

Surface Brightness Variation of the Contact Binary SW Lac: Clues From Doppler Imaging



Poster No.: G29



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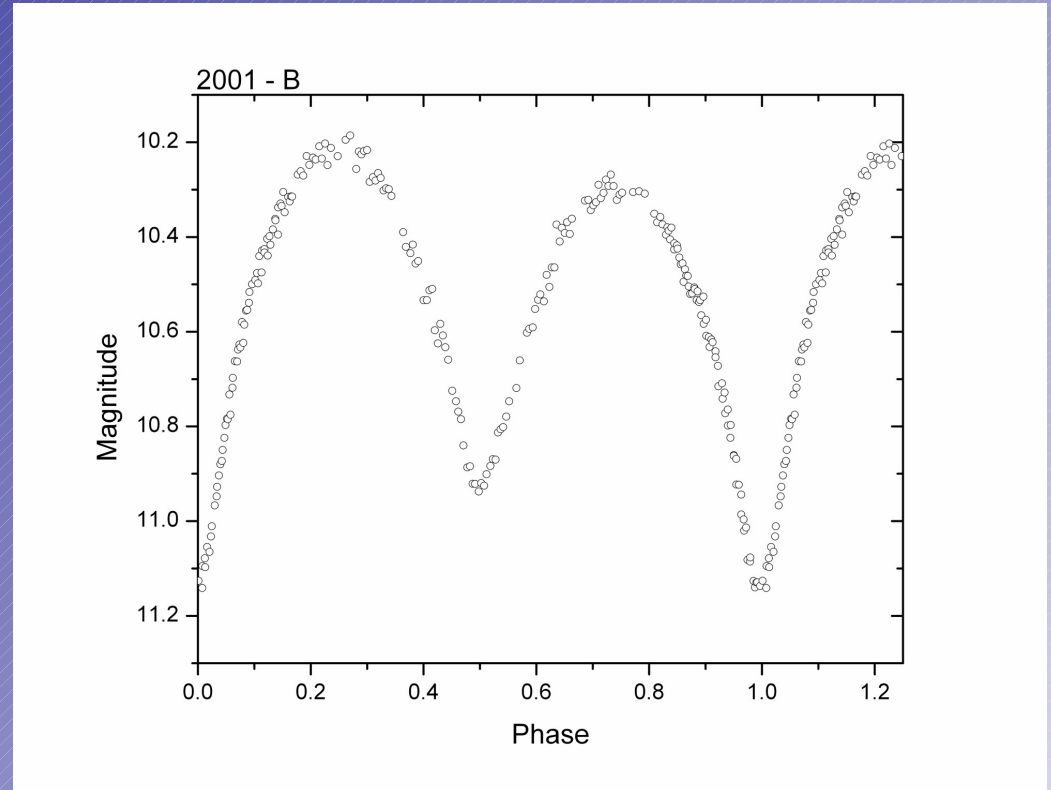
IAU Symposium 282

From Interacting Binaries to Exoplanets:
Essential Modeling Tools

Tatranská Lomnica, Slovakia
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History & Aim

- SW Lac ($P_{\text{orb}} = 0^{\text{d}}.32$, $V=8^{\text{m}}.99$) → contact binary
- Light variation without eclipses → very well known since its discovery by Miss Ashall (Leavitt 1918)
- Several photometric observations → light curve asymmetries → existence of cool spot(s)
- Several IUE & X-Ray Observations + Analysis → Chromospheric + Coronal Activity



2001 – 2010 B band light curves of the system obtained at the Ankara University Observatory

