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ON THE VARIABILITY OF 19 AURIGAE AS OBSERVED BY THE HIPPARCOS SATELLITE

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An important aspect of the differential photometry is to use non-variable comparison and check stars. Many stars used for this purpose have not been checked for constancy. Fortunately, the high quality photometric data from the Hipparcos and Tycho Catalogues (ESA 1997) now permits one to make variability tests for stars down to at least 8th magnitude. If this is done before the observations, it should reduce the chances of selecting variable comparison and check stars. Recently, Adelman (1998a) has used the photometry from the Hipparcos catalogue in order to verify the constancy of four magnetic CP stars, the comparison and check stars used for variability studies with the 0.75-m Four College Automated Photometric Telescope. He found a few comparison and check stars to be variable. The conclusion about variability is based on the large standard errors and the amplitudes of these stars as determined by Hipparcos. However, it is debatable that a star is constant within standard error and amplitude similar to those of "normal" B and A non-variable stars. In this note we will show that selecting comparison and check stars using the standard error and amplitude taken from Hipparcos Catalogue are not enough to draw a conclusion about constancy of these stars.

To investigate the photometric variability of a double lined eclipsing binary star AR Aurigae, Adelman (1998b) has used 18 Aurigae (HR 1734, Sp: A7 V, $m_v = 6\overset{m}{.}49$) as comparison star and 19 Aurigae (HR 1740 = NSV 1925, Sp: A5 II, $m_v = 5\overset{m}{.}03$) as check star. According to investigation of Adelman (1998a), 18 Aur and 19 Aur are non-variable stars, because the standard error and amplitude taken from Hipparcos Catalogue for both stars is equal to $0\overset{m}{.}0010$ and $0\overset{m}{.}02$, respectively. However, 19 Aur is marked in SIMBAD data base as variable, because this star was included in the New Catalogue of Suspected Variable Stars (Kukarkin et al. 1982). On the other hand, 18 Aur is not marked in SIMBAD data base as variable. We decided to investigate 19 Aur for variability, before starting the program of the differential photometry of AR Aur. Therefore, the Hipparcos Variability Annex was used, which is available on the world-wide web under http://astro.estec.esa.hl/Hipparcos/. The Hipparcos Catalogue contains 75 observations of this star made on 21 separate days. It should be mentioned that the Hipparcos magnitude (Hp) system is close to but somewhat different from V magnitudes (Van Leeuwen et al. 1997). The upper panel of Fig. 1 shows the Hipparcos photometry of 19 Aur as a function of time. As one can see from Fig. 1, the Hp magnitude of the star is variable. There is a clear maximum around JD 2 448 390. In between, two minima are indicated

