

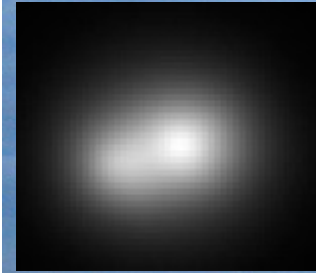
POSMATRAČKI INSTRUMENTI ZA ASTRONOMSKU STANICU NA VIDOJEVICI

I. Vince

6. 9. 2010.

Fried parameter measurements

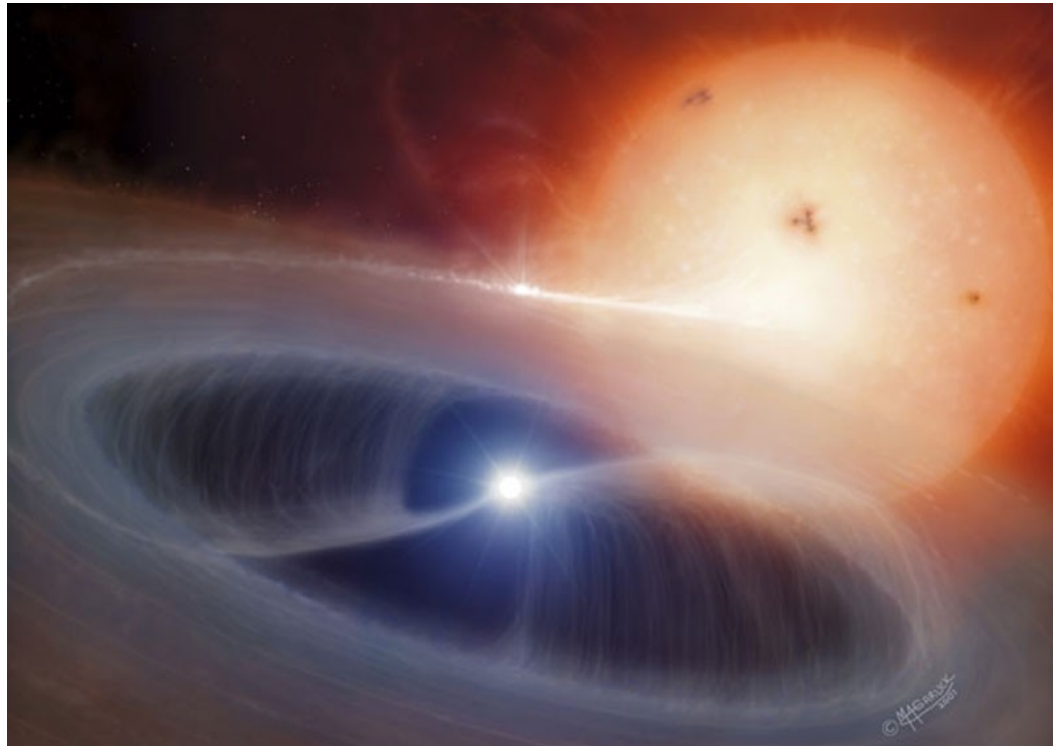
18.11.2003.



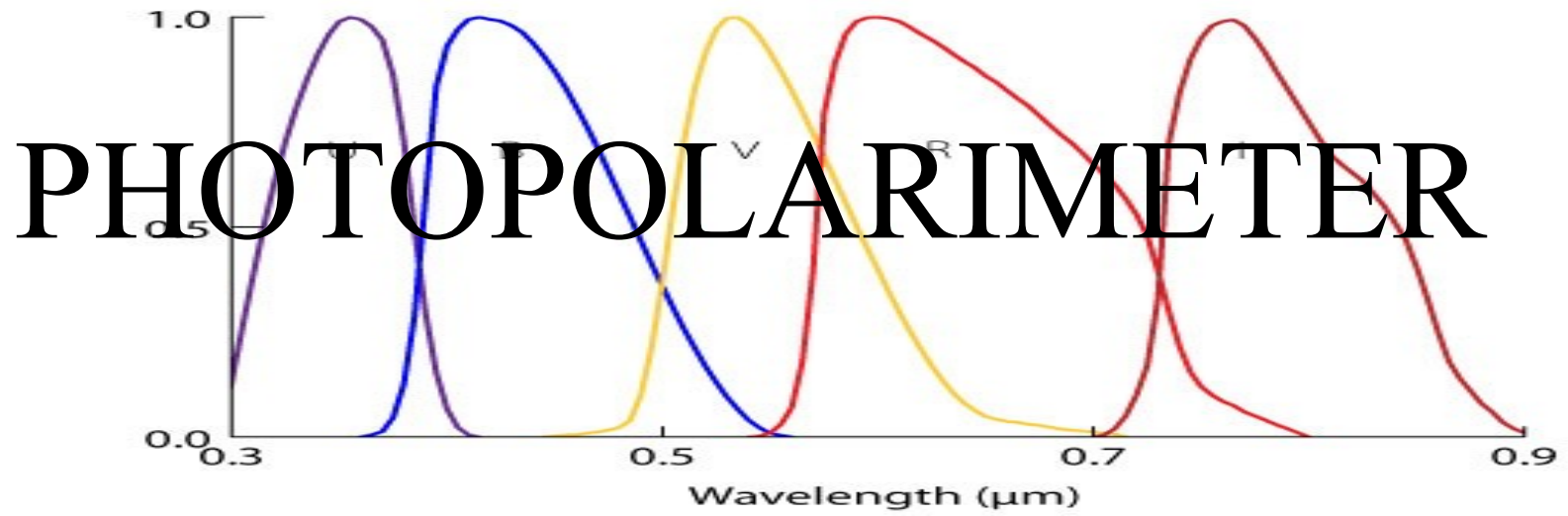
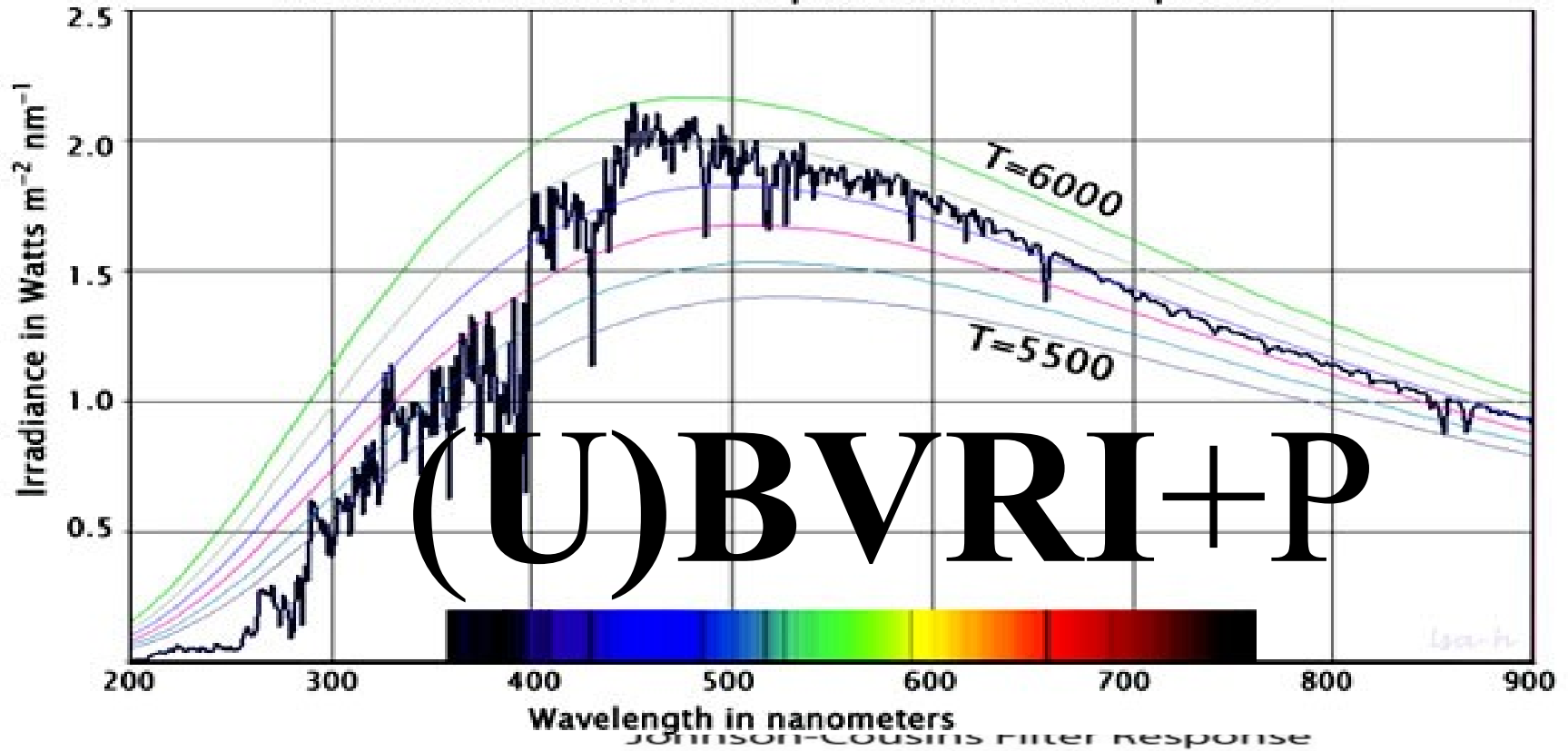
Cassegrain 60 cm (f:10/7) telescope 5. 1. 2005.



