New modes of observation at the 2-m telescope of Rozhen observatory: parameters of the instruments and first results

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International BELISSIMA Conference:
FUTURE SCIENCE WITH METRE-CLASS TELESCOPES
18-21 September 2012 -- Belgrade, Serbia

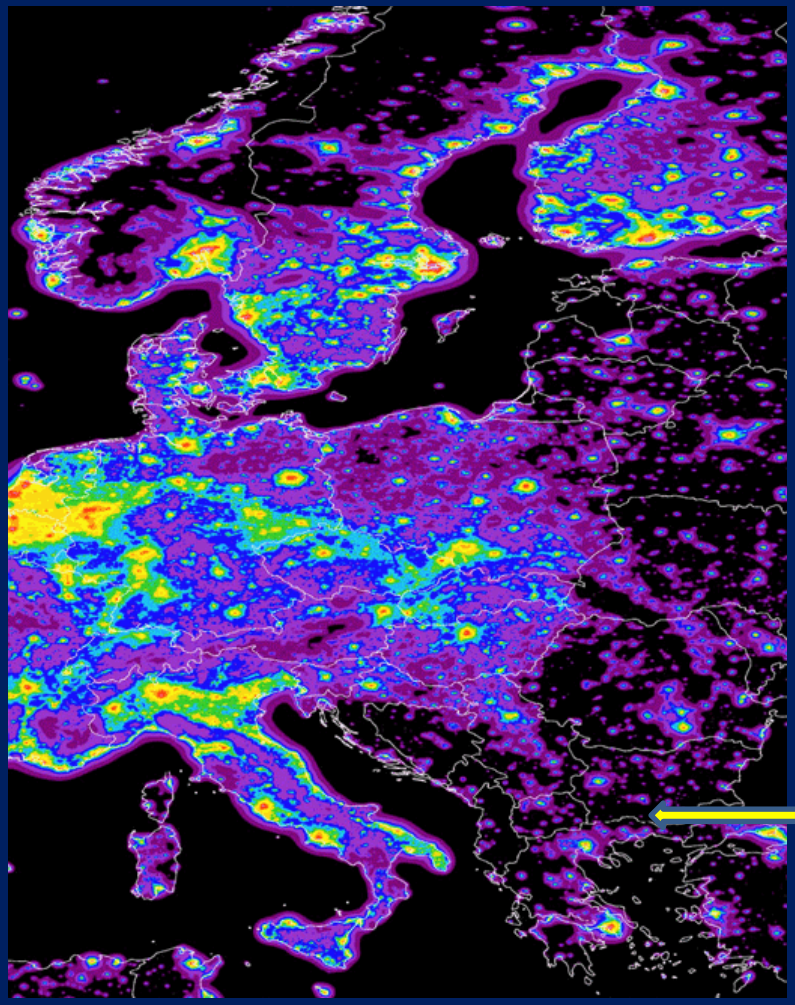
Outline

- The 2-meter telescope – basic parameters
- New camera in the red channel of the FR
- Spectropolarimetry with low spectral resolution
- New slit unit for the low-resolution spectroscopy mode of the FR
- New set of Sloan filters for use in the RC-focus and with the FR
- The near future – fiber-fed echelle spectrograph

Location of the National Astronomical Observatory – Rozhen

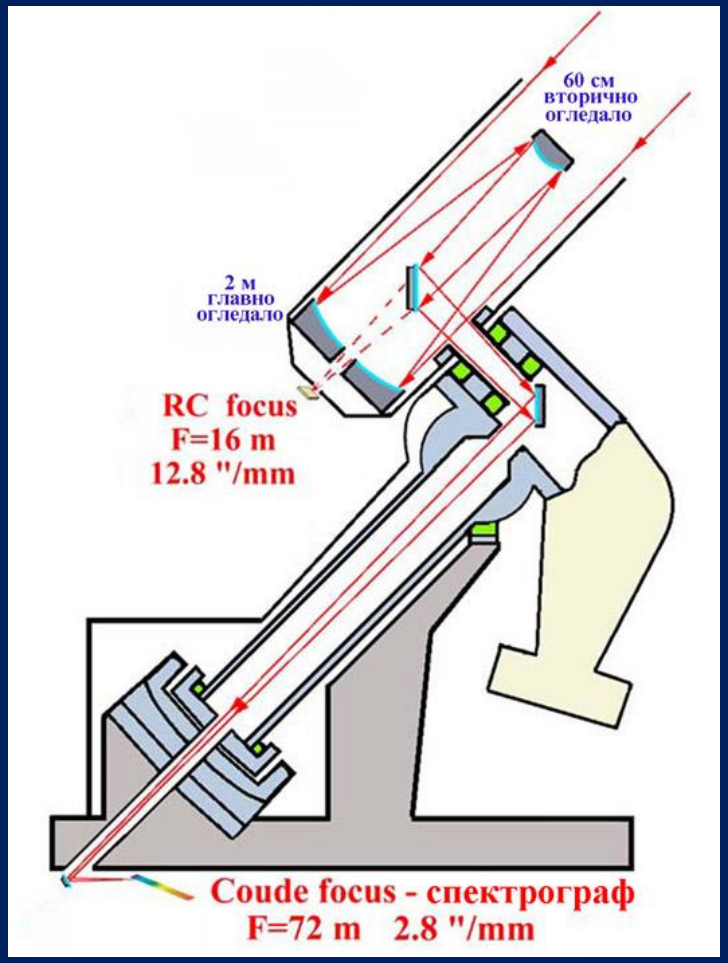
$\lambda = 24° 45'$ E,
$\varphi = +41° 41.5'$
Altitude: 1750 m

