

Preliminary results on DI And: a probable W Virginis? (1992-1999)

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DI And (S3535, 208.1943 And, $\alpha=23^{\text{h}} 26^{\text{m}} 50^{\text{s}}$; $\delta=+48^{\circ}56'.0$ ICRS 2000.0) entered the GEOS priority program in 1993. The known facts were scarce, to say the least. Hoffmeister reports (Mitteilungen 1966, Band 3, Haft 5): "The amplitude is less than 1 mag, and the available data favor a delta Cephei classification. Further observations show no significant light variations in a single night study. Maxima seemingly repeat every 3-6 days, but no exact period could be found". No studies have followed this very first communication. In some few databases (e.g. AAVSO) the star is classified as a IS? type object, meaning (Kukarkin 1985) 1. irregular light variations within hours or days; 2. Δm of 0.5-1 mag; 3. no association with nebulosity (Orion type, INS). The reported light range is $m_p = 12.3-13.6$, with unknown spectral type.

We collected visual and photoelectric observations made by GEOS members in the last 6 years, for a total of 379 visual, and 80 photoelectric measures obtained during two missions at the Jungfrauoch Observatory, subdivided as follows:

MAA	visual	228	04.12.1993 - 14.02.1999
VRR	visual	139	30.10.1994 - 11.10.1996
BEN	visual	12	05.09.1992 - 20.09.1993
Jfj	phot.	80	30.08.1997 - 03.09.1997 / 26.08.1998 - 28.08.1998
Tot.		459	05.09.1992 - 14.02.1999

Taken separately, only the 229 measures of MAA and the 139 of VRR return meaningful spectral signals. From the composited light curve, however, only the frequency at $0.2951 d^{-1}$ pass careful inspection. This frequency is detected in both data series with a recursive Fourier transform, being the third most significant line in VRR and the fifth in MAA. When all 459 measures are treated together, the signal at $f_0 = 0.2951 d^{-1}$ and its aliasing stand out by far as the strongest (Fig. 1).

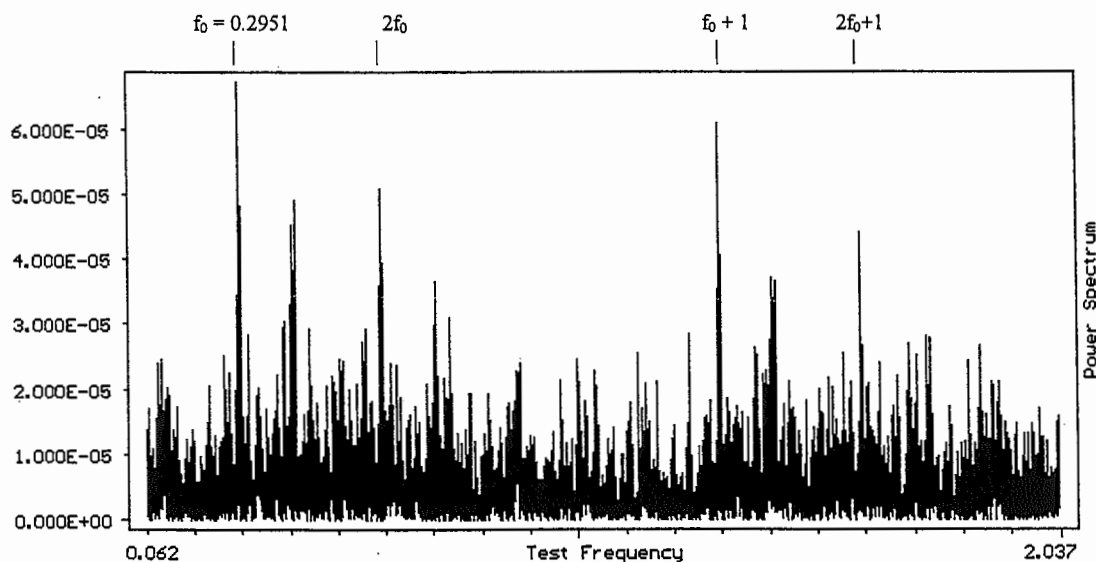


Fig.1 Recursive Fourier Transform power spectrum $[0.1-2] d^{-1}$ at $5 \times 10^{-4} d^{-1}$ frequency resolution on all 459 measures.

The phased light curve computed with $P_0 = 3.38868 d$ is diagrammed in Figure 2. Data from different observers are drawn with different point styles. Figure 3 shows the result when applying an arithmetic mean on the whole data set.

