

## THE ONDŘEJOV EXOPLANET GROUP

M. Blažek<sup>1,2</sup>, P. Kabáth<sup>1</sup>, M. Skarka<sup>1,2</sup>, T. Klocová<sup>1</sup>, M. Špoková<sup>1,2</sup>, J. Šubjak<sup>1,3</sup>, J. Dvořáková<sup>1,4</sup>,  
J. Žák<sup>2</sup>, D. Dupkala<sup>1,4</sup> and E. Plávalová<sup>5</sup>

**Abstract.** Ground-based telescopes are an integral part of exoplanetary space missions. Our poster presented results from the high-resolution Ondřejov Echelle Spectrograph (OES) installed at the Perek 2-m telescope in Ondřejov, Czech Republic and operated by the Czech Academy of Sciences. We focussed on results from monitoring KEPLER/K2 and *TESS* objects during 2018–2019, and other activities and collaborations carried out by the group.

Keywords: Telescopes, Instrumentation: spectrographs, Planetary systems, Eclipses.

### 1 Introduction

The exoplanet group at the Astronomical Institute of the Czech Academy of Sciences was formed in 2015; more than ten members belong to the group. The research is dedicated to radial-velocity (RV) follow-up observations of exoplanetary candidates, and the characterisation of exoplanetary atmospheres.

The main scientific topics are:

- Radial-velocity follow-ups
- Detection and characterisation of exoplanetary atmospheres
- Space missions and ground-based instrumentation

### 2 Radial-velocity follow-ups

We are using the 2-m Perek telescope and its échelle spectrograph to characterise the host star of a candidate system and to measure RVs. We are following up planetary candidates from KEPLER/K2 missions. In 2019 we started to perform ground-based follow-up observations for the *TESS* space mission, and in the future we plan to follow up candidates from the *PLATO* space mission too.

The main characteristics of the OES are as follows:

- Spectral resolving power: 50,000
- Wavelength coverage: 370–850 nm
- Detector: CCD 2048 × 2048 pix
- Calibration lamp: Th/Ar

---

<sup>1</sup> Astronomical Institute of the Czech Academy of Sciences, Fričova 298, 251 65 Ondřejov, Czech Republic

<sup>2</sup> Department of Theoretical Physics and Astrophysics, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic

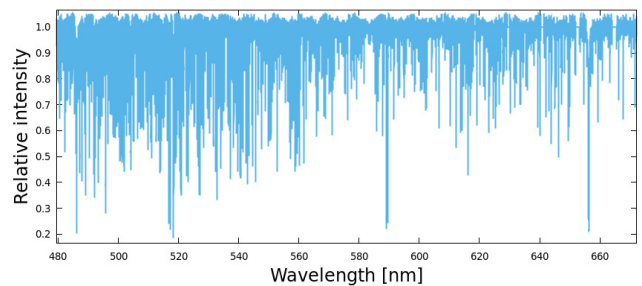
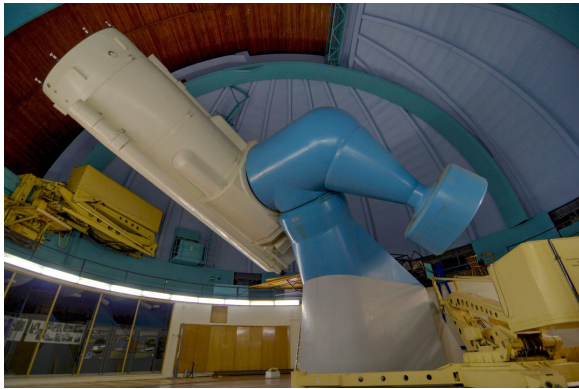
<sup>3</sup> Astronomical Institute, Charles University, Faculty of Mathematics and Physics, V Holešovičkách 2, 180 00 Praha 8, Czech Republic

<sup>4</sup> Institute of Physics, Faculty of Philosophy and Science, Silesian University in Opava, Bezručovo nám. 13, 746 01 Opava, Czech Republic

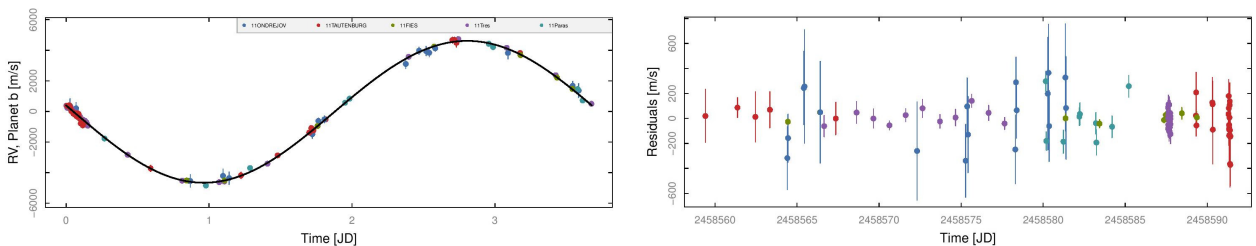
<sup>5</sup> Astronomical Institute, Slovak Academy of Sciences, Štefánikova 49, 811 04 Bratislava 1, Slovak Republic