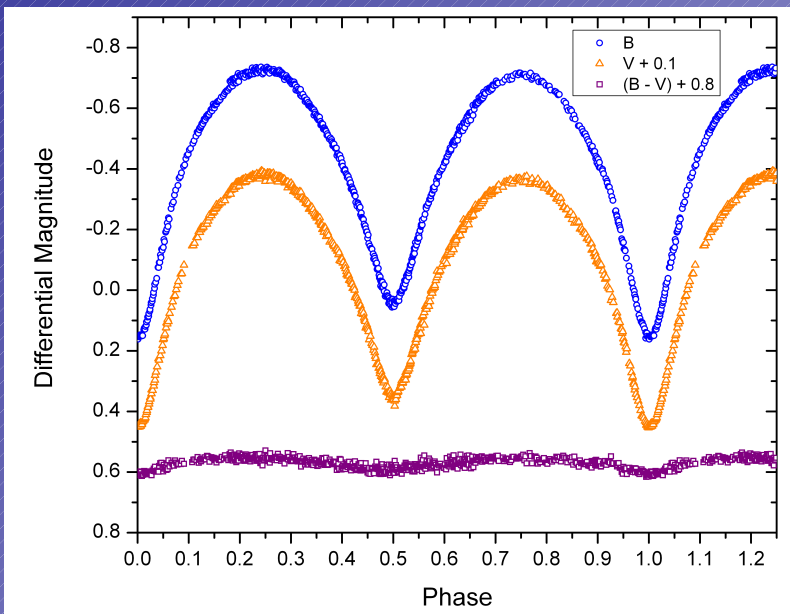
* Aim: Preliminary LC Analysis + Spot Modeling of 2009 & 2010 light curves → the information from Doppler Maps (Şenavcı et al. 2011)

Observations & Data Reduction

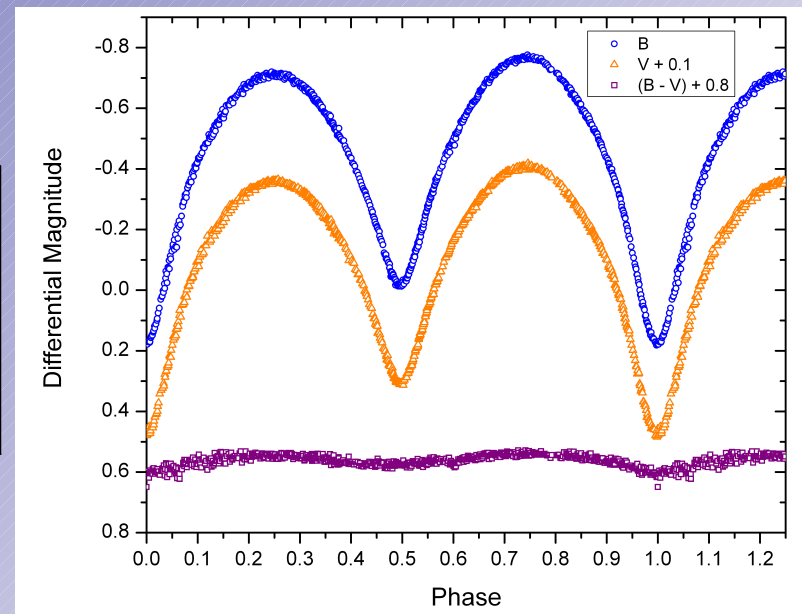
- Observations → Apogee Alta U47 CCD camera attached to a 40 cm Cassegrain telescope
- Comparison → BD +37° 4715
- Check → BD +37° 4711
- # of points (2009) → 700
- # of points (2010) → 995
- Mean errors → 0.003 – 0.004
- Data Reduction → standard packages of IRAF



