



# SHAMAKHY ASTROPHYSICAL OBSERVATORY: history, scientific directions, potential of collaboration

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# Location of the Republic of Azerbaijan: in South Caucasus, between Europe & Asia





# Azerbaijan





# Typical landscape of Azerbaijan





# Mountains in Azerbaijan



# Azerbaijan in figures:

- Population: 8.6 million
- Territory: 86.6 sq km
- Capital city: Baku
- Territorial division: 66 regions
- Geographical Longitude: 44.46 – 50.50 E
- Geographical Latitude: 38.24 – 41.54 N
- The highest point: 4400 m (Bazarduzu mountain)
- The lowest point: – 20 m (Caspian Sea)



# Occupied territories of Azerbaijan



# Azerbaijan as an ancient place of humans (drawings on rocks 5-6 thousands years ago)





# National Academy of Sciences

MAIN BUILDING





Shamakhy  
district

where the  
Observatory is  
located





# Shamakhy Astrophysical Observatory at a bird fly









# Astrolabe of Maragha Observatory in Southern Azerbaijan



# Maiden Tower in Baku (Golden Ages)





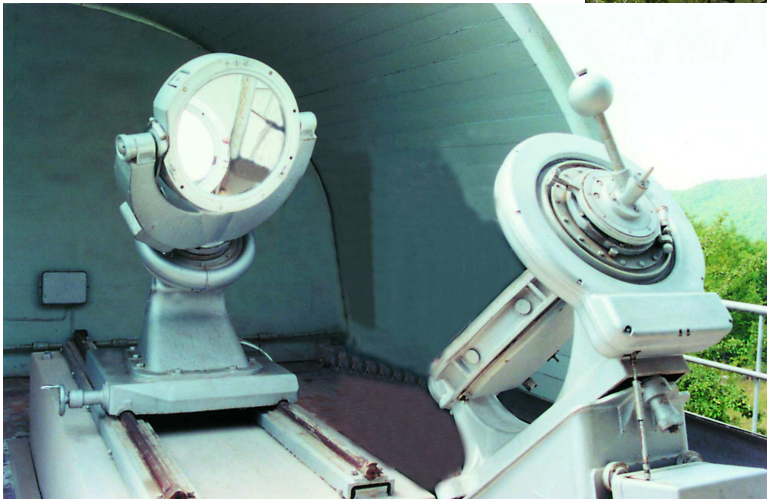
# ShAO in figures:

- Geographical location:  
48 deg 35'04''E, 40 deg 46'20''N
- Altitude: 1500 m
- Date of establishment: 1960
- Staff: 140 (including 50 scientists and 16 engineers)
- Number of clear sky days – 150-160
- Resolution of stellar image: 0'.6 - 2'

