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EIGHT NEW SMALL AMPLITUDE VARIABLES

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Long term photometric monitoring of variable stars with Automatic Telescopes (APT) likely leads to the detection and characterization of a number of new variables used as comparison stars. Detections of new variable stars in the course of our monitoring programme of AGB variables with the Vienna APTs on Washington Camp, Arizona, have been reported by e.g. Lebzelter (1999). In the present paper we analyze data on further eight small amplitude variables.

Table 1: Summary of our observations and their results. The two stars listed at the bottom have been observed in the V- and I-bands, the other stars in B and V

Star	V-amplitude [mag]	spectral type	period [d]	variability type	Program star	Comparison star
SAO 15812	0.08	M2	20–50	SR/L	SS Dra	HD 108720
SAO 18231	0.05	K5	15–20	SR/L	SZ Dra	HD 179238
HD 291070	0.10	M2	40–50	SR/L	V352 Ori	HD 41061
SAO 90186	0.08	M0	40	SR/L	TW Peg	HD 209420
HD 103847	0.05	G5	13	solar type	GK Com	HD 104785
HD 170270	0.04	K5	10	SR/L	V585 Oph	HD 169930
SAO 154153	0.3	M0	25	?	AC Pup	HD 70738
HD 105036	0.1	M0	20	SR/L	RW Vir	HD 105061

Photometric data have been obtained between March and December 2000. From mid July to mid September the telescope was closed due to the bad weather season. Typically, every second night a data point has been obtained. The accuracy of the individual measurements is better than $0\overset{\mathrm{m}}{.}02$. The first six stars listed in Table 1 have been observed in Johnson B and V filters, while SAO 154153 and HD 105036 have been monitored in V and I. The latter two have been observed continuously since November 1996.

None of the eight stars has left any significant echo in the literature, except for HD 103847, which will be discussed below. All objects of our sample have been measured by the Hipparcos/Tycho mission (van Leeuwen et al. 1997). For three stars, HD 103847, SAO 154153 and HD 105036, usable parallax measurements exist due to this mission. According to this, HD 103847 and SAO 154153 are both main sequence stars, while HD 105036 is a supergiant. Due to the failure to measure a parallax for the other objects, we classified these stars as giants or supergiants on the basis of their visual brightness values. Jorissen

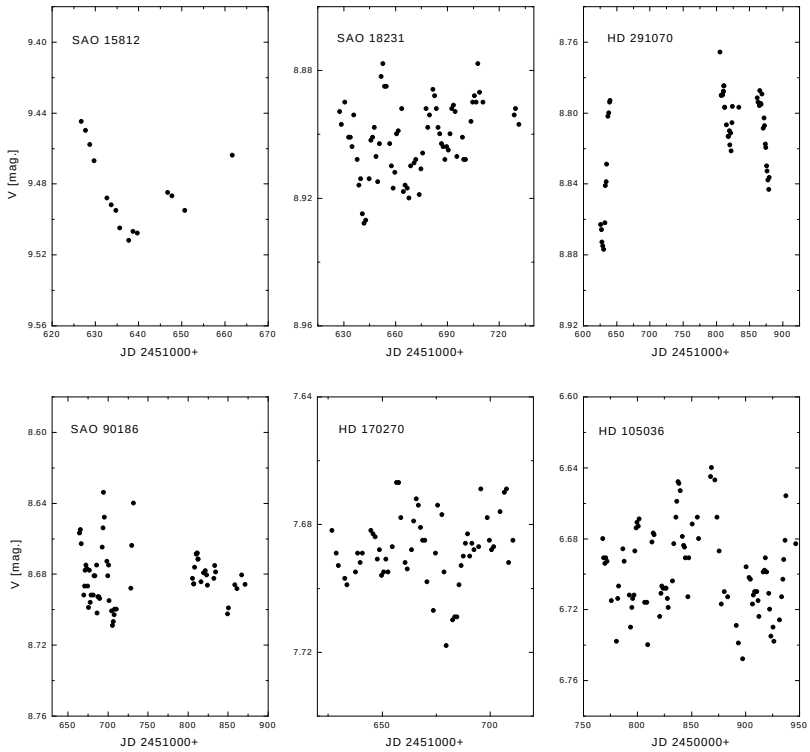

Figure 1. Visual light curves of the stars in Table 1

et al. (1997) have noted that small amplitude variability is very common among red giants of spectral type K and M. It is therefore not surprising that we detected variability of these stars. The Hipparcos mission found variability already in two stars of our sample, namely HD 103847 and HD 105036. Both stars have been classified as unsolved variables. The light amplitudes given by the Hipparcos catalogue are in reasonable agreement with our data. According to the Hipparcos catalogue none of the program stars is a close binary.