PRIBORI ZA FOTOMETRIJU i POLARIMETRIJU



Solar Irradiance at the Top of Earth's Atmosphere



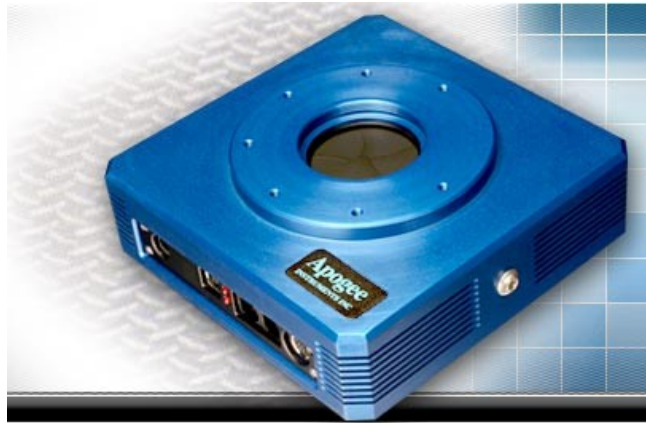
PHOTOPOLARIMETER SYSTEM

1 piece of Apogee Alta U47+ Gr 1 (USB or Ethernet) CCD camera system 15,000 USD

1 piece of Optec #17350 IFW 2" Filter Changer 1,250 USD

1 set of Bessell 5 mm thick BVRI+Clear 2" Filters 1,350 USD

1 piece of Polarizer filter (2" circular or linear – photo-optical quality) 50 USD



CCD E2V CCD47-10 Back-illuminated

Array Size (pixels) 1024 x 1024

Pixel size 13 x 13 microns

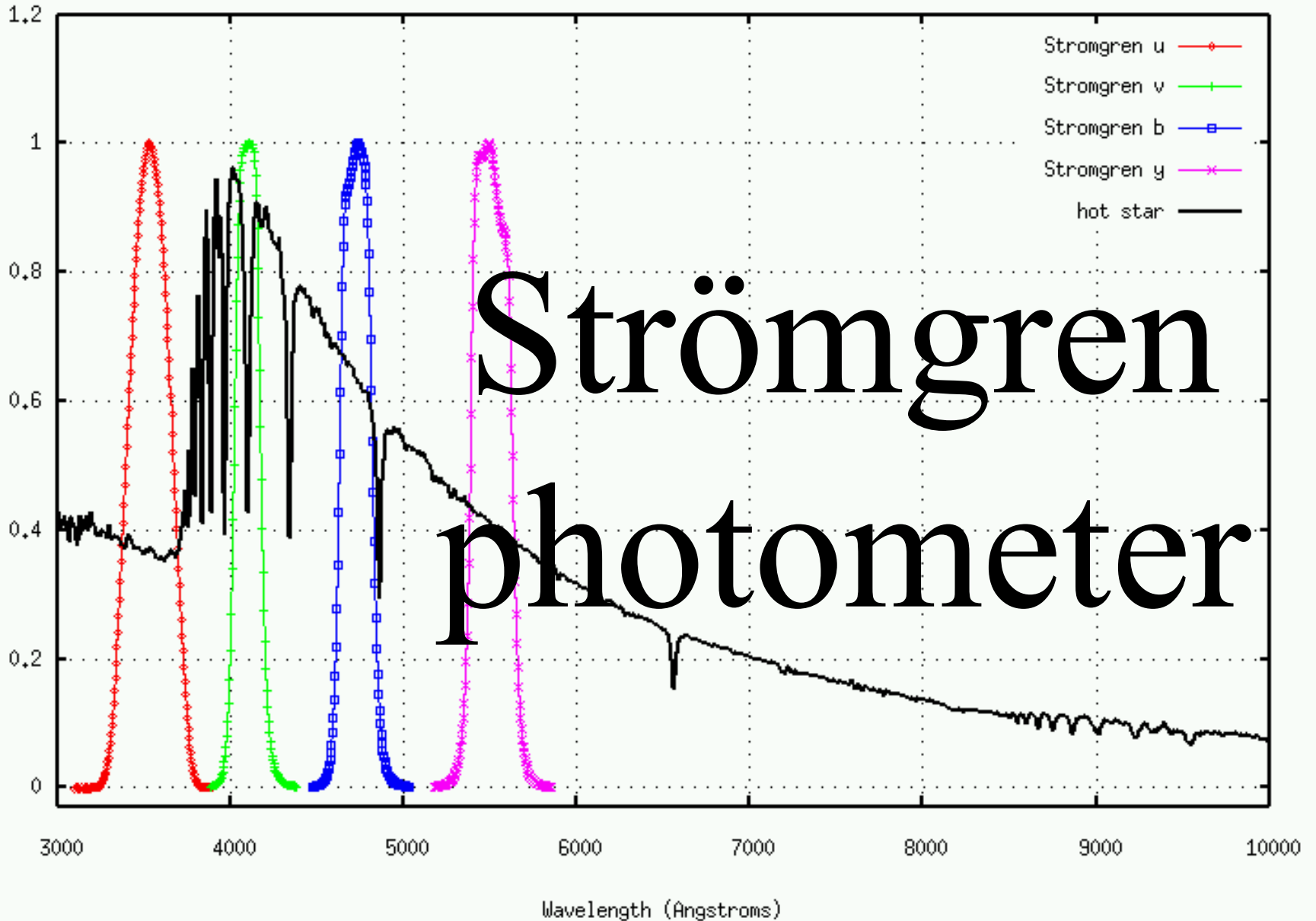
Imaging area 13.3 x 13.3 mm (177.2 mm²)

Imaging diagonal 18.83 mm

Linear Full Well (typ.) 100,000 e-

Dynamic Range >83 dB

The Stromgren passbands



Strömgren CCD photometer



Omega Optical 2" round Strömgren filter set [v(411/17), b (469/18), y(549/23), H-beta (486.1/4.5), H-alpha (656.3/4.5)] w/o filter cell