# Structure of ShAO (departments)

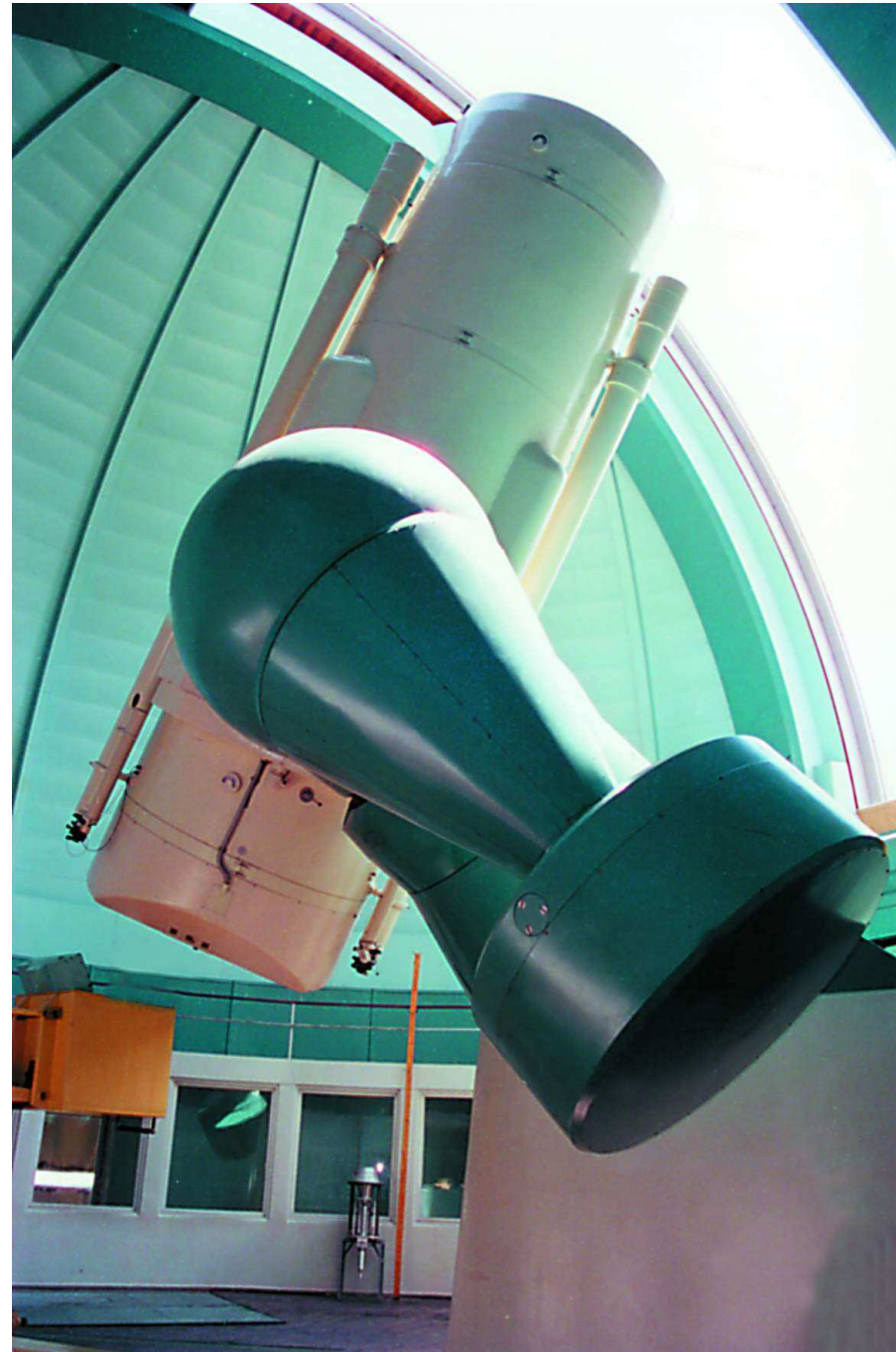
- Spectroscopy of Celestial Bodies
- Photometry and Polarimetry of Celestial Bodies
- Sun and Solar-Terrestrial Relations
- Planets and Small Celestial Bodies
- Technical Support of Observations
- Coordination and Organizing
- Baku City Department







