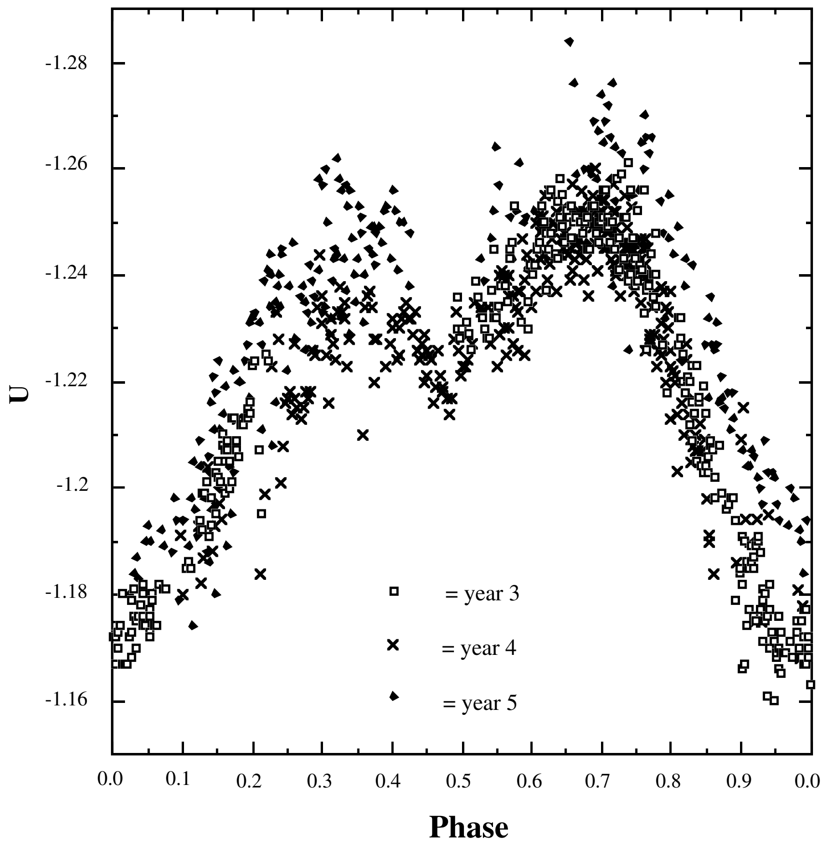

Figure 1: The U light curves for years 3, 4, and 5. Data from year 3 is shown as open squares, from year 4 as crosses, and from year 5 as closed diamonds.

3 Final Comments

It is important that 56 Ari continue to be observed photometrically to refine the second period of approximately 5 years. Further the changes in the light curve amplitudes as well as the small changes seen in the various photometric filters remain to be modeled. That this star's rotational axis precesses indicates that the photosphere deviates slightly from being spherical. Thus information about the shape of the stellar photosphere still remains to be extracted. Further as the abundances are nonuniformly distributed over the photosphere in such mCP stars, such a study should be done in combination with high quality line profiles.

Acknowledgements

This work was supported in part by NSF grant AST-0071260 and earlier grants for the FCAPT.