Apogee Alta U-42 UV Grade 0 (highest quality) CCD camera

Array Size (pixels) 2048 x 2048

Pixel Size 13.5 x 13.5 microns

Imaging Area 27.6 x 27.6 mm (764 mm²)

Imaging Diagonal 39.1 mm

Video Imager Size 2.44"

Linear Full Well (typical) 100K electrons

Dynamic Range 82 dB

Peak QE (550 nm) >90%

Anti-blooming none

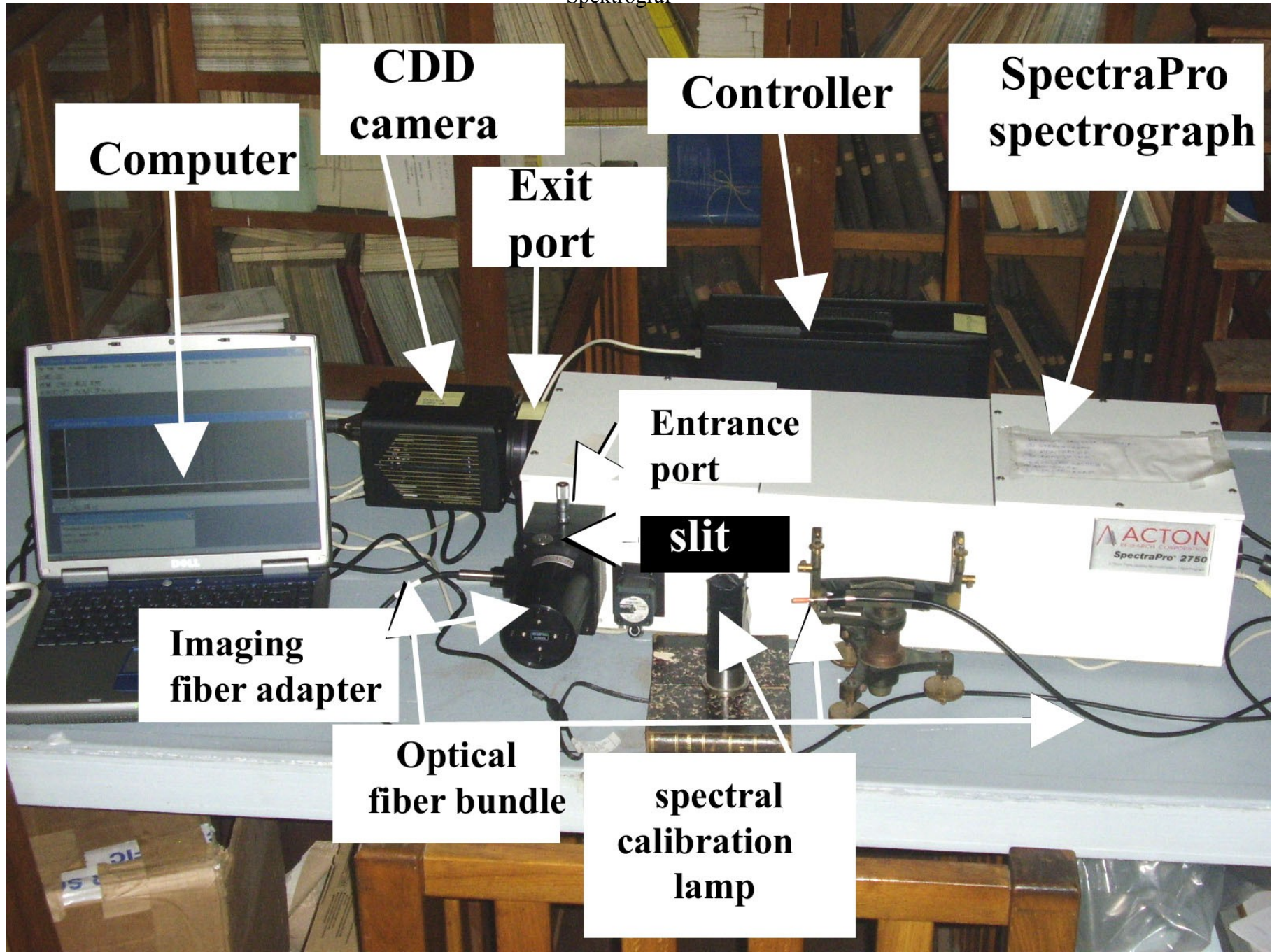


Strömgren – (u)vby β_n +H α

Oblast	Efektivna talasna dužina (nm)	Poluširina (nm)
u	349	30
v	411	19 (17)
b	467(469)	18 (18)
y	547(549)	23 (23)
β_w	489	15
β_n	486 (486.1)	3 (4.5)
Hα	656.3	4.5



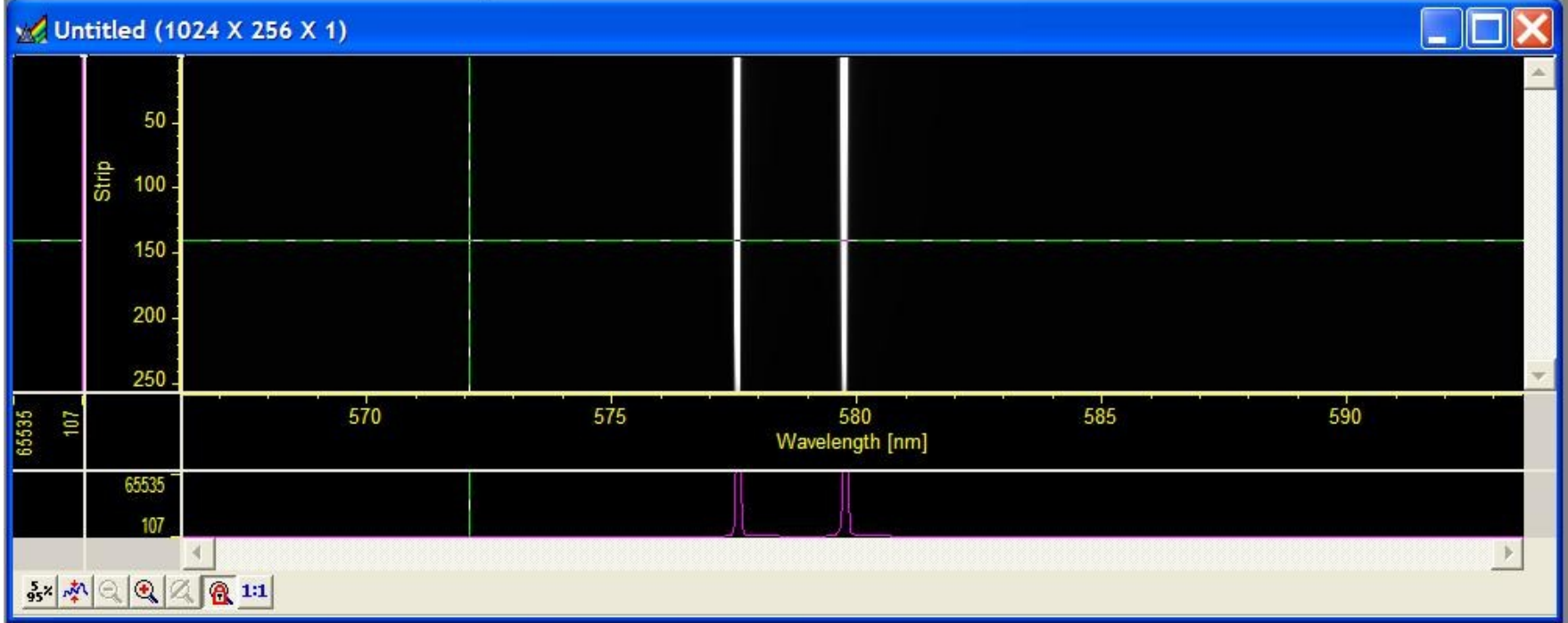
**PRIBORI
ZA
SPEKTROSKOPIJU**



SpectraPro750

Focal length	750 mm
Aperture ratio	f/9.7
Optical design	computer-optimized Czerny-Turner
Scan range	0 to 1400-nm mechanical range
Resolution	0.023 nm
Dispersion	1.1 nm/mm ±0.1 nm
Accuracy	
Repeatability	±0.05 nm
Drive-step size	0.0025 nm
Focal-plane size	27 mm wide x 14 mm high
Standard slits	adjustable from 10 µm to 3 mm wide; 4- or 14-mm slit heights; motorized (optional)
Grating size	68 x 68 mm; 68 mm x 84 mm (optional)
	Configuration
Grating mount	triple-grating turret
Grating turrets	interchangeable (standard)
Size	30 in (762 mm) long; 11 in (280 mm) wide; 8 in (203 mm) high; 4.12-in (105-mm) optical axis height
Weight	45 lb (20.5 kg)

