

# New and upgraded observing facilities at Tartu Observatory

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UNIVERSITY OF TARTU  
Tartu Observatory

## Tartu Observatory

Location: 26 16 51 E, 58 15 55 N, 76 m altitude

Tartu Observatory has three telescopes:

- 1.5-meter telescope AZT-12 for spectroscopy and photometry (see Figure 1)
- 31 cm fully remotely controllable telescope RAITS for photometry
- 60 cm classic Cassegrain telescope Zeiss 600 for photometry

Astroclimate: 75-100 observing nights per year, white nights (midnight twilight) in the summer (not suitable for photometry), 14-hour-long nights in December.

Most probable seeing is 2.7 arcseconds.

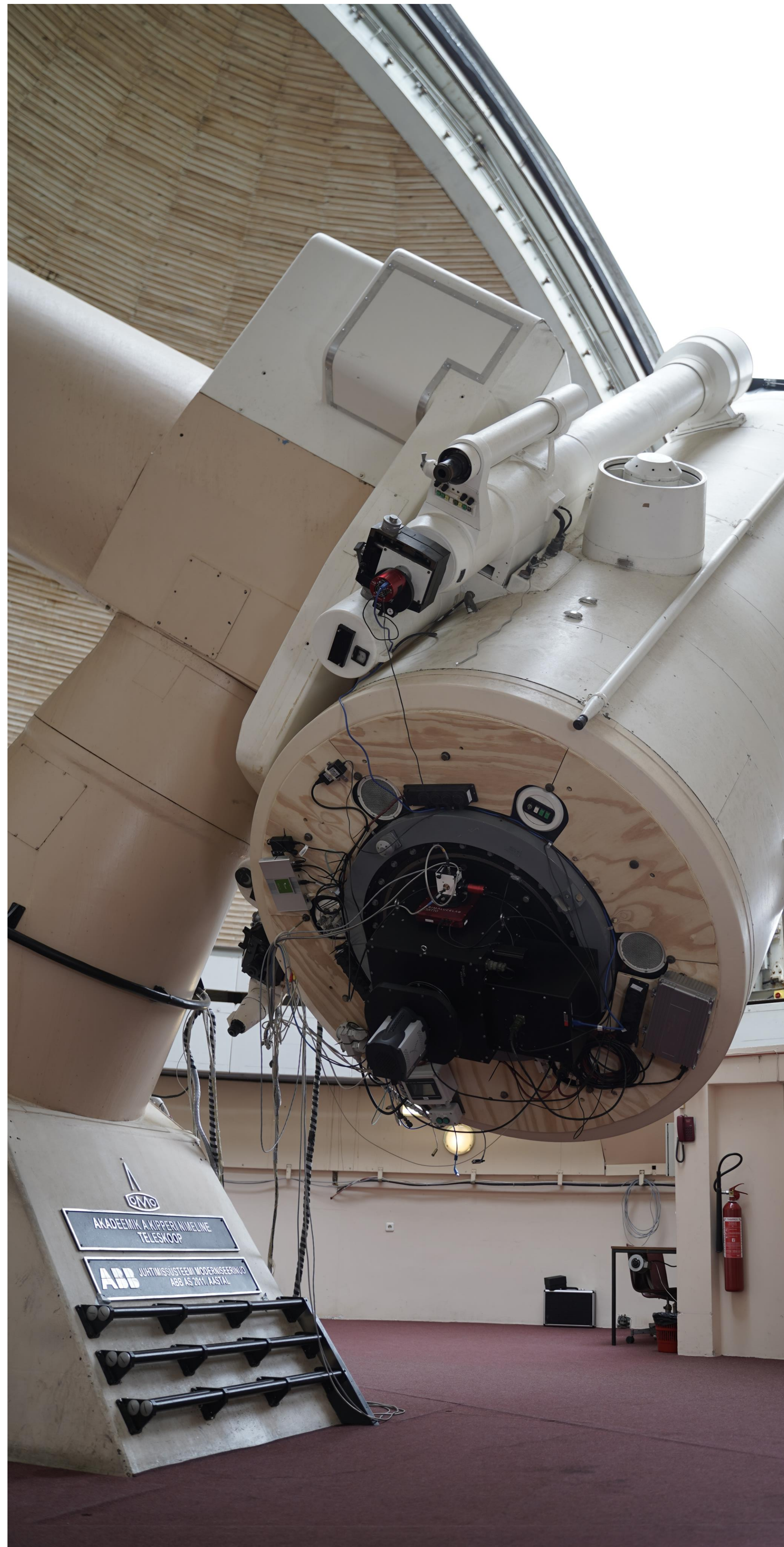
## Request for observing time

Observations are available upon request and collaboration with our astronomers. Contact us:

<https://kosmos.ut.ee/en/telescopes>



Figure 1. The telescope AZT-12



## The 1.5-meter AZT-12 telescope

The AZT-12 telescope has been the main observing instrument at Tartu Observatory since mid-1970s, it has been used for the last 35 years exclusively for low to medium-resolution long-slit spectroscopy.

Instrument upgrades in the spring of 2026:

- A commercial moderate-resolution fibre-fed white-pupil echelle spectrograph Whoppsel from Shelyak Instruments, with code name TOFES (Tartu Observatory Fibre-fed Echelle Spectrograph)
- A CCD-photometer with an Andor iXon Ultra 888 EM-CCD camera and 12 filters.
- On special request for specific projects, the long-slit spectrograph ASP-32 with a wide range of very low to moderate spectral resolutions ( $R \sim 300 \dots 10000$ ) is available.

New instruments are attached to a custom-made Cassegrain focus instrument cube and focal reducer (see Figures 1 and 2), which allows to select one of four channels:

- Wide-field channel for photometry (corrected Field of View (FoV) 10 arcminutes)
- Three narrow-field channels for spectral instruments (corrected FoV 3 arcminutes)

