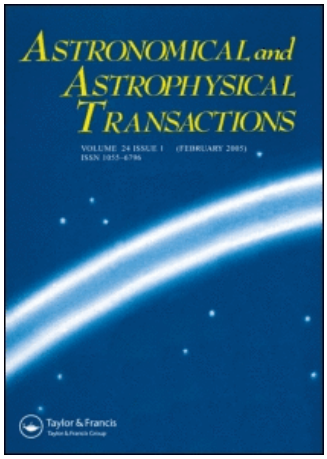

Astronomical & Astrophysical Transactions
The Journal of the Eurasian Astronomical Society
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713453505

Observational evidence of interacting processes in the system TW Draconis

M. Zejda [a]; Z. Mikulášek [a]
[a] Institute of Theoretical Physics and Astrophysics, Masaryk University, Brno, Czech Republic

Online Publication Date: 01 February 2007
To cite this Article: Zejda, M. and Mikulášek, Z. (2007) 'Observational evidence of interacting processes in the system TW Draconis', Astronomical & Astrophysical Transactions, 26:1, 125 - 128
To link to this article: DOI: 10.1080/10556790701312657
URL: http://dx.doi.org/10.1080/10556790701312657

Astronomical and Astrophysical Transactions
Vol. 26, Nos. 1–3, February–June 2007, 125–128

Observational evidence of interacting processes in the system TW Draconis

M. ZEJDA* and Z. MIKULÁŠEK

Institute of Theoretical Physics and Astrophysics, Masaryk University, Kotlářská 2, 61137 Brno, Czech Republic

(Received 19 February 2006)

TW Draconis is one of the best studied Algol-type eclipsing binaries. There is significant evidence for miscellaneous interacting physical processes between binary components and these are manifested in period and light curve changes. We studied these processes on the basis of a long-time series of photometric and spectroscopic observations.

Keywords: Close binaries; Eclipsing binaries; Short-time variations in oscillations; TW Dra

1. Introduction

TW Draconis ($\alpha = 15\,\mathrm{h}\,33\,\mathrm{min}\,51.1\,\mathrm{s}$, $\delta = 63^\circ\,54'\,26''$ (2000.0)) is a well-known and often-observed Algol-type eclipsing binary. The variable star is the A component of the visual binary ADS 9706. The light variations of TW Dra with a B amplitude of about 2.3 magnitude are caused predominantly by eclipses of the hot main-sequence star A8V by the cooler and fainter giant component K0III in the primary minimum and orbital period close to 2.807 days. The eclipses are relatively long: 11.5 h. The system has been studied both photometrically and spectroscopically. However, a satisfactory complex solution of this unique system has not been published up to now.

2. $O - C$ diagram

The unmistakeable indications that interacting processes occur in the binary system are seen in the $O - C$ diagram. In spite of the fact that the eclipsing variability was discovered in 1910, the $O - C$ diagram of the times of the primary minima illustrates changes in the orbital period in the last 150 years—the long oscillations as well as the shorter oscillations of the period after JD 2 432 000 (figure 1).

*Corresponding author. Email: zejda@physics.muni.cz

Astronomical and Astrophysical Transactions
ISSN 1055-6796 print/ISSN 1476-3540 online © 2007 Taylor & Francis
http://www.tandf.co.uk/journals
DOI: 10.1080/10556790701312657

