The MACRO Consortium

Tools for Optical-Path Spectroscopy on MACRO's *Robert L. Mutel Telescope*

AAS 244
Madison, WI

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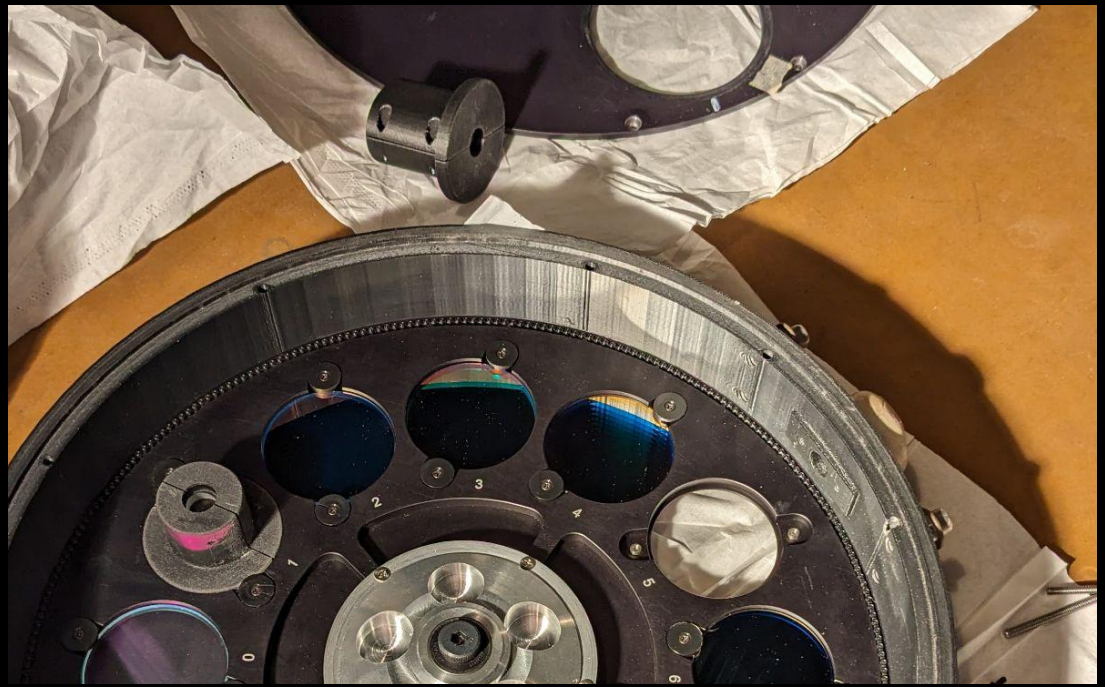
RLMT’s Compact Grism Spectrometers

Low-resolution grism:

- 400 nm $\lesssim \lambda \lesssim$ 750 nm
- R ≈ 300

High-resolution grism:

- 590 nm $\lesssim \lambda \lesssim$ 720 nm
- R ≈ 3000



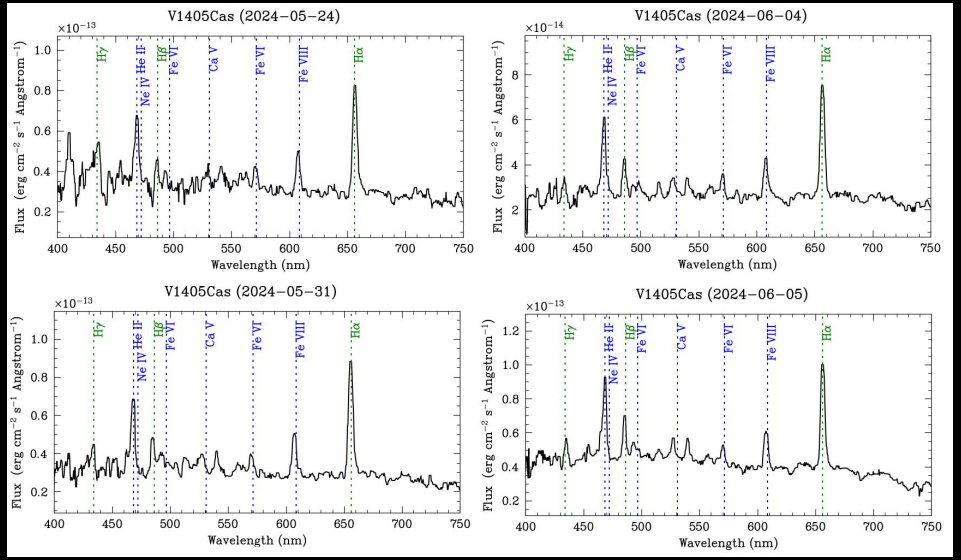
Why do spectroscopy with a small telescope?