The Kreiken Telescope

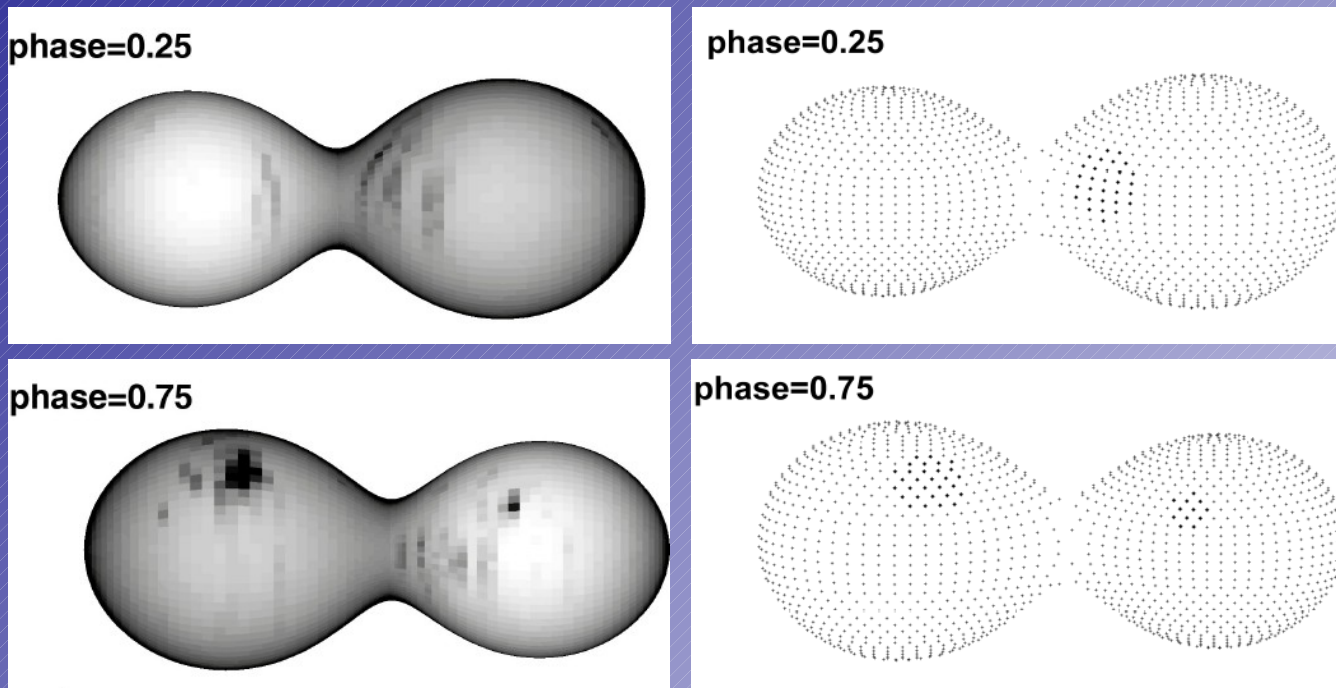


2009 (left) &
2010 (right)
BV light curves
together with the
color curves



The Light Curve Analysis

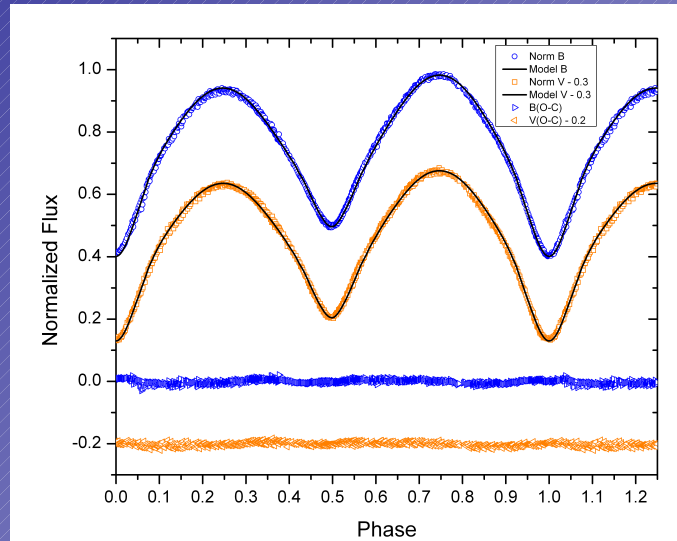
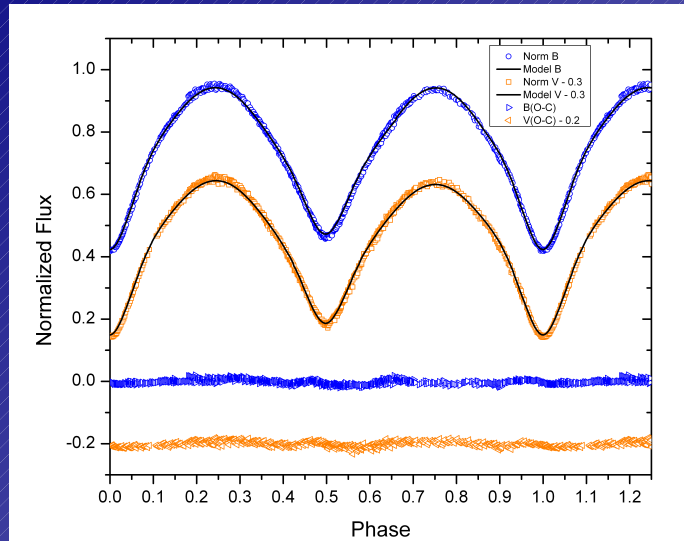
- 2009 & 2010 BV light curves + RV curves (Rucinski et al. 2005) → simultaneous analysis → PHOEBE (Prsa & Zwitter 2005)
- Fixed parameters → q_{sp} , A_{12} , g_{12} , T_1
- Spot modeling → Doppler maps (Şenavcı, H. V.; Hussain, G. A. J.; O'Neal, D.; Barnes, J. R. “Investigating the surface inhomogeneities of the contact binary SW Lacertae. I. Doppler imaging”, 2011, A&A, 529, 11)