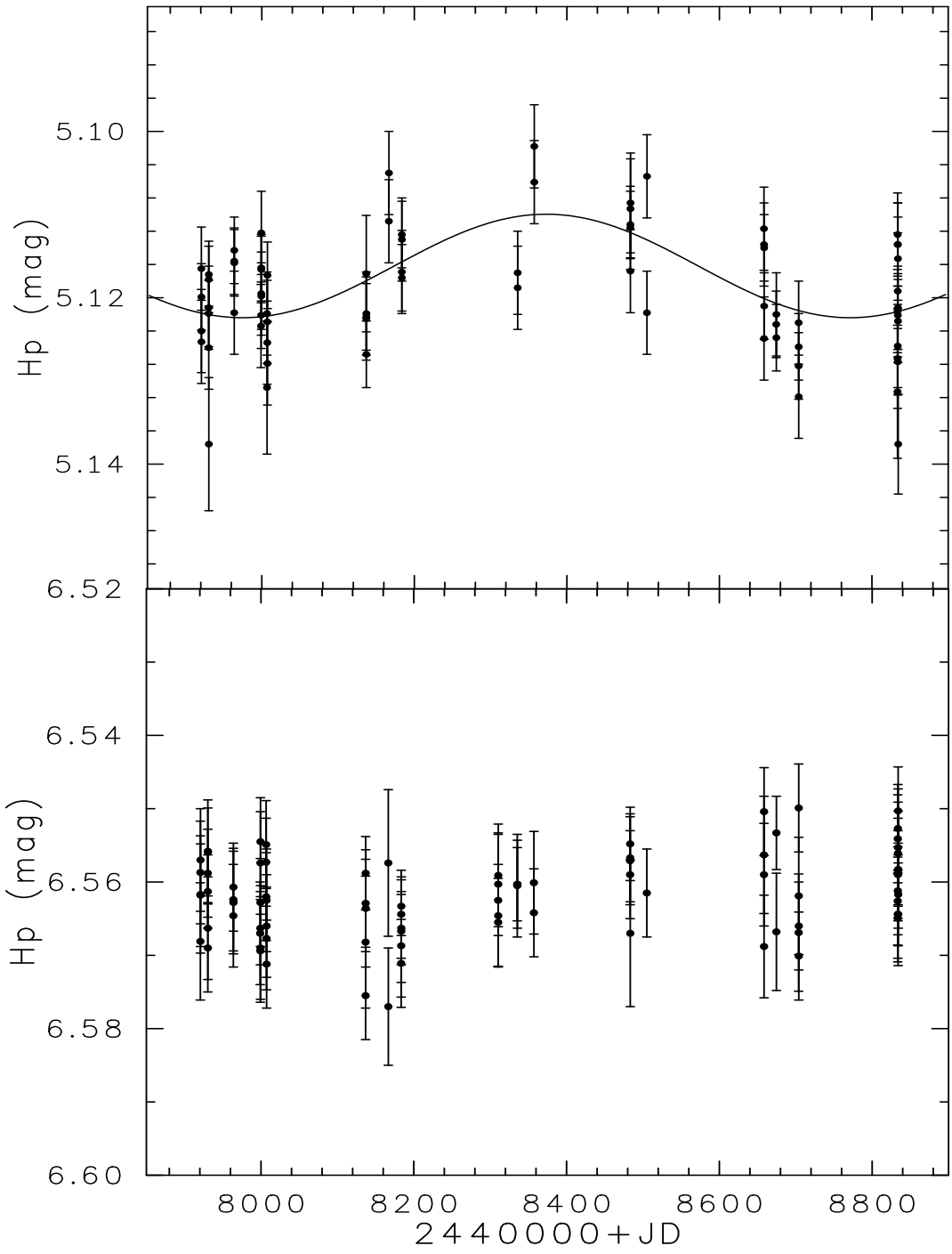

Figure 1. The Hipparcos photometry of 19 Aur (upper panel) and 18 Aur (lower panel) as a function of time. The solid line is the least square fit.

around JD 2 447 980 and JD 2 448 770. To check the observed variation of Hp magnitude of 19 Aur, the star 18 Aur was used. The Hipparcos Catalogue contains 83 observations of this star. It should be noted that 18 Aur was observed by Hipparcos satellite simultaneously with 19 Aur. The Hp magnitudes of 18 Aur as a function of time are shown in the lower panel of Fig. 1. The star is non-variable on the span of the observations and it supports the reliability of the obtained variability of 19 Aur. The periodogram analysis (Scargle 1982) of the Hp magnitudes of 19 Aur showed that the following preliminary ephemeris can be derived:

$$\mathrm{JD(Hp\ min)} = 2447972 + 797 \times E. \qquad (1)$$

In order to estimate the amplitude of the Hp magnitude variation a linearized least-squares method was used, which was described by North (1987). A least-squares fit by one-frequency cosine curve was applied to the Hp magnitudes of 19 Aur. The fitted cosine curve was computed from Eq. (1) and it was plotted as the solid line on the upper panel of Fig. 1. The computations give the following results: the minimum and the maximum values of the Hp magnitude are equal to $5\overset{\mathrm{m}}{.}1224$ and $5\overset{\mathrm{m}}{.}1100$, respectively. The amplitude is close to the standard error taken from Hipparcos Catalogue. According to the SIMBAD data base, the minimum and the maximum values in the V magnitude is equal to 5.03 and 5.09, respectively. Nevertheless, the span of the observations covers just over one cycle of the proposed period. Since no single cycle has been observed over a sufficient fraction of the light curve, the amplitude and period may be quite spurious. Evidently 19 Aur must be observed in the future in order to make final conclusion about the amplitude and period of its brightness variation.

Finally, the analysis performed in this note has shown that selecting comparison and check stars using the standard error and amplitude taken from Hipparcos Catalogue is not without problems. Fortunately, the star 19 Aur was used as the check star by Adelman (1988b), but it should be replaced in future studies of AR Aurigae.

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