Pedagogical:

- Spectral classification
- SN/Nova evolution
- Astrochemistry
- Doppler/redshift

Practical:

- Time series observations
- Adaptability



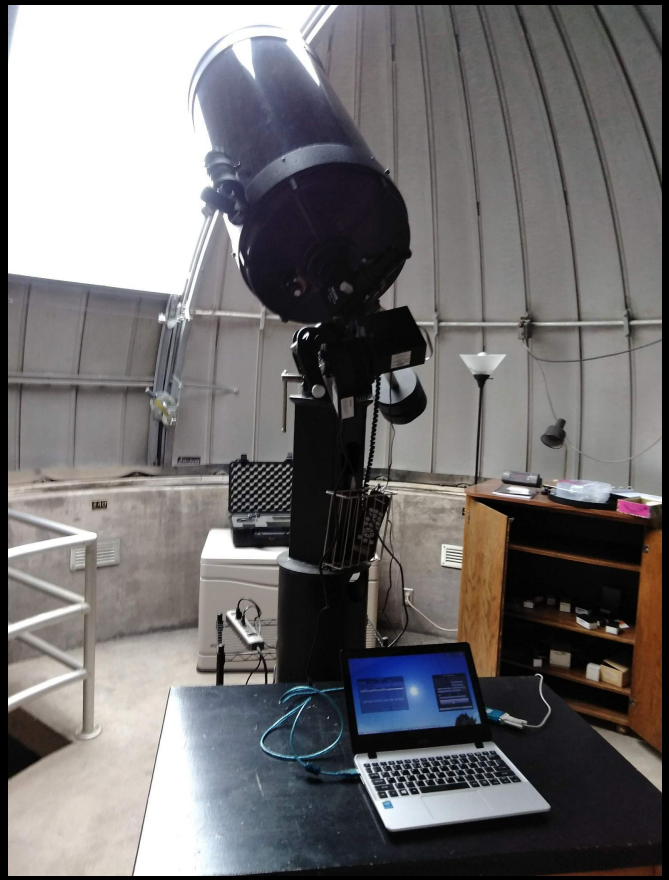
V1405 Cas spectra (#228.16)

The Harsh Reality

Difficulties:

- Weight
- Guiding
- Disassembly required

DSS-7 Spectrometer at Carl Gamble Observatory

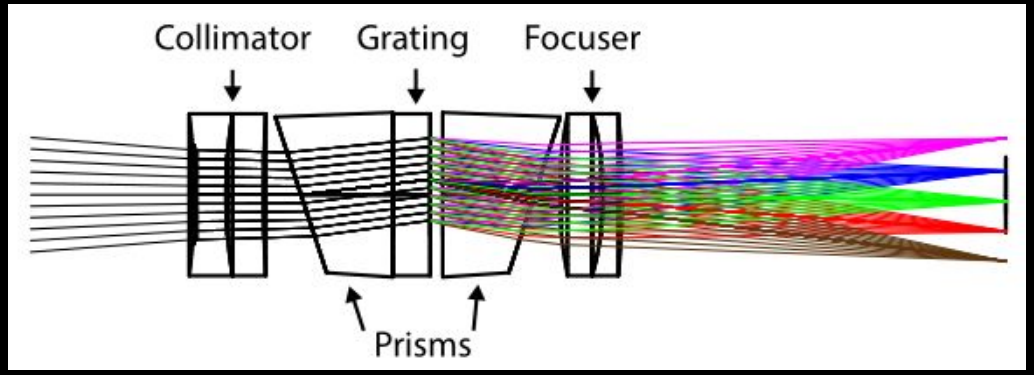


Design

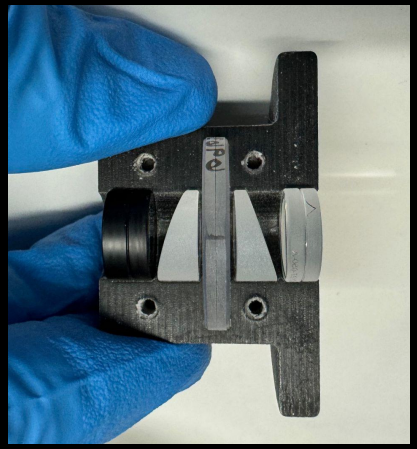
- Diverging/collimating lens
- Wedge prisms: 10°
- Grating: 600 lpmm (dispersion angle 19°)
- Refocusing lens
- 3D-printed housing

