RESULTS OF GEOS OBSERVING PROGRAMS

NdlR : Ce texte est l'exposé présenté par Roland BONINSEGNA lors de la réunion de l'AAVSO à Bruxelles, en juillet 1990.

I. INTRODUCTION

GEOS is an international European group of amateurs and professional astronomers devoted to the observation and study of variable stars. One of the exciting aspects is the visual monitoring of suspected variable stars and named ones lacking valuable published elements. Some of us concentrated themselves on periodic stars with supposed short period, clearly those classified E?,RR?,S?,IS?.

II. OBSERVATIONS

A) METHOD

We mainly use the Argelander or the fractional method, or a mixture of these, to estimate the brightness of the star. Along with the date and time (U.T.), the estimates are recorded in the form A (x) V (y) B , where "x" and "y" are the steps defined by whatever method used.

The comparison stars are to be chosen by the observer himself, but a definitive sequence is set after discussion with other observers. The magnitude of the comparison stars are often unknown, a value is determined in comparison with other reference stars of another variable star in the surrounding, or using a scale expressed in tenth of a magnitude, or even in using an arbitrary scale. One must not forget that the main purposes being the confirmation of the variation and type, and the search of a possible period, several observers could present their own observations with a different scale: the most important is the detection of extreme which should allow to compute a period.

As the stars observed are supposed to vary quite rapidly, several hours of monitoring are needed each night to confirm or not the rapid variations, the amplitude, and to collect enough data for the searching of the star's period if any. With star of high amplitude (at least 1 magnitude), we prefer to use a simple least square method. On the contrary, we use more sophisticated programme for more complicated cases especially when a pulsating period exceed several days.

We observe stars with amplitude variation greater than 0.4 magnitude, but in fact the difficulty of detecting small amplitude variations (less than 1 magnitude) is not a great problem, if you can use suitable comparison stars with one almost matching the mean brightness of the suspected variable star. For more informations, about the visual detection of small amplitude variables, see Cerada et al. (1988).

In general we are lonely observers, but sometimes we gather on a place for several nights of observation, where we observe the same stars with a severe rule: no comments on the behaviour of the stars during the observing session. When some of the stars studied need some confirmation or more precise data, we try to participate or to organize a photoelectric mission into a professional observatory in Europe. Below are two examples of stars observed and studied by GEOS.

B) NSV 4285 Cnc

Discovered by Weber (1962), the star was listed in the New Catalogue of Suspected Variable Stars (1982) as a star with rapid variation. Its coordinates for 1950.0 are the following : α: 8h40m56s δ: +24°00' (see Figure 1). The visual observations began in 1983. during the first night, it became obvious that the star was indeed varying rapidly. Only a few nights were necessary to precise the RRAB type. Until 1989, 19 Geos observers performed 2200 estimates and recorded 66 maxima. Figure 2 presents the composite light-curve made by the author using more than 800 visual estimates, compared with the photoelectric V curve (see next paragraph). From that figure, one can notice the very good agreement in phase between the two curves. More worrying is the scattering of the visual curve especially around the minimum light. How to stand for the visual observation of low amplitude variable stars in these conditions ? It could be explain by an astrophysical, a psychological and an atmospheric reason. NSV 4285 is a star, as most RRAB stars, affected by a Blazkho-effect which distorts the light-curve in phase and in brightness. More important is the way the observer express the brightness of the variable when it match a comparison star: in the Figure 2, it is obvious that the observer sometimes notes the brightness of the variable as equal as the comparison (arrows), but never notes correctly the brightness of the variable to be just a little more or less bright than the comparison star. That effect was already noticed long ago, and affects many observers. However, it is clearly seen on composite light-curves construct from many estimates, as two empty spaces just up and below the brightness of each comparison star. Visual observations, made during several hours along the night, are not corrected from differential absorption which could affect especially the bluer stars, if the comparison stars are not of the same color. All in these, account for the scattering of this light curve. Figure 3 presents the 100 mean points from the same visual light-curve.

