Peculiar Versus Normal Phenomena in A-Type and Related Stars
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SEARCH FOR λ BOOTIS STARS IN OPEN CLUSTERS

K. PAVLOVSKI
Hvar Observatory, Zagreb University, Kačićeva 26, 41000 Zagreb, Croatia

A. SCHNELL and H.M. MAITZEN
Institut für Astronomie der Universität Wien, Türkenschanzstrasse 17, 1180 Wien, Austria

ABSTRACT It was shown by Maitzen & Pavlovski (1989) that a majority of λ Bootis stars stand out by negative Δa indices. Using this as detection tool, three candidate stars with λ Bootis characteristics are picked up in open cluster Praesepe.

INTRODUCTION

λ Bootis stars have regained the interest of stellar astrophysicsts during the last years very probably because of the increasing awareness concerning abundance variations detectable by high S/N spectroscopy with high wavelength resolution. The definition of these stars is still somewhat controversial, but there is certain convergence about metal deficiency (e.g. Gray (1988) and review paper by Gerbaldi & Faraggiana (1992)).

A. Slettebak has suggested that one should try to study the photometric behaviour of λ Bootis stars, e.g. in the Δa system (Maitzen 1976). Maitzen & Pavlovski (1989) have subsequently shown that a majority of these objects stand out by negative Δa values, hence are of opposite behaviour to the magnetic peculiar stars which are easily identified photometrically through their substantial positive deviations in Δa.

Michaud et al. (1983) have suggested a scenario in which moderate mass loss during main sequence life time from a star with a quiet abundance stratified atmosphere may eventually show up in a sequence of over and underabundances with the latter occuring mainly at the end of the main sequence era.

It seems quite natural to subject this proposal to an empirical test by carrying out a survey in a suitable number of open clusters of different age. Since such an undertaking requires statistically significant numbers of stars spectroscopic studies will encounter huge problems, mainly because of the modest brightness levels at which such stars in open clusters are to be expected.

More promising is the application of photometric indices, more precisely Δa, even if we consider that the hitherto measured values are only 10–20 mmags below normality line, hence only slightly more than the conventional 3σ level.

At the moment it has not yet been established whether this type of photometric work could be speeded up the employement of CCD photometry,

but first attempts are pointed at the necessity of using old fashioned photomultiplier photometry just because of the very high level of accuracy needed.

OBSERVATIONS

We have started this type of work with the well known open cluster Praesepe, one of the oldest clusters included in a programme devoted to the identification of CP2 stars in open clusters. Praesepe, as a matter of fact, was already observed and has published Δa–photometry obtained at Hvar Observatory (Maitzen & Pavlovski 1987). In that paper, however, a strange difference of the normality line has been pointed out, making the Am stars of the cluster as peculiar in Δa as never found among these objects. It was therefore decided to reobserve Praesepe adding some new stars and checking for the accuracy of the first measurements. This was done by one of us (AS) at the 60cm photometric telescope at Leopold Figl Observatory (Mt Schöpfl) of the University of Vienna.

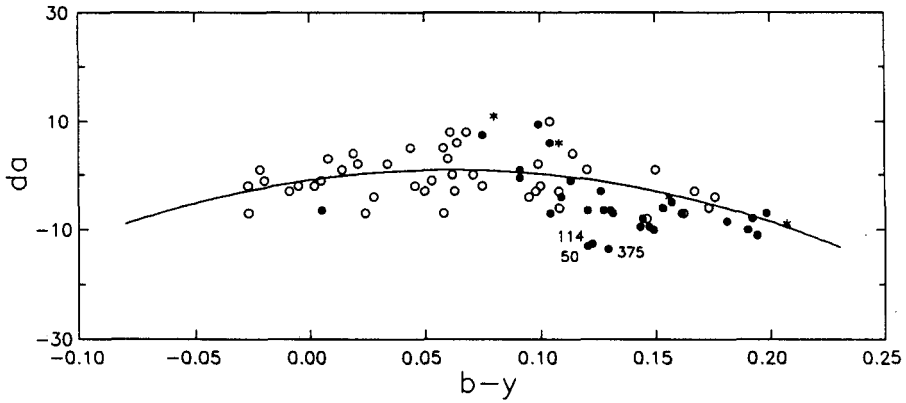

Fig. 1. Δa–photometry of open clusters: Praesepe (open circles) and α Per and Coma Ber (filled circles). Am stars are represented by asterisk, and candidate λ Boo stars in Praesepe are numbered.

RESULTS

The merged Schöpfl and Hvar measurements of Praesepe together with Hvar results for the cluster α Per and Coma Ber are shown in Fig. 1. Through this synopsis it become clear that the adopted linear run of the parameter a with $b-y$ failed at the red of the diagram rendering the Δa values too low. Therefore, a quadratic term was included in deriving the normality line.

While the majority of Praesepe stars line up rather close to the points of the other clusters at the red end (there may be still an overall preponderence of slightly negative Δa values in Praesepe) there are 3 objects, KW 50, 114 and 375 which deviate still noticeably from the normality line.

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Henry et al. (1977) have studied metal abundance in Praesepe. For KW 50 and KW 375 they state that they appear to be relatively metal poor, which is reflected also by their Strömgren m_1 values. However, Gray & Garrison (1989) classified Praesepe star KW 50 as normal star, and used it as "low–$v\sin i$" late A–type standard star.

The 3 pronounced negative Δa deviators should be studied spectroscopically in order to find out possible λ Boo characteristics.

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