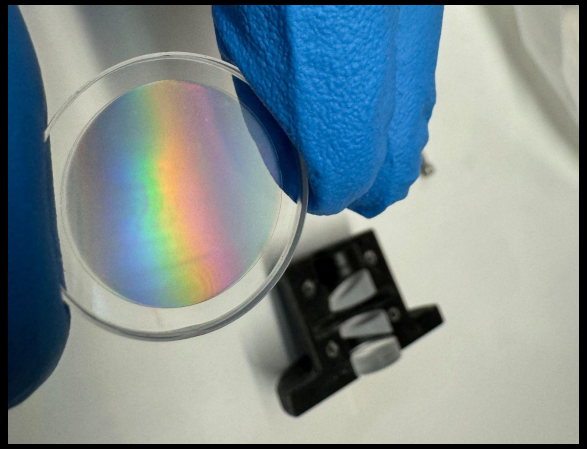
Questions/3D Models:

macroconsortium.org/contact



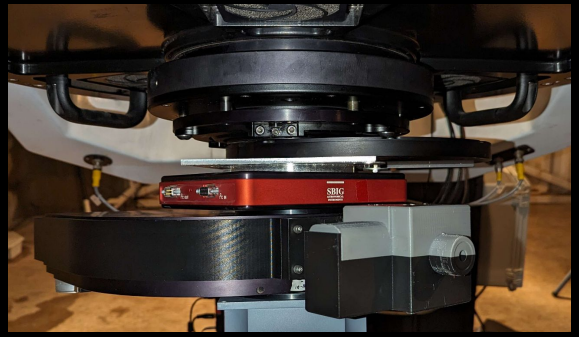
Ludovici & Mutel (2017)

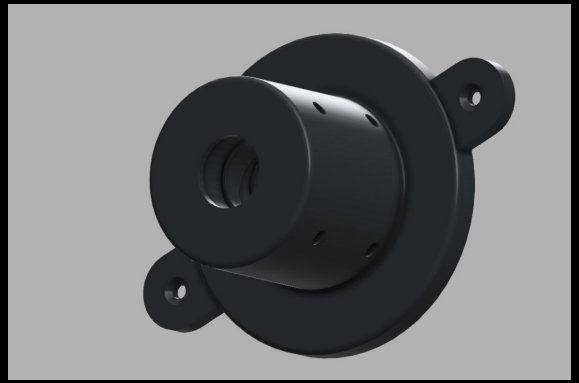




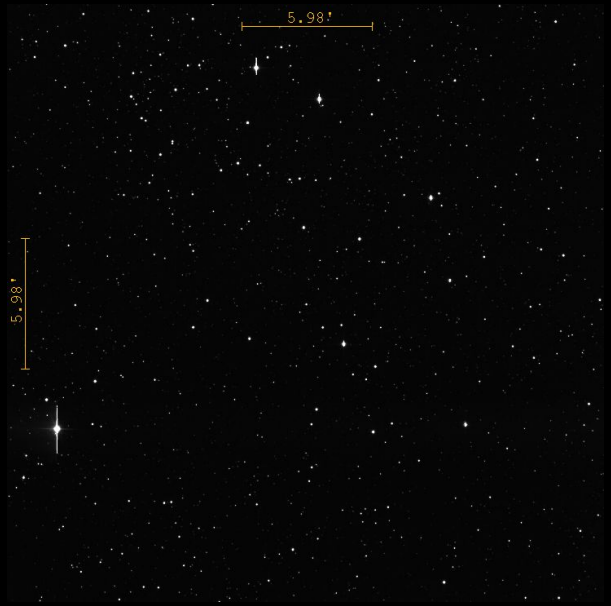
Installation

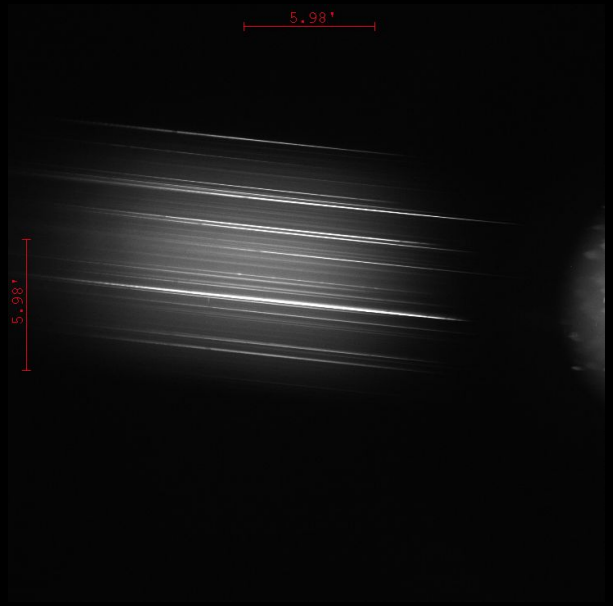
- Grisms mounted directly in filter wheel
- 3D-printed filter wheel housing extension
- Updated keyed housing design fixes orientation of dispersion axis