During two photoelectric missions at the end of 1987 and 1988, 79 measures in B and V were recorded by Geos members using a cooled photometer equipped with filters of the Geneva photometric system, attached to the Jungfraujoch Observatory's 76 cm telescope . Transformation of the B-V values from Geneva system into Johnson and Morgan's system, was made using Meylan and Hauck formulae (1981). The V amplitude reach just 1.0 magnitude (see Figure 2).

All the data now allow us to publish the first ephemeris for NSV 4285. The error bands were calculated with a 95% level of confidence.

$$\begin{array}{lll} \text{H.J.D. } 2447153.696 & + & 0.545785 \text{ E} \\ \pm 0.003 & & \pm 0.000002 \end{array}$$

From time to time, others observations will be necessary to check the ephemeris, as it should be interesting to do the same with many others RR Lyrae or eclipsing stars.

C) RRVI-51 Lyn

Discovered by Kinman et al.(1982) during a search for RR Lyrae stars towards the galactic anticenter, the star was classified as an EA? eclipsing, relying on 63 photographic plates. These photographic observations range from 10.70 to 12.60 with a mean at 11.20. However, the star was too bright for the 20 inch Lick astrograph, so that the measures are somewhat imprecise. Its 1950.0 coordinates are the following: α:7h53m03s δ: +40°50.9 (see Figure 4). From 1983 to 1987, 11 Geos observers have made about 1000 visual estimates. After several nights, it became clear that the star was indeed an eclipsing binary with a period of 1.2 d., but not of the EA type: the brightness variation were found to be continuous with minima of unequal amplitude, like EB systems, with a maximum amplitude a little less than 1.0 magnitude. Using 17 primary minima, determined by the tracing paper method, a first ephemeris was calculated.

To check the validity of this first ephemeris, we have made a composite light curve on the photographic observations (see Figure 5). A primary minimum, clearly visible, is shifted around phase 0.97, but there is no evidence for a secondary one. For more information, see Dequinze (1990).

A mean visual light curve of 40 mean points was computed using the final ephemeris and 455 estimates from the author. The near sinuate aspect of the curve reinforce the EB type for the star (see Figure 6).

Three photoelectric missions at the end of 1987,1988 and 1989, organized by Geos at Jungfraujoch Observatory in Switzerland, have recorded 227 measures in B and in V, using a cooled photomultiplicator photometer equipped with filters of the Geneva photometric system, attached to the 76 cm telescope . Transformation of the B-V values from Geneva system into Johnson and Morgan's system, was made using Meylan and Hauck formulae (1981). The shape of the V light curve confirms the visual observations, the amplitude reach 0.89 magnitude for the primary minimum and 0.33 magnitude for the secondary one (see Figure 7). The B-V index light curve (see Figure 8) shows clearly that the system is composed of two early type A stars: the bluer and hotter component is occult by the secondary during the primary minimum, the total amplitude of the color index is faint (0.13 magnitude). The system unocculted (at maximum light) seems a little redder and fainter before primary minimum than after.

New photoelectric data now allow us to improve the first ephemeris for RRVI-51 published by Dequinze (1990). The error bands were calculated with a 95% level of confidence.

$$\text{H.J.D. } 2442776.961 \pm 0.007 + 1.199839 \pm 0.000005 \text{ E}$$

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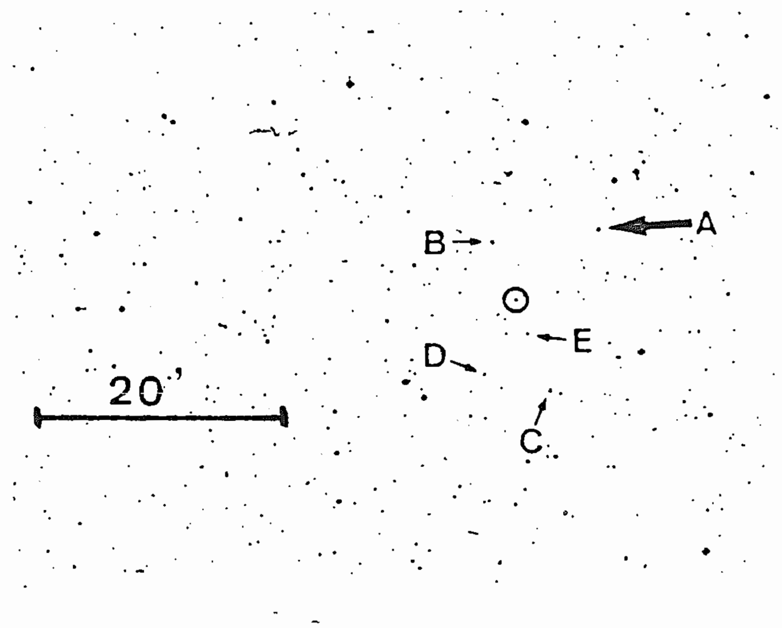