- 3 main spot regions
- Circular spots → problem

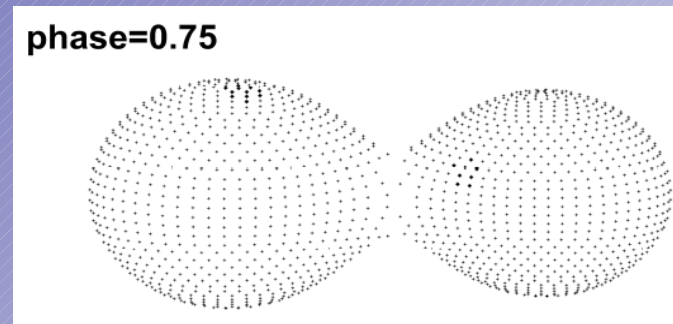
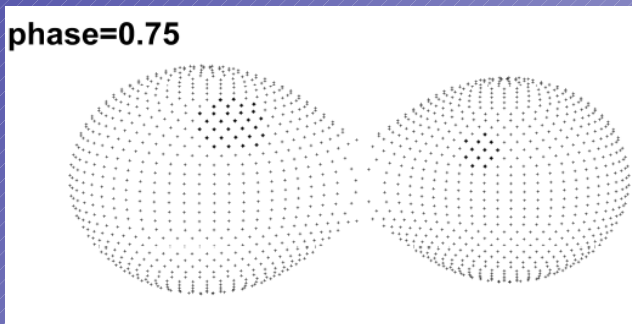
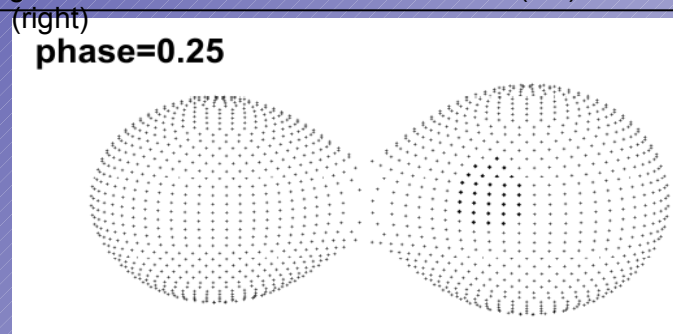
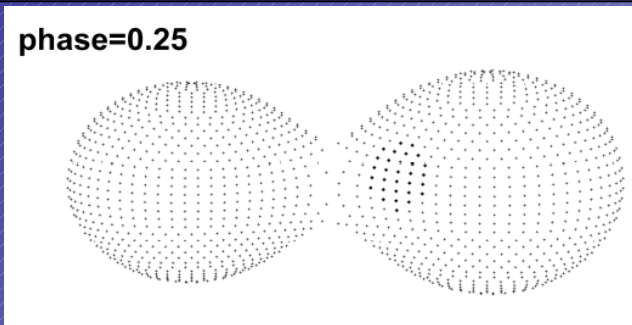
The Doppler maps (left) and the adopted spots (right) for LC modeling