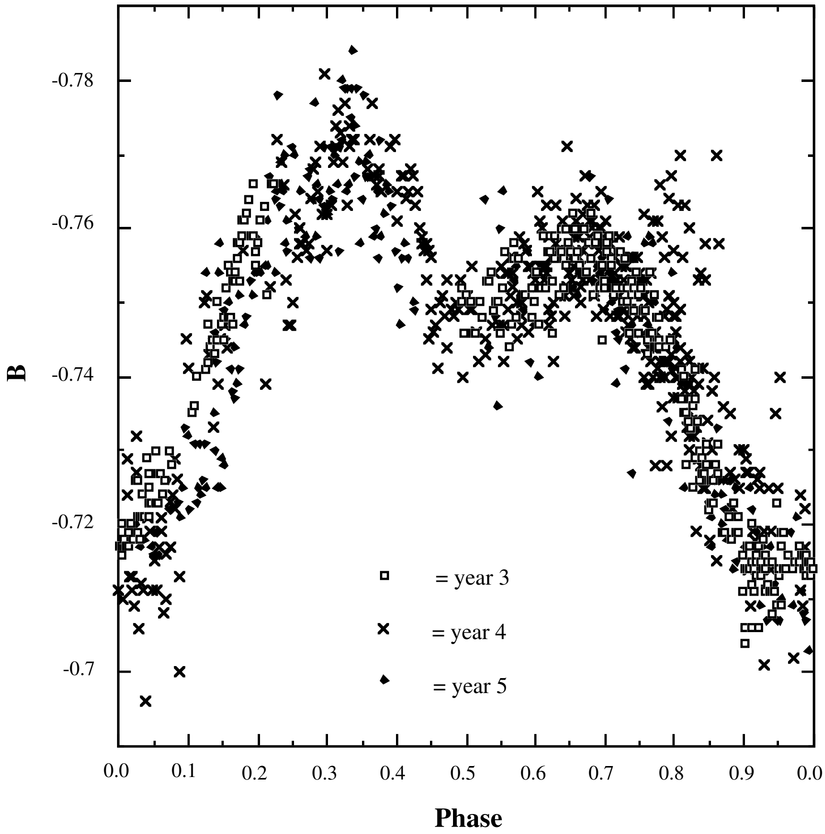

Figure 2: The B light curves for years 3, 4, and 5. Data from year 3 is shown as open squares, from year 4 as crosses, and from year 5 as closed diamonds.

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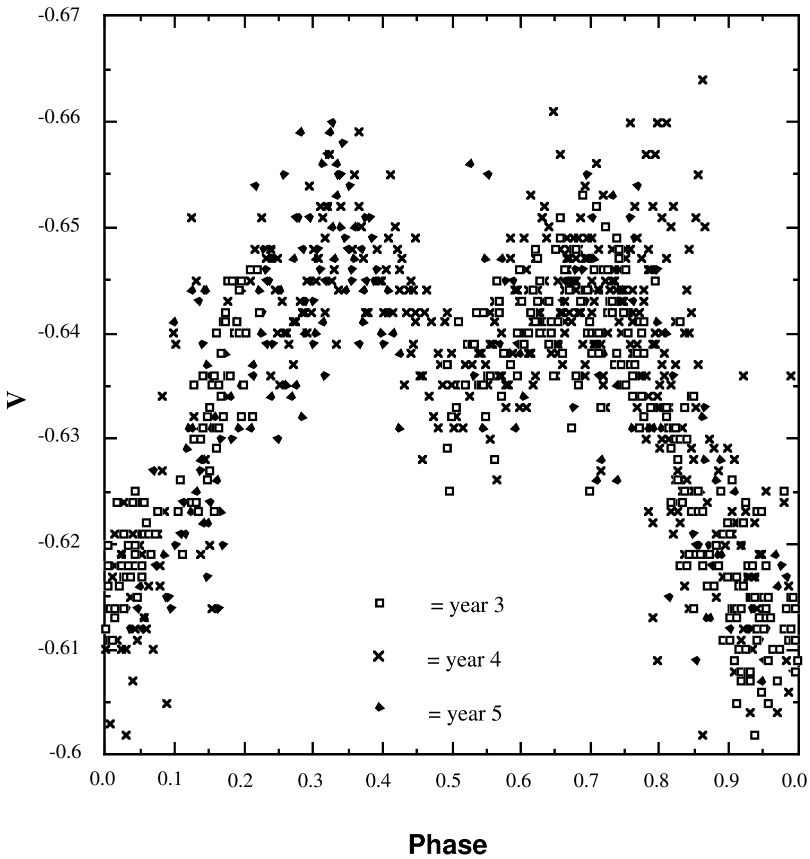

Figure 3: The V light curves for years 3, 4, and 5. Data from year 3 is shown as open squares, from year 4 as crosses, and from year 5 as closed diamonds.

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