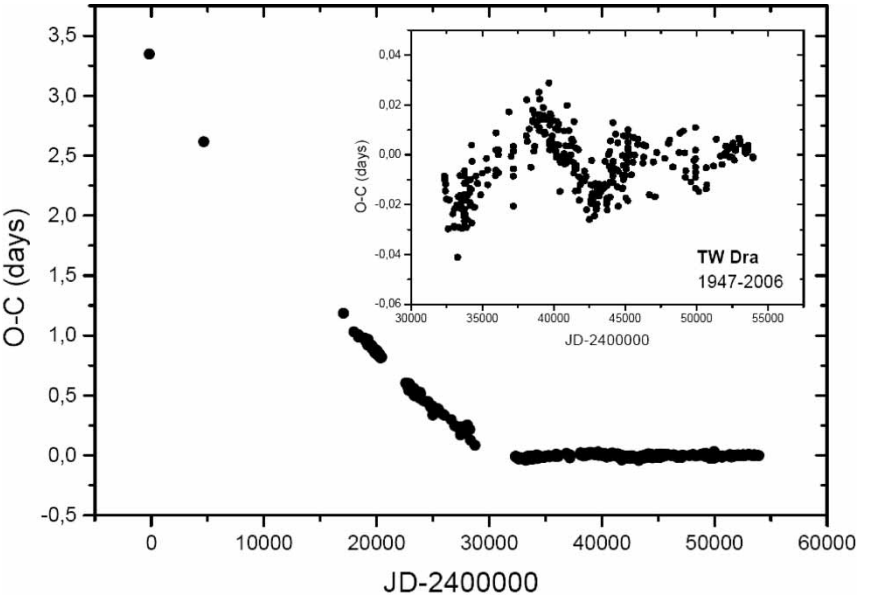

Figure 1. $O - C$ diagram of the times of the primary minima of TW Dra (1858–2006).

3. Photometry

We have caried out charge-coupled device and photoelectric photometry on this star using different telescopes at observatories in Brno (Czech Republic), Hvar (Croatia) and Suhora (Poland) since 2003. In total we have collected more than 45 000 *UBVRI* brightness measurements so far (figure 2). We have confirmed the presence of small variations (equal to hundredths in magnitude) in the light curve on the timescale of tens of minutes as described in [2], [3]. Their incidence during the total minima rules out any δ Scuti-like pulsations of the primary star; however, the nature of the oscillations remains unclear as yet.

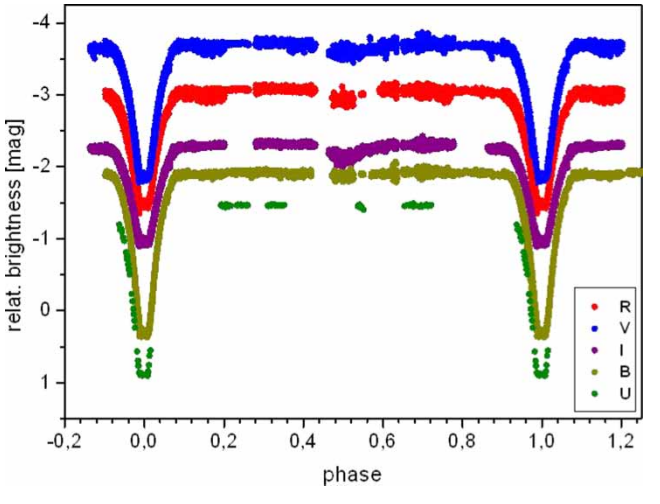

Figure 2. (a) Complete light curve of TW Dra. The secondary minimum is not very noticeable in the B filter. (b) Residuals after subtraction of the orbital light changes in the B filter phased with the period $P = 0.0519(5)$ days.

