TA ASU – Ondřejov observatory

Astronomical Institute of the Czech Academy of Science

Brankica Kubátová

brankica.kubatova@asu.cas.cz

Department of Stellar Physics
Astronomical Institute of the CAS

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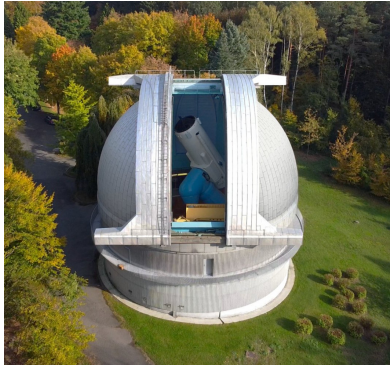
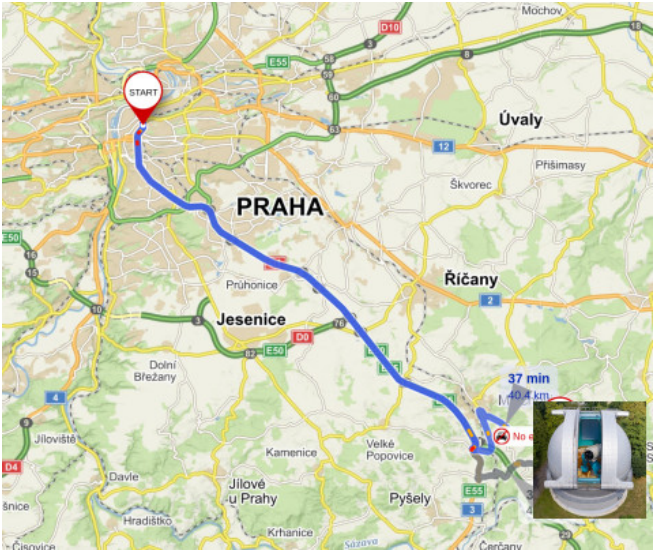
Astronomický ústav AV ČR



Location

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101008324 (ChETEC-INFRA).



- Latitude: 49°54'54.6" North
- Longitude: 14°46'51.6" East
- Altitude: 528 m
- $\sim$ 40 km from Prague

Telescope and Instrumentation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101008324 (CHETEC-INFRA).

The Perek 2-m Telescope

Credit: ASU

- Used for:
  - scientific observations: stars, stellar systems, and exoplanets
  - international monitoring campaigns
  - training of students
- Detailed technical description of the telescope and its instrumentation:
  https://stelweb.asu.cas.cz/en/index.php?section=telescope

Specifications

- Manufacturer: Carl Zeiss Jena, designer: Alfred Jensch
- Type of mount: Equatorial
- Apertures: primary parabolic mirror D=2m
- Original optical settings: primary, Cassegrain, coudé foci
- Current optical settings (since 2019): optical fiber primary $\rightarrow$ coudé
- Optical fibers: active core diameter 0.1mm; CeramOptec technology; octagonal type

Instrumentation

- Spectrographs: single order & echelle, both in the coudé focus
- Photometric and imaging camera: in the primary focus

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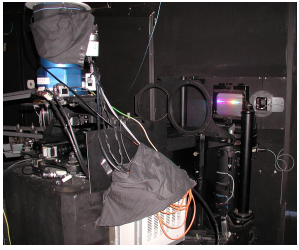
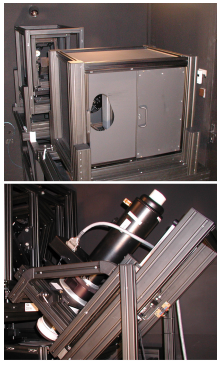
Single order spectrograph



Credit: M. Šlechta

- **Resolution:**
  R $\sim$ 13000 at Hα
  R $\sim$ 25000 at 4300 Å
- **Wavelength coverage:**
  2nd order: **4000 – 5100 Å**
  1st order: **5100 – 8900 Å**

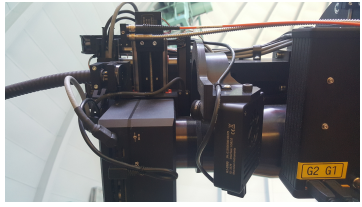
Echelle spectrograph (OES)



Credit.: M. Šlechta

- **High-resolution: R $\sim$ 40000 at Hα, R $\sim$ 60000 at Hγ**
- **Wavelength coverage (56 orders): 3753 – 9195 Å**

Photometric Camera



Credit: M. Šlechta

- **Resolution: R = 0.2 arcsec/px**
- **Field of view: 7x5 arcmin**
- **Filters:**
  Sloan (u', g', r', i', and z')
  and narrow band Hα (3 nm)

The fraction of usable nights per year

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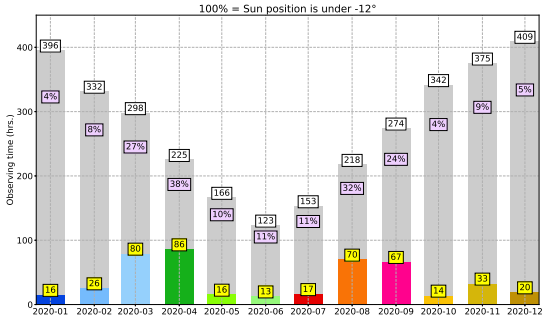

Violet text boxes - the percentage of actually uses observing hours per each month. Yellow text boxes - the number of used observing hours per each month. White text boxes - the total amount of hours per each month available for observations. Credit: Jan Fuchs.

