COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 3155

Konkoly Observatory
Budapest
15 March 1988
HU ISSN 0374 - 0676

THE PERIOD OF TWO Bp Si Mg STARS: HD 60431 AND CoD -51°3378

The Si Mg peculiarity type is extremely rare among the hot Ap stars with enhanced silicon lines. To our knowledge, there are only three of them: HD 3473, HD 60431 and CoD -51°3378. The latter two are in the southern celestial hemisphere and were monitored with the Swiss telescope at the European Southern Observatory, La Silla (Chile), using the Geneva photometry. HD 60431 was observed at the beginning of 1987, while CoD -51°3378 (classified Si Mg by Bidelman, 1985) was measured in January 1988.

Both stars show a fairly large amplitude in the [U] band, reaching almost $0^m.1$ peak-to-peak, while the amplitude in the V band hardly reaches $0^m.04$. All colours vary in phase.

The period of HD 60431 is very short and certainly holds the record among the classical magnetic Ap stars (Preston's CP2 category): we have obtained

$$P = 0.475518 \pm 0.000059 \text{ d.!}$$

This is shorter than the shortest periods known to date, such as 0.5207 (HD 124224, Si) or 0.51747 (HD 164429, Si Cr Sr). The only star which could have a similar, or even shorter, period is HD 177517 (Hg Si), but the published periods are ambiguous and uncertain (P=0.4877 or 0.33772 d., Manfroid and Mathys, 1985).

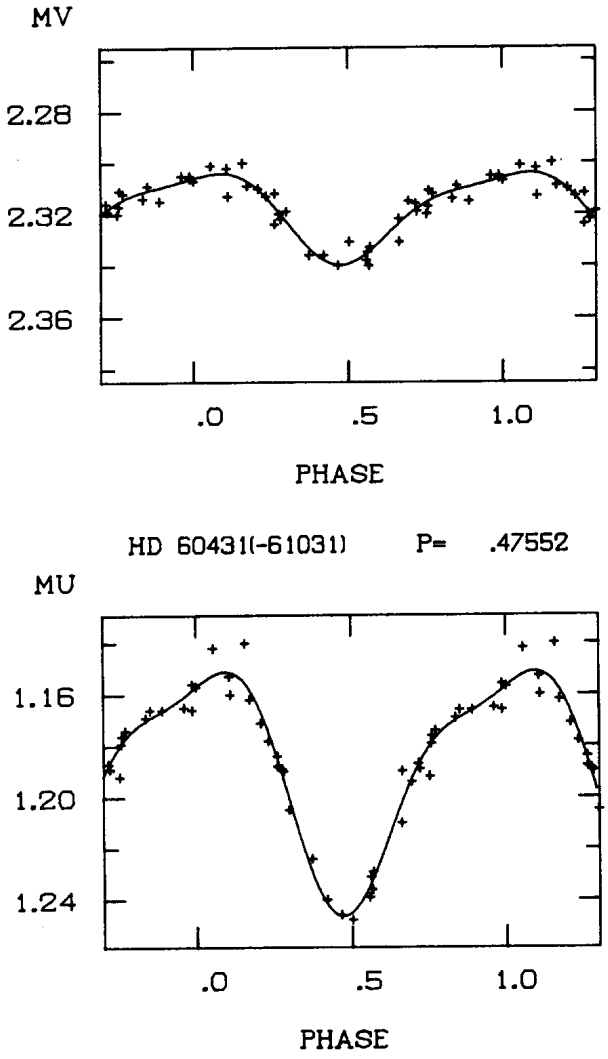
MV
2.28
2.32
2.36
.0
.5
1.0
PHASE
HD 60431(-61031) P= .47552
MU
1.16
1.20
1.24
.0
.5
1.0
PHASE