Softver



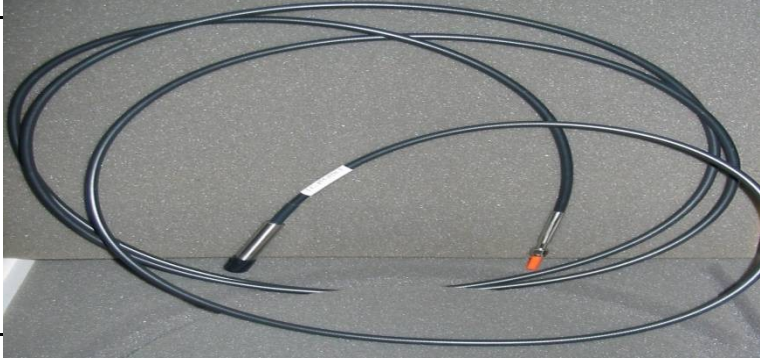


Info - Untitled (1024 X 256 X 1)

Wavelength [nm]: 572.138 Strip: 140 Intensity: 677.00

frame: 1 aspect: 1.00

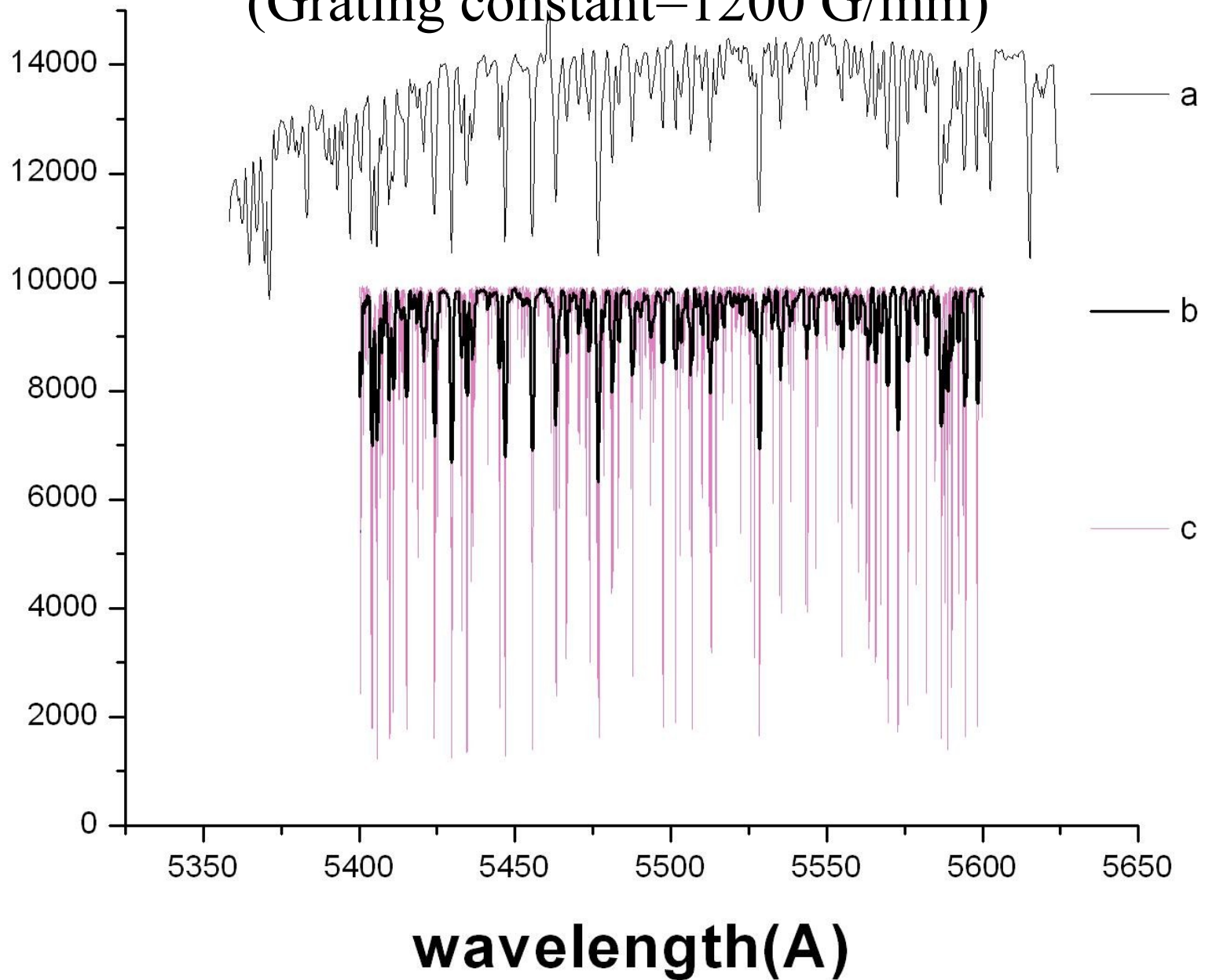
zoom: 0.84, 0.84

Accessories

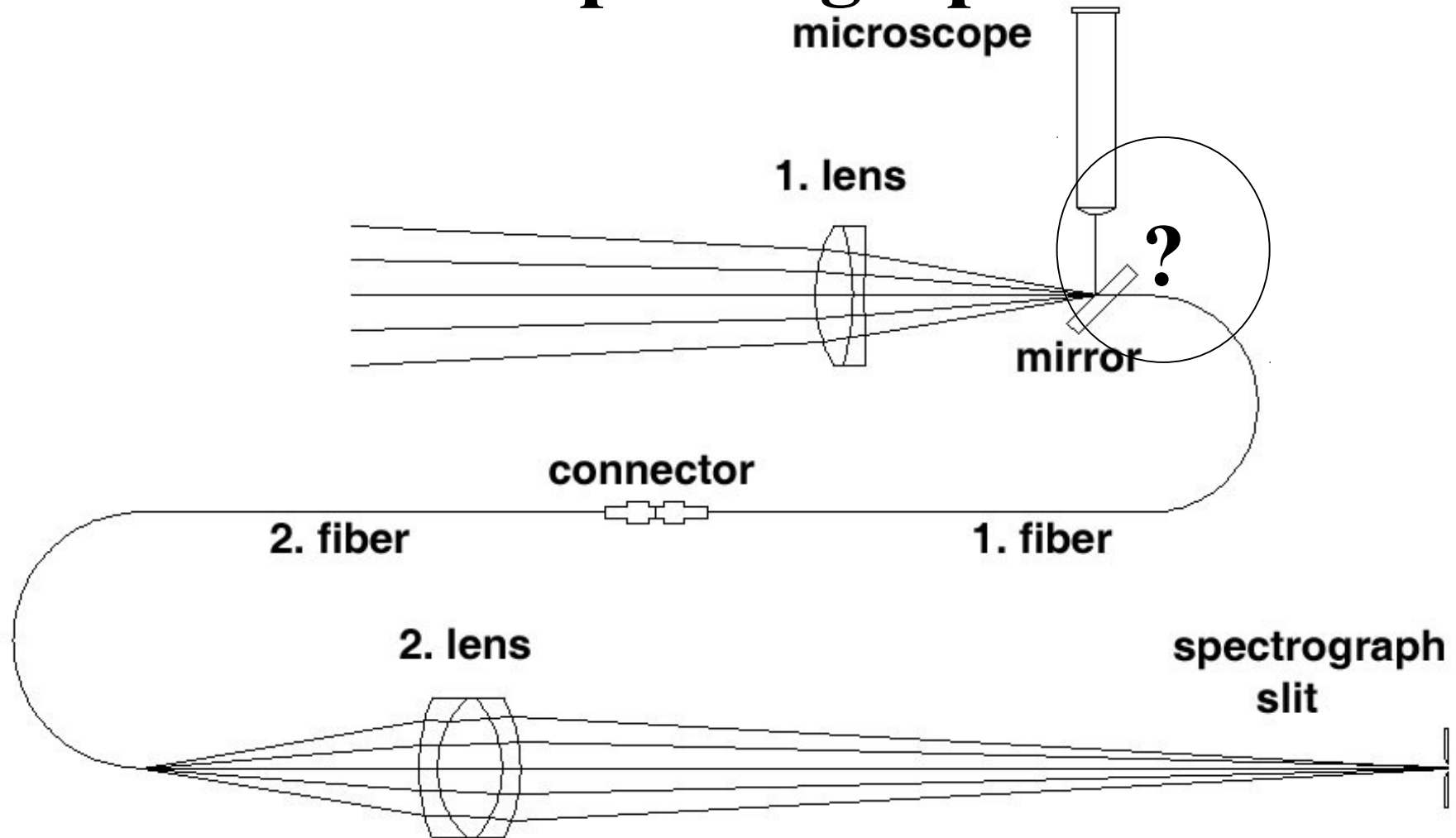
Gratings	Fibers	Order sorting filters
<p>Ruled Grating, 68x68mm, 500 G/mm 500nm blaze</p>	<p>3 meters long, 190nm to 1100nm. Single row of 200um fibers arranged as slit in 100 um diameter ferrule on one end, circular arrangement connector on other end</p>	<p>Six position filter wheel 320 nm, 590 nm 665 nm, 715 nm</p>