2-M  
telescope  
Carl Zeiss Jena  
1966

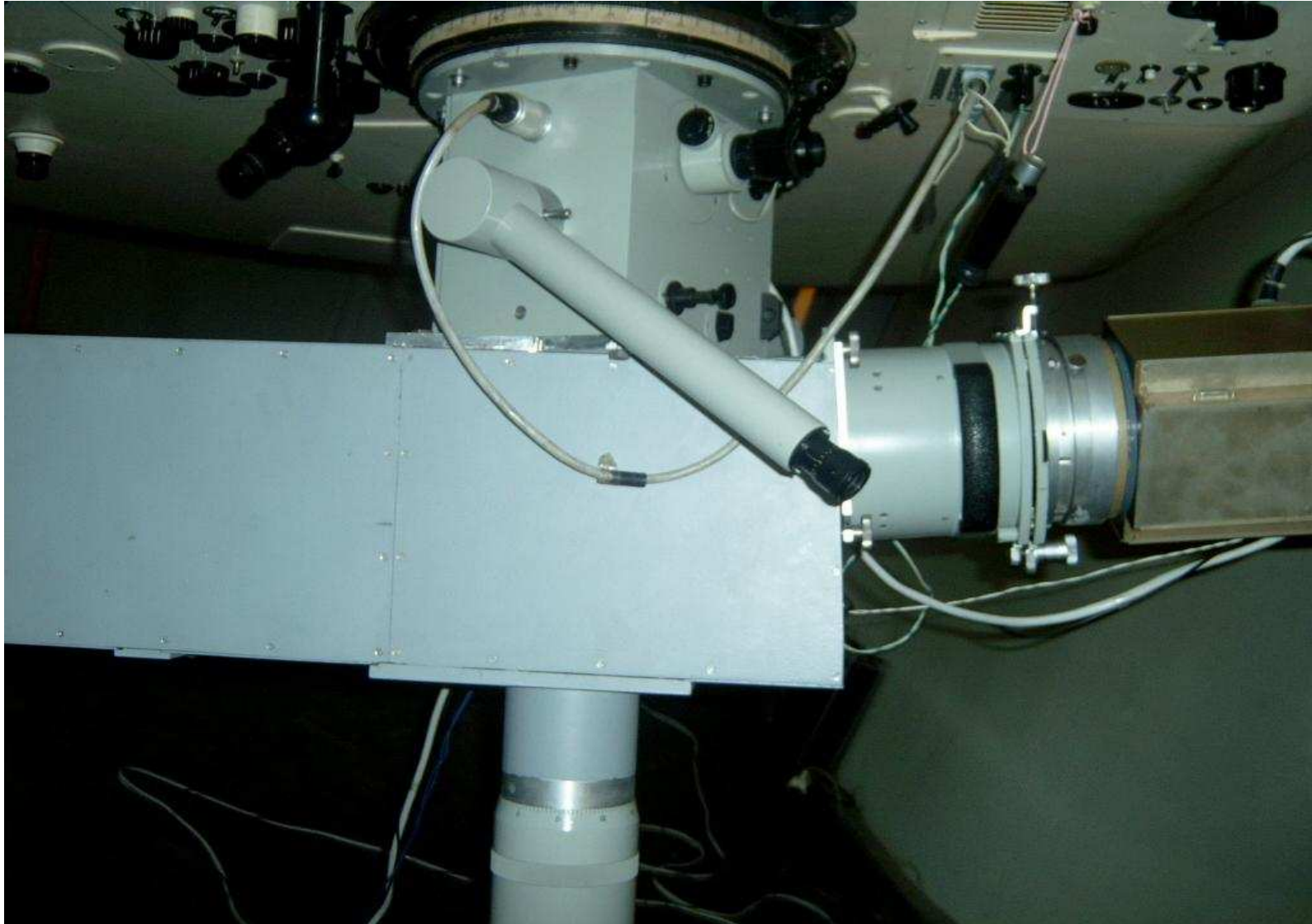


# Technical characteristics of the 2m telescope

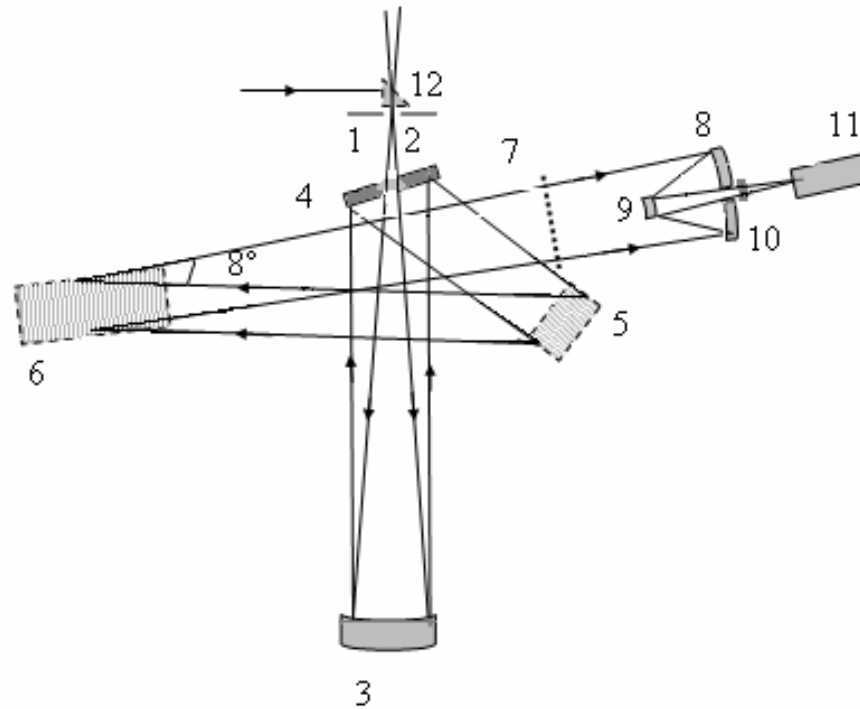
- Primary system with focal length of 9000 mm  
useful field 21' x 21'
- Cassegrain system – f.l. 29 500 mm (6'x6')
- Coude system – 72 000 mm