Figure 1: NSV 4285 and its comparison stars

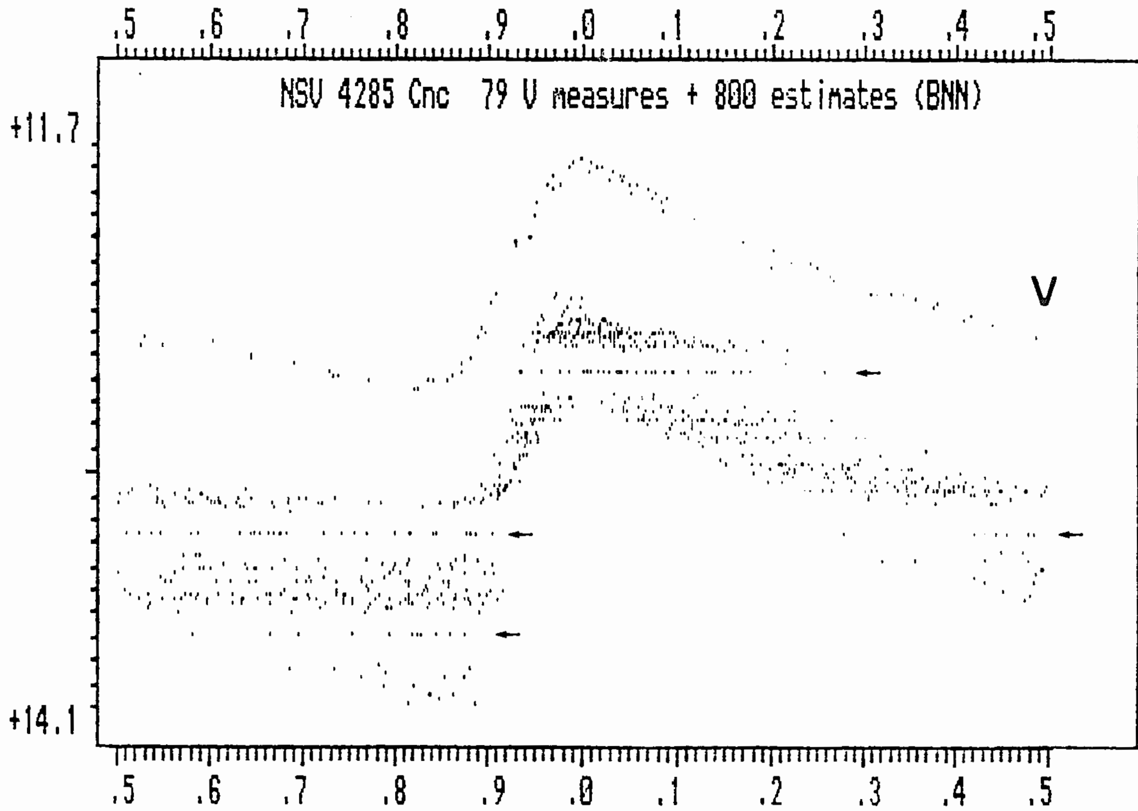

Figure 2: Composite light-curve on NSV 4285, from 800 visual estimates made by the author, compared with the V curve made at Jungfraujoch Observatory (Switzerland)