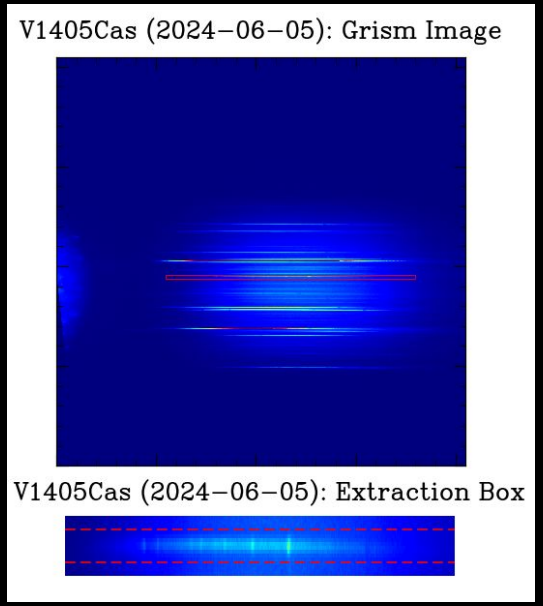




Re-Centering/Extraction

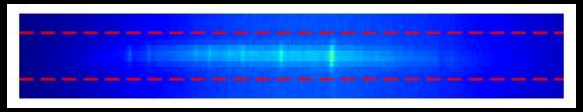


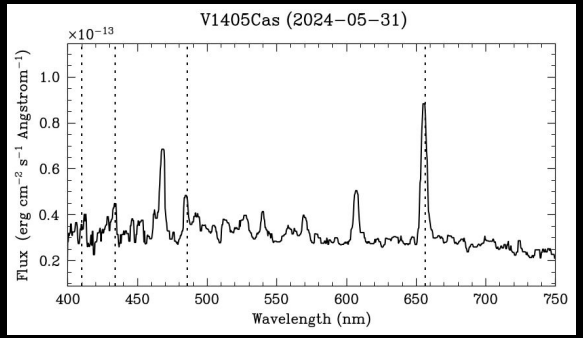




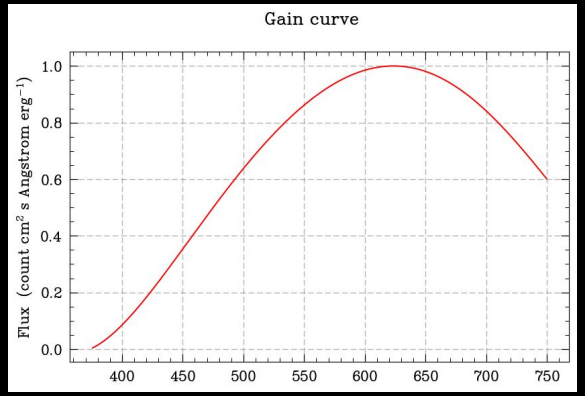
Calibration

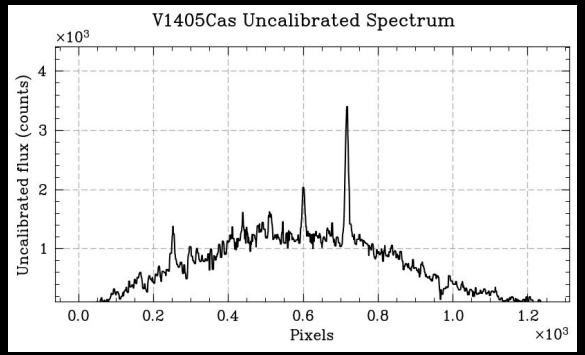
- Vertical summing of pixels in extraction box with background subtraction
- Gain curve computed from multiple observations of 10 Jacoby stars



