R Centauri, an Interesting Southern Variable

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Abstract An analysis of the long period Mira-type variable R Centauri, based on 527 visual observations over 3,350 days, is presented.

1. Introduction

R Centauri (R.A. $14^h12^m57^s$, Dec. –59° 04.0' (1950)), is a very interesting southern variable star. According to the fourth edition of the *General Catalogue of Variable Stars* (GCVS, Kholopov *et al.* 1985), R Cen has been classified as a long period Mira-type variable with the following elements: 1) Range of variation in *V* light: 5.3 at maximum and 11.8 at minimum; 2) Spectral type: varies between M4e and M8 Iie; 3) Ephemeris for maximum: Tmax = JD 2441942 + 546.2 E; 4) Morphology of the light curve points to a double-maxima Mira-type variable.

2. Observations

This study is based on 527 visual observations performed by Dominguez during the interval JD 2447195–JD 2450545 (3,350 days), which covers six main cycles of R Cen. The visual measurements were performed with a 104-mm (4-inch), *f*/d = 8.9, Newtonian telescope, with a 23-mm Kellner eyepiece, using the real step Pogson's method.

3. Reduction, analysis, and discussion

Using these observations, we determined the power spectrum using software by Bazterra and García (1992). The discrete Fourier analysis gave two periods: one that included the whole maximum of 261.9 days, and the other that discriminated between the two maxima of 524.3 days. The mean light curve, using JD 2447407 as an initial epoch of primary maximum and a period of 524.3 days, is plotted in Figure 1 (left panel), and is centered on a primary maximum. We then determined the times of the primary and secondary maxima, and applying least-squares, we found the following new elements, in complete agreement with Fourier analysis: T_{max} = JD 2447406.71 (±0.48) + 524.31 (±0.16). The standard error for the

calculation R^2 was 0.9999996. The shape of the mean light curve, from Figure 1, is (m II–M I)/P=0.26; (M I–m I)/P=0.77; (M II–m II)/P=0.18; (m I–M II)/P=0.33. The amplitude between M I and M II is 1 magnitude, and between m I and m II is 2 magnitudes. Due to the presence of other peaks in the power spectrum, we analyzed the observations using software called Weighted Wavelet Z-transform (Foster 1996), resulting in the two-dimensional diagram (Figure 1, right), which shows the weighted wavelet Z-transform for the different frequencies involved in the time-series, and their behavior. The shift of the curves means a change in frequency. For the center at about 0.0018, it means an increase in frequency. For the center around 0.004, the frequency decreases. The other peak is diffuse and shows how the curve appears to smooth softly.

4. Conclusion

The new obtained elements are the best representatives of the star's behavior for the interval from February 1988 to April 1997, but due to the results of the weighted wavelet Z-transform analysis, it is not possible to accept them as valid hereafter. Further analysis will be performed using a data series longer in time.

5. Acknowledgements

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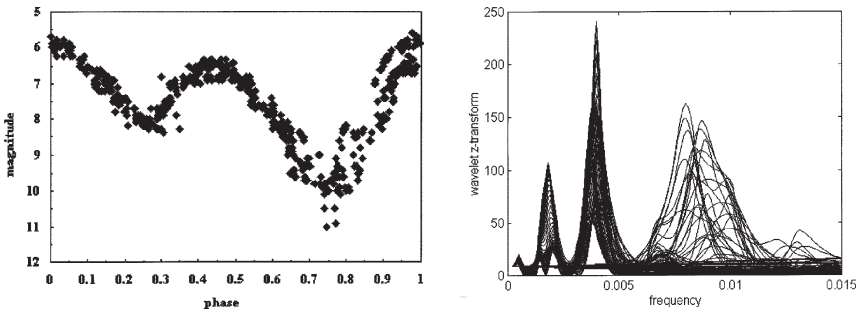

Figure 1. Left: mean light curve for R Cen, P = 524.31d; right: weighted Wavelet Z-transform for R Cen.