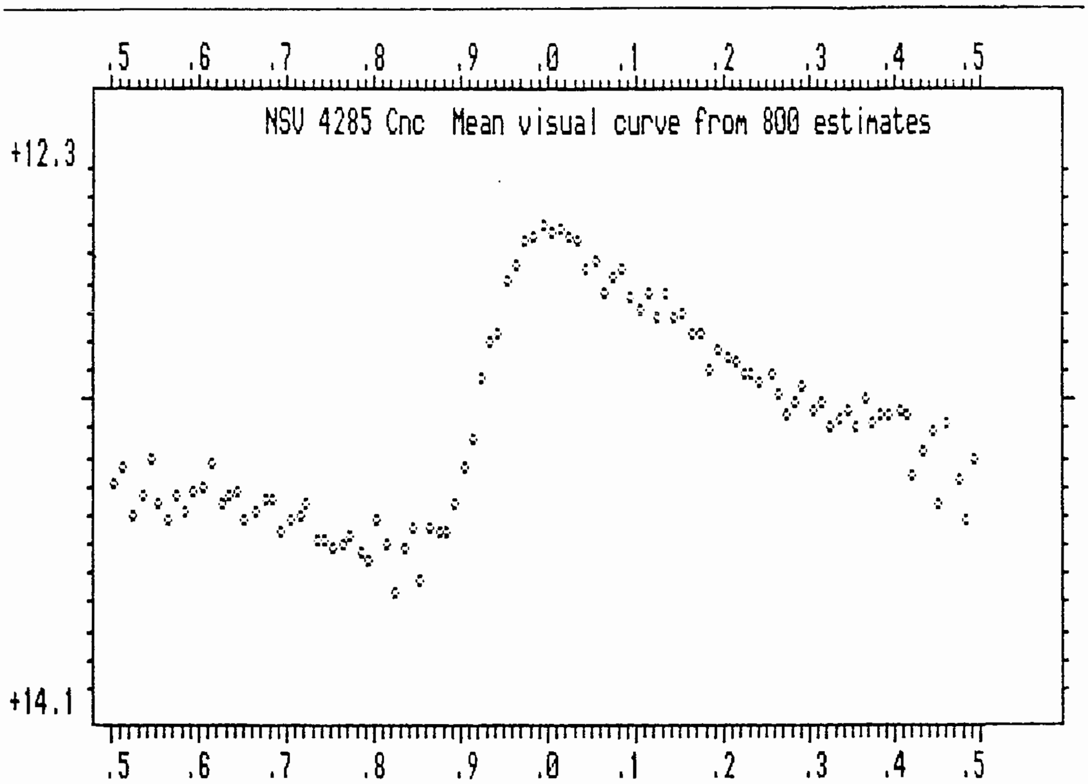

Figure 3

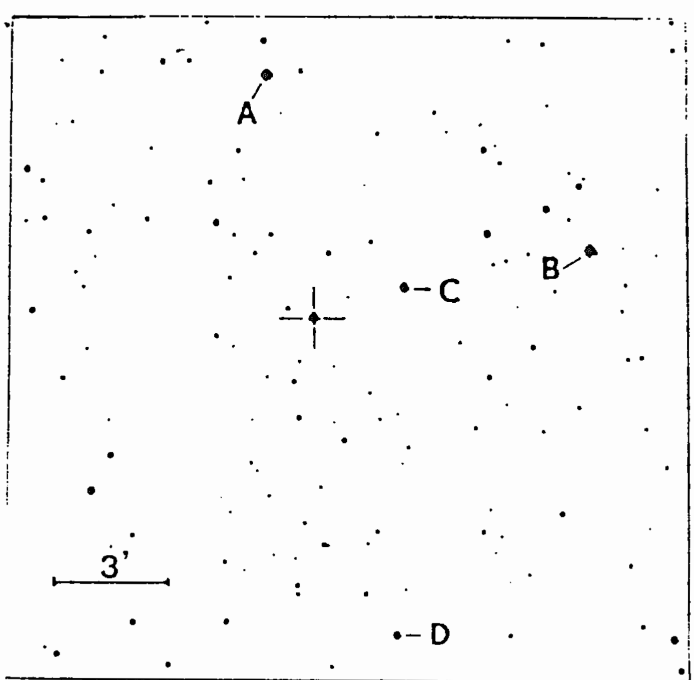

Figure 4:

RRVI-51 and its comparison stars

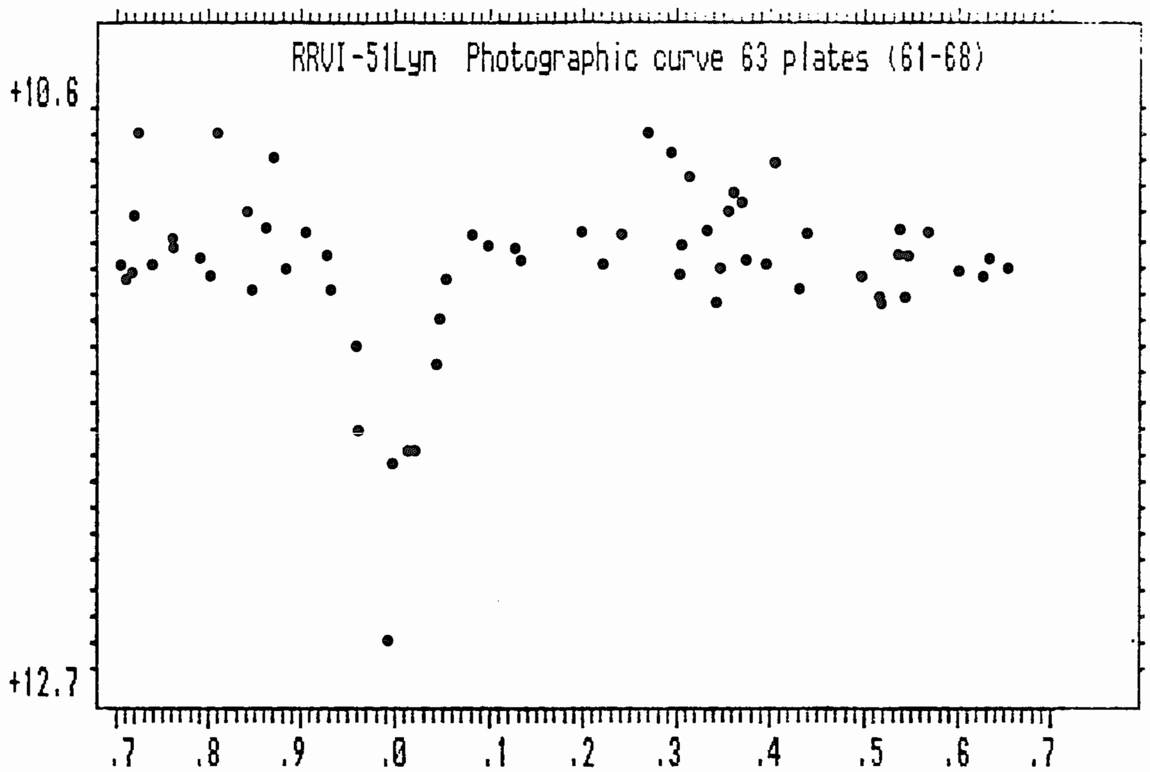

Figure 5: Photographic curve rebuild from 63 plates (Kinman et al. 1982) using the ephemeris of this paper. No secondary minimum is visible