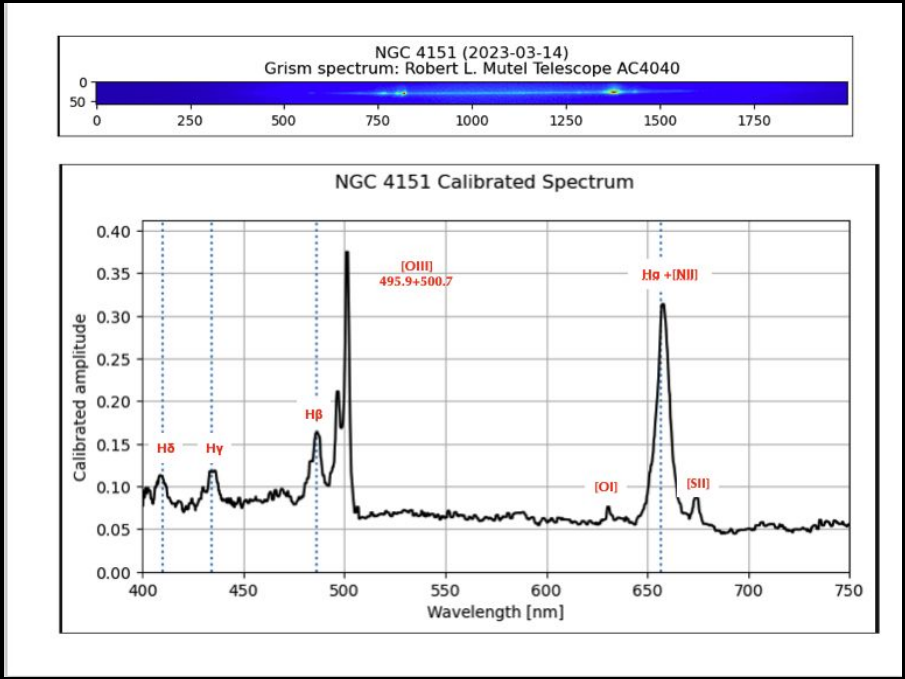


V1405 Cas (Augustana)
H-Balmer lines marked for reference

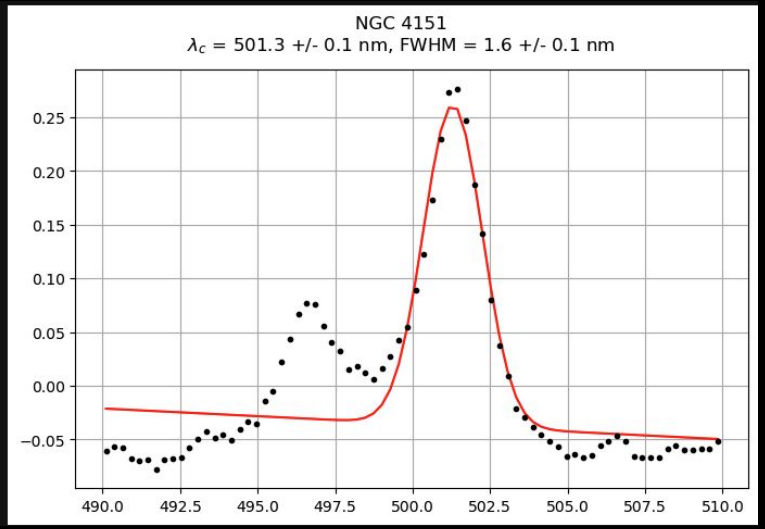




Resolution



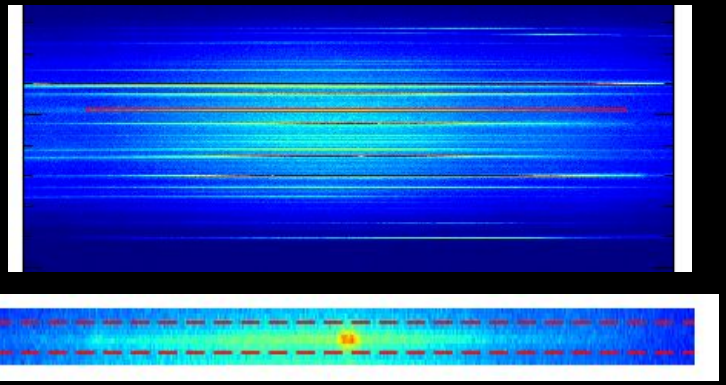
Seyfert galaxy NGC 4151 grism spectrum (Mutel)



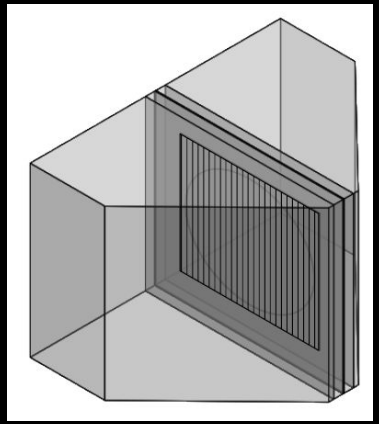
- Forbidden OIII doublet 495.9nm, 500.7nm
- 1.6nm FWHM spectral resolution