An epoch of minimum could not be directly obtained since the original data are too sparse. Except for the photoelectric series spanning however less than 2 hours ($< 3\%$ of the probable period), the density of visual

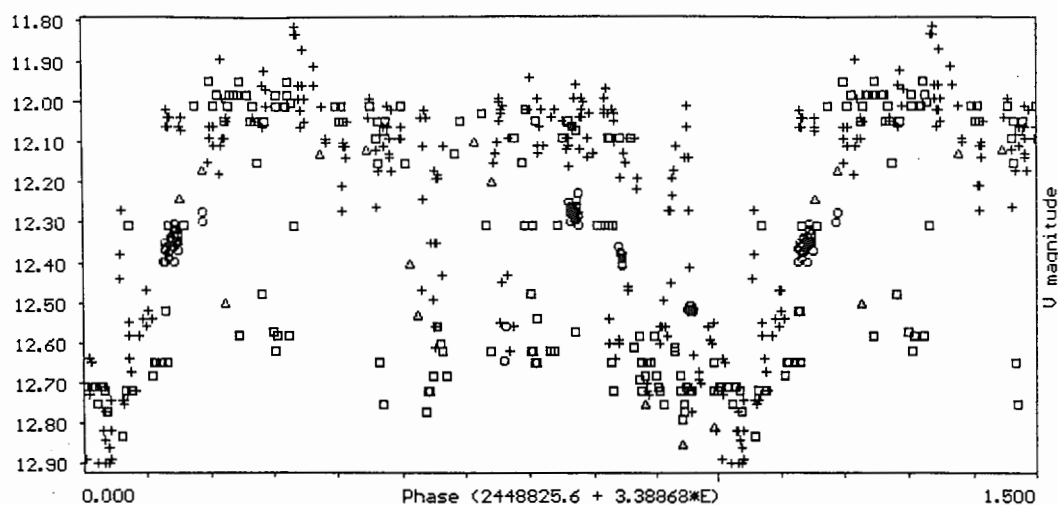


Fig. 2 Compositage over 1.5 of the period ($f_0=0.2951$). Symbols are as follows: MAA (+), VRR (□), BEN (Δ), J.joch (○).

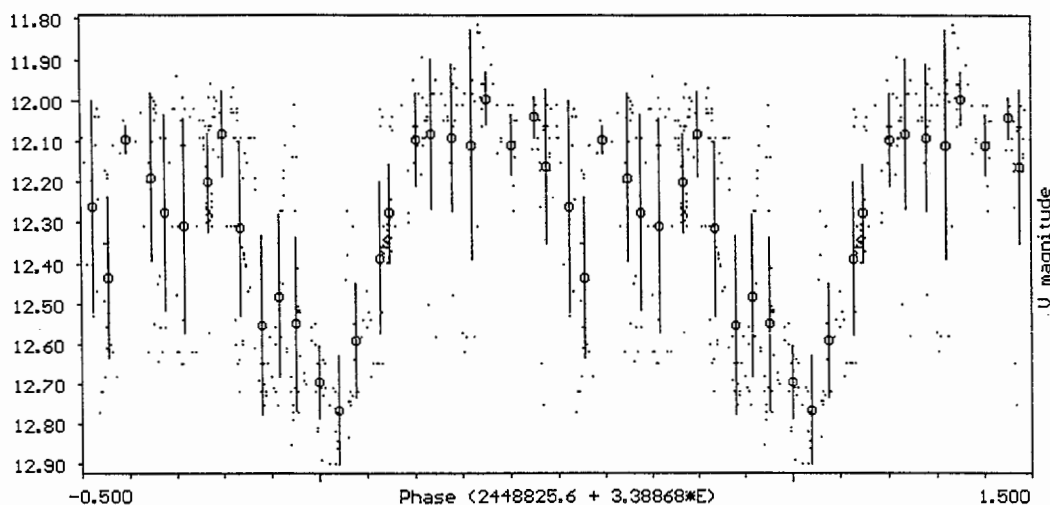


Fig. 3 Arithmetic mean on all data set. The quadratic dispersion bars are also drawn.

observations do not exceed 2-6 data points in the first half of a night, over no more than 2 consecutive nights. Using the phased data to get a fiducial epoch, we propose the tentative ephemeris

$$\text{Min} = 2448825.6 + 3.38868 * E$$

well aware of the fact that a bimodality or semiregularity in the stellar brightness cannot yet be ruled out solely on the basis of the present data. Specifically, the light drop around phase 0.5-0.7 had been detected by all visual observers, and is further supported by at least two photoelectric measurements.

The annealing process of the 379 visual estimations via the zero entropy normalization algorithm (Gaspani, 1995) returns the optimum amplitude 0.86 ± 0.01 mag. As for the Geneva B-V color index about mean 12.37 ($m_v = 11.94 - 12.80$), this is ≈ 0.3 , corresponding to an early F spectral type star.

We can tentatively classify DI And as a W Virginis star. Amplitude (0.86), spectral type (early F) and light curve (a long-lasting maximum, with some continuous, rounded variations, followed by a rapid, asymmetric drop to an acute minimum) all support this interpretation. Irregularities in both amplitude and period are common among these population II objects, though one would expect them to be more drastic at longer periods (>10 d) as the star rapidly evolves through the instability strip.

This star demands more data to certify its classification to the W Virginis group. In view of its possible irregularities we urge observers to plan their observations so to cover a full period of variability and finally get reliable instant of minima.

Processing and plots were obtained by the authors using the Algol Software, Version 2.11. We thank BEN, VRR and RMS for providing their measures. These results were first presented at the GEOS Symposium held in Mt. Generoso last April.