Europe: light polution

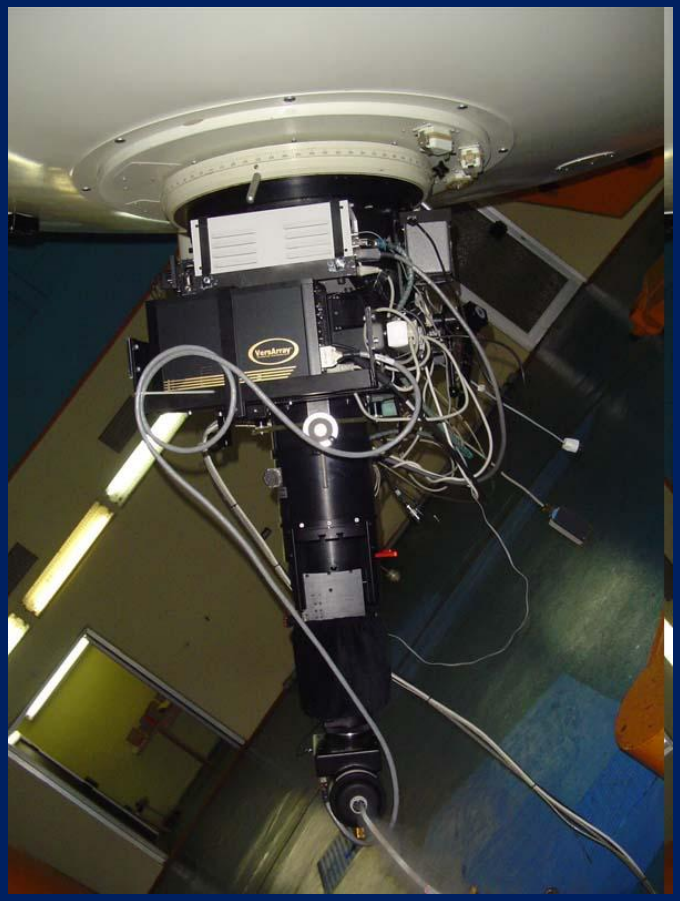


The dome of the 2-meter telescope

The 2 meter telescope



The 2-channel Focal Reducer – FoReRo2

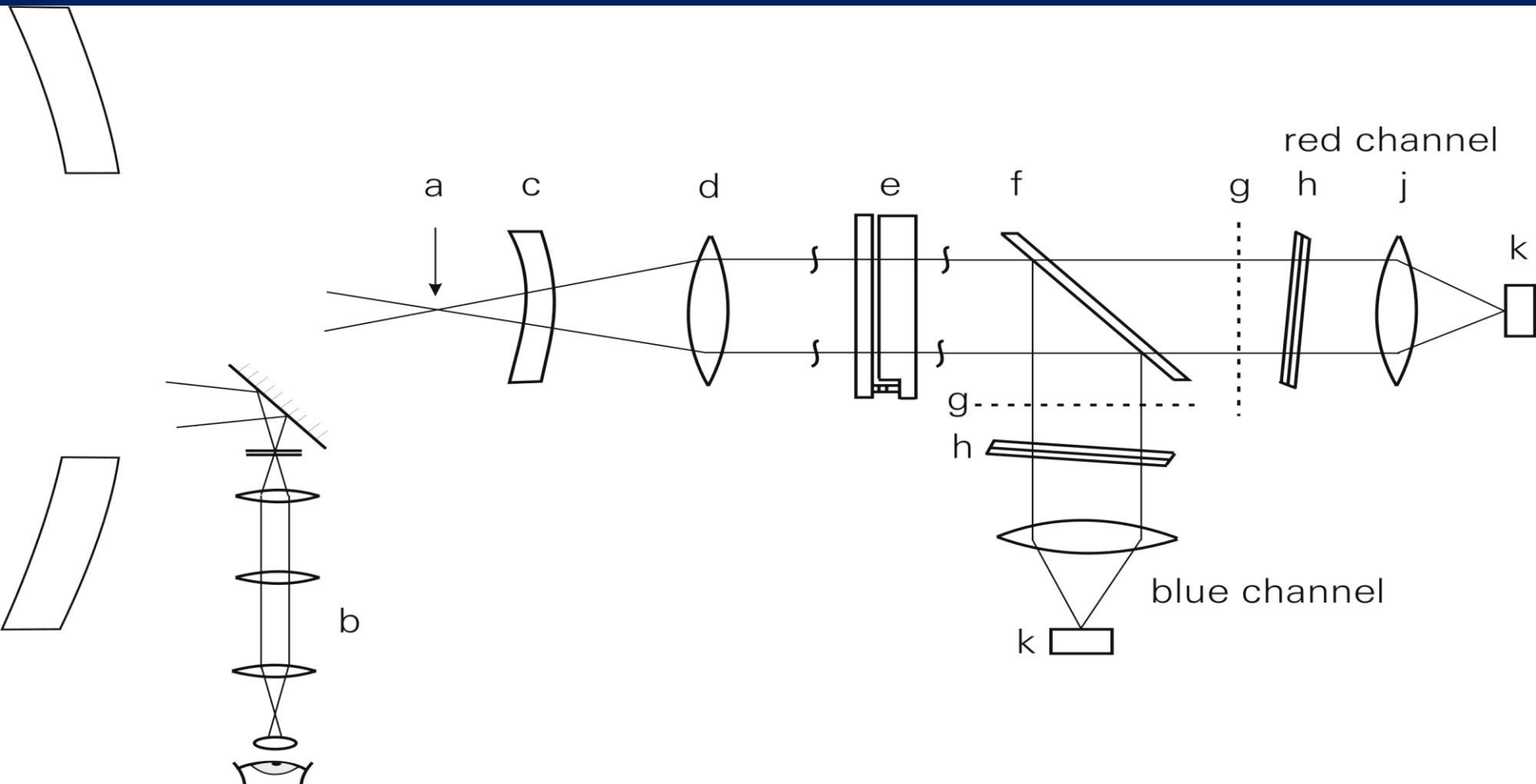


1. Broad band imaging
2. Narrow band imaging
3. Long slit spectroscopy
4. Fabry-Perot imaging
5. Imaging polarimetry

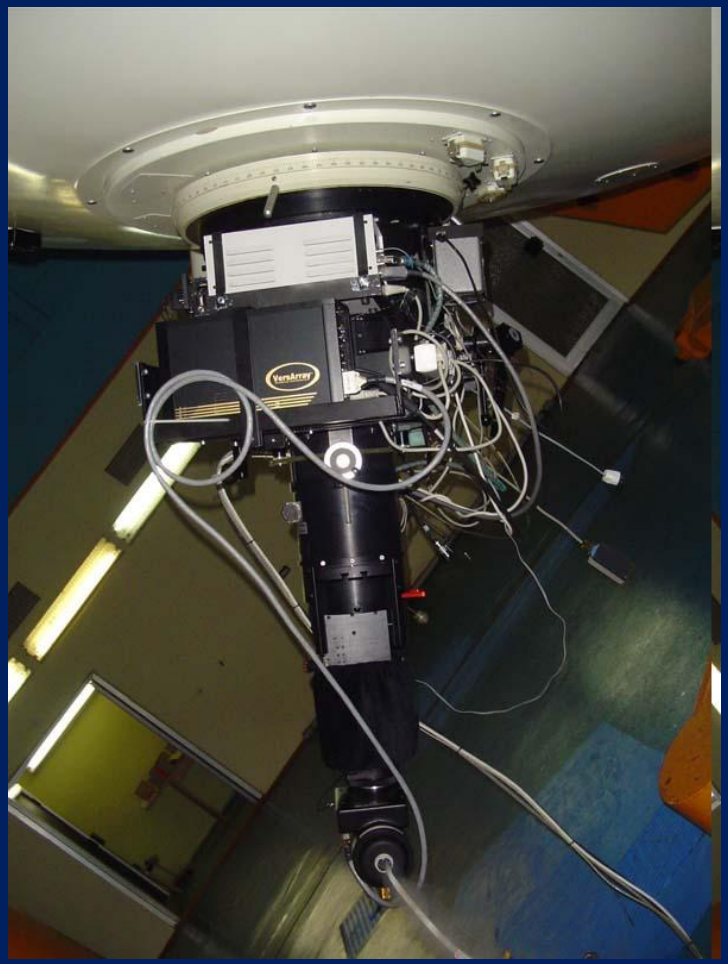
<u>New:</u>

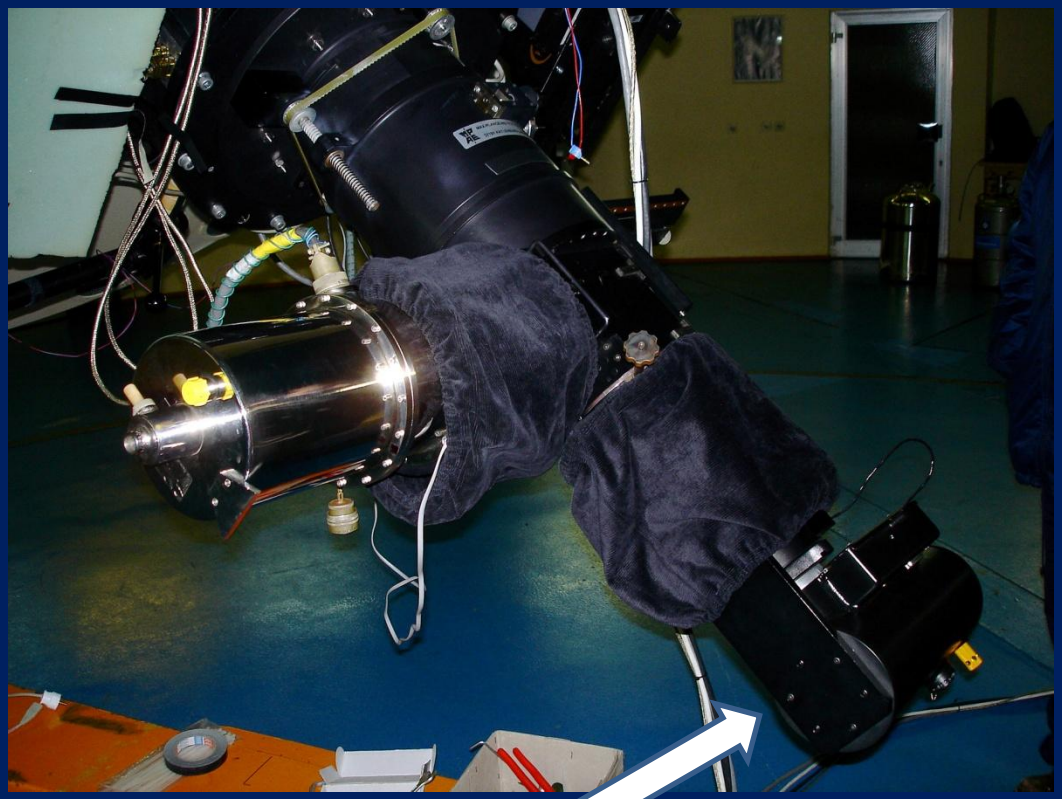
spectropolarimetry and a larger CCD in the red channel

16 m	Focal length	5.6 m
f/8	F-ratio	f/2.8
0.26 “/px	Scale (1px = 0.02 mm)	0.74 “/px



