

THE MYSTERY OF HR 6815

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Presented at the 85th AAVSO Annual Meeting, November 2, 1996

Abstract

The catalogue data for HR 6815 (V669 Herculis) are very incomplete. A literature search was carried out in an attempt to find the missing parameters, and a possible source for the single catalogued datum was found. Further suggested elements are provided, based on 105 photoelectric observations made between 1991 and 1996.

1. Introduction

HR 6815 (V669 Her) is listed in *Sky Catalogue 2000.0* (Hirschfield and Sinnott 1985) as type unknown, maximum and minimum unknown, period 6.3 days, and amplitude 0.14 magnitude. In the fourth edition of the *General Catalogue of Variable Stars* (GCVS)(Khopolov *et al.* 1985), the data are the same, but the 6.3-day period is omitted. How could a star earn a variable star designation with so few parameters available, and how could a precise period and amplitude be obtained without knowing maximum and minimum?

Also known as 104 Herculis, HR 6815 was assigned to the author as an “adopted” star in Project SARV (Percy *et al.* 1994). This photometric survey of the known and suspected variables in the *Bright Star Catalogue* (Hoffleit and Jaschek 1982) has the purpose of clarifying their variability status, and learning more about their pulsation properties, processes, and evolution. A preliminary report on the progress of the project (Percy *et al.* 1994) gave for HR 6815 a range of 4.88 to 5.00 in V and a period of about 20 days.

2. Photometry

Photoelectric photometry was carried out with an Optec SSP-3 photometer attached to a 0.25-meter Schmidt-Cassegrain telescope and a 286 computer running Robert Jones’ data acquisition program ACQ (Jones 1991). The computer handled the recording of real time, the length of the integration periods, and the averaging of the three integrations, and produced a data file which was fed to the AAVSO reduction program written at AAVSO Headquarters by Charles M. Jones.

Figures 1–5 show the light curves produced from data obtained in 1991, 1992, 1993, 1995, and 1996, respectively. No observations were made in 1994. Figure 6 shows the power spectrum obtained from all 105 observations, using the Date Compensated Discrete Fourier Transform program of the Maria Mitchell Observatory (Ferraz-Mello 1981), which shows a best fit of 21 days and a second-best of 22 days.

Working from the light curves directly, 10 clearly-marked maxima can be seen, with the following separations: 18, 42, 27, 24, 19, 33, 29, 17, 20, and 22 days. This gives a mean separation of 25.1 days. The maximum ΔV is -0.834, and the minimum is -0.685, indicating an amplitude of 0.149.

