

Recent measurements of HR Del – formerly Nova Del 1967

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This short article is the result of an unexpected triple coincidence. On July 12th I gave a talk at the BAA Summer Meeting at University College London about the variable star observations of Sir Patrick Moore. The star he observed most over the years, and therefore one of the stars which I highlighted in my talk, was the nova discovered in Delphinus in 1967 by George Alcock and subsequently given the name HR Del. Shortly afterwards Prof Joe Patterson, who coordinates observations by the global network of amateurs known as the Center for Backyard Astrophysics, proposed an observing campaign on a number of old novae including HR Del. And finally, we had an unusually long run of clear nights during late July which enabled me to obtain time-series V-band photometry of HR Del on 9 nights between July 21st and 31st.

Joe's interest was to see if there was any evidence in the light curve of periods other than the orbital period of 0.214165d found spectroscopically by Kuerster & Barwig (1988) and later confirmed photometrically by Friedjung et al. (2010).

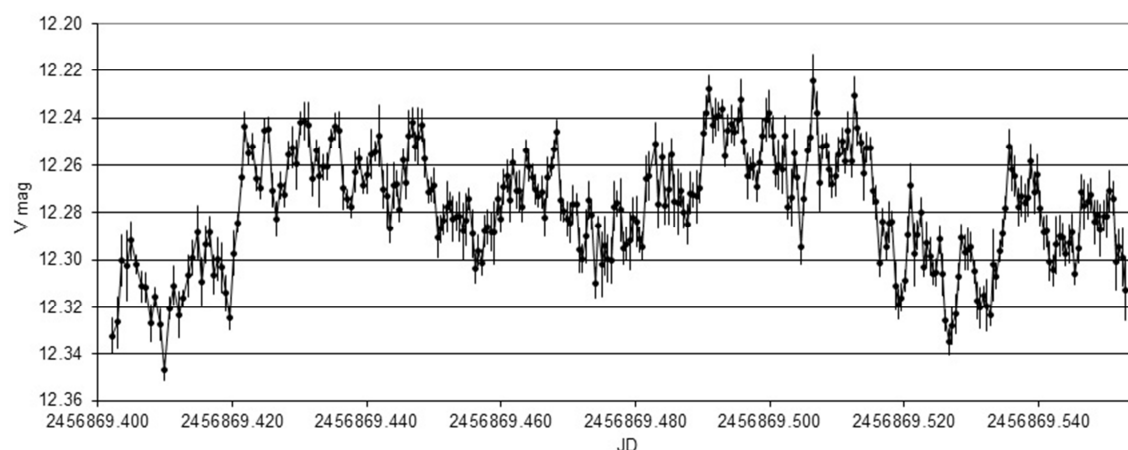


Figure 1. V-band light curve of HR Del pn 30 July 2014.

Figure 1 shows a typical light curve from July 30th. The star displays continuous, apparently random, flickering with average total amplitude about 0.04 mag. This indicates the likely presence of an accretion disc in this white dwarf plus donor star binary system. As the inclination of the binary orbit is reported to be around 42 degrees there are no eclipses.

A period analysis of all my data using the Lomb-Scargle method in Peranso gives the power spectrum shown in Figure 2. According to Peranso the strongest signal is at a period of 0.2142 ± 0.0012 d, consistent with the published orbital period. Inset into Figure 2 is the spectral window function of the data showing that strong alias signals with frequency differences of $1c/d$ are to be expected since the data were recorded at one day intervals.