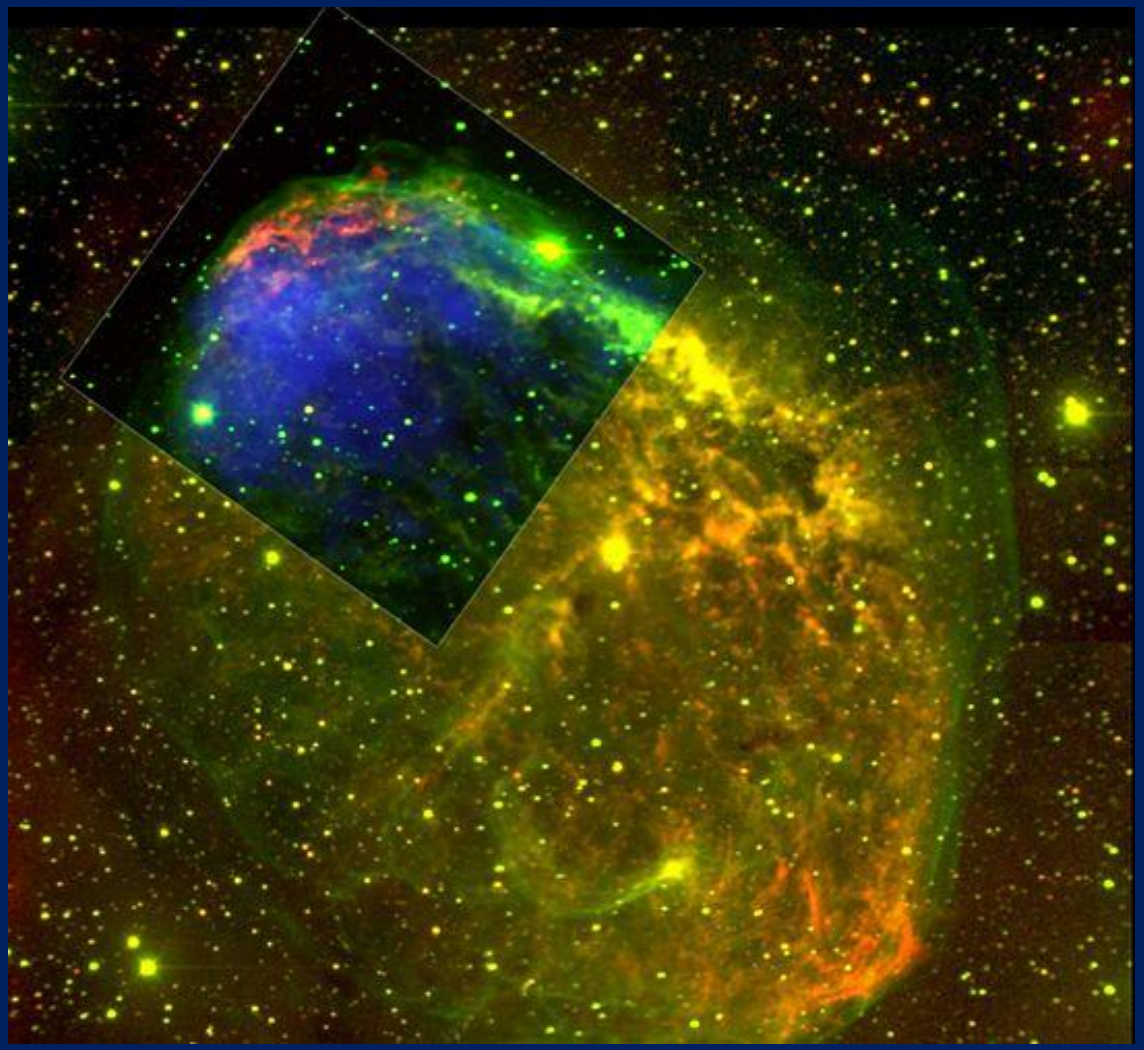
The 2-channel Focal Reducer – FoReRo2





Small (512 x 512 px) camera in the red channel

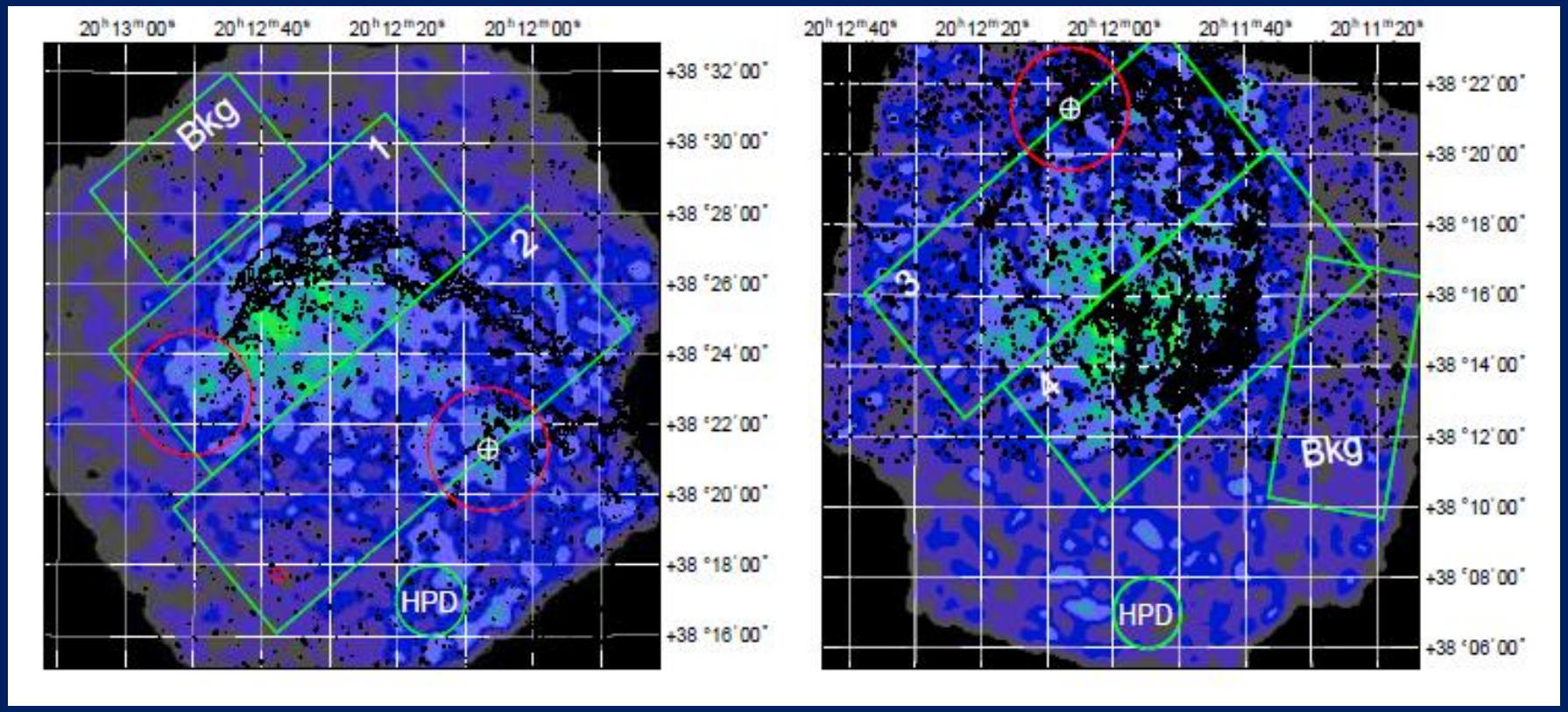
One of the motivations for using a larger CCD: NGC 6888; the crescent nebula. Observations with the Chandra X-ray Observatory and optical



Y.-H. Chu & R. Gruendl (Univ. Illinois) et al. X-ray; CXO / NASA,

Optical; SDSU / MLO (San Diego State University, Mount Laguna Observatory)

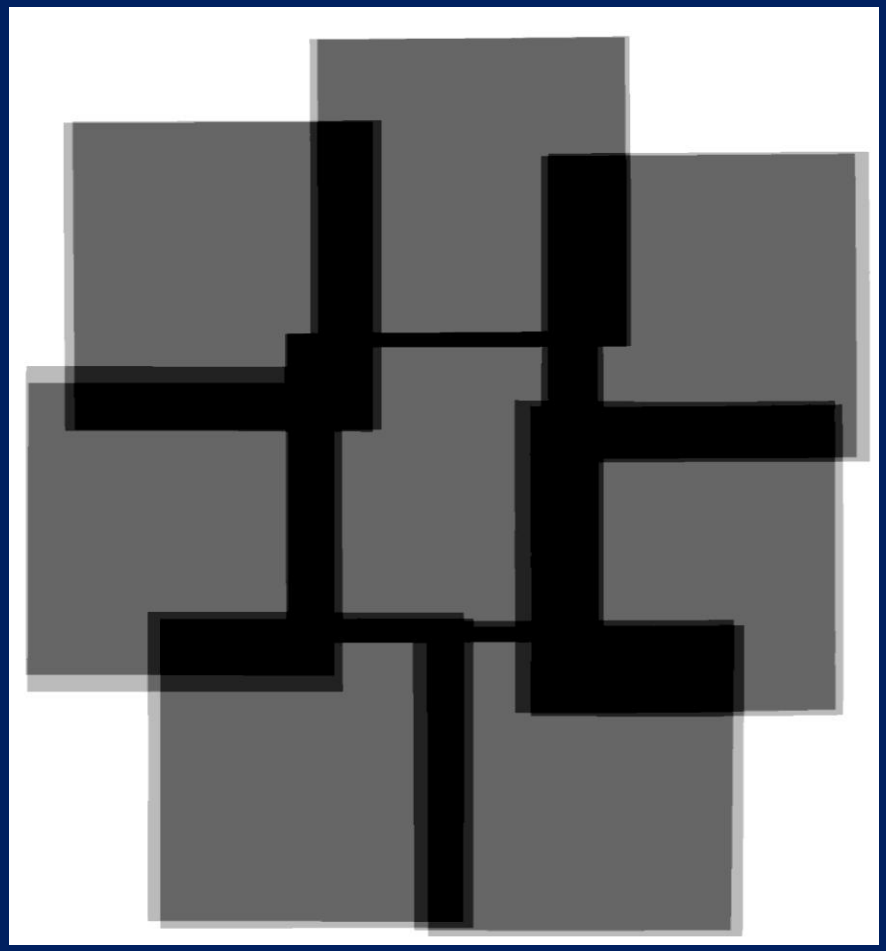
NGC 6888; the crescent nebula: Suzaku observations

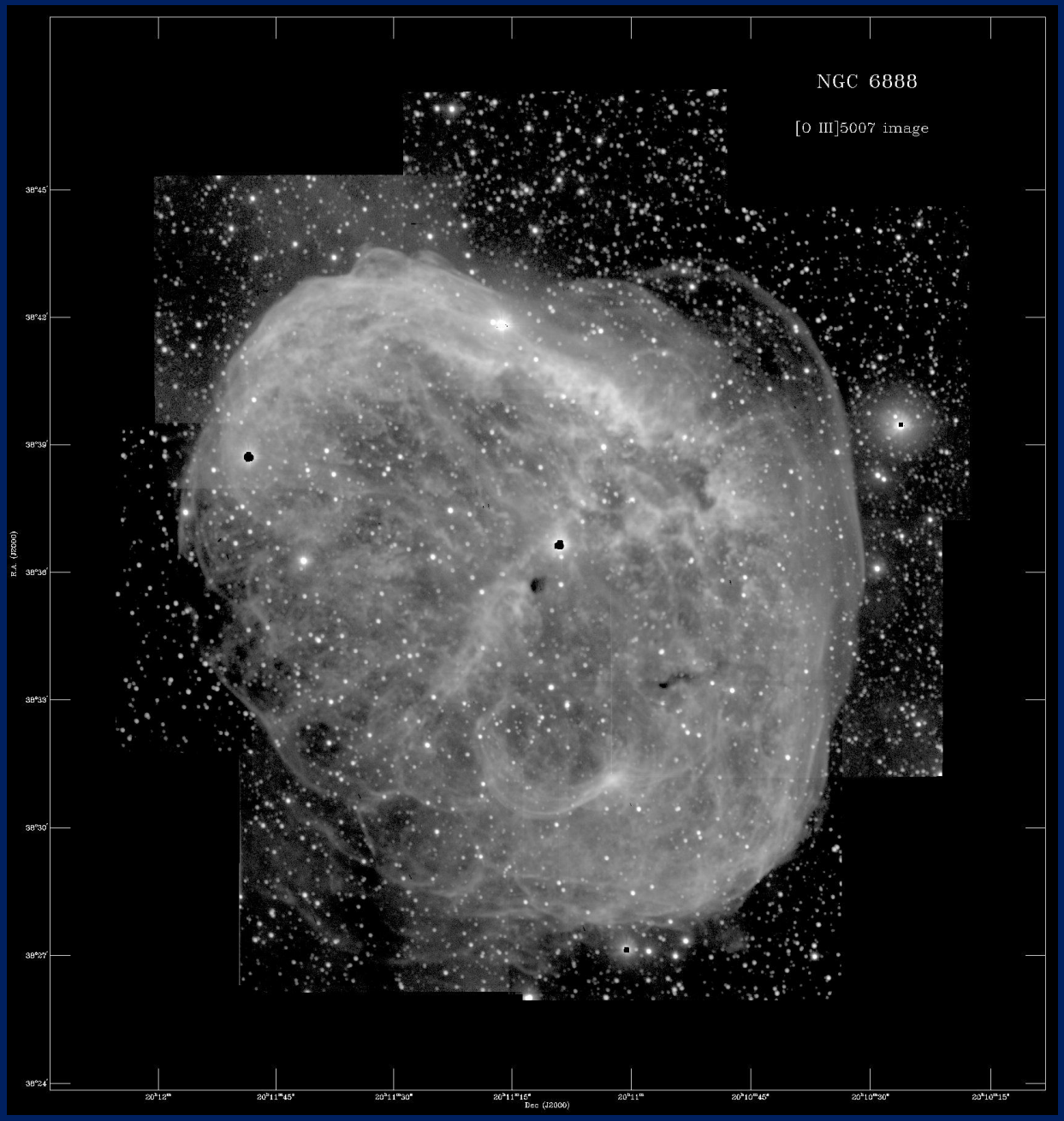


Svetozar A. Zhekov and Sangwook Park, 2011, *Suzaku Observations of the Prototype Wind-Blown Bubble* NGC 6888, ApJ, 728, 135

Motivation for the use of a larger detector with the focal reducer

Data for the old camera:
512 x 512 px
Size of px: 0.024 mm
Scale: 0.88 arcsec/px
FOV : 7.5 x 7.5 arcmin
Angular size of NGC 6888:
12 x 18 arcmin
Imaging of all the nebula possible only by the use of mosaic of 8 subimages