3. Searching for solutions

The fourth edition of the GCVS, in which the designation V669 Herculis first

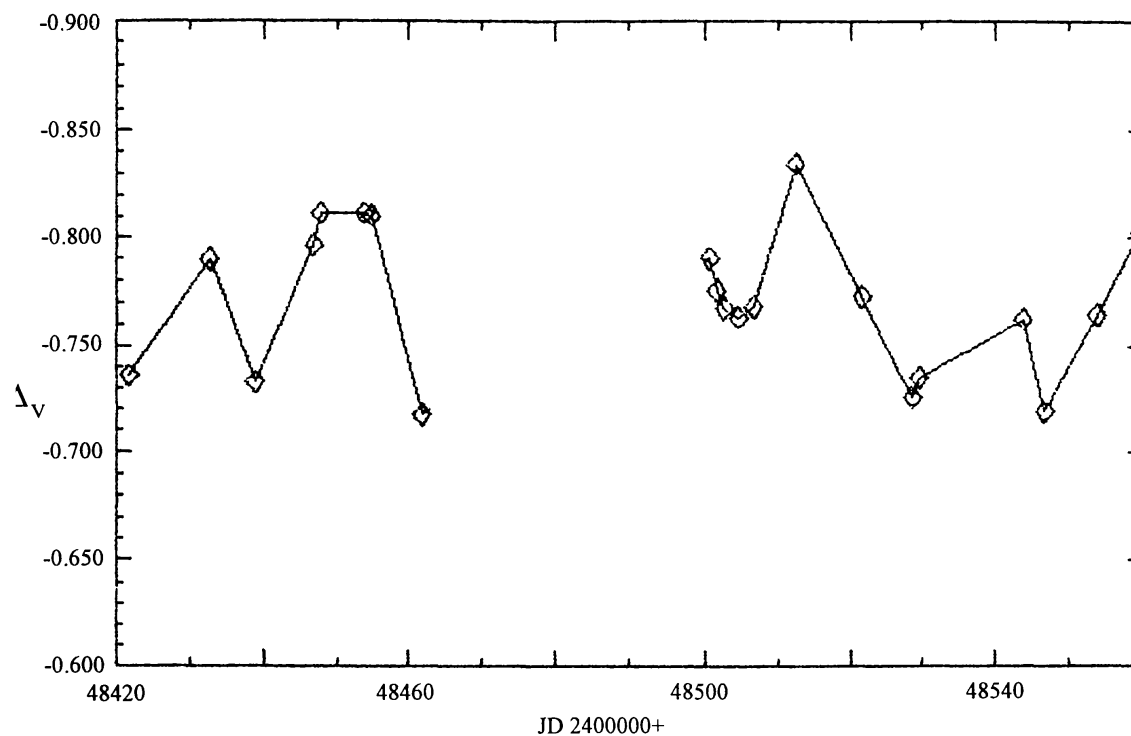


Figure 1. Photometric light curve of HR 6815 for 1991. Assuming the second maximum occurred midway between JD 2448447 and 2448453, the separation between the first two maxima is 18 days. There were no other clearly defined maxima this year, and the gap between 2448461 and 2448500 was produced by a summer holiday hiatus.

