=TOSC=

an algorithm for the tomography of spotted transit chords

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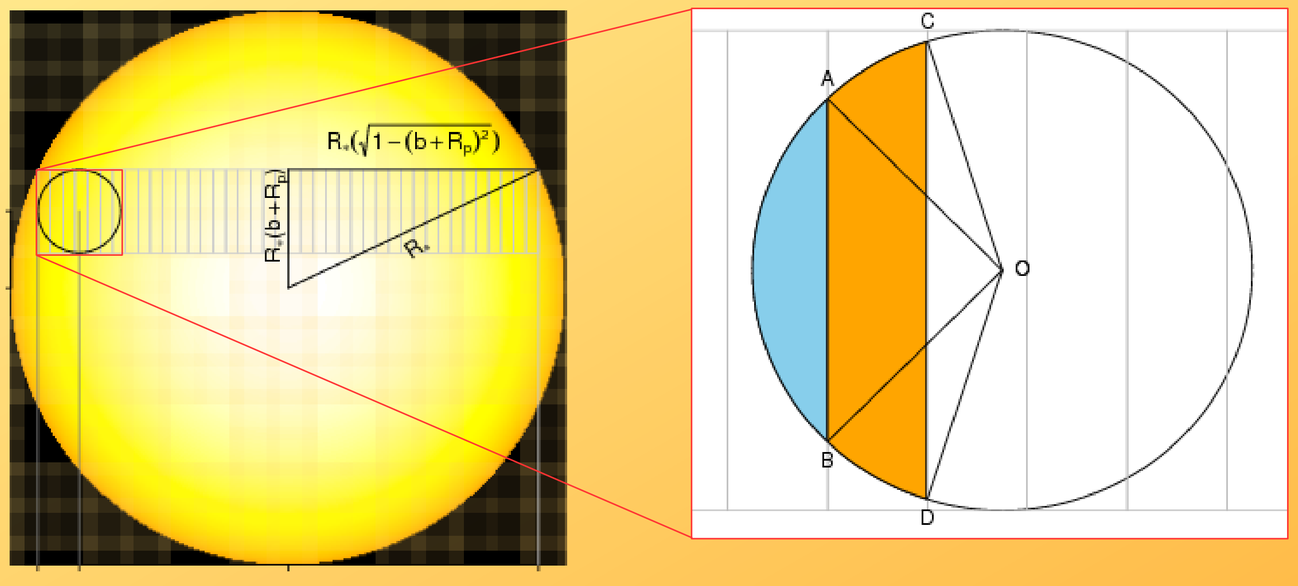
Abstract TOSC (Tomography Of Spotted transit Chords) is a tomographic inverse-approach tool which reconstructs the flux distribution along the transit belt. It provides robust results for light curves with photometric accuracies better than 1 mmag, returning the spot-photosphere temperature contrast with an accuracy better than 100K. The analysis of real data with TOSC returns results consistent with previous studies.

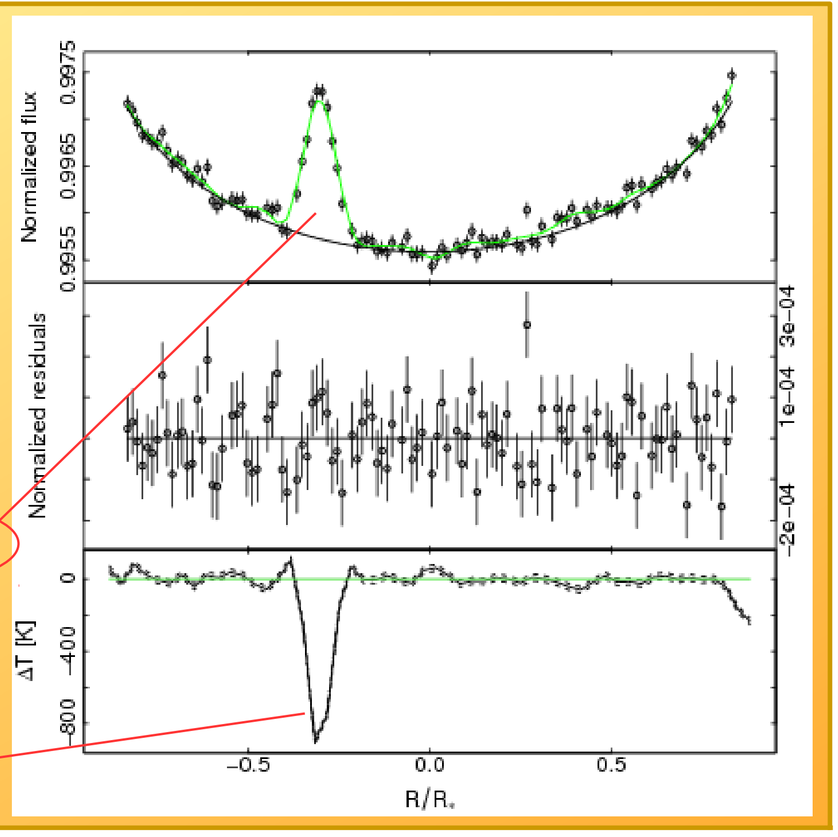
The model The transit chord is divided into adjacent rectangular cells. For each photometric points collected during the planetary transit at time *t*, the flux occulted by the planet $F_{occ}(t)$ corresponds to the sum of the fluxes radiated by the intersected cells *F*, weighted by the fractional overlap area *w(t)* between the cells and the planetary disk.



Each photometric points corresponds to the weighted sum of the unknown fluxes F_i. The sample of photometric points gives a system of linear equations. The aim of TOSC is to invert this system and return the flux, and thus the temperature, along the transit chord.

$$\begin{bmatrix} w_1(t_1) & \cdots & w_N(t_1) \\ \vdots & \ddots & \vdots \\ w_1(t_M) & \cdots & w_N(t_M) \end{bmatrix} \cdot \begin{bmatrix} F_1 \\ \vdots \\ F_N \end{bmatrix} = \begin{bmatrix} F_{occ}(t_1) \\ \vdots \\ F_{occ}(t_M) \end{bmatrix}$$

Analysis of HAT-P-11 HAT-P-11 is a V=9.6 K4 dwarf (T_{eff}=4780 K) in the Kepler field (Borucki et al. 2010), orbited by a hot Neptune every 4.9 days (Bakos et al. 2010). We analyze the *Kepler* photometry of the transit occurring at BJD=2454967.6 (top panel). The reconstructed chord (green line in the top panel) shows a cool spot centered at $\simeq -0.3R_*$ and is $\simeq 0.15R_*$ wide. The fitted spot-photosphere temperature contrast is $\Delta T \simeq$-900 K (bottom panel).



Conclusions Extensive tests show that TOSC reconstructs the crossed spots for a photometric accuracy better than 1 mmag, and that the temperature contrast is returned with an uncertainty <100 K. TOSC is consistent with previous approaches available in literature, also with more sophisticated algorithms. For a complete description of TOSC, please check arXiv:1707.01153 (soon on A&A).

TOSC is available as a web interface where the user can run the algorithm feeding a few input files and retrieving the output. The web page contains also extensive instructions and some example data. The source code is available for download too. For support, please contact the authors.

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