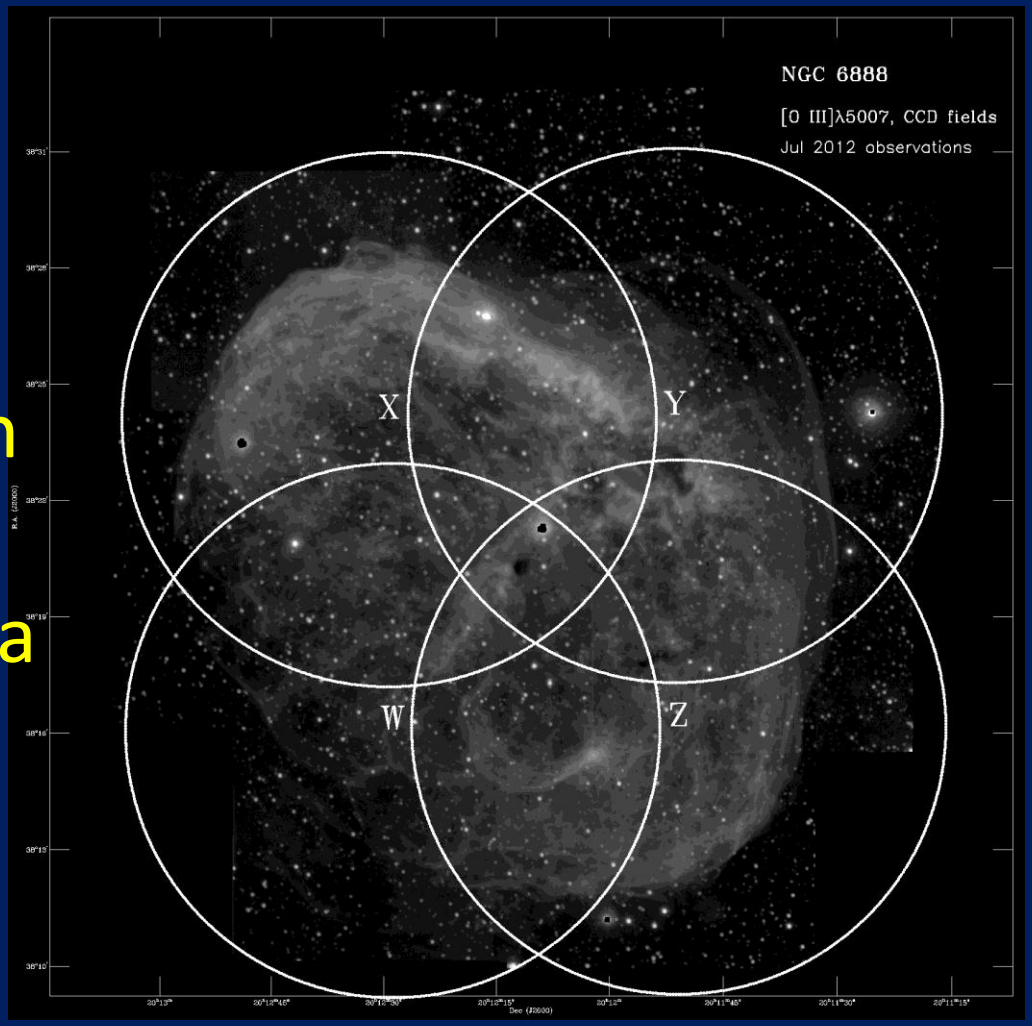


[OIII]5007 image of NGC6888 composed of 8 sub-images Obtained in 2011

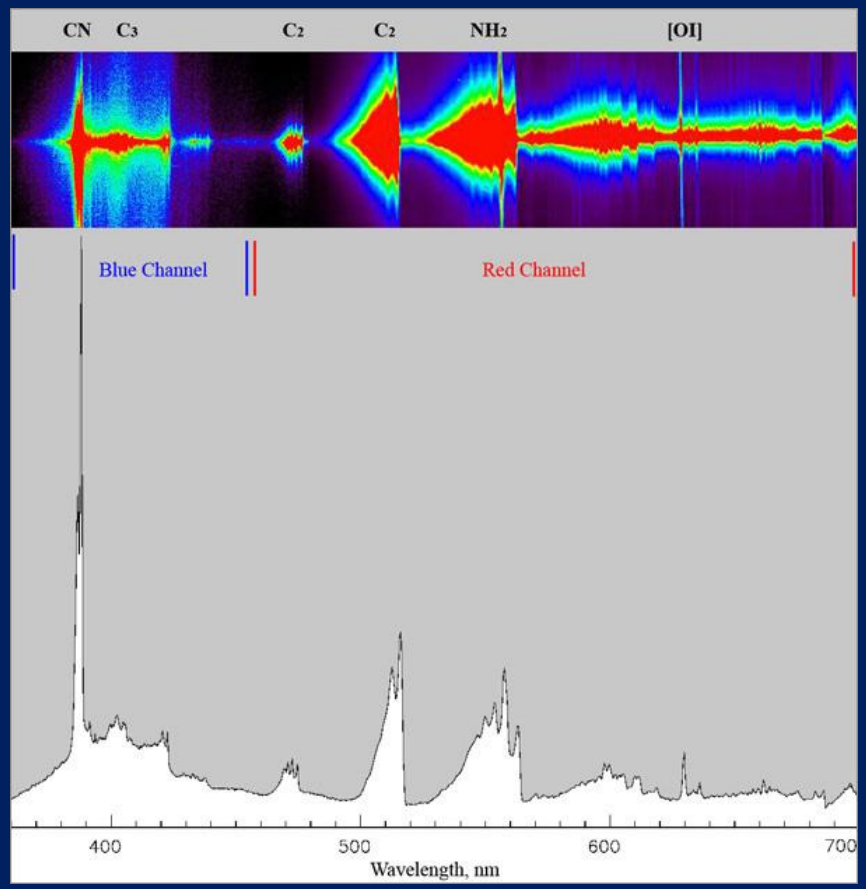
Parameters of the focal reducer used with a larger CCD: VersArray 1300 B

Data for the new CCD:
1340 x 1300 px
Size of px: 0.020 mm
Scale: 0.74 arcsec/px
FOV : 16.4 x 16.0 arcmin

Imaging of all the nebula possible with a mosaic of 4 subimages .



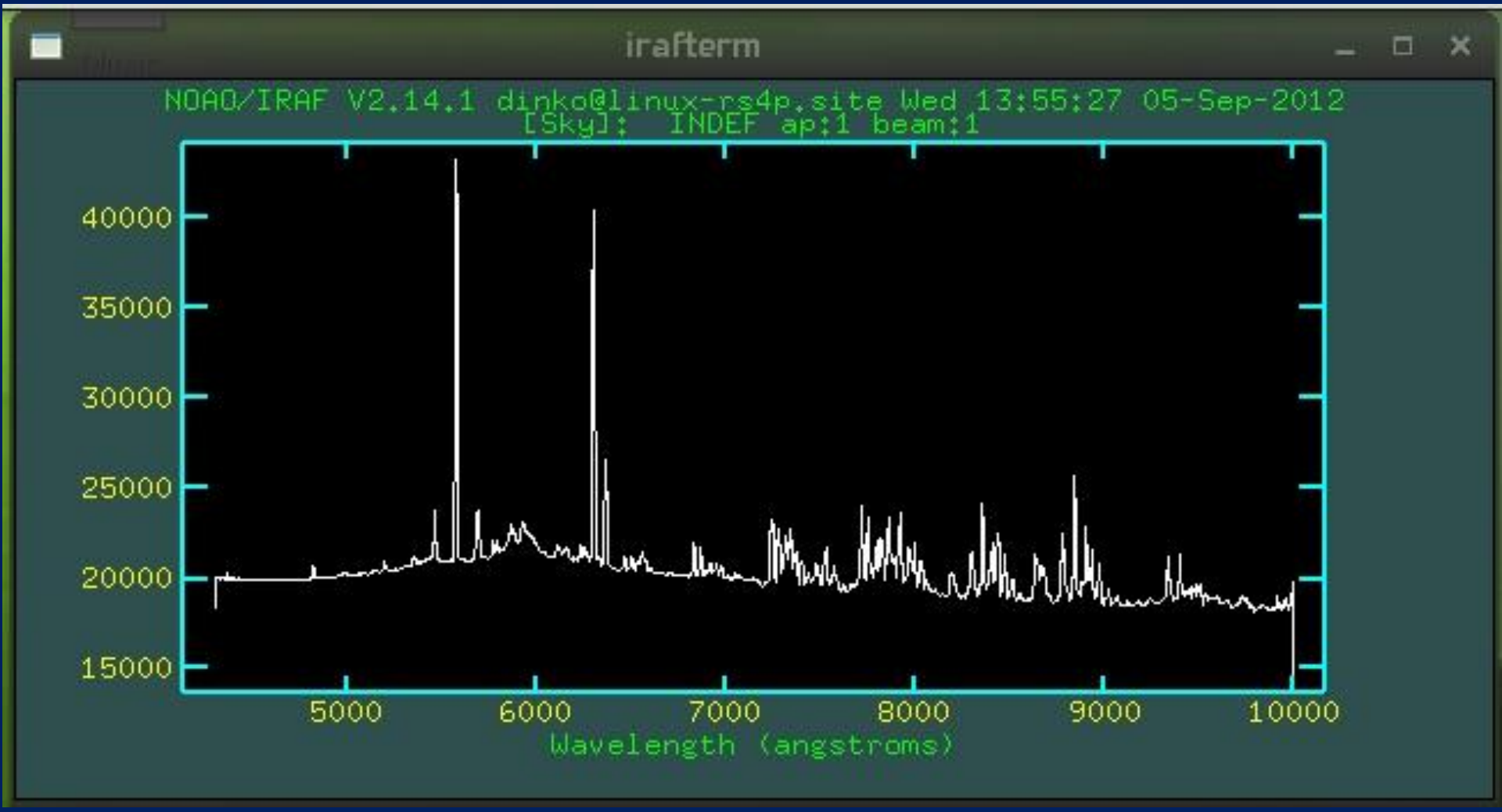
Low resolution spectroscopy: another motivation for using of a larger detector with the focal reducer



Low resolution spectrum obtained with FoReRo2 at the 2-m Telescope with the old CCD.