Figure 1

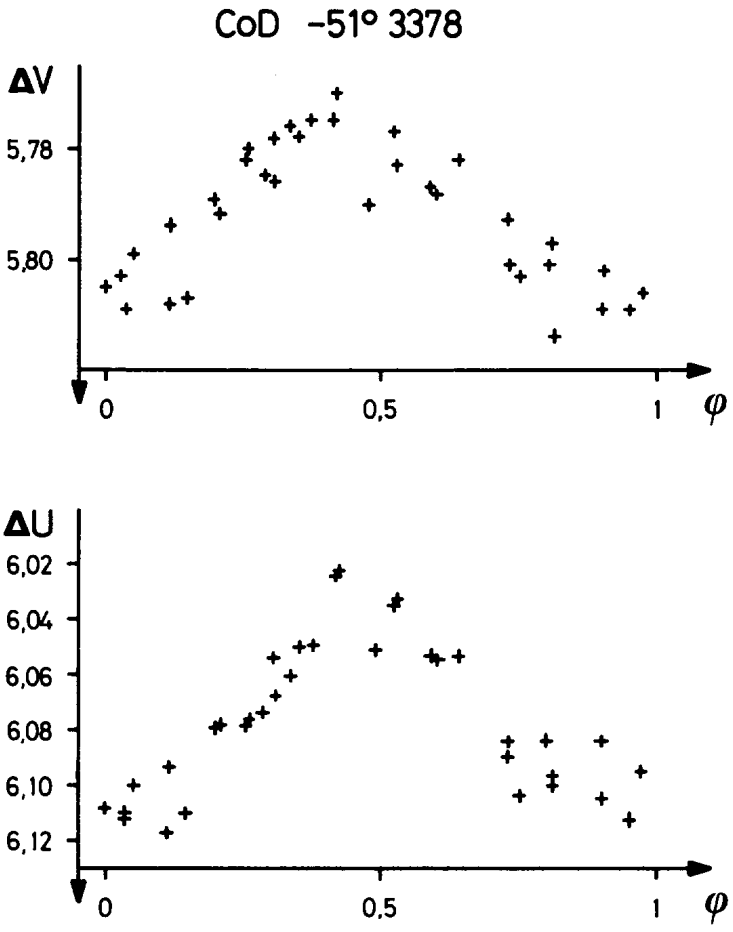

Figure 2

Applying the oblique rotator model, i.e. the well-known formula $v_{eq.}=50.6\ \frac{R}{P}$, such a short period implies an equatorial velocity $v_{eq.}=245$ km s^{-1} if we assume $R \simeq 2.30\ R_{\odot}$. The latter radius holds for a 4.5 $M_{\odot}$ star lying on the ZAMS (the mass is deduced from the calibrated X and Y parameters of the Geneva photometry), so it must be considered rather as a lower boundary. Therefore, the 245 km s^{-1} value of the equatorial velocity is probably a lower limit too. Such a rapid rotational velocity is more typical of the normal stars than of the Ap stars, and may be a challenge to the theory of radiative diffusion, the most promising one for explaining the Ap stars' abundance patterns. Indeed, rapid rotation induces meridional circulation, which will tend to counteract the diffusion processes. It would be most interesting to determine the magnetic field, which is an essential ingredient in the diffusion processes, among the Si stars (Mégessier, 1984).

CoD -51°3378, on the contrary, has a period

$$P=1.282 \pm 0.006$$

which is quite common, since it is close to the maximum of the period distribution of the young Si stars (North, 1987).

Fig. 1 shows the lightcurves of HD 60431 for the [U] and V bands. The magnitudes are differential ones, relative to HD 61031.

Similarly, Fig. 2 shows the lightcurves of CoD -51°3378. Here the differential magnitudes are relative to HD 76805.

P. NORTH, J. BABEL and T. LANZ
Institut d'astronomie de
l'Université de Lausanne et
Observatoire de Genève
CH-1290 CHAVANNES-DES-BOIS
Switzerland

References:

Bidelman, W.P.: 1985, Astron. J. 90, 341
Manfroid, J. and Mathys, G.: 1985, Astron. Astrophys. Suppl. Ser. 59, 429
Mégessier, C.: 1984, Astron. Astrophys. 138, 267
North, P.: 1987, Astron. Astrophys. Suppl. Ser. 69, 371 59