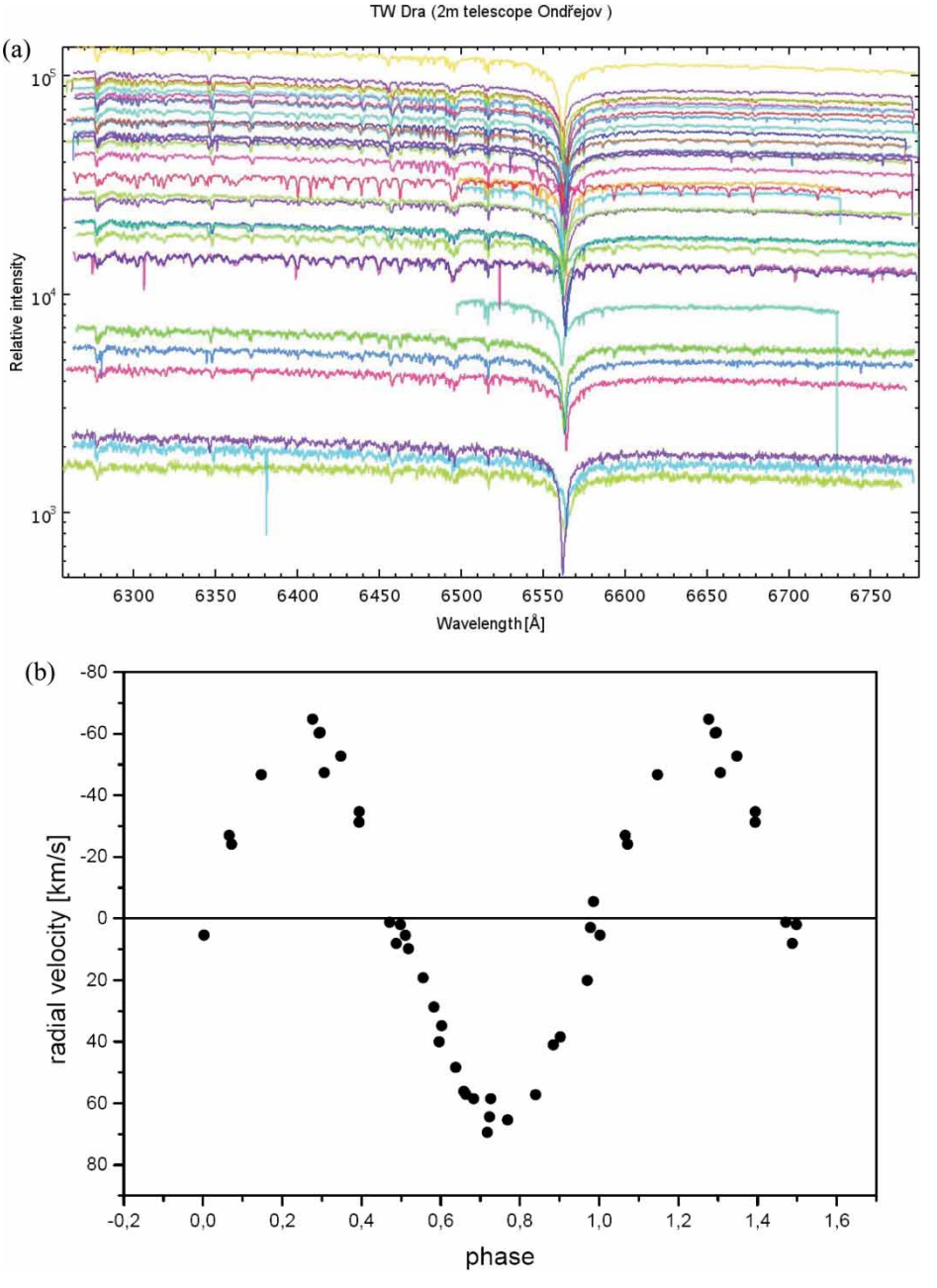

Figure 3. (a) Collection of available spectrograms (in the Hα region) of TW Dra plotted in SPLAT-VO [1]. (b) The radial velocity curve of the primary component with an amplitude of about 70 km s^{-1}.

4. Spectroscopy

Spectroscopic observations were made with a 2 m telescope (at the Ondřejov observatory). We have obtained 34 high-dispersion spectrograms in the Hα region (6230–6770 Å) (figure 3). The secondary component is detectable on some well-exposed spectrograms. The following

spectral lines were detected and measured in SPEFO [4]: Hα, Si II, Fe I, Fe II and Ca I. However, the next more precise spectrograms in a longer series are desirable for a more detailed study of the influence of spectra by interacting processes in TW Dra.

5. Conclusions

There are several strong indications of interacting processes in the TW Dra system. The $O - C$ diagram shows that the time span of period changes and their amplitude tend to be smaller in the last few decades. The light curve varies; however, the nature of the small variations remains unknown so far. Our detailed light curves and analyses of the radial velocity curve using different codes will be published elsewhere.

Acknowledgements

This investigation was supported by the Grant Agency of the Czech Republic under grants 205/04/2063 and 205/06/0217.

References

[1] P.W. Draper, SPLAT—spectral analysis tool. Available online at: http://www.starlink.ac.uk/splat (2001–2003).
[2] S.-L. Kim, J.W. Lee, S.-G. Kwon *et al.*, Astron. Astrophys. **405** 231 (2003).
[3] A.V. Kusakin, D.E. Mkrtichian and A.Yu. Gamarova, Inf. Bull. Variable Stars No. 5106 (2001).
[4] P. Škoda, in *Astronomical Data Analysis Software and Systems V*, ASP Conference Series, volume 101, edited by G.H. Jacoby and J. Barnes (Astronomical Society of the Pacific, San Francisco, California, 1996), p. 187.