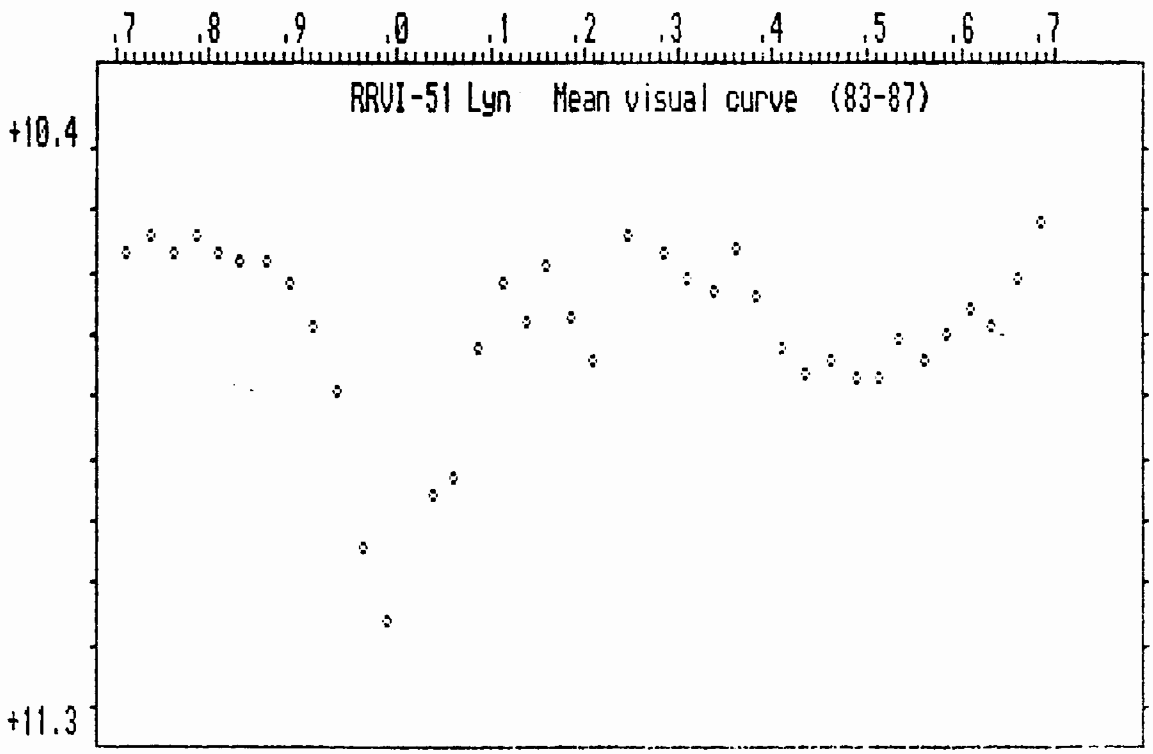

Figure 6: Mean composite light-curve on RRVI-51, from 455 visual estimates made by the author