All of the eight stars show semiregular to irregular light changes with periods of a few ten days and amplitudes up to $0\overset{\mathrm{m}}{.}1$. In Fig. 1 we show the light curves for these stars except HD 103847 and SAO 154153 for which light curves will be presented below. As the periods of the variations are very short compared to the total time span of observations, we show only representative parts of the light change for the sake of clarity. The scale on the magnitude axis is the same for all objects ($0\overset{\mathrm{m}}{.}18$) except HD 170270 and SAO 18231, for which it has been enlarged. The K and M type giants can therefore all be classified as either semiregular or irregular variables. The nature of the light change and the time span of our observations do not allow a more detailed classification. Similarly, we can give only a range for the typical time scale of the variability. The severe problems in determining an accurate value of the period have been discussed already in an earlier paper (Lebzelter 1999). We note that there is a clear difference in the time scale and amplitude of the variability between the K and the M type giants of our sample, the latter having longer periods and larger amplitudes.

Two stars of our sample seem to be worth a further discussion. HD 103847 has the earliest spectral type of the stars in our sample. According to Strassmeier et al. (2000), this star shows H and K Ca II emission lines. Together with its spectral type, luminosity and period, it follows that HD 103847 is likely to show the same type of variability as the sun, but at a higher level of activity. According to our measurements, the $B-V$ variation of this star is very small (i.e., essentially below $0\overset{\mathrm{m}}{.}015$). Therefore, we only show the variation of the B magnitude of this star in Fig. 2.

For the time shown, the light curve can be fitted rather well by a sinus curve with a period of 13 d and a B-amplitude of $0\overset{\mathrm{m}}{.}05$. A period about twice as long cannot be ruled out. Further observations of this star are needed to determine the period accurately. Determination of the period is also complicated due to the fact that on longer time scales, the amplitude changes. The variability of the spots is occurring on a time scale similar to the rotation period of the star. This is in accordance with the results of Strassmeier (1990) and Strassmeier et al. (1997), who already reported amplitude and period variations of similar stars, presumably being due to rapid starspot variability.

