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RAPID SPECTROSCOPIC VARIABILITY IN BE STARS

The advent of high signal-to-noise solid state detectors has led to the discovery of short timescale variability ($\sim$ tens of minutes) in absorption line profiles of a wide variety of stars (e.g. Smith, 1991 and references therein). The variability consists of weak (less than 1% of continuum) absorption features moving from blue to red accross the line profiles ("moving bumps"). The phenomenon was first detected in a Be star (ζ Oph) by Walker et al. (1979).

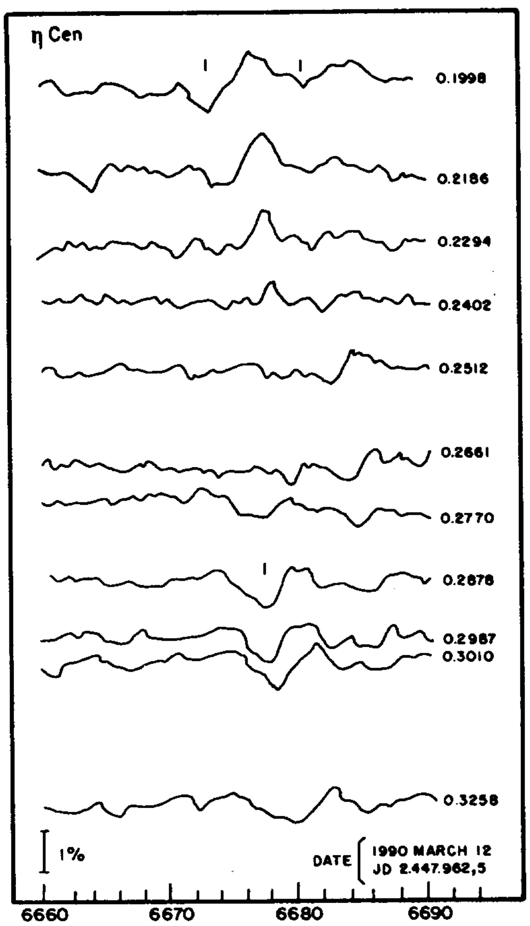
The bumps are often variable in intensity: a bump sometimes disappears or a new one appears were none existed. They are not evenly spaced accross the line profile and different bumps may have different rates of travel ("accelerations"). The visibility of the bumps varies from time to time and in Be stars may be correlated with veiling by circumstellar matter (Smith et al., 1991).

The moving bump phenomenon is generally interpreted as the photospheric manifestation of high-order ($\mid m \mid > 4$) sectorial modes of nonradial pulsations (NRP). Recently, Balona (1990) proposed another explanation in terms of rotational modulation (RM) of spots colder than the surrounding photosphere. The two models are virtually observationally undistinguishable: they fit equally well non-simultaneous spectroscopic and photometric data. In any case, it seems quite probable that some kind of surface magnetic activity is involved in Be variations of timescale < day (Smith, 1991). The NRP vs. RM controversy can only be decided with the help of simultaneous (or, at least contemporary) multi-technique observations (e.g. Balona, 1991).

We have started in 1990 a search for moving in the HeI λ 667.8 nm of (mainly) southern, bright Be stars. The objects of our sample have been selected on the basis of confirmed or suspected photometric variability (Cuypers et al., 1989; Balona, 1991). High resolution ($R \geq 30{,}000$), high signal-to-noise ratio ($S/N \geq 300$) spectroscopic observations have been performed at the Brazilian Laboratorio Nacional de Astrofisica with a CCD camera attached to the coudé spectrograph of the 1.6 m telescope. Ten stars have been observed in various epochs (Table 1).

Moving bumps have been detected for the first time in η Cen (Janot-Pacheco et al., 1990). Figure 1 shows the residuals (individual minus average spectra sequence) for

FIGURE 1



this star obtained in March 12, 1990. Some bumps are indicated. Moving subfeatures were also seen in ζ Oph and η Cen, and possibly in γ Arae and ζ Ori. From the average spacing and acceleration of the bumps one can derive the order of the spectral NRP mode supposed to be responsible for the variations (e.g. Yang et al. 1988).

TABLE I

STAR	EPOCH OF OBSERVATIONS	BUMPS
α Eri	June 1990	A
λ Eri	Nov 1990	?
ζ Ori	Apr 1991	D?
κ Ori	Apr 1991	A?
α Col	Apr 1991	?
κ CMa	Mar 1990	?
μ Cen	June 1990	C
η Cen	Mar,Jun 1990 Apr 1991*	D
ζ Oph	June 1990	C
γ Arae	June 1990	D?

A=Absent ; D=Detected ; C=Confirmed ; * International campaign

For η Cen and ζ Oph, our observations are consistent with order $1 = | m | \sim 20$. Janot-Pacheco et al. (1991) have shown that the photometric behaviour of η Cen in 1988 can only be reproduced with the RM model by a judicious sequence of dark and bright spots, which is incidentally reminiscent the sectorial type.

Anyone who has photometric or other data of the stars in Table 1 in 1990 or 1991, or who are interested in the problem exposed here is welcome to join us in a collaboration. A better understanding of the physics behind the rapid variations shown by Be stars will also throw light over the "Be phenomenon" problem.

E. JANOT-PACHECO and N.V. LEISTER
Instituto Astronômico e Geofísico
Universidade de São Paulo
C. Postal 9638 CEP 01065 São Paulo SP/Brasil
A.M. HUBERT, M. FLOQUET and H. HUBERT
Observatoire de Paris - Meudon
92145 Meudon - France

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