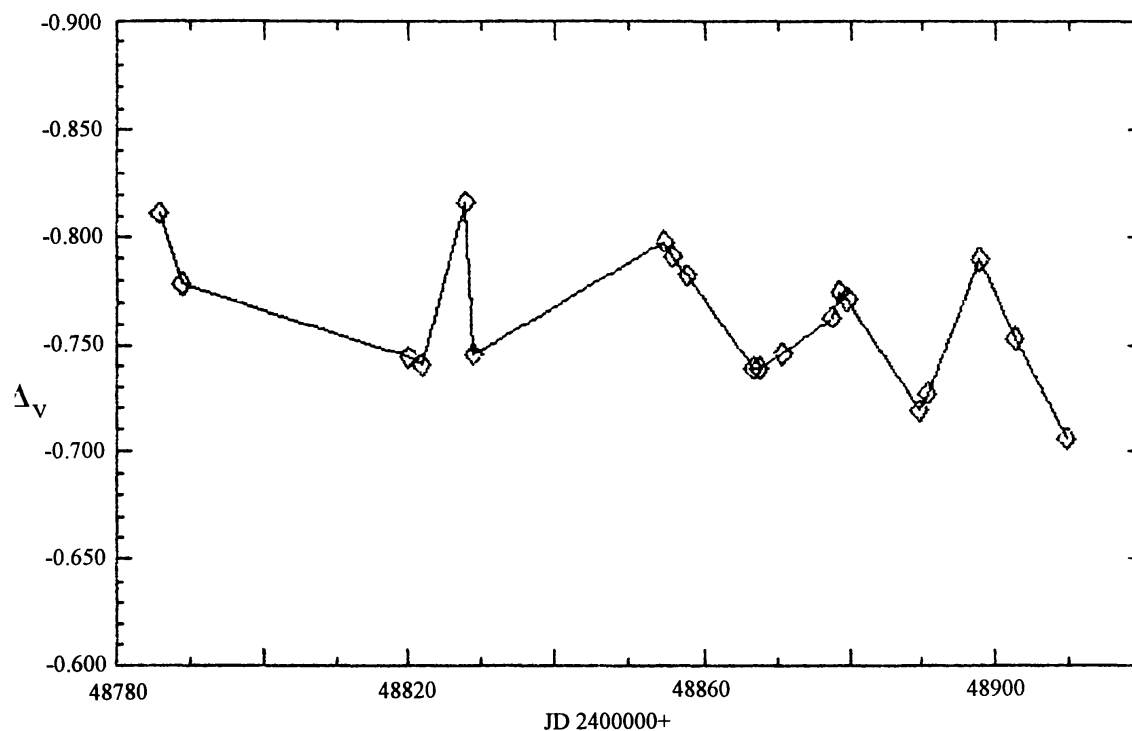


Figure 2. Photometric light curve of HR 6815 for 1992. This year saw 5 well-defined maxima with separations of 42, 27, 24, and 19 days.

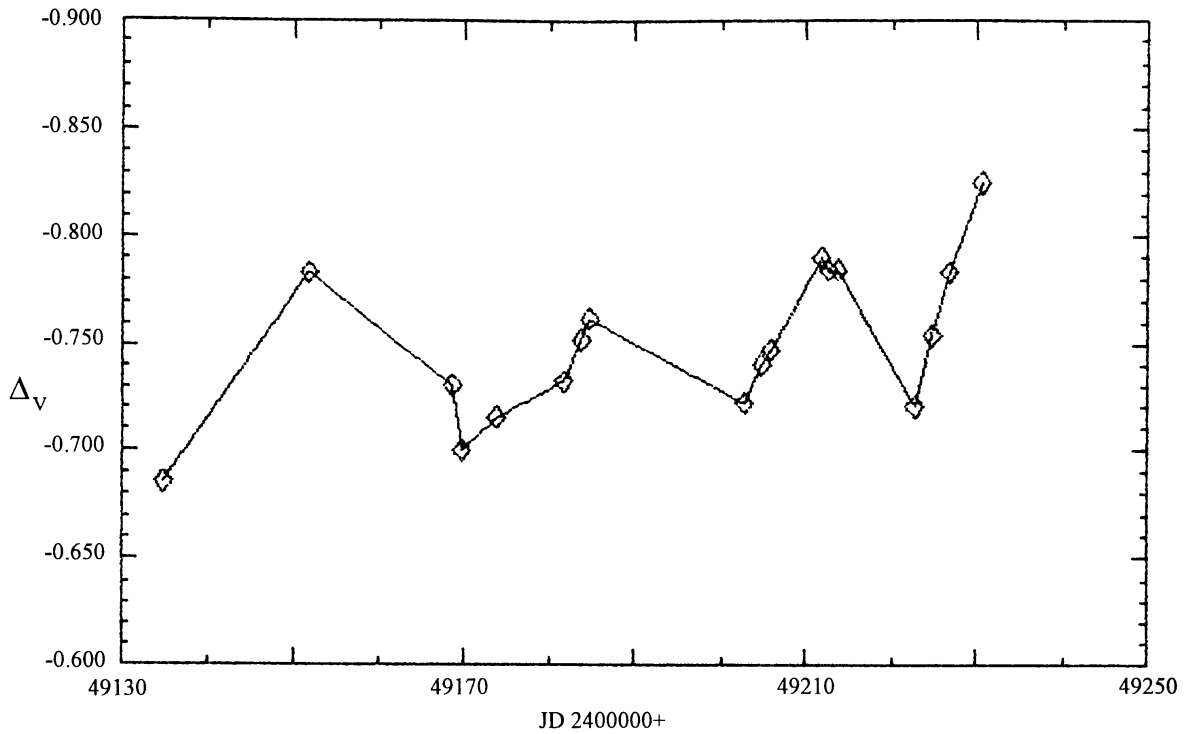


Figure 3. Photometric light curve of HR 6815 for 1993. Another 4 clear maxima were observed in 1993. The separations are 33, 29, and 17 days.