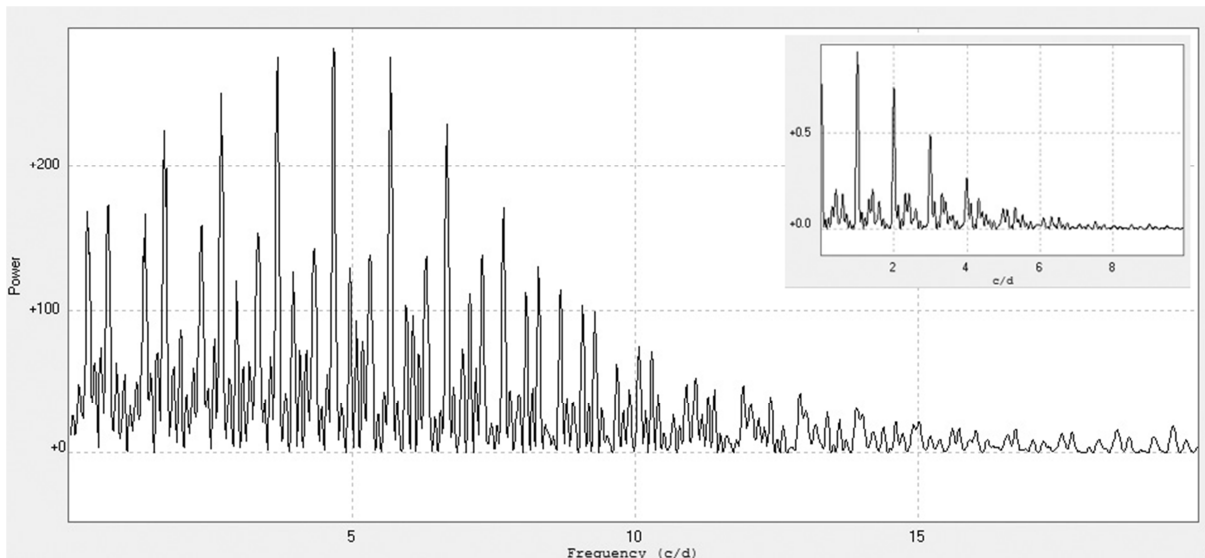


Figure 2. Power spectrum of HR Del and spectral window function.

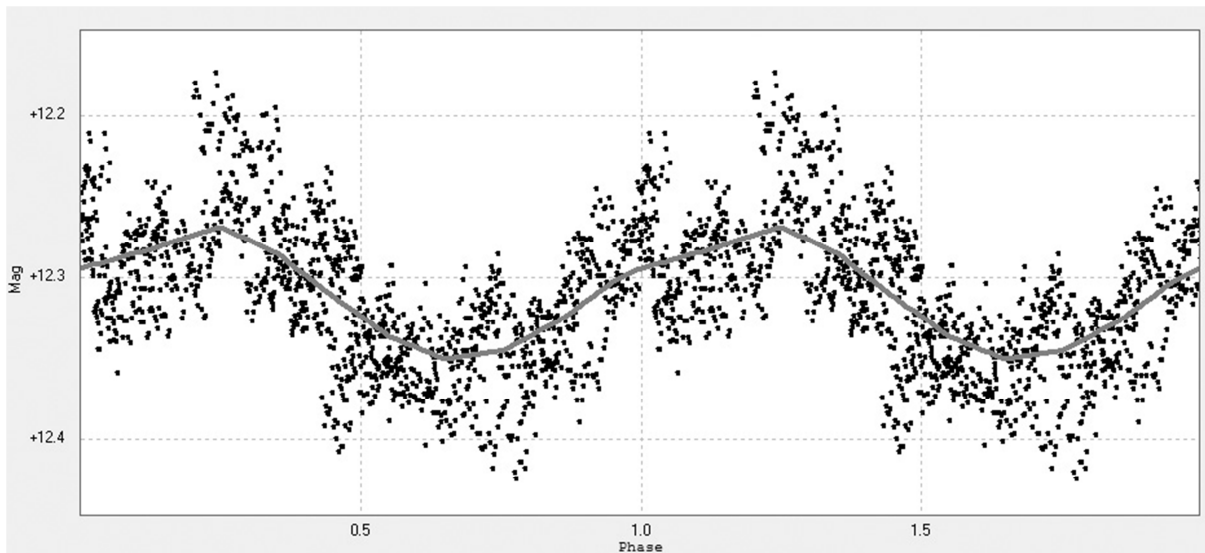


Figure 3. Phase diagram of HR Del for the orbital period of 0.2142d.

Figure 3 shows the phase diagram of the data folded on this period with the orbital modulation of about 0.08 mag clearly visible under the scatter due to flickering. Removing this period does not reveal any other periods of significance within this relatively small amount of data. In due course my data will be combined with that of other CBA observers at different longitudes to provide a more comprehensive analysis.

The long term light curve of HR Del from the BAAVSS database shown in Figure 4 is unusual in that little change has occurred in its magnitude over the last 30 years. When preparing my talk I recorded a spectrum of HR Del, Figure 5, which shows that it is still a very hot object, probably because thermonuclear burning of hydrogen continues at a low level on the surface of the white dwarf and maintains its magnitude. The flux level in my spectrum is very similar to that of a spectrum obtained at the INT 6 years ago as reported in Friedjung et al. They speculate that the orbital modulation is due to irradiation of one face of the donor star by the hot white dwarf and its accretion disc.