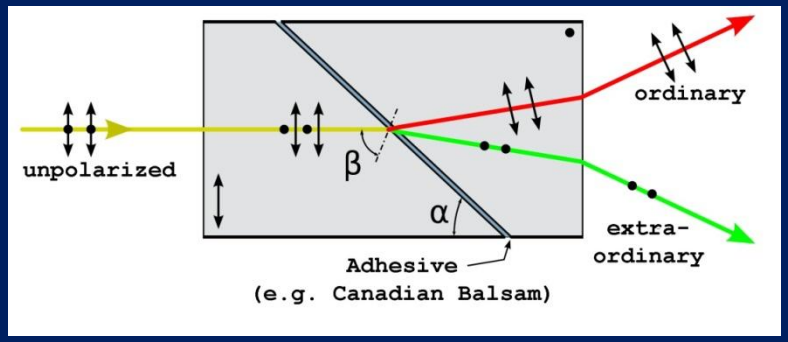
Inv. Linear dispersion: 5.0 A/px.
Spectral range: 2560 A (in the red channel)

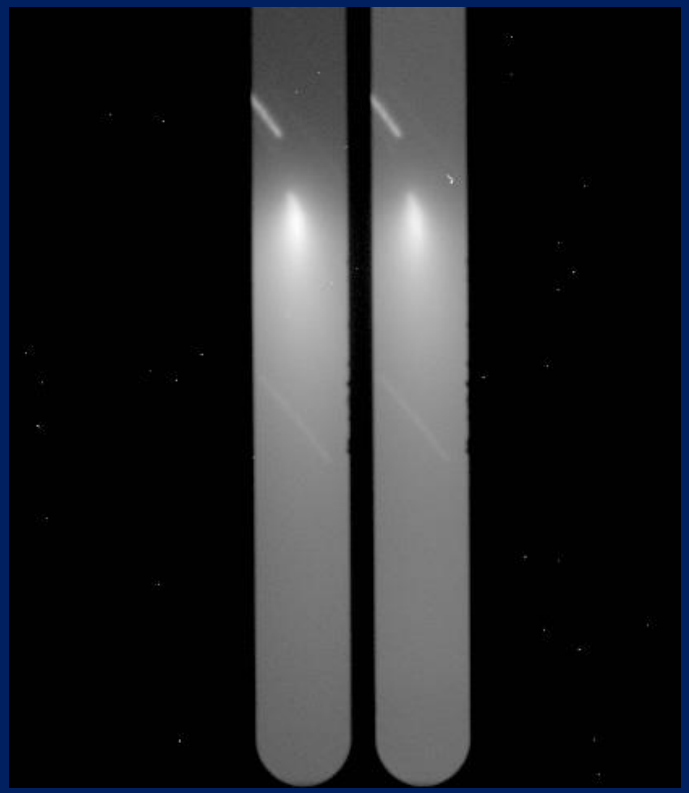
Spectrum of the night sky over Rozhen obtained with the CCD Versarray 1300B: Full spectral range: 5800 Å
Inversed linear dispersion: 4.3 Å/px; (red channel only!)



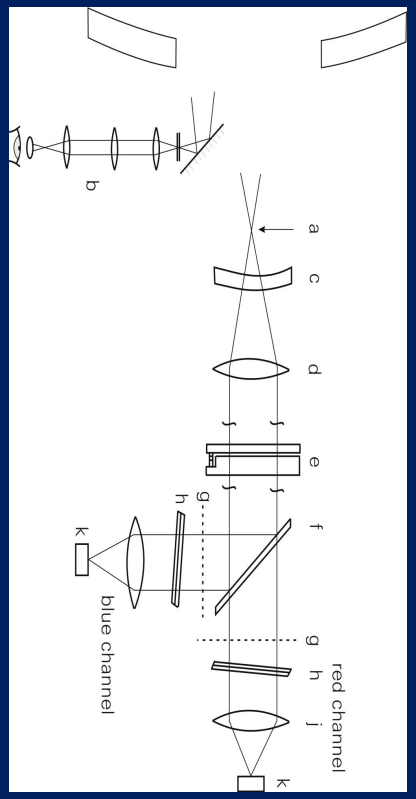
Examples of observations with the focal reducer

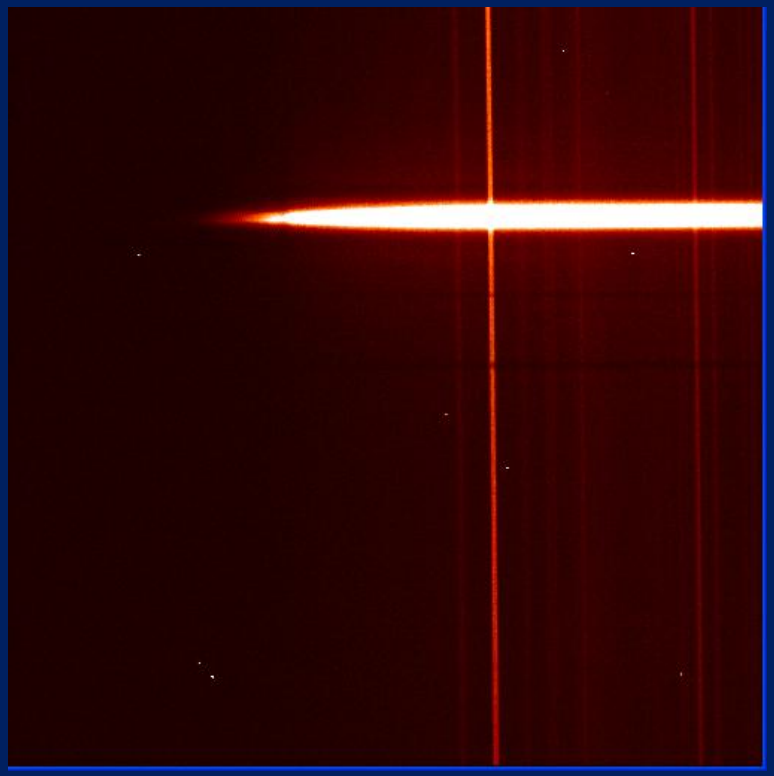
Polarimetry





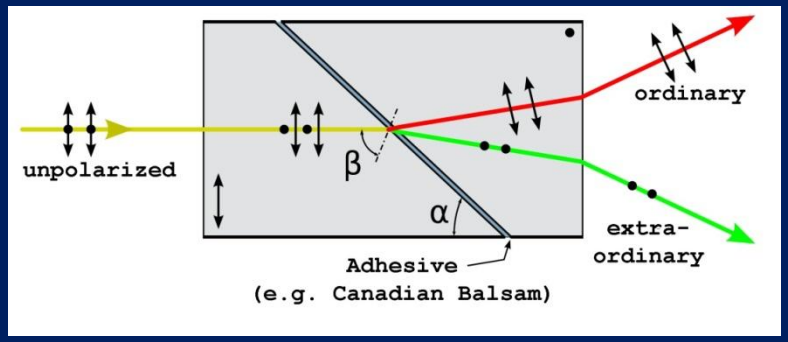
low dispersion spectroscopy

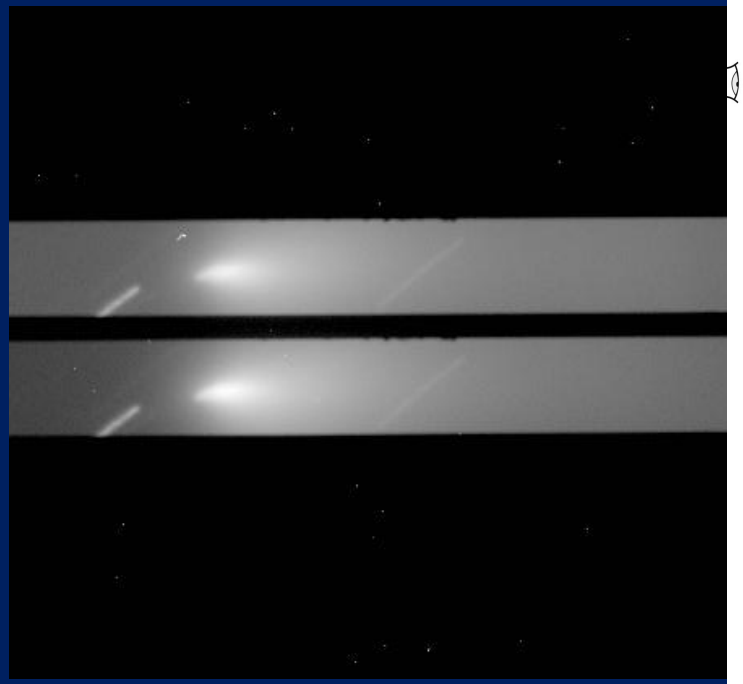




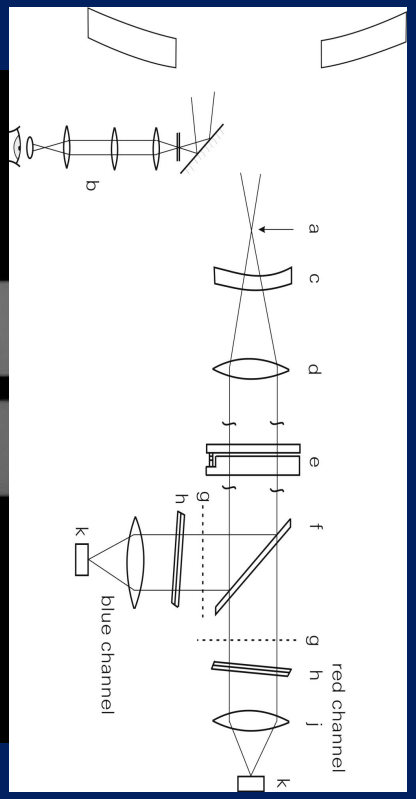
Examples of observations with the focal reducer

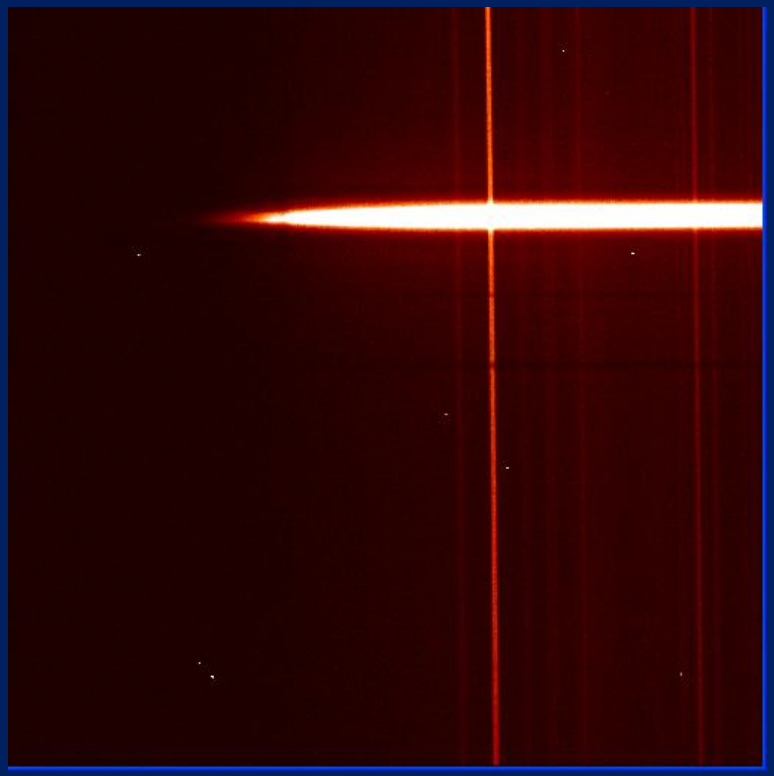
Polarimetry





low dispersion spectroscopy





Spectropolarimetry: First observations and results

Comet C/2009 P1 (Garradd)