<p>Ruled Grating, 68x68mm, 600 G/mm with 500nm blaze</p>		
<p>Ruled Grating, 68x68mm, 1200 G/mm with 500nm blaze</p>	<p>Four-leg fiber optic bundle, 1 meter long for 190nm to 1100nm, with three fibers par leg</p>	
<p>Holographic Grating, 68x68mm, 2400 G/mm, VIS optimized</p>		

Solar spectrum around 550 nm

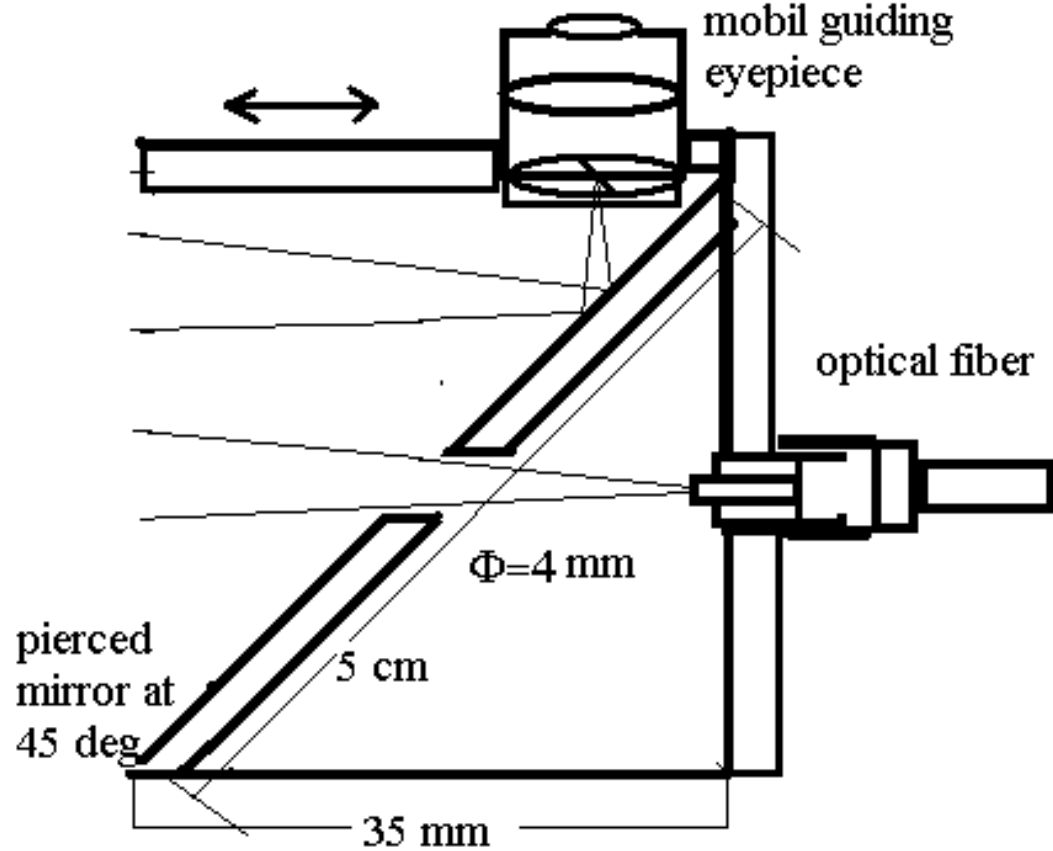
(Grating constant=1200 G/mm)



Link between telescope and spectrograph



Link between the optical fiber and telescope ?



1.5 m

TELESCOPE

PHOTOMETRIC SYSTEMS:

*UBVRI

*STRÖMGREN

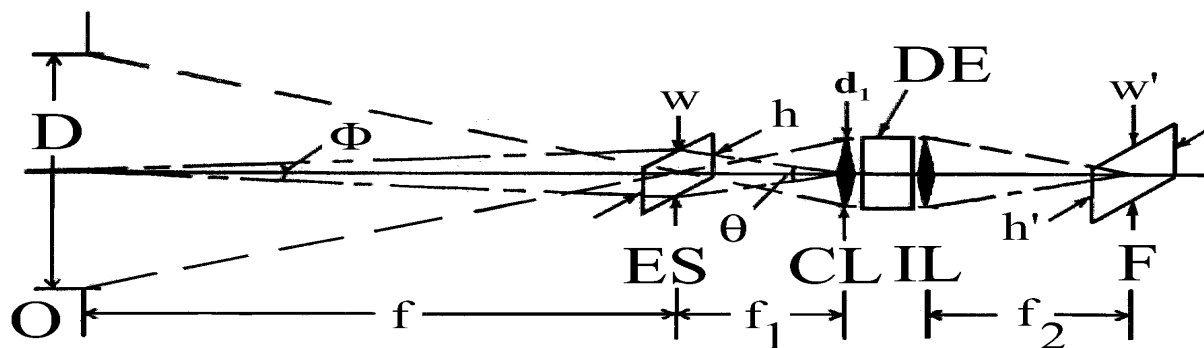
* OTHER (FILTERS)

SPECTROGRAPH

FOR THE 1.5 m CLASS TELESCOPE

???

