MAIN-SEQUENCE BROADENING, Be STARS, AND STELLAR ROTATION IN h AND χ PERSEI*

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1. Introduction

The double cluster h and χ Persei is one of the richest clusters containing early-B stars, and therefore is important for observational and theoretical studies on the fundamental parameters of massive stars. The colour-magnitude diagram of the double cluster shows an important scatter (see Figure 1). It has long been known that h and χ Persei are extremely rich in Be stars (Slettebak 1968). Our previous contention (Waelkens et al. 1990) that the large-amplitude variable stars we discovered are also Be stars, could be confirmed for a few objects. Rotation velocities for stars in h and χ Persei are usually high, which is not surprising in view of the large fraction of Be stars.

2. Rotation and main-sequence broadening

Rotation can affect colour-magnitude diagrams of open clusters in (at least) two ways :

1. Colours and magnitudes are affected by gravity darkening and geometric effects. These effects tend to brighten and redden the stars with respect to non-rotating stars (Maeder & Peytremann 1970, 1972; Collins 1987).
2. Very rapid rotation may thoroughly mix the stellar interior and so lengthen the main sequence life time (Maeder 1987). This effect would imply blueward evolution.

Rotation velocities for stars in h and χ Persei have been obtained by Slettebak (1968, 1985). We have also determined $v \sin i$ values for several cluster members, using the high-resolution spectrograph Aurélie of the Observatoire de Haute-Provence. We have adopted Slettebak's $v \sin i$ values to ours, since a systematic difference between his and our $v \sin i$-values was found for the stars common to both data sets and since our velocity determination is based on profiles with a higher resolution.

* Based on observations obtained at the Observatoire de Haute-Provence, France

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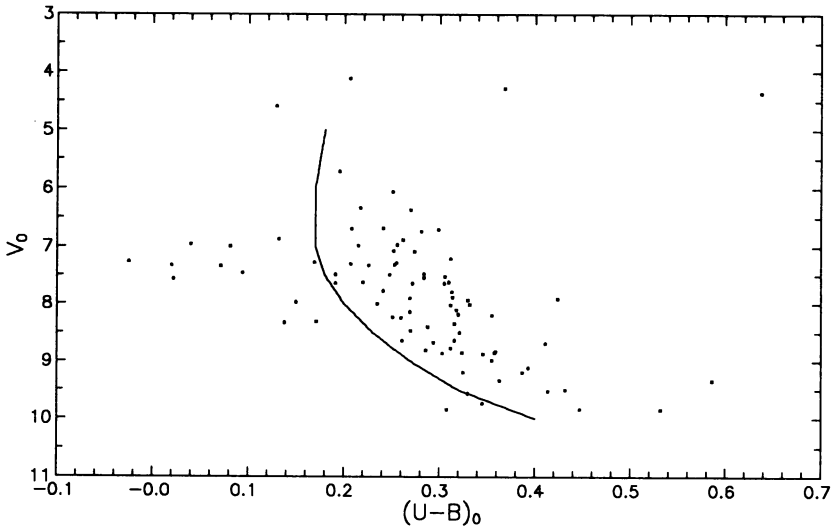

Fig. 1. Colour-magnitude diagram for stars in h and χ Persei. Most stars on the left of the ZAMS are Be stars.

3. Discussion

The histogram of the observed $v \sin i$ values cannot be explained by effects of different inclination angles alone. Star-to-star variations of the equatorial rotation velocities are definitely present.

The average $v \sin i$ value for stars on the left of the ZAMS is 193 km/s, while it is 136 km/s for stars on the right of the ZAMS. This result may support the suggestion by Maeder (1987) that the blue-straggler phenomenon can be due to mixing induced by rapid rotation. However, the distance to the ZAMS is not correlated with $v \sin i$.

Also for stars on the right of the ZAMS, there is no clear relation between $v \sin i$ and colour excess. It is then not possible to accurately determine the effects of rotation on colours and magnitudes for these stars.

We then have to conclude that the effects of rotation are not sufficient to explain the observed main-sequence broadening in h and χ Persei.

References

Collins, G.W., 1987, In *Physics of Be stars*, Proceedings of the 92nd Colloquium of the IAU, eds. A. Slettebak & T.P. Snow, Cambridge University Press, p.3
Maeder, A., 1987, A&A 178, 159
Maeder, A., Peytremann, E., 1970, A&A 7, 120
Maeder, A., Peytremann, E., 1972, A&A 21, 279
Slettebak, A., 1968, ApJ 154, 933
Slettebak, A., 1985, ApJ 59, 769
Waelkens, C., Lampens, P., Heynderickx, D., Cuypers, J., Degryse, K., Poedts, S., Polfliet, R., Denoyelle, J., Van Den Abeele, K., Rufener, F., Smeyers, P., 1990, A&AS 83, 11