The Light Curve Analysis



- Only T_2 and L_{12} adjusted for 2010 LC solution
- Theoretical LC are in accordance with the observed ones, in spite of the circular spot modeling
- Spot migration is clear in both latitudinal and longitudinal directions from season to season
- Both components have cool spots, which is first in the literature for this system

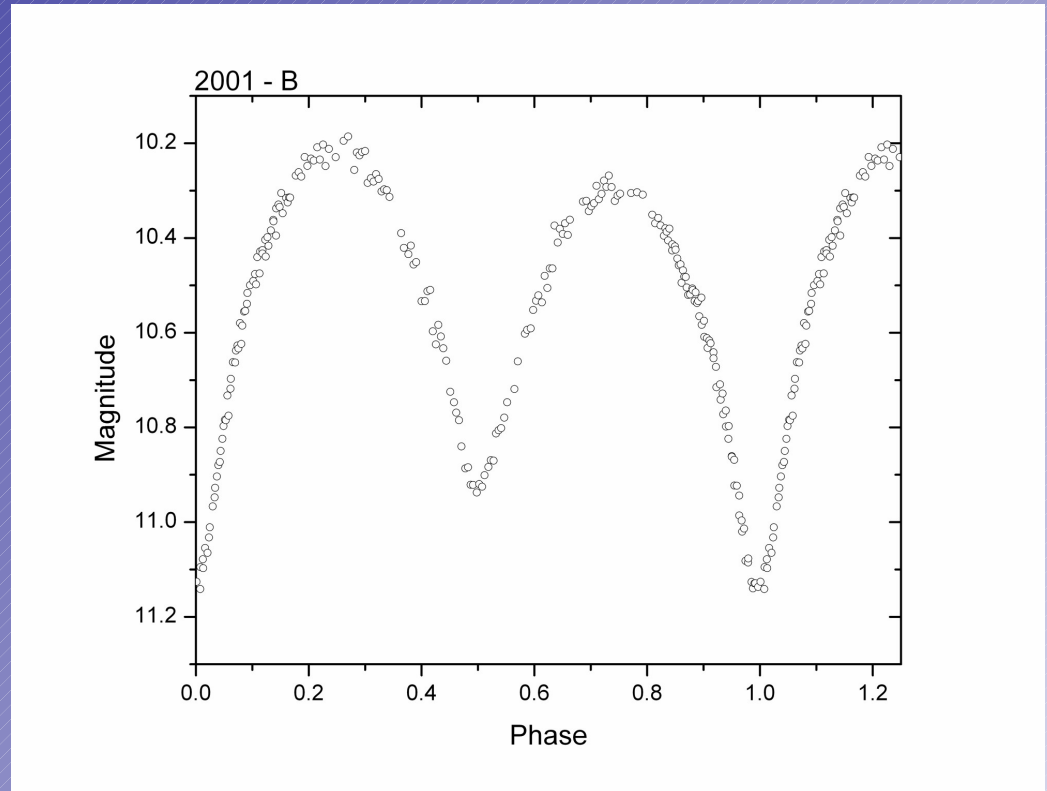
A comparison of observational and theoretical light curves with O-C residuals for 2009 (left) and 2010 (right)



Roche geometry with the spots modelled for 2009 (left) and 2010 (right) spot modeling

Discussion

- The most noticeable difficulty → circular shaped spot modeling limitation and the constraints in adjusting some of the parameters (here T_1 for the contact mode) of LC analysis code
- It is clear from the Doppler maps → Spots are not circular!
- Future work → LC and spot modeling of SW Lac using the photometric data spanning 11 years (2001 – 2011).
- Doppler Imaging of W UMa type stars are too few in the literature (4 papers) and should be increased in order to enlighten the activity behaviours of such systems



Many thanks for your
patience!