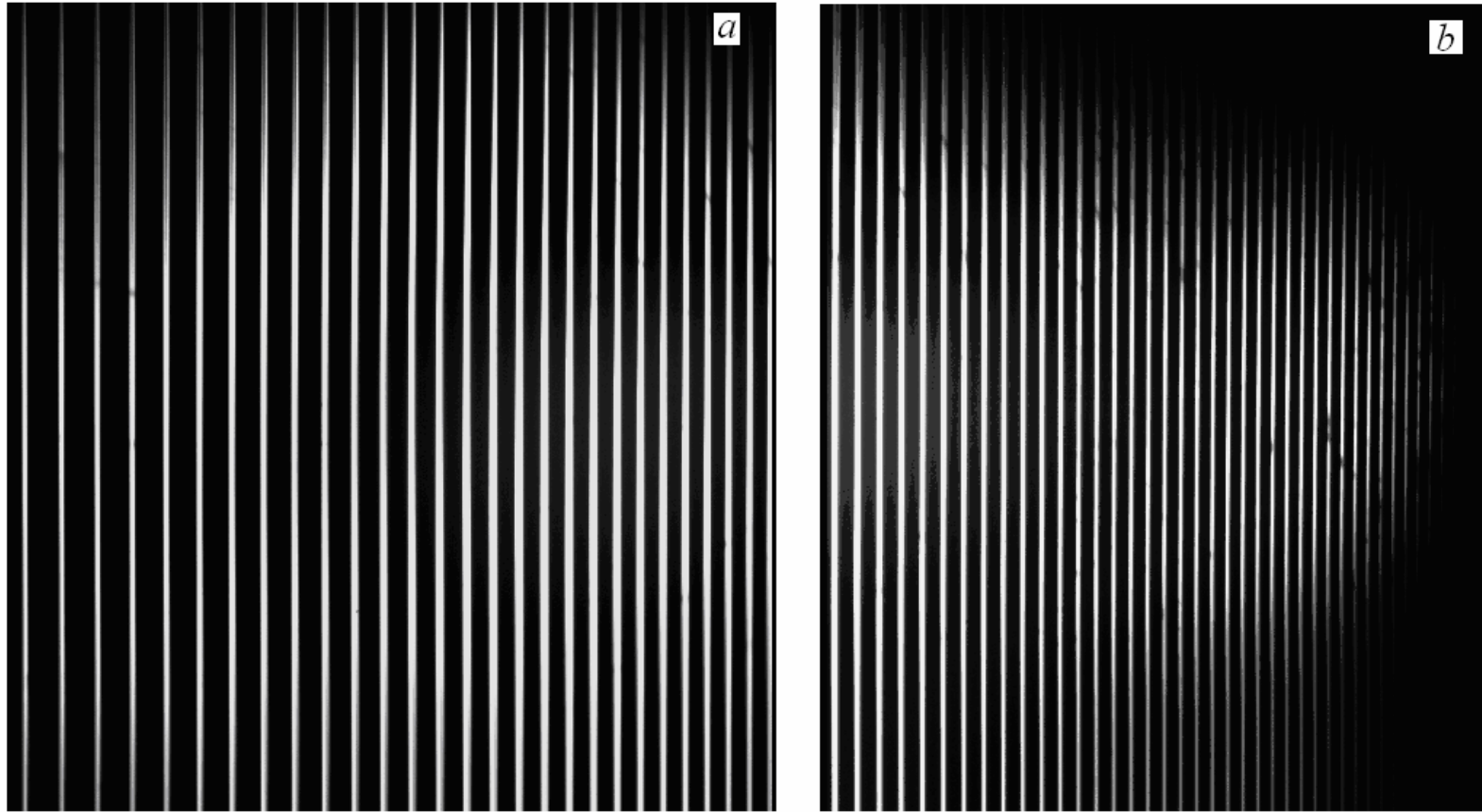
# Echelle spectrograph for Cassegrain focus (R=14 000)



