G1 425, A SLOWLY ROTATING BY DRA-TYPE STAR

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Some red dwarfs may show photometric variations attributable to dark spots on their surfaces, which is called BY Dra syndrome (e.g. Torres and Ferraz Mello, 1973). Almost all of these stars show Hα emission lines (Torres et al., 1983). Bopp et al. (1981) proposed that:

I - The Hα line is an abrupt indicator for the onset of BY Dra syndrome

II - There is a trigger rotational velocity to the appearance of the BY Dra syndrome of about 5 km/s.

In the I.T.A. photometric survey on southern red dwarf stars we discovered some objects that seem not to satisfy the above hypothesis. One of them is G1 425.

This star was observed differencially on 32 nights in 1971 and 1972 in 3 photometric systems. To analyse the data the observations were adjusted to a common mean value. A period analysis (Quast et al. 1983) shows a variation with a period of $11\overset{d}{.}58$ and an amplitude of 0.035 mag. (see figure 1). G1 425 is a visual binary and both stars were included in the diaphragm. The secondary is about 3 mag. fainter and we therefore consider the brighter component to be the variable one.

Since G1 425 is not known as an Hα emission line star we observed both components with an intensified Reticon detector at the Cassegrain Spectrograph of 1.6m telescope of the Brazilian Astrophysical Observatory. As shown in figure 2 the brighter component has a filled-in Hα line and the faint companion is a typical dMe star. We propose a spectral classification of dM0e and dM4e for the pair.

An intense flare of G1 425 was found in the records of the photometric data as shown in figure 3, indicating that in this aspect it behaves like a normal BY Dra star. It seems unlikely that the flare occurred on G1 425 B, since in that case we would have $\Delta B \sim 4$ mag, a very rare event indeed.

If we suppose that G1 425 A is on the main-sequence (and indeed, its slow rotation indicates that a braking mechanism has been operating for a rather long time), then we can assume a radius of about 0.65 $R_{\odot}$, and obtain a rotational velocity $Vr \sim 3$ km/s, contrary to Bopp's hypothesis II. We note that at about 4 km/s there are, at least, five other variables (DK Leo, ξ Boo, HD143313, EV Lac, TW PsA), which, at best, places the limiting velocity at a lower value.

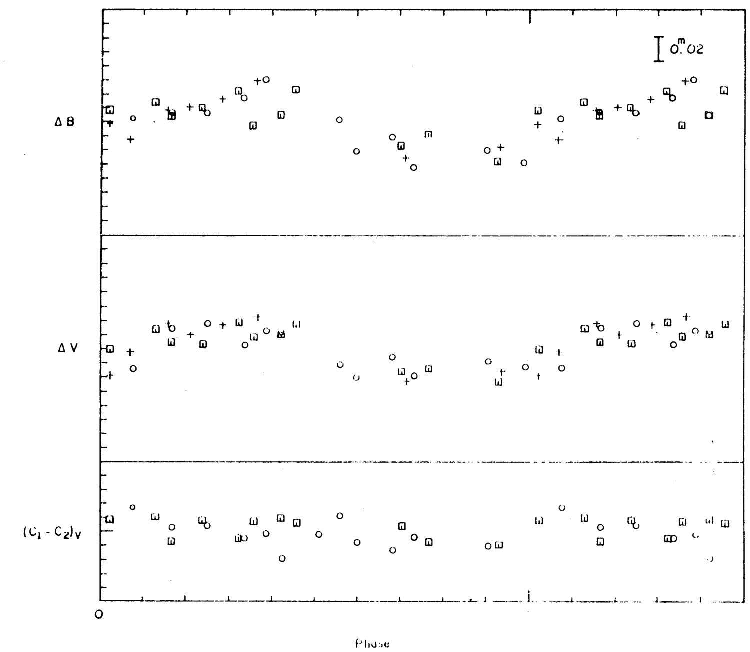

Fig. 1. Differential blue and visual photoelectric measures of Gl 425 against HD 97977. Phase is computed from φ = JD2441389.0 + 11.58E. Crosses are May-June, 1971 observations; circles, July, 1971; squares, March-May, 1972. The lower panel is visual photoelectric difference between HD 97977 and a check star, HD 98251.

