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Search for Pulsational Instability among h Persei Stars

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Abstract. The northern-hemisphere double cluster h and χ Persei is one of the richest young open clusters. At least half of the brightest stars in the cluster appear to be variables and most of them are Be stars. Till now there was no evidence for the presence of β Cephei stars in the cluster. It is remarkable that the similar age southern cluster NGC 3293 and other clusters belonging to the same age group are documented as clusters in which β Cephei stars have been observed. In this work we report finding one suspected β Cephei-like object, basing on our own observations.

1. Introduction.

A new thorough search for pulsational instability among h Persei stars has been undertaken during last months of 1994. The search was focused on three types of variable stars: β Cephei, Supergiant and Slowly Pulsating B stars, which should pulsate due to the same excitation mechanism, i.e., κ-effect acting in the metal opacity bump (Dziembowski et al. 1993). The CCD observations of the central region of the h Persei cluster were carried out with 60-cm telescope (equipped with an autoguider) at Mt. Suhora Observatory. The field of view of a CCD camera, equal to 4x6 arc minutes, allowed us to take images of nearly a hundred stars in the same frame, but only about 20 of them were stars, which fall into instability strip predicted by the theory. Exposures were taken through the V filter close to Johnson's V filter and with integration times from 50 up to 150 seconds. To derive instrumental stellar magnitudes for the brightest separated (or semi-separated) stars visible in frames, an aperture method was used. The accuracy of a single measurement was better than 0.02 magnitude for 11-th magnitude stars.

2. Results.

Among 40 stars taken into analysis we have found one suspect β Cephei-like object with P=0.172 days, which was identified to be the Oo 692 h Persei, B0 type (9.45 mag. in V) and luminosity class V star. This type corresponds to the $\log(T_{\rm eff})$ value equal to 4.48 and $\log(L/L_{\odot}) = 4.72$. It means that the Oo 692 star has mass $\sim$17 $M_{\odot}$ and can be placed at the edge of an instability strip, determined for the metal abundance of Z=0.02.

There is no doubt that this star is a fast rotator (v*sin(i)=135 km/sec, Waelkens et al. in preparation), thus its behaviour (if pulsations are real) would be very important in connection with the problem of damping of pulsations in fast rotators.

The Oo 963, B2 IV (m=10.7 mag. in V) star has been also taken into analysis as a β Cephei suspect from a list of β Cephei suspects published by C. Sterken and M. Jerzykiewicz (1992), but we cannot confirm this type of variability. If this star is a variable, its amplitude of variations should be less than 0.01 magnitude.

References

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