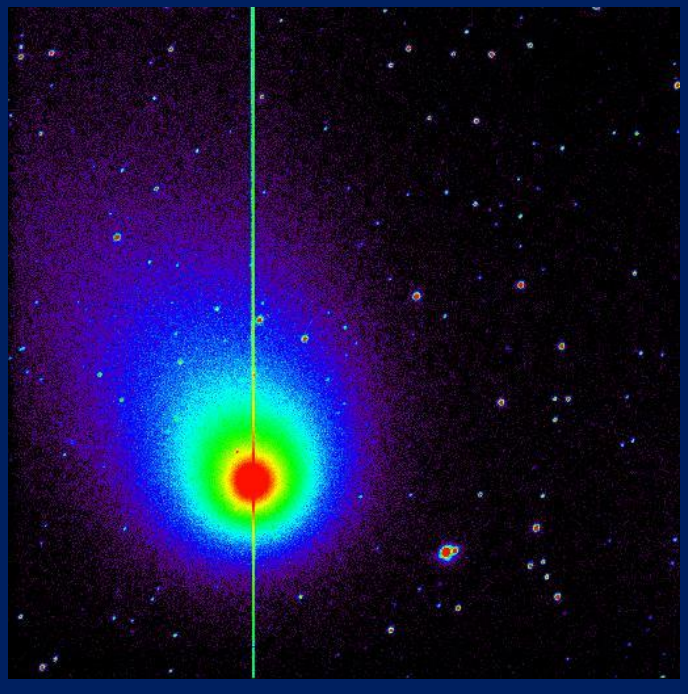
2011-Oct-21 19:00

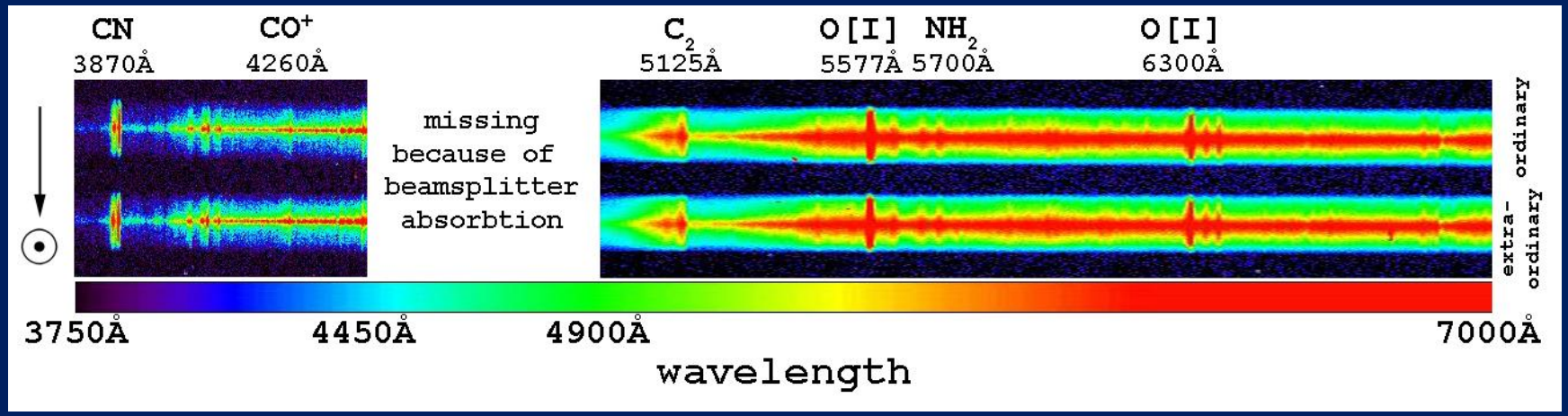
R.A.=17 43 28.39

Dec.=+18 44 37.2

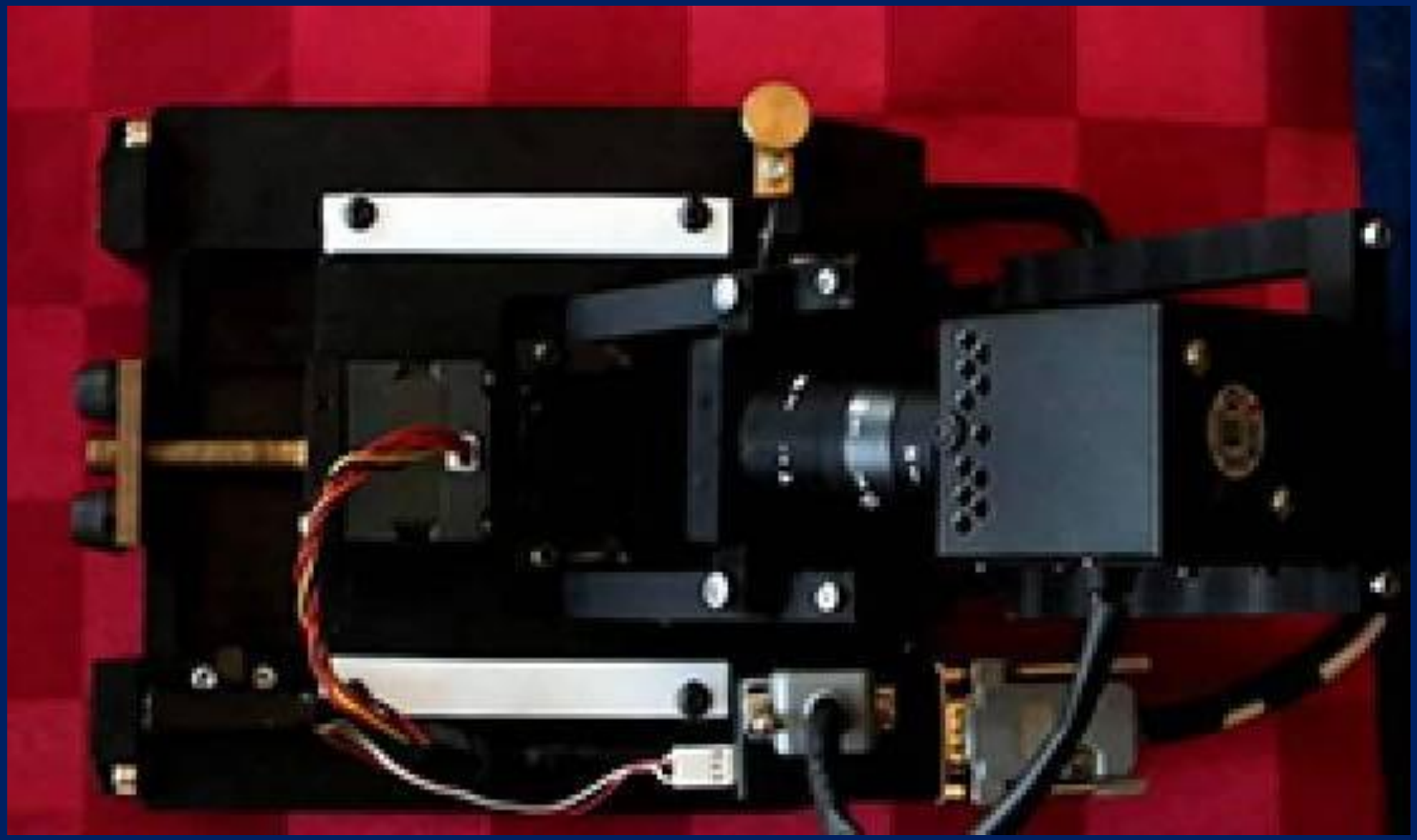
S-T-O=30.89

PsAng=68.56





New auxiliary tool for supporting the low resolution spectroscopy: slit unit



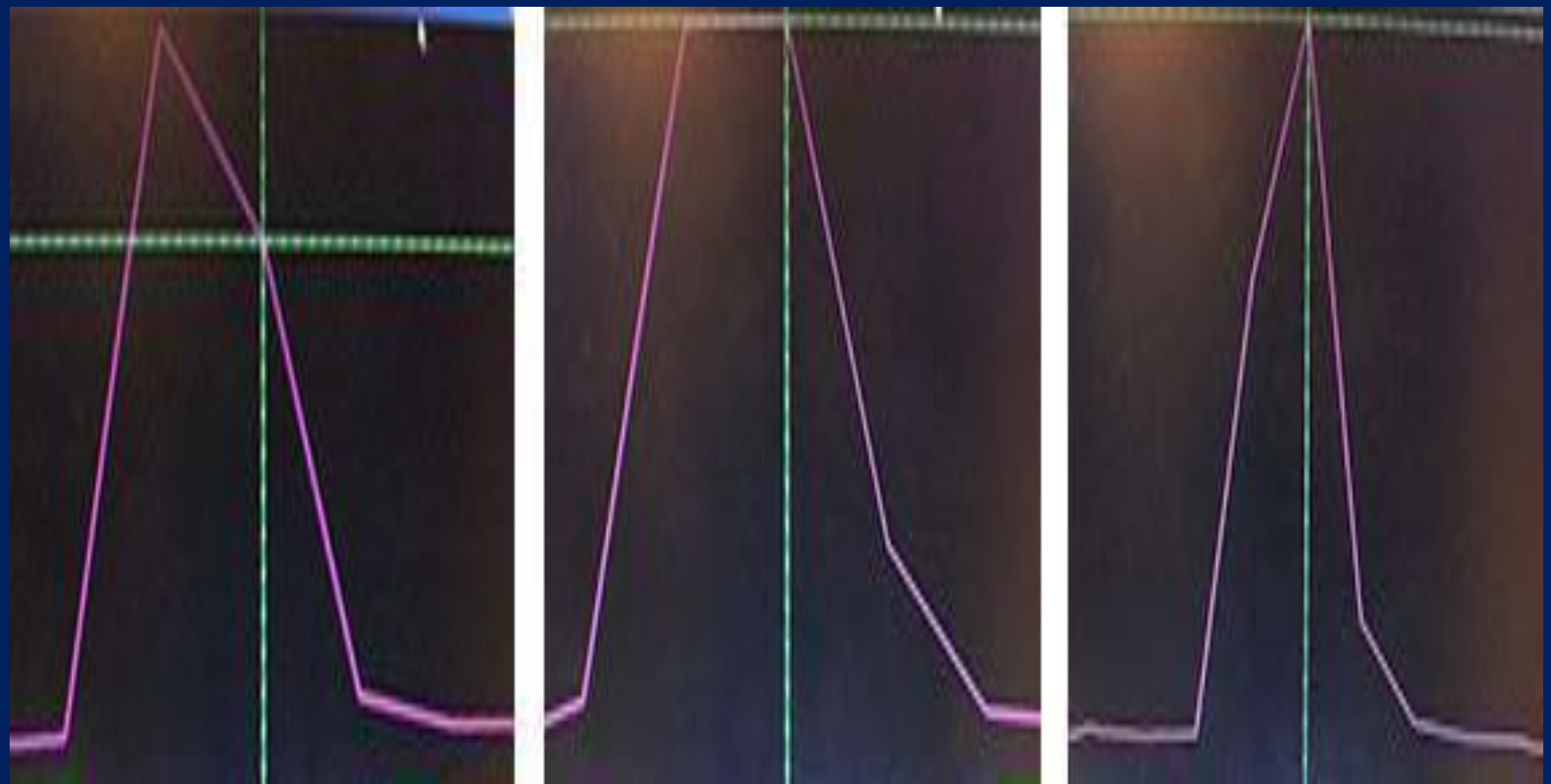
Properties and advantages of the slit unit