We also plan a ground-based RV follow-up facility at the 1.52-m telescope at La Silla. A state-of-the-art échelle spectrograph *PLATOSpec* will be built and operated by a consortium led by the Astronomical Institute of the Czech Academy of Sciences, with Thüringer Landessternwarte Tautenburg and Universidad Católica de Chile as partners. This new instrument, which will have a spectral resolving power of 70,000, will be dedicated to ground-based support of *TESS*, *PLATO*, and (later) *ARIEL*. More information about *PLATOSpec* can be found at <https://stelweb.asu.cas.cz/plato/index.html>.

To highlight the most recent results, we mention the discovery of the first brown dwarf, observed by *TESS*, which is orbiting a metallic-line A star. A paper on this discovery has been submitted to the AJ (Šubjak et al. 2019), and is the result of a collaboration between Harvard University, PRL India, and the KESPRINT consortium. We have also published an article about the Ap star HD 99458 as being the first ever  $\delta$  Scuti pulsator in a short-period eclipsing binary./ That research was mainly based on observations with the OES (Skarka et al. 2019, see also Skarka et al., [PAGE]).



**Fig. 1. Left:** The Ondřejov 2-m telescope, Czech Republic. **Right:** Part of the spectrum of HD 109358 (G0V,  $V = 4.25$  mag) obtained with the OES in an exposure of 600 seconds.



**Fig. 2. Left:** Example of a radial-velocity curve obtained with the OES (blue circles) and other instruments. **Right:** Residuals from the same RV curve, after removing the orbital model.

### 3 Exoplanetary atmospheres

Our group uses large telescope facilities (such as ESO Paranal) to detect and characterise exoplanetary atmospheres via transmission spectroscopy and emission photometry (Kabáth et al. 2019; Kabáth et al. 2019b; Žák et al. 2019), Blažek et al., in prep.). We are also involved in investigating the profiles of spectral lines and their impact on those characterizations.

### 4 Space missions

Our group is involved in the *PLATO* scientific programme. We are members of the *PLATO* Mission Consortium and are coordinating the Czech contribution to *PLATO*. The OES will be used to observe planetary candidates in the northern hemisphere, and will act as a follow-up instrument for that mission. We will also perform an initial screening of the candidates and the characterisation of hot Jupiters.

## 5 Collaborations

We are collaborating with Tautenburg Observatory (Germany) on RV follow-ups of *TESS* targets (Sabotta et al. 2019). We are also working closely with AI SAS (Gajdoš et al. 2019; Skarka & Kabáth 2019; Kabáth et al. 2019a), and are a member of the KESPRINT consortium (Gandolfi et al. 2019; Persson et al. 2019).

P. Kabáth, M. Blažek, M. Špoková, and J. Šubjak acknowledge grant GAČR 17-01752J. M. Skarka acknowledges the support from an OP VVV PostdocMUNI (No. CZ.02.2.69/0.0/0.0/16\_027/0008360).

## References

- Gajdoš, P., Vaňko, M., Pribulla, T., et al. 2019, MNRAS, 484, 4352
- Gandolfi, D., Fossati, L., Livingston, J. H., et al. 2019, ApJ, 876, L24
- Kabáth, P., Skarka, M., Sabotta, S., & Guenther, E. 2019a, Contributions of the Astronomical Observatory Skalnaté Pleso, 49, 462
- Kabáth, P., Žák, J., Boffin, H. M. J., et al. 2019b, PASP, 131, 085001
- Kabáth, P., Zak, J., Boffin, H., Ivanov, V. D., & Skarka, M. 2019, in AAS/Division for Extreme Solar Systems Abstracts, Vol. 51, 326.28
- Persson, C. M., Csizmadia, S., Mustill, A. e. J., et al. 2019, A&A, 628, A64
- Sabotta, S., Kabáth, P., Korth, J., et al. 2019, MNRAS, 489, 2069
- Skarka, M. & Kabáth, P. 2019, Contributions of the Astronomical Observatory Skalnaté Pleso, 49, 137
- Skarka, M., Kabáth, P., Paunzen, E., et al. 2019, MNRAS, 487, 4230
- Šubjak, J., Sharma, R., Carmichael, T. W., et al. 2019, arXiv e-prints, arXiv:1909.07984
- Žák, J., Kabáth, P., Boffin, H. M. J., Ivanov, V. D., & Skarka, M. 2019, AJ, 158, 120