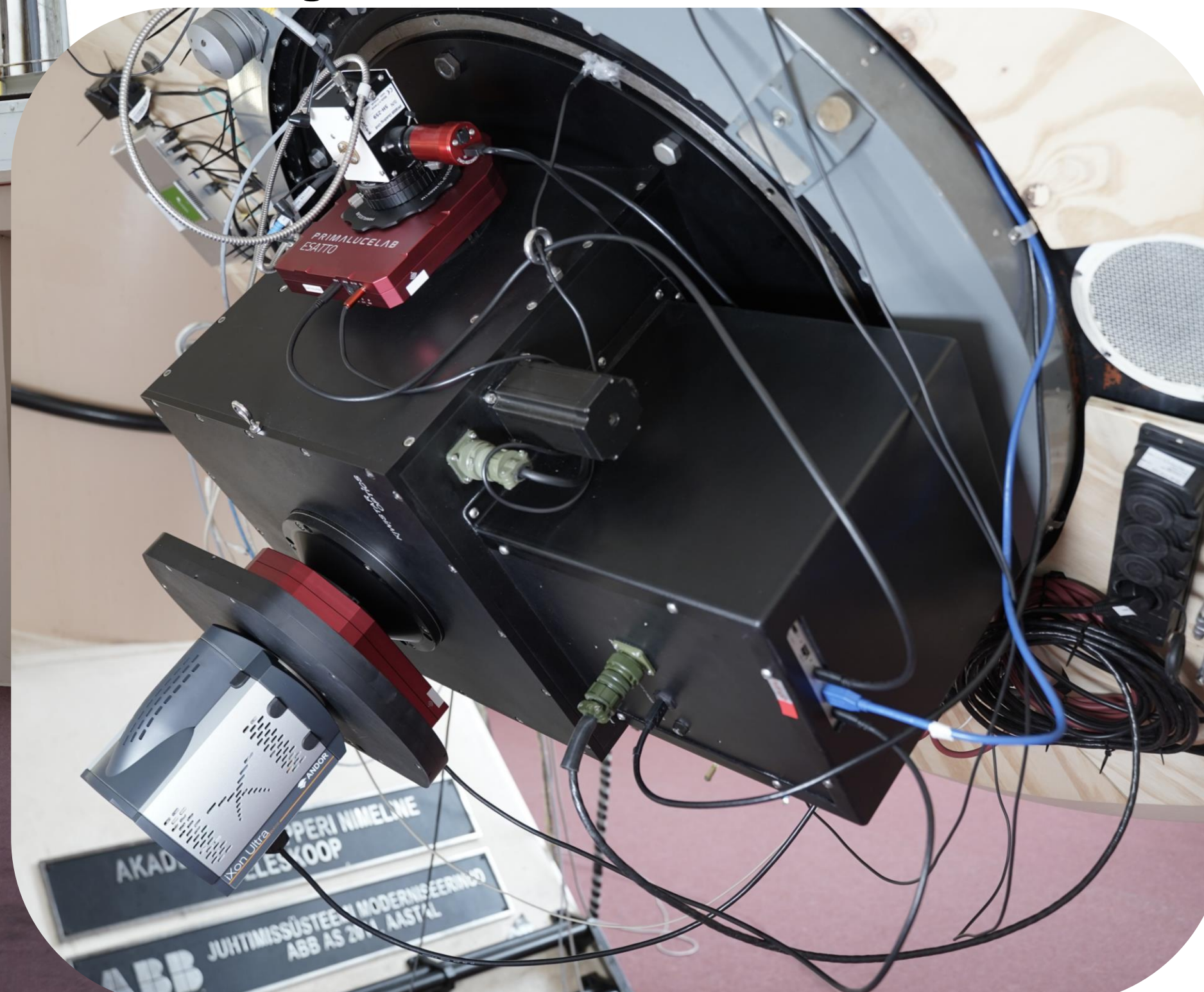
## The CCD photometer

The main properties of AZT-12 photometer are:

- FoV of 3.8 x 3.8 arcminutes
- Pixel scale is 0.223 "/pix
- Very fast EM-CCD camera with photon counting capability and reasonably fast full-frame read-out times (1 s or 10 s)
- Covers wavelength range from near-UV to near-IR with 12 filters:
  - Johnson-Cousins B, V, Rc, Ic from Baader Planetarium (BP)
  - SDSS  $u'$ ,  $g'$ ,  $r'$ ,  $i'$ ,  $z'$  from BP
  - 3.5 nm H $\alpha$  from BP and 3 nm [NII] 6583 from Astrodon
  - Wide bandpass Luminance (400-700 nm)
  - SDSS  $y$  and ExoBB long-pass filters on demand for longer projects

The estimated photometer performance is  $SNR \approx 880$  for a 100-sec exposure of a  $V=15^m$  star at zenith, with scintillation noise of 0.23 ppt.

Figure 2. AZT-12 instrument cube



## The spectrograph TOFES

The fibre-fed spectrograph TOFES can be used in low- and high-resolution regime, offering following capabilities:

- Spectral resolution  $R \sim 33000$  and  $R \sim 16000$ , which is determined by used optical fibre diameter
- Wavelength range limits are 380 – 910 nm in 53 orders
- Limiting magnitude in a 1 hour exposure and with  $S/N=100$  is  $7.5^m$  for high-resolution mode.
- Wavelength accuracy  $\sim 150$  m/s.
- Data reduction pipeline TOFES-DRP (Borthakur 2026), based on PyReduce (Piskunov et al 2021)
- Instrument commissioning is in progress.

## First results

Based on commissioning observations, an SNR estimate has been made for TOFES high-resolution mode using observations of the CALSPEC (Bohlin et al. 2025) standard star  $\eta$  UMa ( $V=1.86^m$ , B3V). The SNR estimate was corrected for exposure time and magnitude difference.