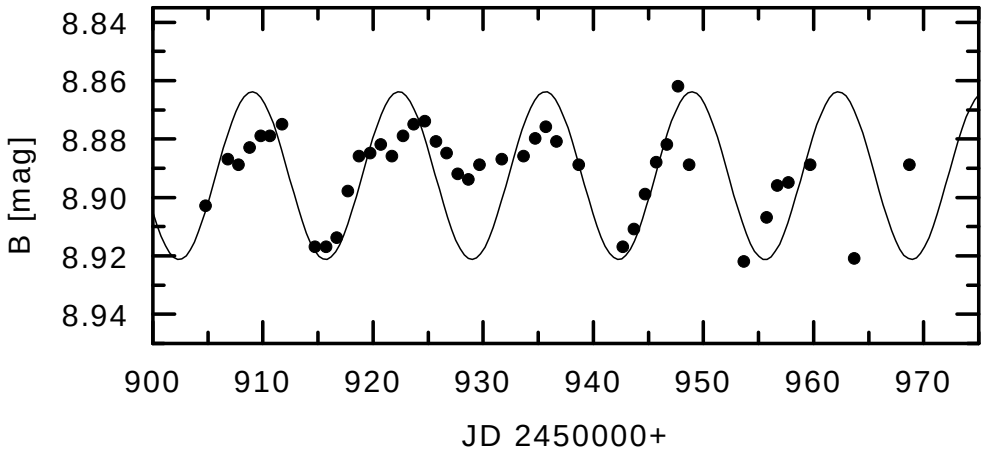

Figure 2. The B-band variation of HD 103847

The second interesting star is SAO 154153. According to its parallax the star is a M type dwarf. The Tycho catalogue lists a $B-V$ value of 1.592. Our measurements give a $V-I$ of 2.6, suggesting a spectral type later than M0. Photometry would therefore be in agreement with the star being either a giant or a dwarf. In the latter case (which is favoured by the parallax measurement), SAO 154153 might belong to the BY Dra group, meaning that the light variability is due to rotational modulation of surface structures. Its visual light curve and $V-I$ variation are shown in Fig. 3. A serious obstacle to classifying this object as BY Dra variable is, however, that the $V-I$ variation of this star, compared to its V amplitude, is untypically large for a spotted star. While an amplitude in $V-I$ of about 0.1 to 0.15 has been observed in spotted stars, in such cases the visual amplitude is still several times higher (e.g. Strassmeier & Oláh 1992). Amado et al. (2000) discussed models of different types of spots (solid spot, umbra/penumbra model, umbra/facula spot model) and their effect on light and colour curves. According to this study (see their Fig. 3) a similar V and $V-I$ amplitude may occur for umbra/facula spots. However, we could not find observational evidence for such a combination in the literature.

We conclude that our data and the information found in the literature are not sufficient for a reliable classification of this star. If the parallax measurement would be wrong, the

results would also be in agreement with a classification as semiregular variable. However, in the Tycho catalogue this star was marked with astrometric quality '3' (T40) indicating rather high photometric accuracy. This star clearly needs further investigation to reveal its nature.

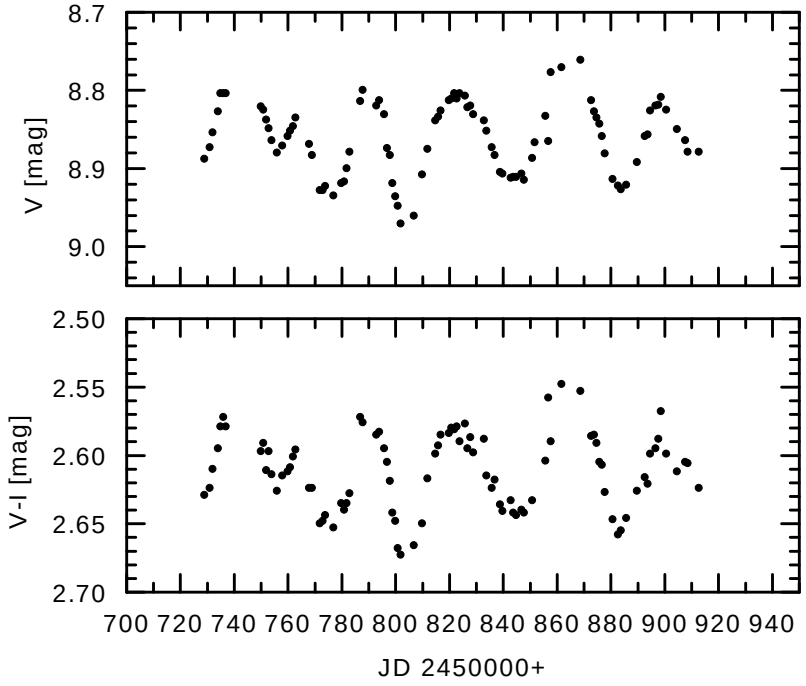

Figure 3. The visual light curve and $V - I$ variation of SAO 154153

Finally we note that HD 105036 has already been used as a comparison star for RW Vir before (Wisse & Wisse 1971). In that investigation the authors found a small scale variability in RW Vir with an amplitude of $0\overset{\mathrm{m}}{.}05$. Based on our data we assume that their result was influenced by the variability of HD 105036. From our data we did not find that kind of variability in RW Vir. The light change of RW Vir itself will be presented and discussed elsewhere.

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References:

Amado, P.J., Doyle, J.G., Byrne, P.B., 2000, *MNRAS*, **314**, 489
Jorissen, A., Mowlavi, N., Sterken, C., Manfroid, J., 1997, *A&A*, **324**, 578
Lebzelter, Th., 1999, *A&A*, **346**, 537
Strassmeier, K., 1990, *ApJ*, **348**, 682
Strassmeier, K., Bartus, J., Cutispoto, G., 1997, *A&A Suppl.*, **125**, 11
Strassmeier, K., Oláh, K., 1992, *A&A*, 259, 595
Strassmeier, K., Washuettl, A., Granzer, Th., et al., 2000, *A&A Suppl.*, **142**, 275
van Leeuwen, F., Evans, D.W., Grenon, M., et al., 1997, *A&A*, **323**, L61
Wisse, M., Wisse, P.N.J., 1971, *A&A*, **12**, 143