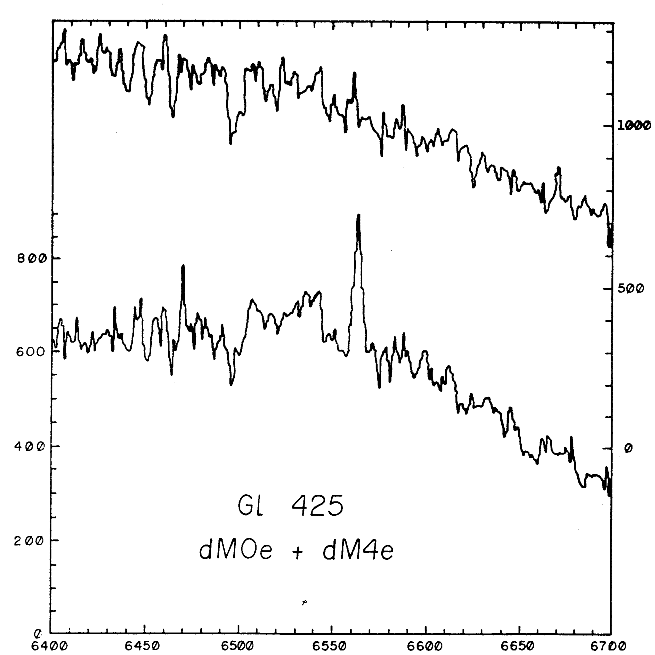

Fig. 2. Hα Intensified Reticon Spectra of both components of the pair Gl 425 at 90 A/mm, in counts/pixel vs. wavelength. Continuum curvature is due to the detector response. The upper spectrum is from the brighter component.

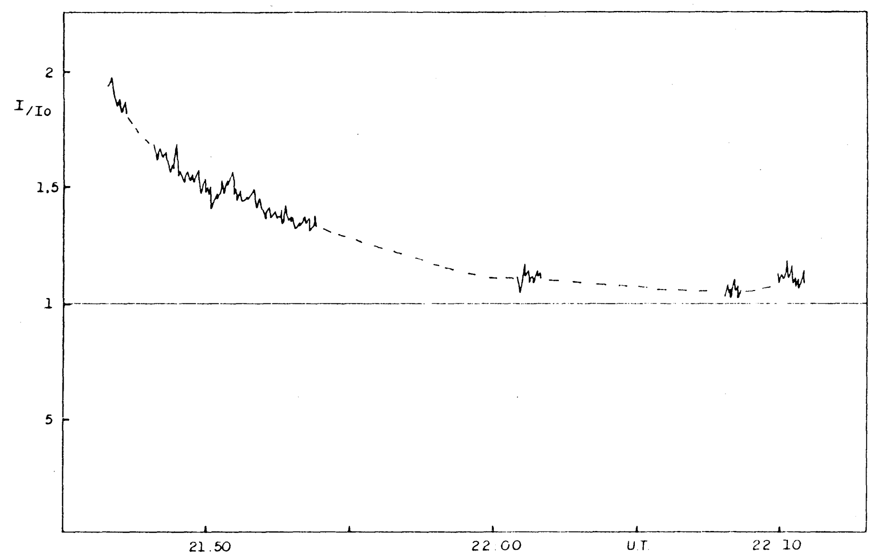

Fig. 3. Flare, in B color, of Gl 425 at the night of June 23, 1971.

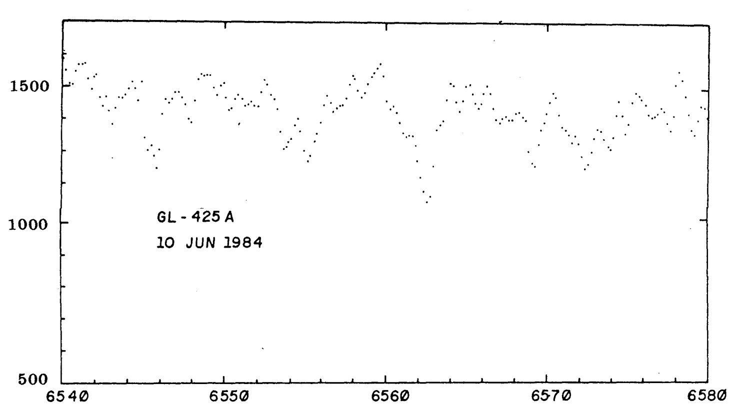

Fig. 4. Gl 425 A Intensified Reticon Spectrum in Hα region taken at June 10, 1984 with the Coudé spectrograph at 18 A/mm from the Brazilian Astrophysical Observatory.

Although Gl 425 is in accordance to hypothesis I, TW PsA is a clearly exception since even at a high dispersion (1.6Å/mm) its spectra at Hα show no trace of emission.

In conclusion, although the rapidly rotating red dwarf emission line stars present evidences of great surface activity, it seems that such activity may be present even in slowly rotating and non-emission line stars.

Note added in proof: six spectra on different nights obtained in 1984 with the Coudé spectrograph at 18Å/mm show Hα of Gl 425 A in absorption (see figure 4). This means that the filled-in Hα line in the Cassegrain spectrum is either an artifact of the reticon or that the star was in an active state (flare). This reinforces that Gl 425 A is an exception to Bopp's hypothesis.

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