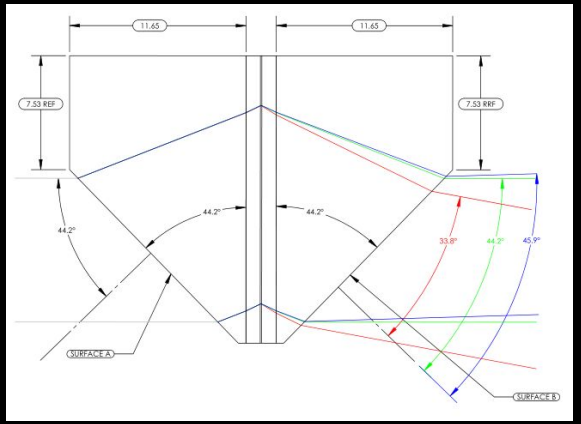
High Resolution Grism

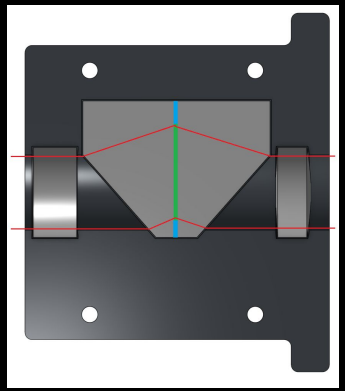
- 2000 lpmm diffraction grating
- 44.2° prisms
- λ ≈ 590-720nm