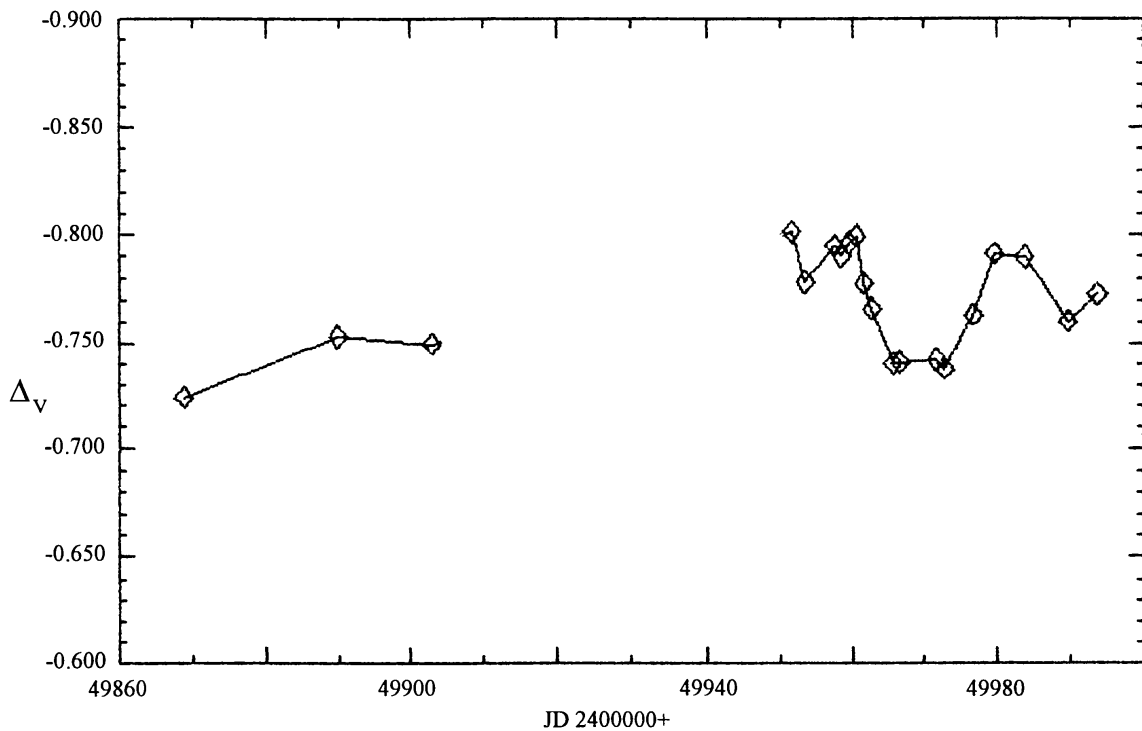


Figure 4. Photometric light curve of HR 6815 for 1995. Once again there was an unavoidable holiday gap from JD 2449902 to 2449951. Estimating the final maximum as occurring between 2449983 and 2449997, the separation between the only two well-defined peaks is 20 days.