USAGLASITI PARAMETRE TELESKOPA I SPEKTROGRAFA

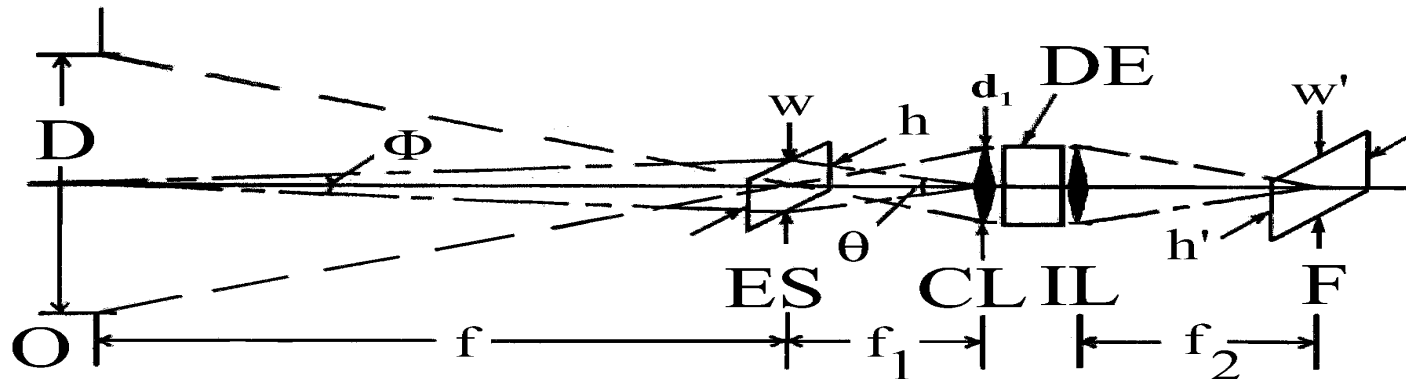


$$\delta\lambda = \ominus \frac{d\lambda}{d\varepsilon} = \frac{w'}{f_2 \frac{d\varepsilon}{d\lambda}} = \frac{w}{f_1 \frac{d\varepsilon}{d\lambda}} = \frac{f \Phi}{f_1 \frac{d\varepsilon}{d\lambda}} = \frac{D}{d_1} \frac{1}{\frac{d\varepsilon}{d\lambda}}$$

VELIKI PREČNIK → MALA
SPEKTRALNA ČISTOĆA

!!!

USAGLASITI PARAMETARA REŠETKE I

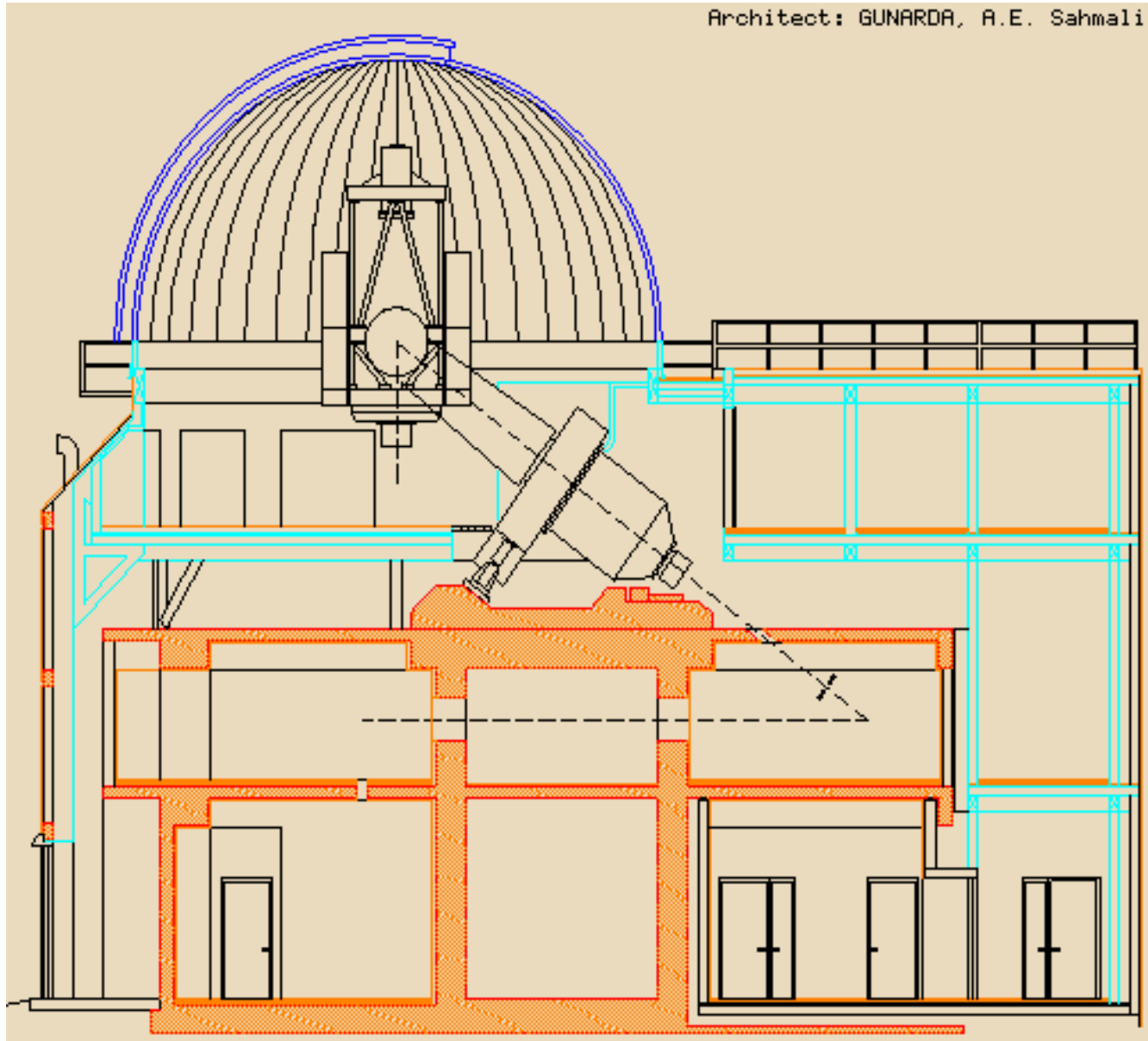


*

$$\delta\lambda = W \frac{d\lambda}{dx} = -\frac{\cos \alpha}{\cos \beta} \frac{f_2}{f_1} W \frac{1}{f_2} \frac{d \cos \beta}{m} = -\frac{W}{f_1} \frac{d}{m} \cos \alpha.$$

Coude spectrograph

Architect: GUNARDA, A.E. Sahmali



Coude spectrograph

- + High resolution (x10000-100000)
- + Stable spectrograph parameters .
- + Accurate line profile measurement
- High price (dome + spectrograph)
- Small spectral coverage (10 nm)
- Large variable intrinsic polarization (~10%)
- Already exists at Rhozhen Observatory

Cassegrain (or R-C) spectrograph

- + Small to medium resolution
- + Low cost → large number of gratings
- + Small, constant intrinsic polarization
- Flexure and flagging
- No high resolution measurements
- No high accurate profile measurements

1st Order

Grating	G/mm	Blaze (Å)	Resolution FWHM (Å)	Wavelength Coverage (Å)
13	150	5000	17.2	6900
11 [2]	158	8000	16.4	6550
09	300	4000	8.6	3450
32	300	6750	8.6	3450
22 [2]	300	10000	8.6	3450
58	400	8000	6.5	2590
16	527	5500	4.8	1965
26	600	4000	4.3	1725
35	600	6750	4.3	1725
56	600	11000	4.3	1725
47	831	8000	3.1	1245
36 [3]	1200	7500	2.2	860

Echelle spectrograph

- + High dispersion (resolution)
- + Wide wavelength coverage
- + Small in size
- + Low (relatively) cost
- High level of scattered light ($\sim 3\%$)
- Complicated reduction (e.g., tilted lines)
- Difficult profile measurements of strong lines
- Problems with extended objects spectra reduction