Light Curve for HR DEL

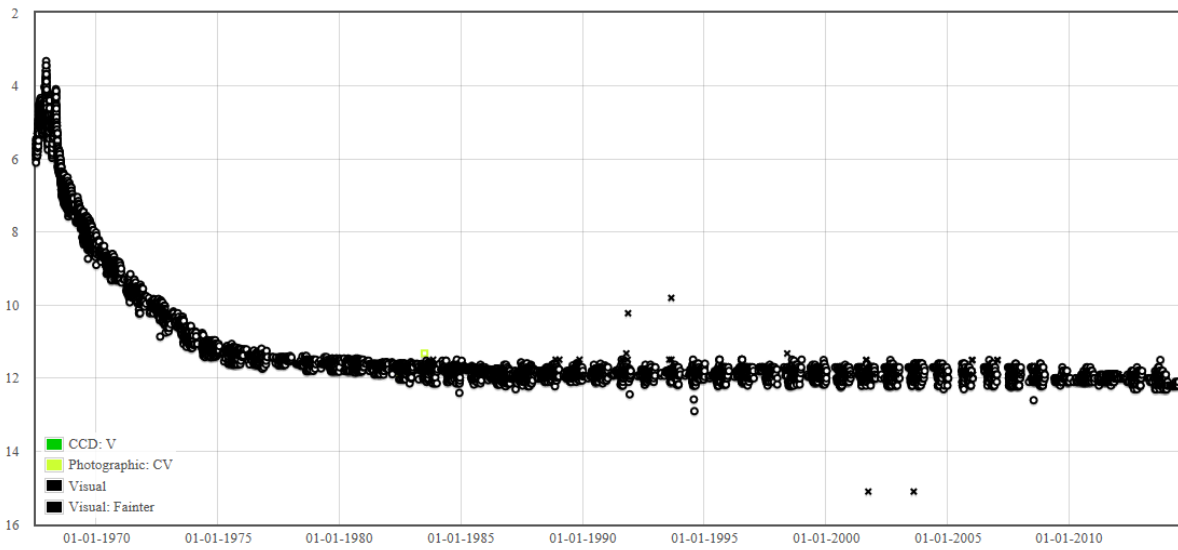


Figure 4. Long term light curve of HR Del from the BAAVSS database.

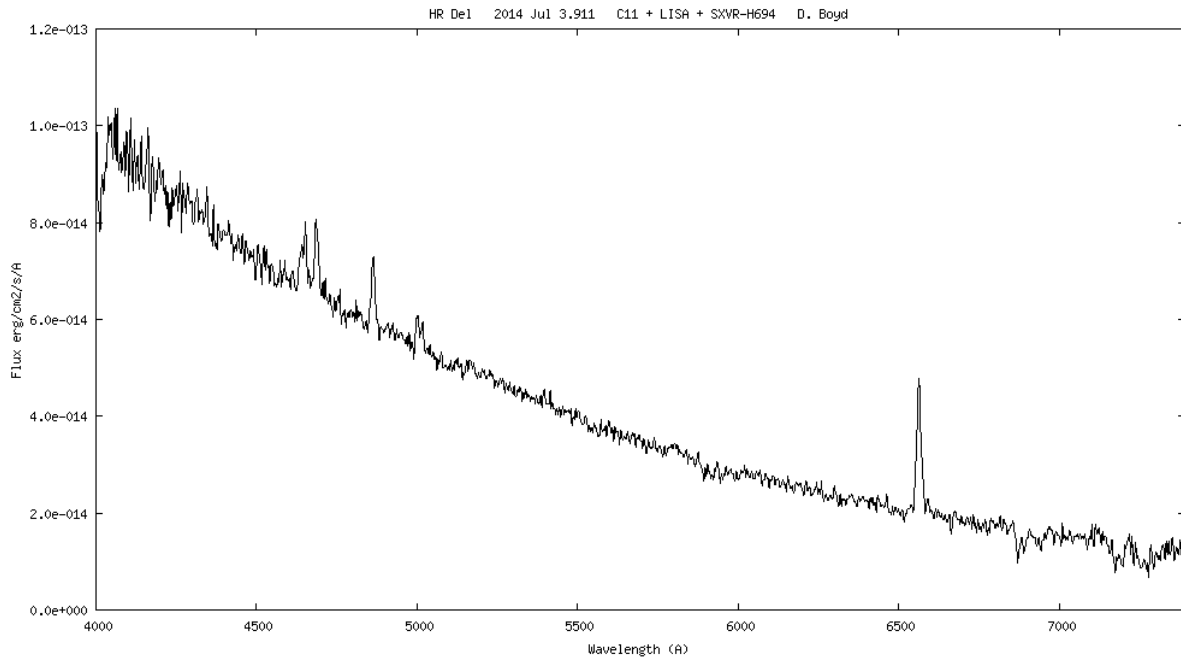


Figure 5. Spectrum of HR Del taken on 3 July 2014.

The fortunate set of circumstances which fell in place during July and led to my observing this star shows that even small contributions from a single observer can provide useful information.

References

- Kuerster M. & Barwig H., *Astronomy & Astrophysics*, 199, 201 (1988)
- Friedjung M. et al., *Astronomy & Astrophysics*, 521, A84 (2010)
- Peranso, <http://www.peranso.com/>

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