Main components:

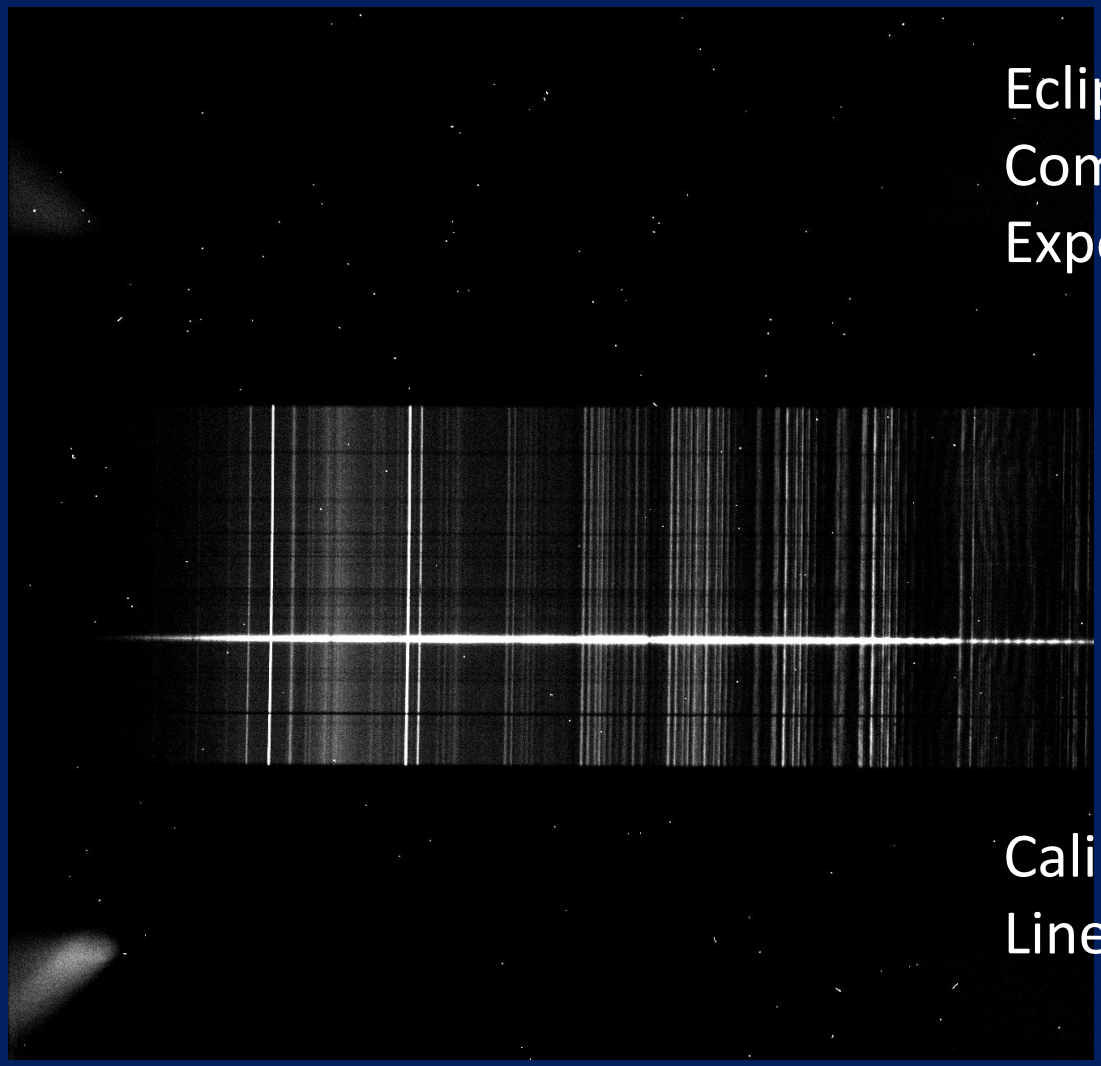
- Slit with variable width, made from polished stainless steel, mounted in the RC- focal plane slightly inclined in respect to the beam
- Web camera, modified for astronomical purposes views permanently the slit. Fast positioning of the program star on the slit. First tests show that stars of magnitude up to 15 can be used for guiding (visually).
- Stepping motor can change the position of the slit, thus changing the spectral range

Illustration of the slit positioning precision

- 8 steps of the stepping motor move the slit projection from one pixel to the next
- Previous positions are reproduced with subpixel accuracy



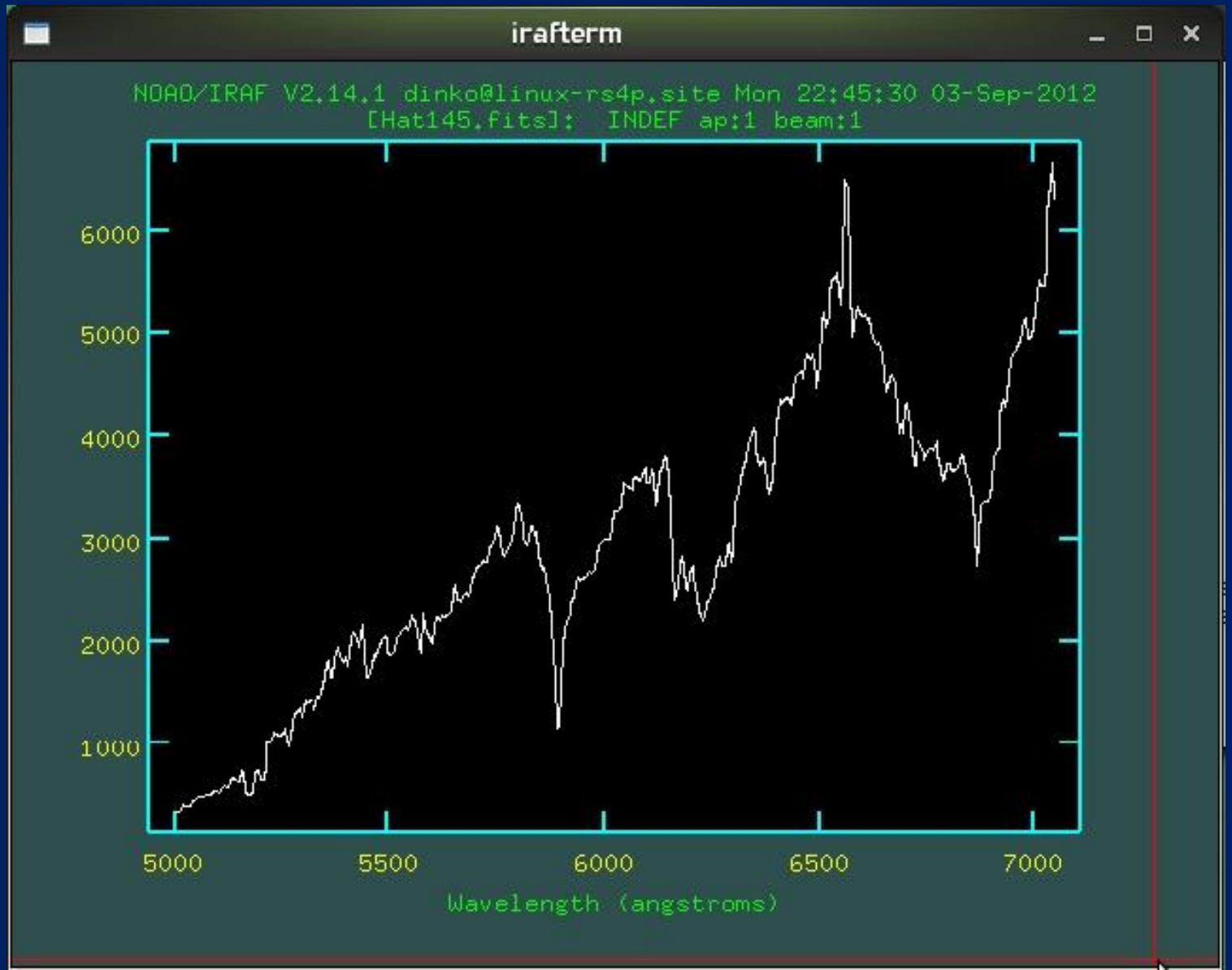
Low dispersion spectrum obtained with the new slit unit and with the new, larger CCD