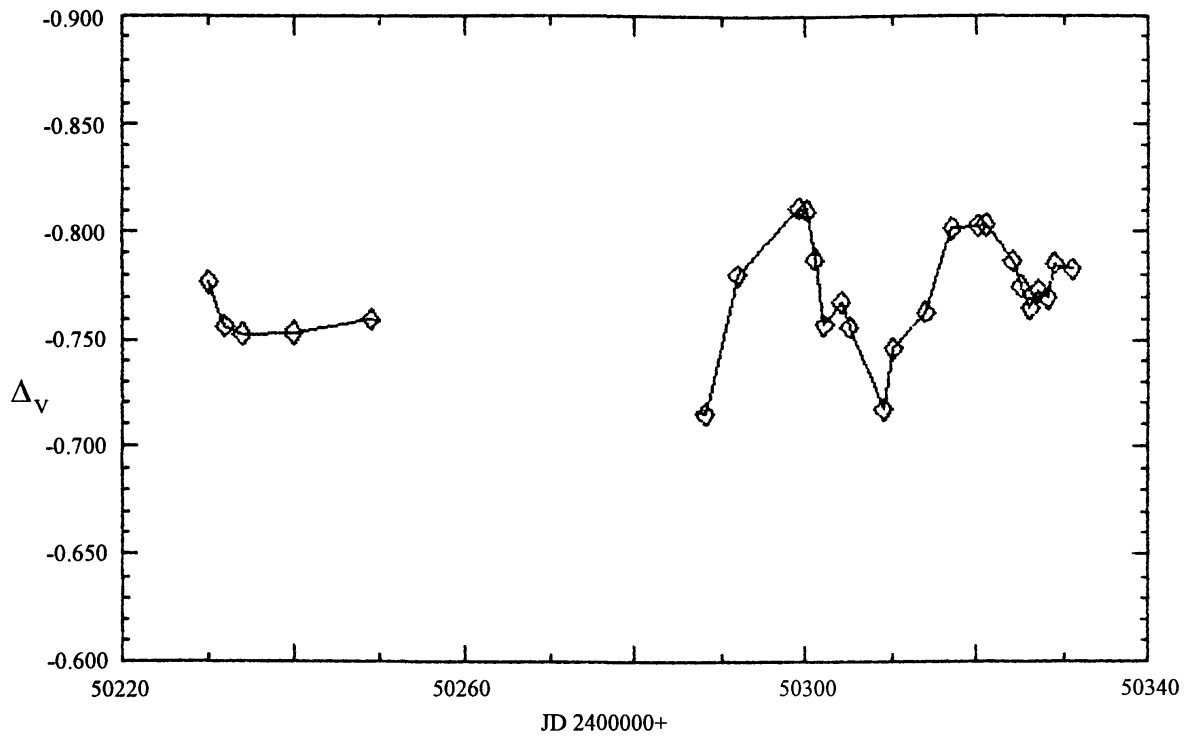


Figure 5. Photometric light curve of HR 6815 for 1996. Once again there is a gap in the data, but the last half of the season produced two maxima, separated by 22 days.