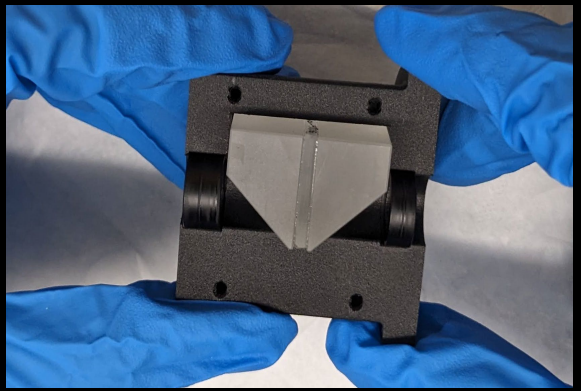


Extraction of high-resolution grism spectrum of V1405 Cas

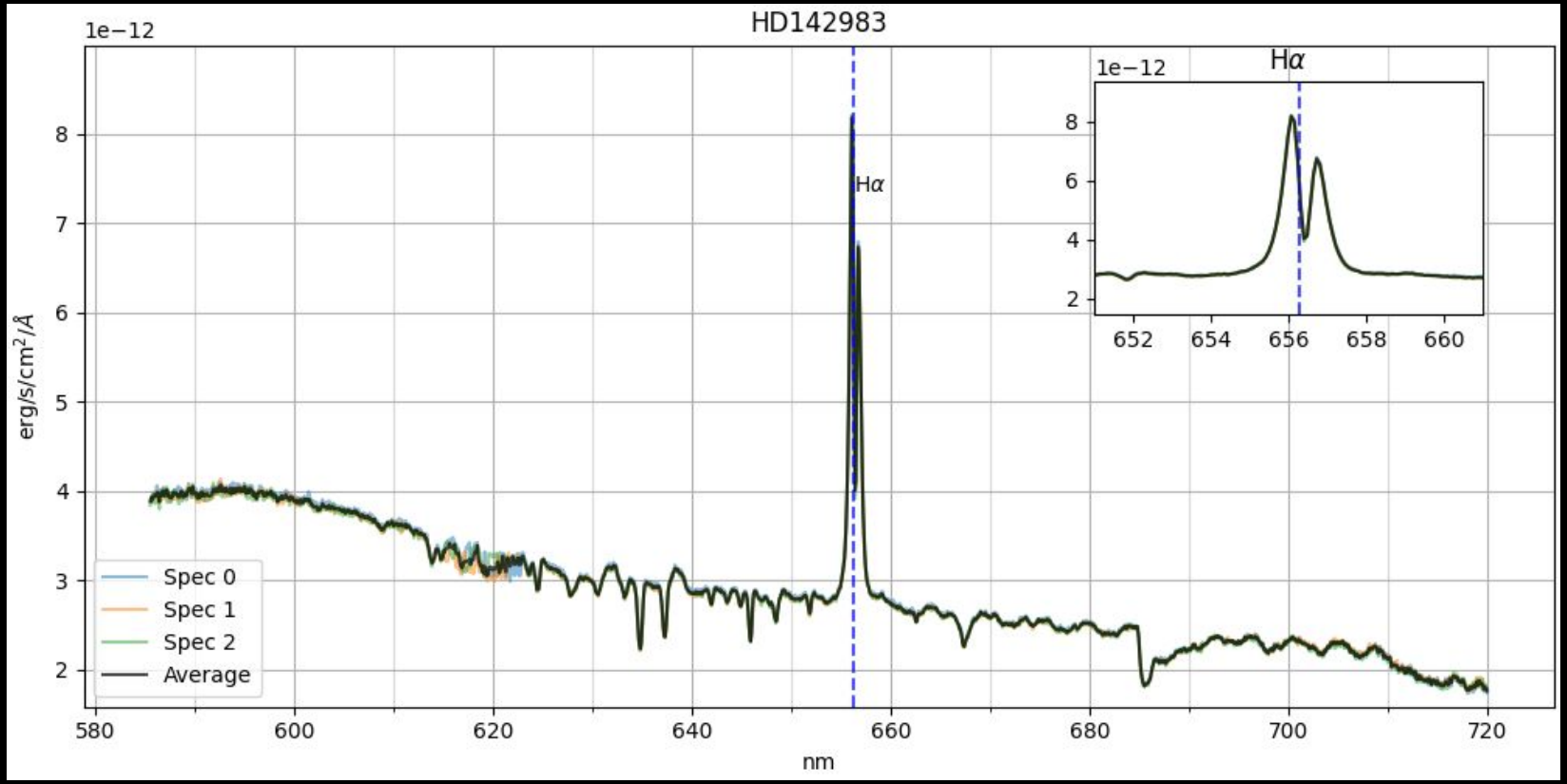




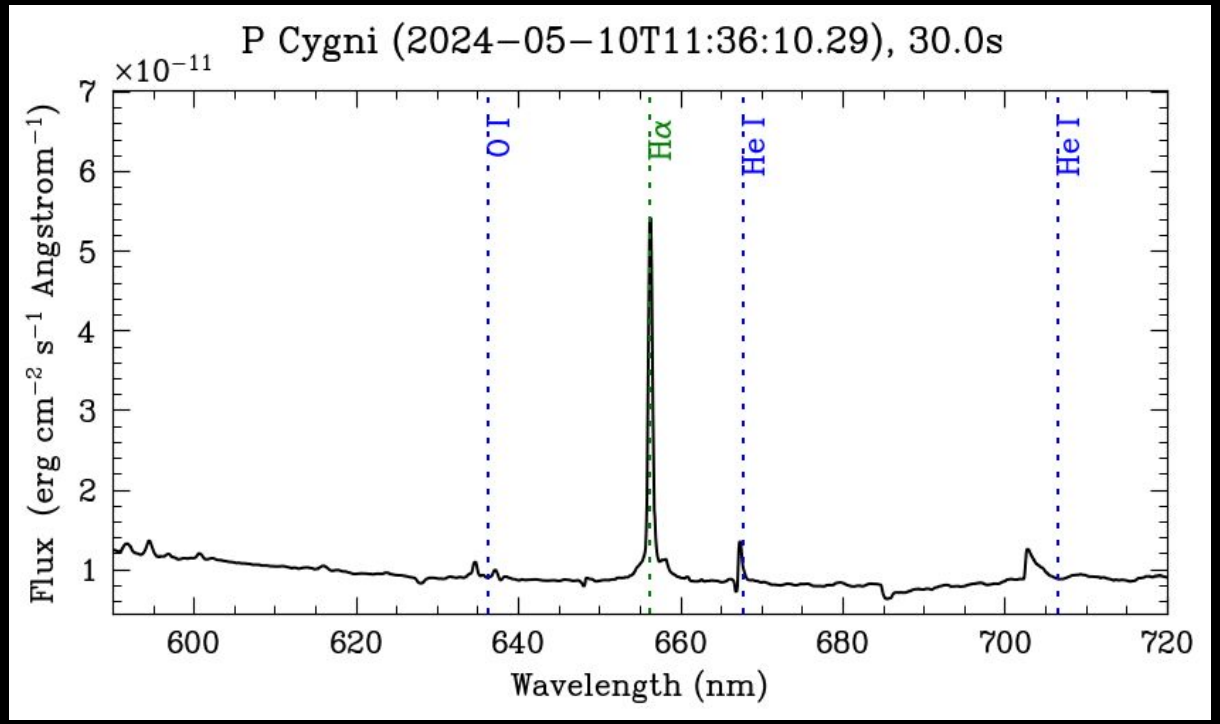


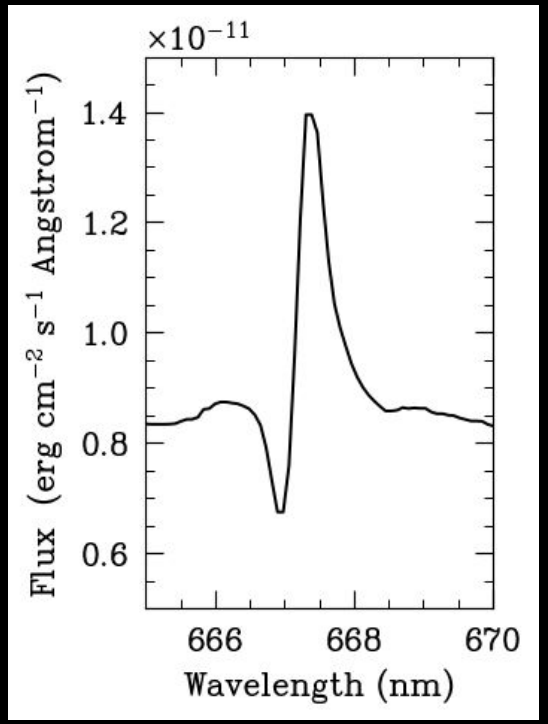


MACRO



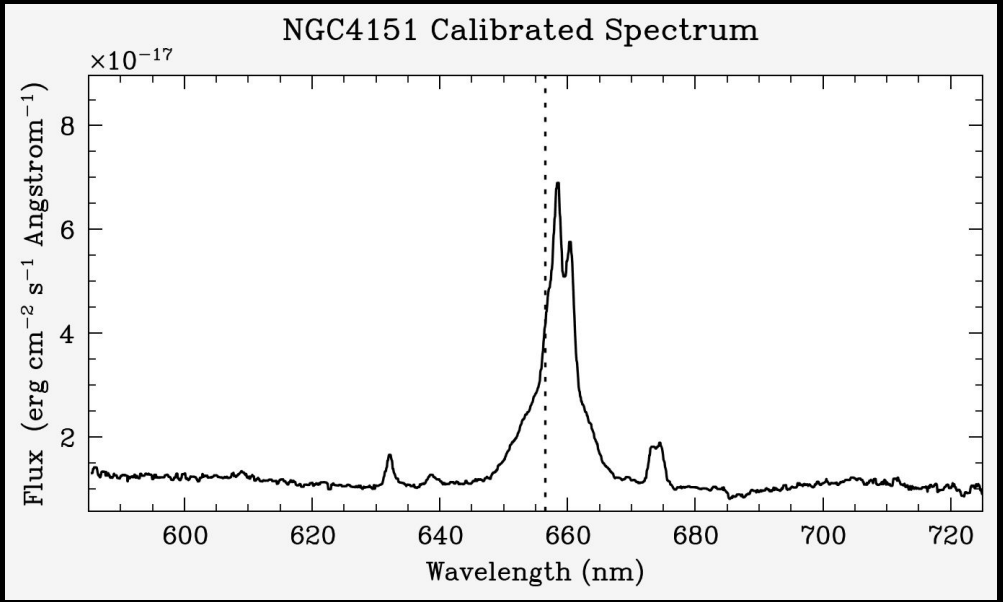
Averaged spectrum of Be star HD14983 (#228.14) revealing asymmetric doubled H-alpha line