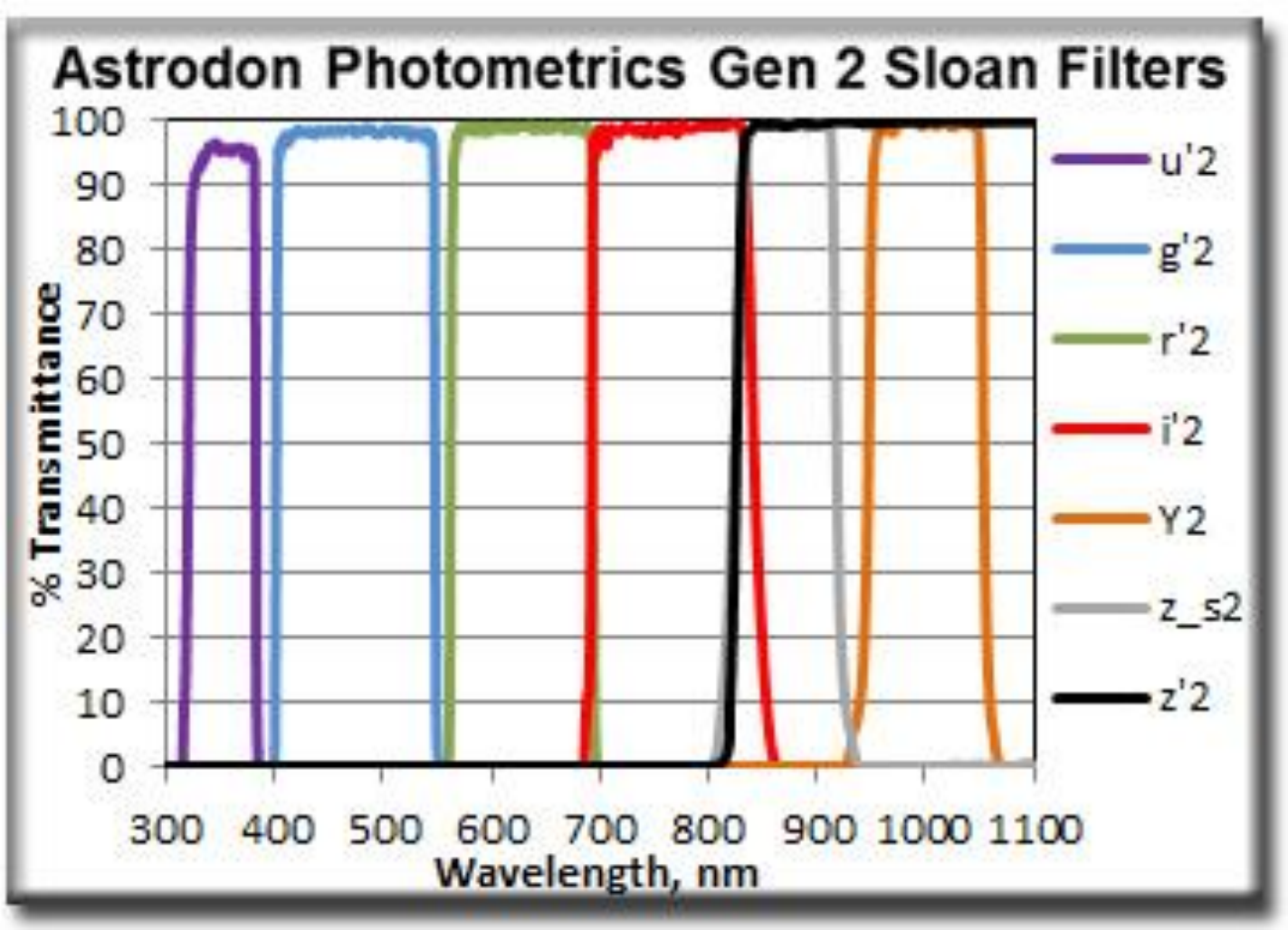
Eclipsing binary HAT-145
Componens: two Me dwarfs
Exposure: 300 sec

Calibration by using night sky
Lines with accuracy 0.3Å/px

Averaged 1-D spectrum of HAT-145 in the range 5000 – 7000 Å



New set of Sloan filters for use in the RC-focus and with the FR

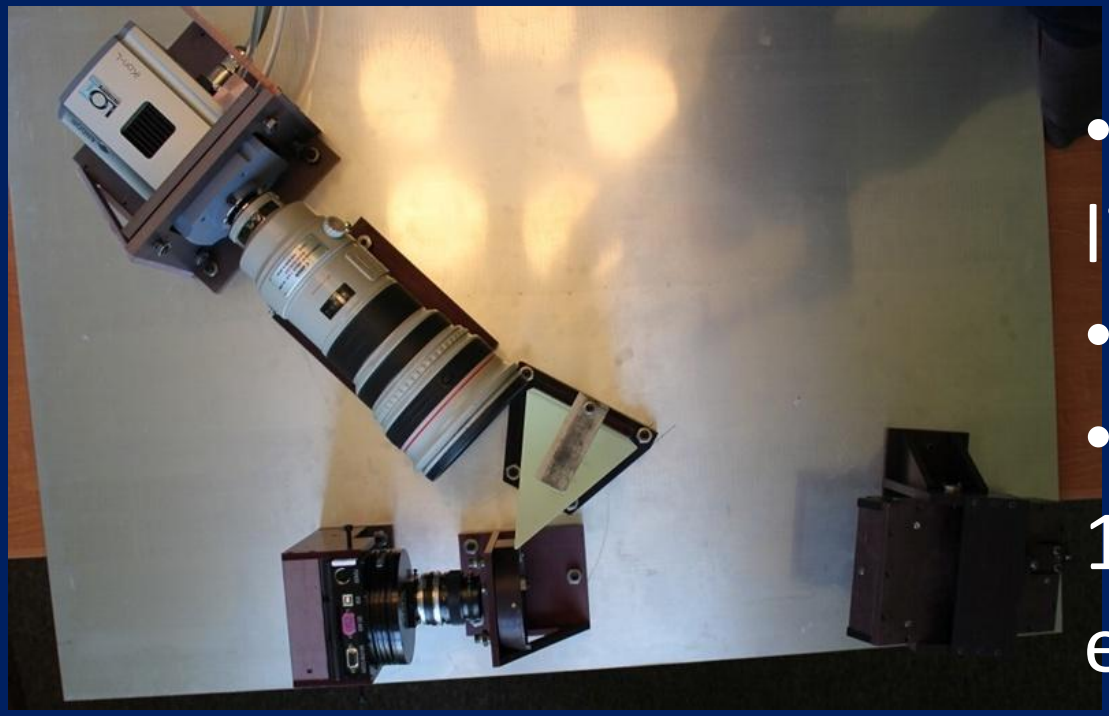


The near future – fiber-fed echelle spectrograph

- Initial plans: white pupil spectrograph a'la FEROS
- First plans were reduced due to reduced funding.

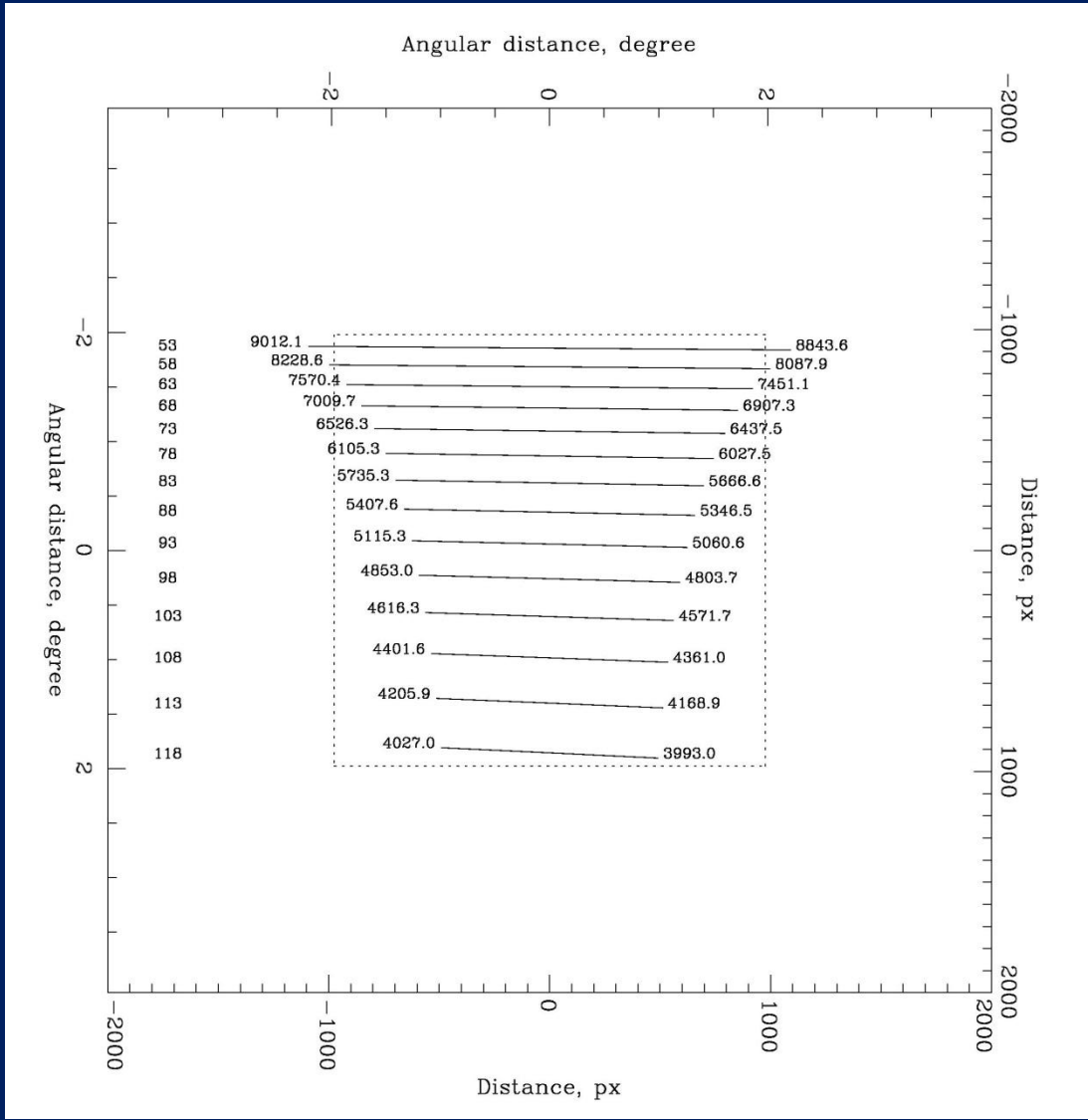
Now: design similar to MUSICOS

- Working example: The Poznan echelle spectrograph



- Echelle R2 grating, 37 lines/mm
- Crossdisperser: prism
- CCD: 2048 x 2048 px. 13.5 micron, thermo-electrically cooled.

Echelle spectrograph for the 2-meter telescope
Simulation of the wavelength distribution



CONCLUSIONS

New modes of observations and new instruments at the 2-meter telescope of Rozhen observatory are improving the efficiency of the observing process and the quality of observations. These are:

- A larger CCD in the red channel of the FR
- Spectropolarimetry
- New slit unit for low-dispersion spectrometry
- New set of Sloan filters
- Planned: echelle spectrograph

Questions please!

Acknowledgements

BELISSIMA

National Science Fund DO 02-85

DDVU 02/40

DO 1-34