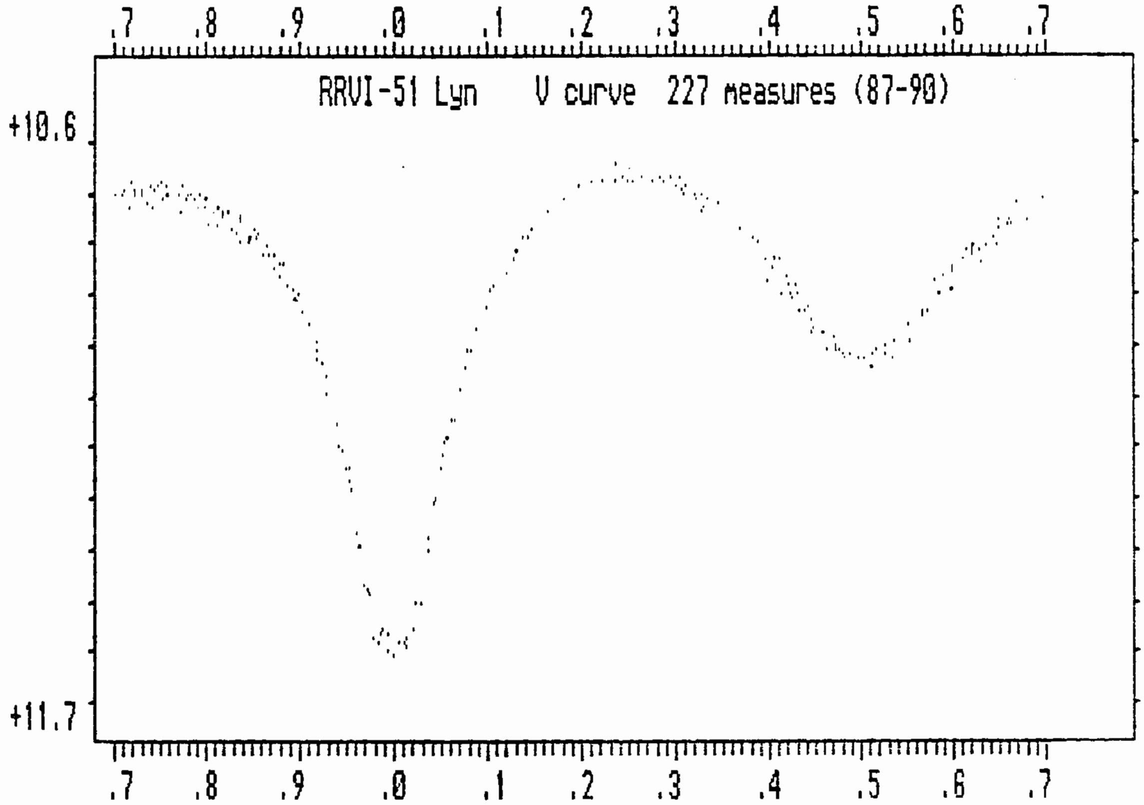

Figure 7: Photoelectric V curve of RRVI-51 made at Jungfraujoch Observatory

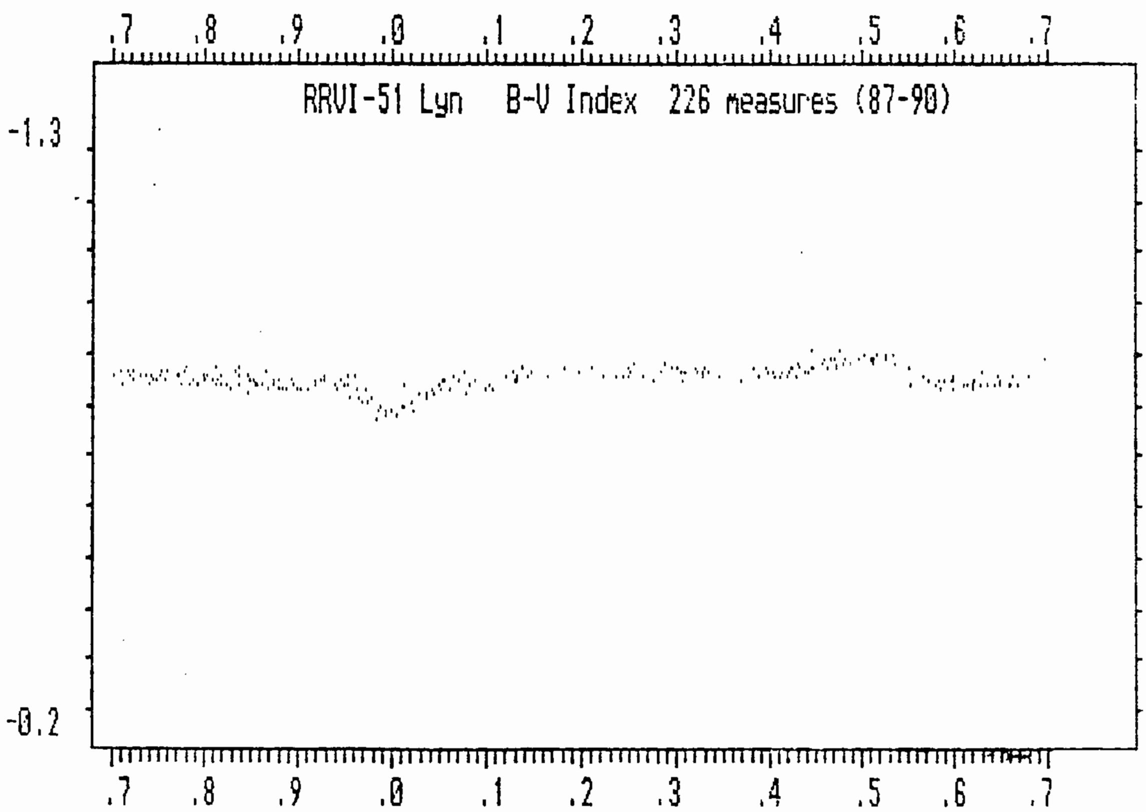

Figure 8