- Central European weather conditions
- **Favorable months for observation: from April to October**
- **Seeing for Ondřejov: $2'' - 3''$** (under excellent conditions $\sim 1.5''$)
- **Limiting magnitude for spectroscopy: V $\sim$ 12**

SNR vs. Exposure Time

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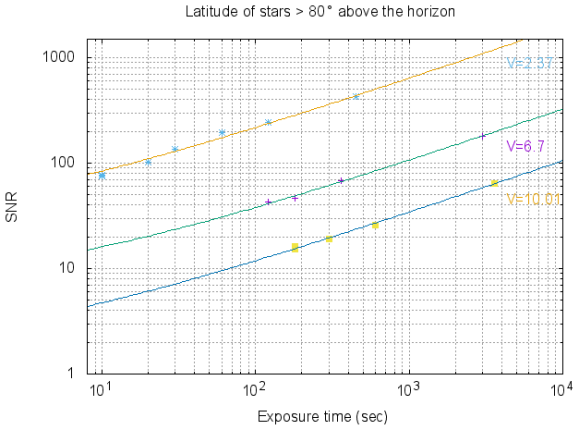

Credit: Miroslav Šlechta.

Echelle spectrograph

- An exposure time of 1000 s
  - $\mathrm{SNR}_{(H\alpha)} \sim 650$ for $\mathrm{V_{mag}} = 2.37$
- An exposure time of 3600 s
  - $\mathrm{SNR}_{(H\alpha)} \sim 200$ for $\mathrm{V_{mag}} = 6.7$
  - $\mathrm{SNR}_{(H\alpha)} \sim 65$ for $\mathrm{V_{mag}} = 10.01$
  - $\mathrm{SNR}_{(H\alpha)} \sim 10$ for $\mathrm{V_{mag}} = 12$
- SNR vs. exposure time depends on the weather conditions and high above the horizon

SNR vs. Exposure Time

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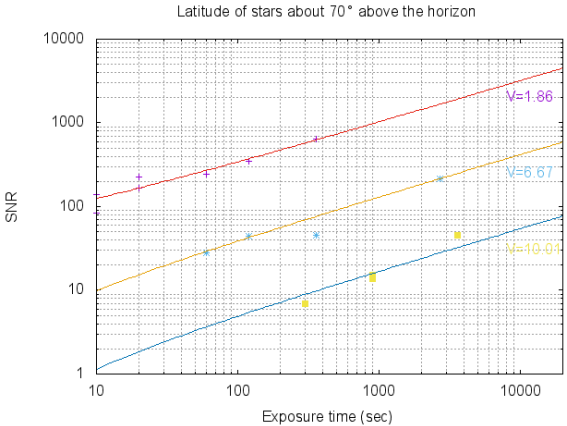

Credit: Miroslav Šlechta.

Single order spectrograph

- An exposure time of 1000 s
  - $\mathrm{SNR}_{(H\alpha)} \sim 1000$ for $\mathrm{V_{mag}} = 1.86$
- An exposure time of 3600 s
  - $\mathrm{SNR}_{(H\alpha)} \sim 250$ for $\mathrm{V_{mag}} = 6.67$
  - $\mathrm{SNR}_{(H\alpha)} \sim 30$ for $\mathrm{V_{mag}} = 10.01$
- SNR vs. exposure time depends on the weather conditions and high above the horizon

Selected results based on the telescope data

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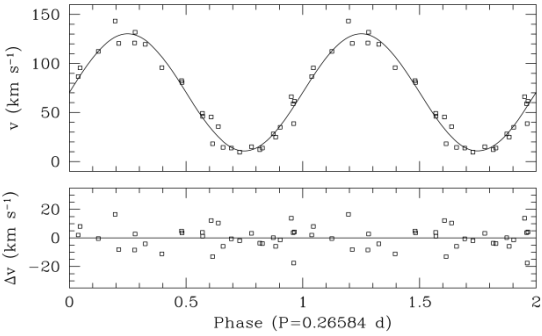
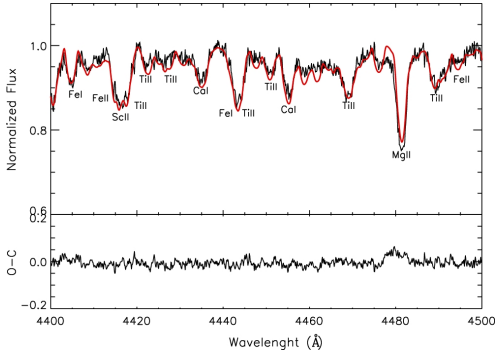
Research using the single order spectrograph (Low-mass stars)



- **Binary parameters determination.** Radial velocity measurements of GALEX J0321+4727 hydrogen-rich sdB (V_{mag}=11.7), folded on the orbital period and best-fit sine curve (Kawka et al. 2010, MNRAS 408, 992).