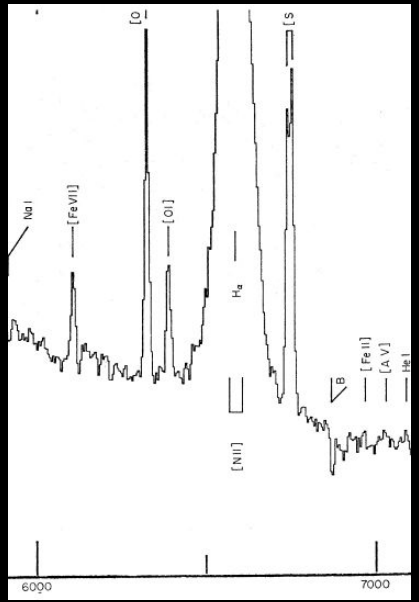


P Cygni LBV showing the eponymous emission + blue-shifted absorption profile for He I (667nm) (#228.05)

Sensitivity limits

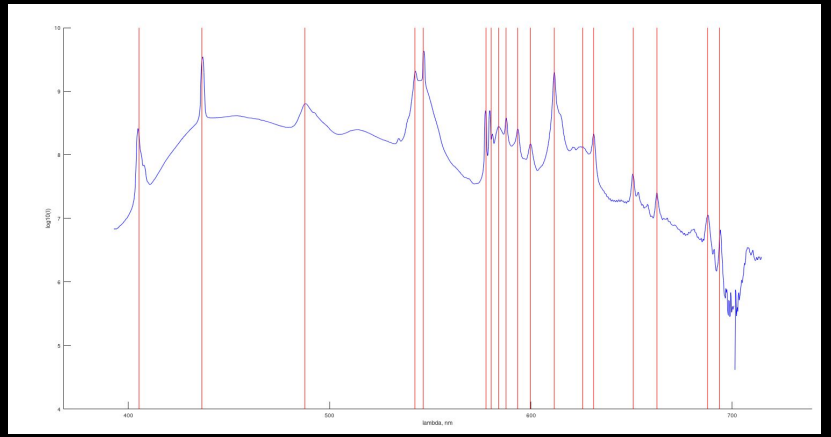


NGC4151 RLMT H-alpha grism spectrum
(#228.15)



Unit Spectrograph
INT 100-inch
(Boksenberg 1975)

Thank You!



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