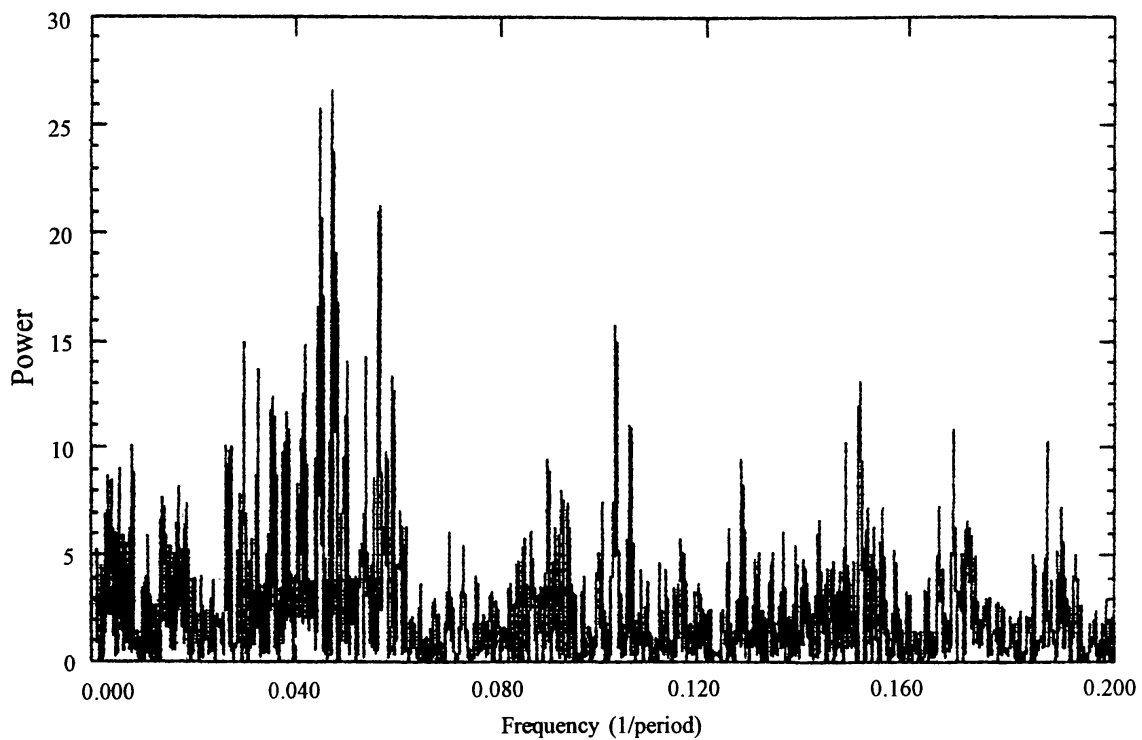


Figure 6. HR 6815 power spectrum, 900 days to 5 days. The two outstanding peaks represent periods of 22.54 and 21.24 days, respectively. The results derive from 1900 trials by the Date Compensated Discrete Fourier Transform program of the Maria Mitchell Observatory, using all 105 data points.

appears, contained a note of a 1928 paper by Stebbins and Huffer from the Washburn Observatory, entitled "The Constancy of the Light of Red Stars" (Stebbins and Huffer 1928). HR 6815 is one of 190 stars observed and the only data listed are 12 observations spread over 415 days, a range of 0.14 magnitude, an average deviation of 0.036, and the indication "variable." There is no mention of maximum, minimum, or period.

In the literature I found references to the star in connection with spectral class, color index, space motion, and absolute magnitude, but nothing relating to periodicity. The closest approach was a 1973 paper by O. J. Eggen, "The Classification of Intrinsic Variables. IV. Very-small-amplitude, Very-short-period Red Variables" (Eggen 1973). Periods and amplitudes are given for 22 stars, but HR 6815 is not among them. It is, however, listed in his Table 4 under the title "Candidates for Very Small Amplitude, Very Short Period Red Variables." Unfortunately, the table provides only color indices, not maxima, minima, periods, or amplitudes, though there is a note referring to the Stebbins and Huffer range of 0.14 magnitude. A check of the index of the *International Bulletin of Variable Stars* produced no reference to HR 6815 or 104 Herculis.

In exploring the literature, use was made of both a Simbad search and the *Bibliographic Catalogue of Variable Stars* (Huth and Wenzel 1983).

4. Conclusions

The general appearance of the light curves suggests a semiregular star with pulsations fluctuating about a mean of just over 20 days. Assuming a magnitude of 5.71 for the comparison star, the range in V would be from 4.876 to 5.025.

The source of the 6.3-day period mentioned in *Sky Catalogue 2000.0* (Hirschfield and Sinnott 1985) remains a mystery. It is possible that a variable star name was assigned to this star in the 1930's on the basis of the Stebbins and Huffer paper alone, but no references to this event were uncovered in my search of the literature.

5. Acknowledgements

This research has made use of the Simbad database, operated at CDS, Strasbourg, France. (Web site: <http://cdsweb.u-strasbg.fr/CDS.html>) The author also wishes to acknowledge the invaluable help of Dr. Stefan Mochnecki, Dr. John Percy, and Ms. Marlene Cummins, Librarian, all of the Astronomy Department, University of Toronto, and also Dr. Douglas Welch of the Physics Department, McMaster University.

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