MODELING STARSPOTS ON LOW MASS STAR YZ CMI OBSERVED BY TESS

CONTACT: BICZ@ASTRO.UNI.WROC.PL

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Kamil Bicz, Robert Falewicz, Małgorzata Pietras **Astronomical Institute of the University of Wrocław**

ONLINE





- -TIC ID = 266744225
- $-RA = 116.17^{\circ}$
- DEC = 3.55°
- Distance = 6 ± 0.002 pc
- SpType = M4.0Ve
- Teff = 3181 ± 157 K
- $-Log(g/[cm \cdot s^{-2}]) = 4.89 \pm 0.0021$
- Radius = 0.33 ± 0.0099 R⊙
- Mass = 0.31 ± 0.02 M⊙
- Luminosity = 0.01 ± 0.002 L⊙
- Rotation Period = 2.7726 ± 0.0000017417 days
- $-vsin(i) = 4.0 \pm 1.5 \text{ km/s}$
- Inclination = 60°

MAST catalogue

Reiners A. et al. Astronomy & Astrophysics, Volume 612, id.A49, 63 pp. MORIN, J., ET AL. Monthly Notices of the Royal Astronomical Society 384, 1 (Jan. 2008), 77-86.

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Zotti, G. et al. (2021). The Simulated Sky: Stellarium for Cultural Astronomy Research. Journal of Skyscape Archaeology, 6(2), 221-258.











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BASSMAN

Best rAndom StarSpots Model cAlculatioN



https://luger.dev/starry/v1.0.0/#

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https://docs.pymc.io



https://docs.exoplanet.codes/en/stable/#







$$T_{\rm spot} = 0.751 T_{\rm eff} - 3.58 \cdot 10^{-5} T_{\rm eff}^2 + 808$$

and to estimate percentage of stellar surface covered by spots we use (Notsu, Y., ET AL. The Astrophysical Journal 771, 2 (Jun 2013), 127 and Shibata, K., ET AL. Publications of the Astronomical Society of Japan 65, 3 (Jun 2013). 49):

$$\frac{A_{\rm spot}}{A_{\rm star}} = 100\%$$

where ($\Delta F/F$) is normalised amplitude of light variations, T_{spot} is mean temperature of spots estimated from upper equation and T_{eff} is effective temperature of the star.

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We compare our results with analytical solution for average temperature of the spots on a star with effective temperature Teff using (NOTSU, Y., ET AL. The Astrophysical Journal 876, 1 (May 2019), 58.):

$$\frac{\Delta F}{F} \left[1 - \left(\frac{T_{\text{spot}}}{T_{\text{eff}}} \right)^4 \right]^-$$











Table 1: Variations of parameters of spots on YZ CMi observed in sector 7.

Spot	Contrast	Size	Temperature	Latitude
number	[%]	[%]	[K]	[deg]
1	0.33	4.47	3094 ± 127	4
2	0.53	2.51	$2824~\pm~381$	40
3	0.34	2.51	$2949~\pm~248$	30



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Table 2: Variations of parameters of spots on YZ CMi observed in sector 34.

Spot number	Contrast [%]	Size [%]	Temperature [K]	Latitude [deg]
1	0.2	1.53	2912 ± 235	-12
2	0.56	2.14	2696 ± 478	36
3	0.36	1.55	$2713~\pm~405$	50
4	0.49	2.13	$2756~\pm~420$	-36



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Start TBJD = 2229.0897



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Table 3: Comparison of analytically estimated spots parameters and received in modeling spots parameters on YZ CMi.

Sector number	Analytical temperature [K]	Model mean temperature [K]	Analytical spots size [%]	Model spots size [%]
7	$2835~\pm~82$	2990 ± 157	9.44	9.49
34	$2865~\pm~82$	2765 ± 198	7.35	7.35



Modeling starspots on low mass star YZ CMi observed by TESS

Recreated spots temperatures and sizes fits quite well to analytical estimations and is quite similar to the models obtained in previous publications* with spottedness variating from 5% to 38%.

ALEKSEEV, I. Y., ET AL. Astronomy Reports 45, 6 (Jun 2001), 482-496.

ALEKSEEV, I. Y., AND KOZHEVNIKOVA, A. V. Astronomy Re- ports 61, 3 (Mar. 2017), 221–232.

BRUEVICH, E. A., AND ALEKSEEV, I. Y. Astrophysics 50, 2 (Apr. 2007), 187–193.

ZBORIL, M. 527-531. Astronomische Nachrichten 324, 6 (Nov. 2003),

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THANK YOU FOR YOUR ATTENTION!

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