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Light variability of HD 224639, HD 224638 and HD 224945 \*

The short period light variability of HD 224639 (7.3, F0) was first detected by Manfroid and Renson (1983) who used it as a comparison star in a programme for the search for Ap variables. Since it was probable that the star could be a  $\delta$  Scuti type variable, we included it in our programme devoted to the study of multimode pulsators.

We observed it in the *B* colour with the 50-cm telescope at Merate Observatory for 3 nights in 1988 and 6 nights in November 1989. During this second run we also observed the star during 9 nights with the ESO 50-cm telescope at La Silla Observatory. These observations showed that HD 224639 is a typical  $\delta$  Scuti star with a maximum amplitude of about 0.13 mag in the *B* colour, and a preliminary frequency analysis of the data indicated the presence of several pulsation modes. The data were in any case unable to allow an unambiguous frequency identification (Mantegazza and Poretti, 1990).

Using HD 224638 (7.2, F0) and HD 224945 (6.9, A3) as comparison stars, and observing them with the same frequency as HD 224639, we discovered that at least one of them was variable with an amplitude of some hundredths of a magnitude and a characteristic time scale of the order of several hours. For these reasons we planned new intensive observations that we performed at La Silla with the ESO 50-cm telescope from September 5 to October 9, 1991. We were able to get data during 20 nights, observing consecutively for several hours (up to 8) on many of them. In order to detect which of the two comparisons was variable we adopted a third comparison star, HD 225086 (8.0, F2), but after the first observing night it was evident that both HD 224638 and HD 224945 were variable, so that in order to check the constancy of HD 225086 and the accuracy of the measurements a fourth comparison star was introduced in the observing cycle. During the successive 4 nights we used HR 11 (6.43, B8 IIIp), but since the colour of this star is consistently different from that of the others, with the need of introducing large colour terms in the reduction procedure, we preferred to drop it and use in the following nights HD 200 instead. In any case HD 225086, HR 11 and HD 200 were found to be constant within a few thousandths of a magnitude. In the Figure, we show the light curves obtained during a typical night. From top to bottom we have plotted the magnitude differences of HD 225086 with respect to HR 11, HD 224945, HD 224638 and HD 224639 respectively (in the sense "HD 225086 minus program star"). We can see that while HD 224639 shows the typical lightcurve of a  $\delta$  Scuti star, with an apparent

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\* Based on observations made at the European Southern Observatory (ESO), La Silla, Chile

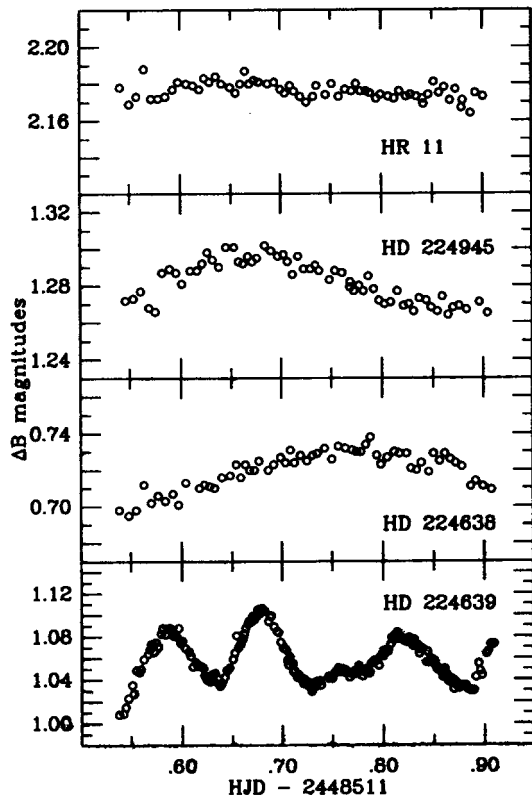


Figure 1

periodicity of the order of 0.1 days, HD 224638 and HD 224945 have a slow variation with timescales longer than the observational baseline. A preliminary examination of the complete set of light curves of these two stars shows the non-regular nature of this variation even if characteristic time scales could probably be defined. F type stars showing the same kind of variability have been discovered with increasing frequency in the last years (Abt et al., 1983; Antonello & Mantegazza, 1986; Krisciunas & Guinan, 1990; Mantegazza et al., 1991) however careful studies are still missing and the nature of the light variability is still elusive. We hope that our conspicuous datasets will enable us to derive the statistical properties of the light variations of HD 224638 and HD 224945. Regarding HD 224639 we have about 2700 differential magnitudes in the *B* colour with respect to HD 225086, corresponding to about 130 observational hours. A preliminary

frequency analysis of these data shows a complex pulsation spectrum with 4 modes, at 6.21, 9.49, 9.54 and 10.57 c/d, having about the same semi-amplitudes of roughly 15 mmag, and with many more of lower amplitudes.

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