- **Abundance analysis.** Comparison of the theoretical (red lines) and observed spectra of δ Sct star HL Dra, V_{mag}=7.36 (Kahraman et al. 2017, MNRAS 470, 915).

Selected results based on the telescope data

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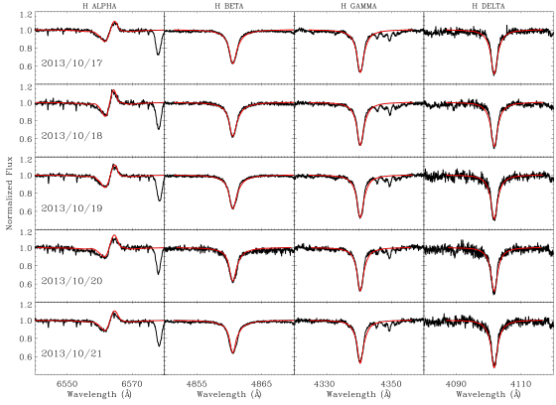
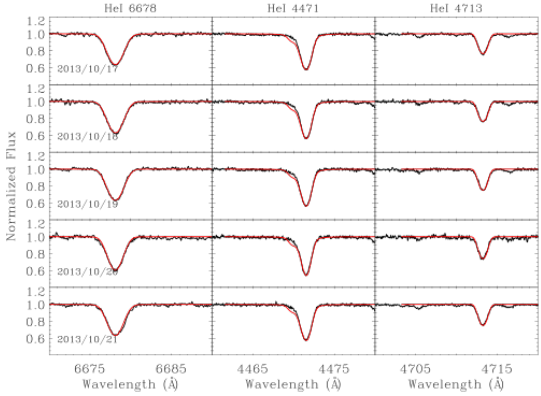
Research using the single order spectrograph (Massive hot stars)





Determination of stellar wind parameters, variability study. Interplay between pulsations and mass loss in the blue supergiant 55 Cyg = HD 198478. Comparison of the theoretical (red lines) and observed spectra (Kraus et al. 2015, A&A, 581, A75). **$R \sim 13\,000$ at H_α and SNR $\gtrapprox 300$.**

Selected results based on the telescope data

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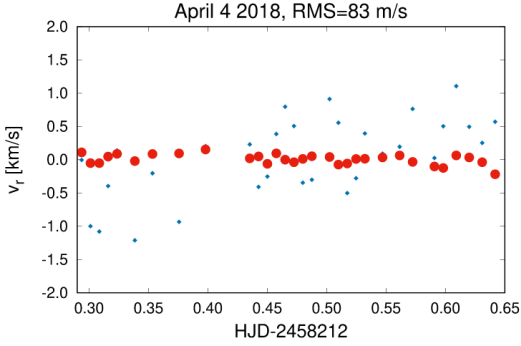
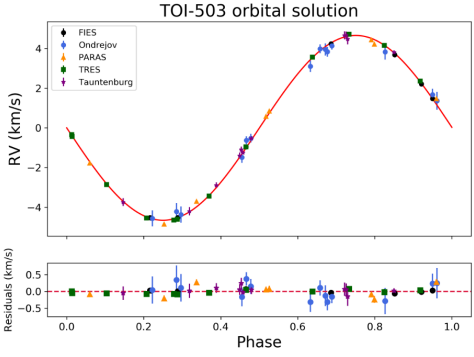
Research using the OES





- The stability of the radial velocity data measured on a 5-mag G-type star (Kabáth et al. 2020, PASP, 132, 5002.). **The RMS $\sim$ 80 $\mathrm{m/s}$ in one night (or 200-300 $\mathrm{m/s}$ in several months) can be achieved.**
- Spectroscopic orbit of TOI-503 – the first known **brown-dwarf / Am-star** binary from the TESS Mission. Ondřejov data are plotted with blue points (Šubjak et al. 2020, AJ, 159, 4).

Proposal system and Observing

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101008324 (ChETEC-INFRA).

Proposal system

- Call for proposals: every month
- Applications for observing time via the ChETEC-INFRA TNA platform
- Applications reviewed: every month (but we can be flexible)

Observing

- Mode of operation: SERVICE
- We can offer min 10 clear nights/year (i.e., in total $\sim$ 40 nights for period 2021-2024)

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CONTACTS

TNA PI: Brankica Kubátová
E-mail: brankica.kubatova@asu.cas.cz

TNA Manager: Olga Maryeva
E-mail: olga.maryeva@asu.cas.cz

TNA Manager Deputy: Tiina Liimets
E-mail: tiina.liimets@asu.cas.cz

TNA financial personnel: Iva Tužinská
E-mail: iva.tuzinska@asu.cas.cz

Web page: https://stelweb.asu.cas.cz/en/


THANK YOU FOR YOUR ATTENTION!