HVALA

Spectroscopy at the ASV and Cooperation with Belogradchik Observatory

**Nadežda Pejović^a and
Žarko Mijajlović^b**

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Belgrade, Serbia*

*^bFaculty of Mathematics, University of
Belgrade, Serbia*

**SPECTRAL LINE SHAPES IN ASTROPHYSICS:
VI Serbian Conference on Spectral Line
Shapes in Astrophysics (VI SCSLSA)
Sremski Karlovci (Serbia), 11–15 June 2007
ISBN: 978-0-7354-0449-6**

Editor(s):

Luka Č. Popović, Astronomical Observatory

Milan S. Dimitrijević, Astronomical Observatory

RADIAL VELOCITY
MEASUREMENTS FOR
INVESTIGATION OF CLOSE
BINARY STARS

RESOLUTION FOR RADIAL VELOCITY MEASUREMENTS

$$**** R = \frac{\lambda}{\delta\lambda} = \frac{c}{v_r} ****$$

$$(v_r = 10 \text{ km/s} \blacklozenge ? R = 30000$$

$$\delta\lambda = 0.02 \text{ nm} \quad \lambda = 600 \text{ nm})$$

Coude spectrograph - Rozhen

$D=2$ m

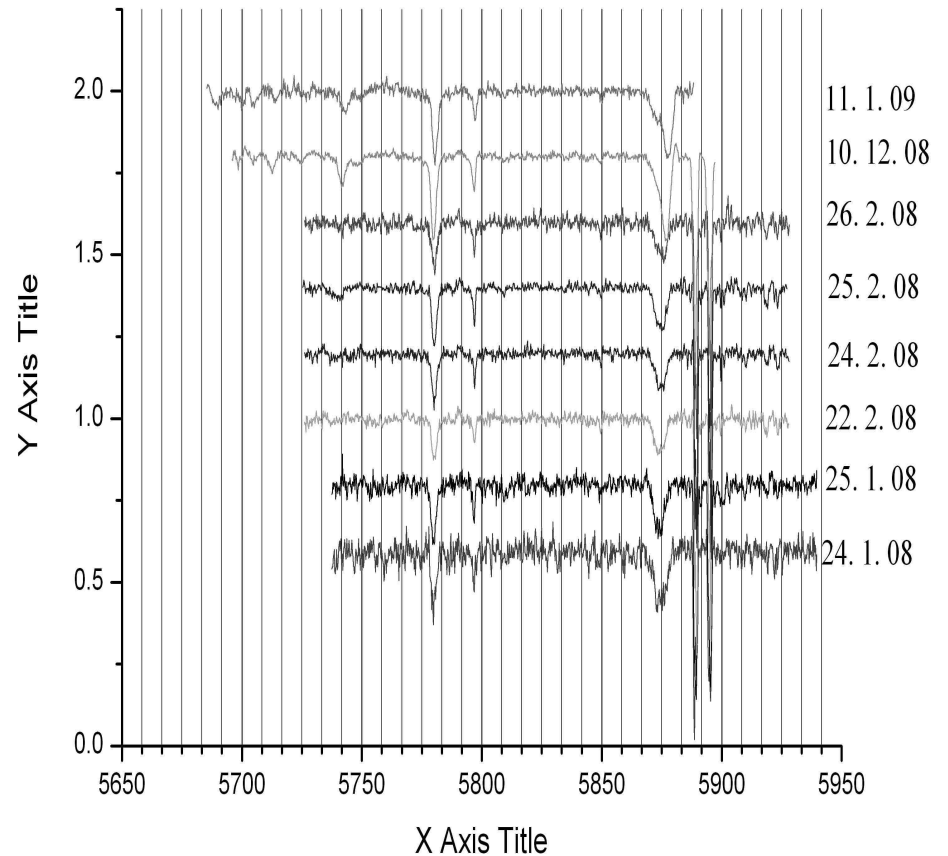
UU Cas, $B= 10.40$, $V= \zeta$

$R\approx 40000$

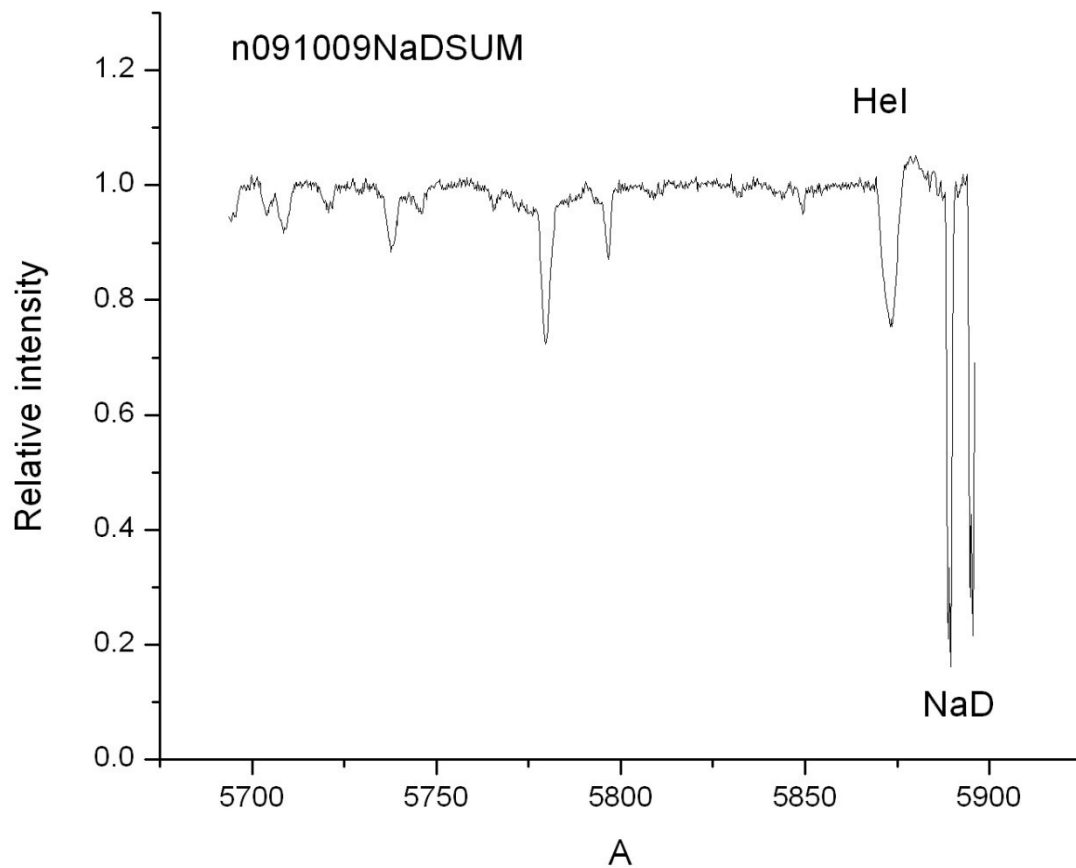
$\Delta\lambda\approx 0.015$ nm

$\Delta v\approx 7.5$ k/s

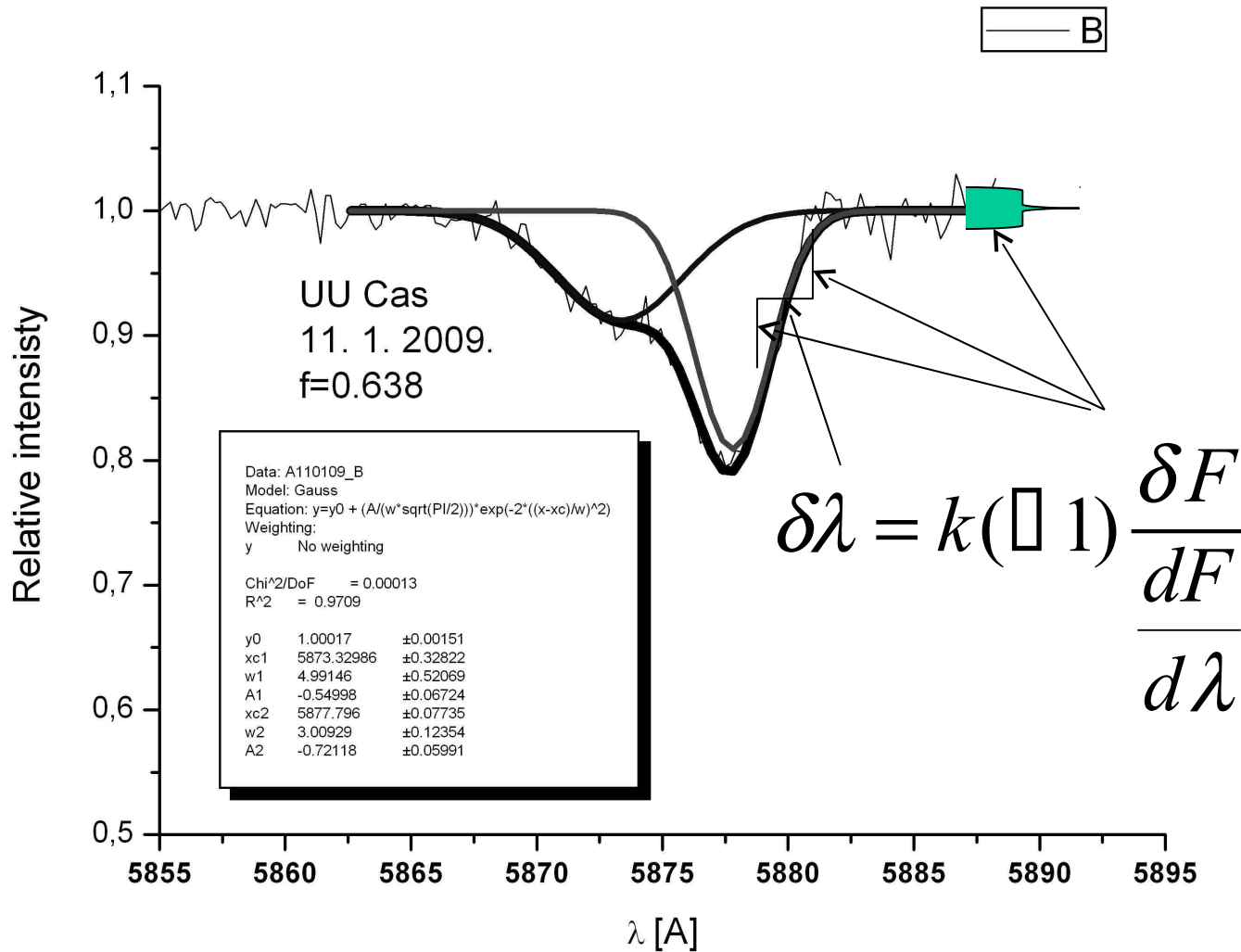
$t_{\text{exp}}\sim 20$ min; $S/N\sim 50$



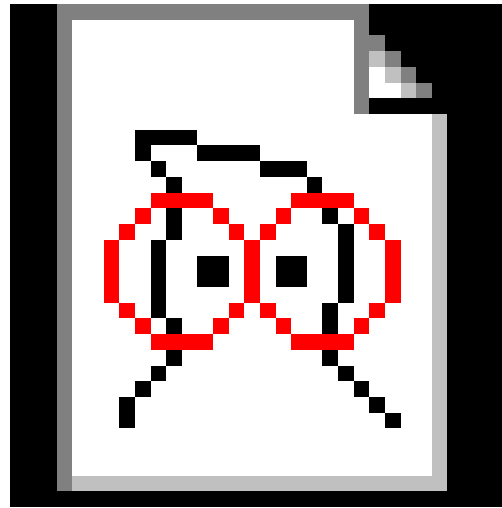
Coude spectrograph 2m telescope – Rozhen



PROFILE ANALYSIS



1.25 m telescope
Echelle spectrograph

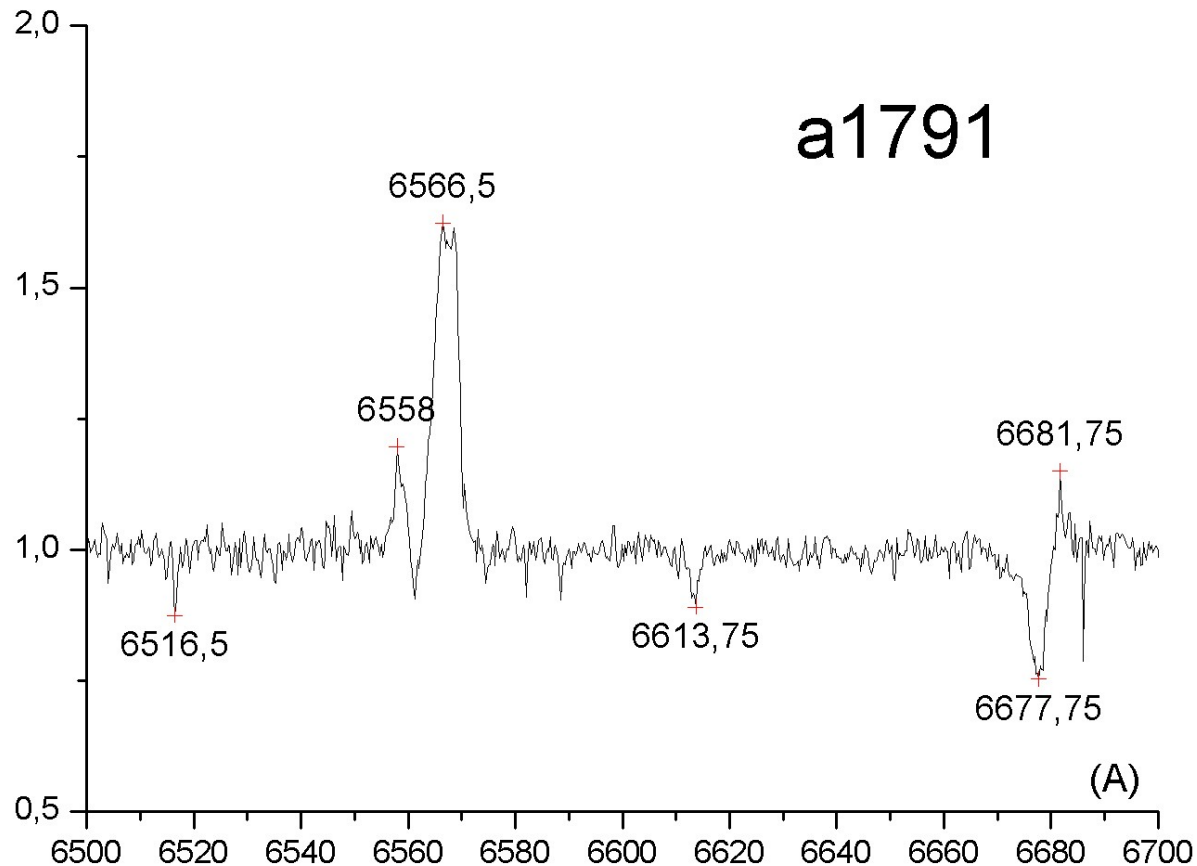


v455_total_sp.ps

Zoom

$D=1.25$ m, $R\approx 10000$, $\delta\lambda\approx 0.065$ nm, $\delta v\approx 30$ km/s

$t_{\text{exp}}=30$ min, $S/N\approx 40$



RADIAL VELOCITY CURVE