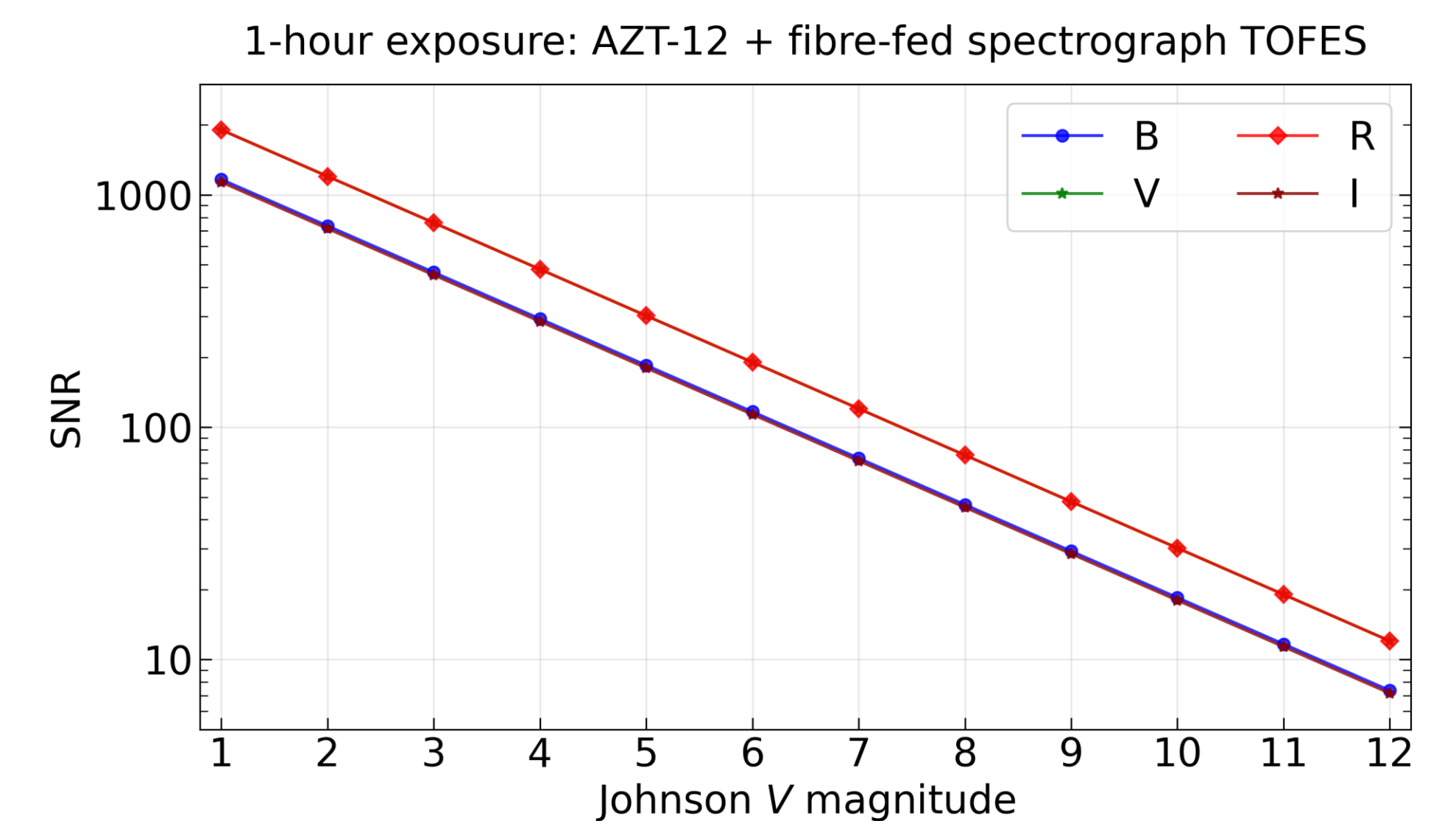


Figure 3. SNR estimate for TOFES,  $R=33000$

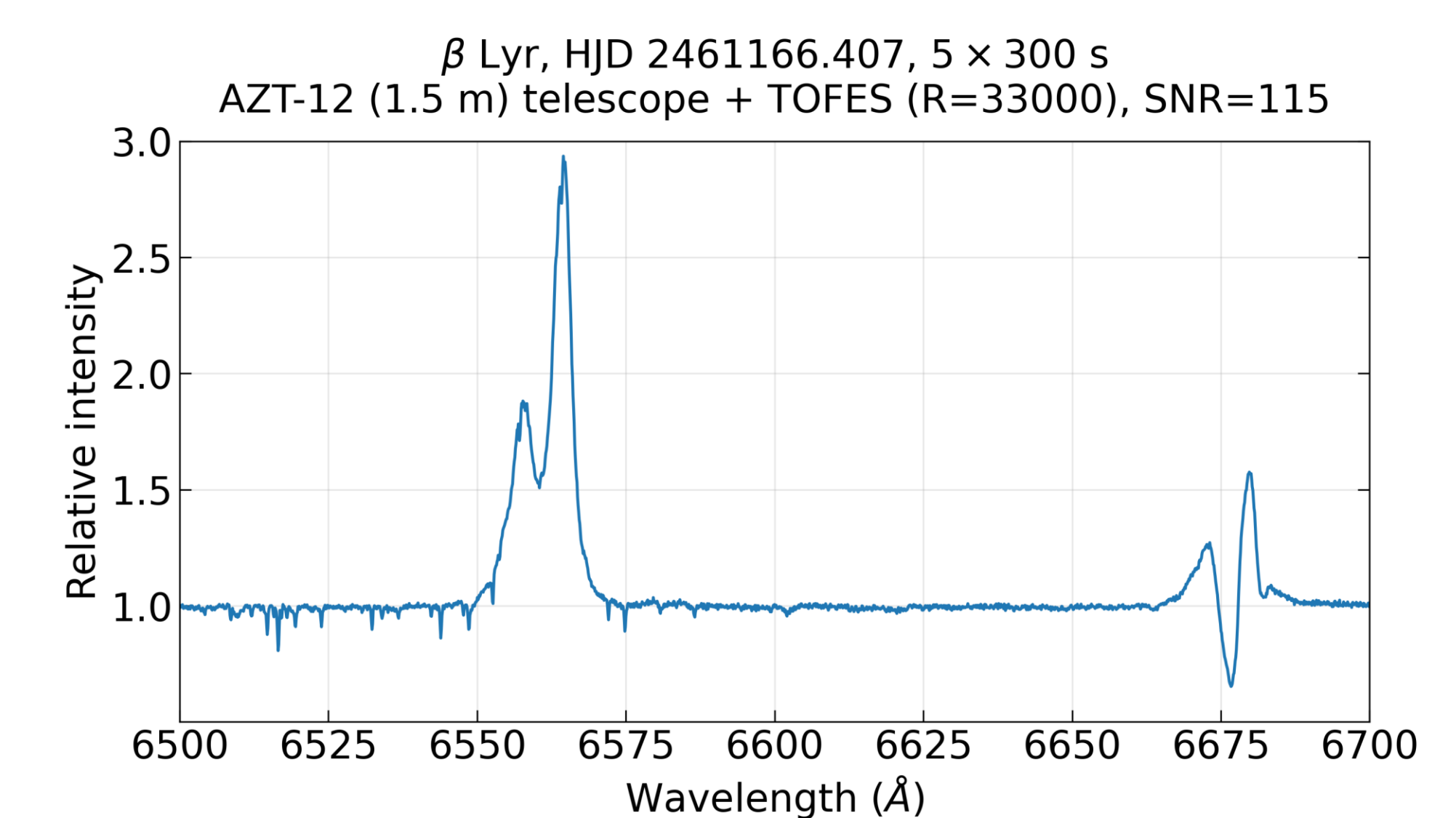


Figure 4. Example spectrum of Shelyak ( $\beta$  Lyr)

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## References

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