# Optical layout of Cassegrain Echelle spectrograph (R=14000)



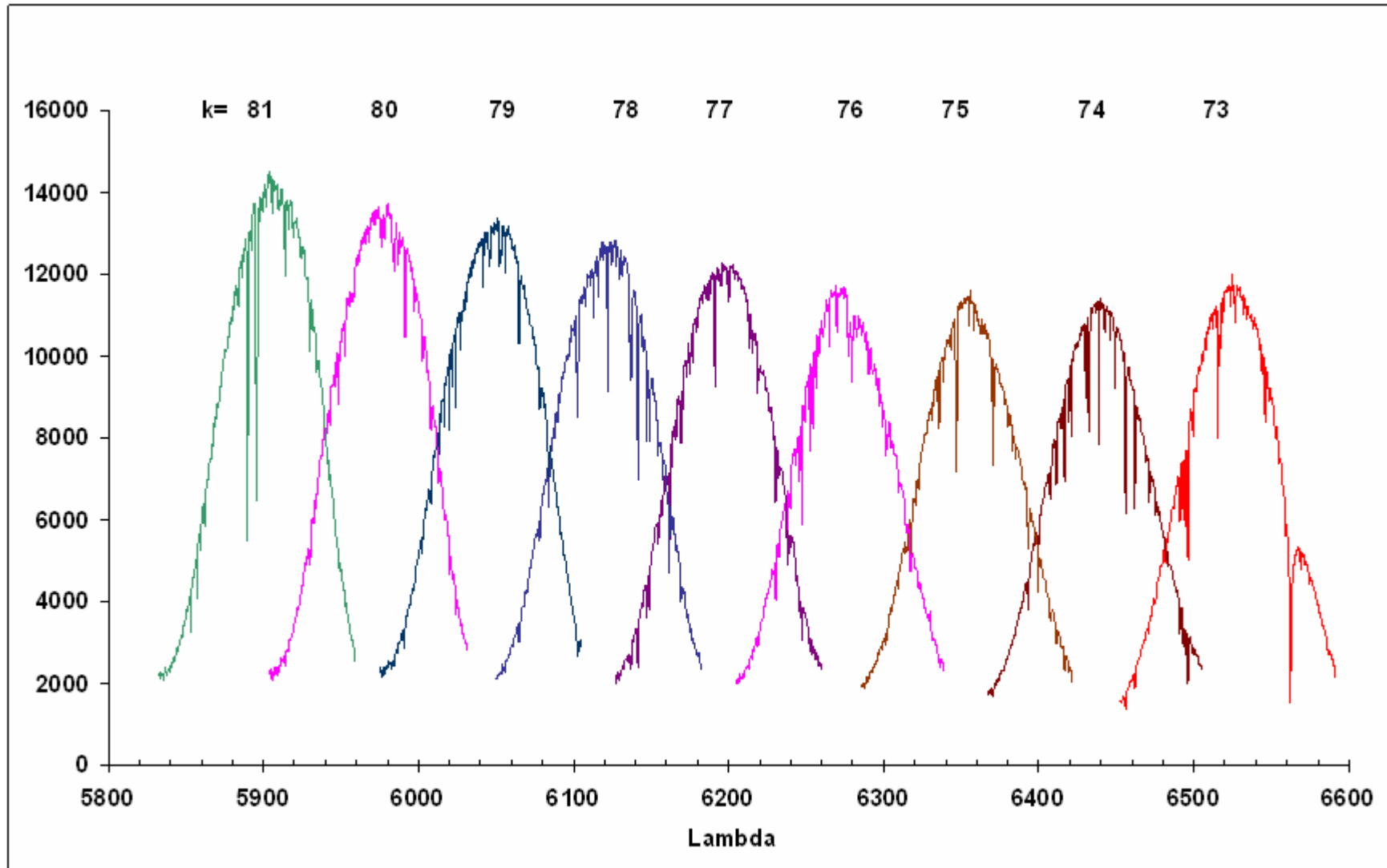
1 - slit, 2 -3- collimator, 4 - plane mirror , 5 – cross dif. grating, 6 -echelle, 7 – Schmidt corrector, 8,9,10 – Cassegrain camera, 11 – CCD camera, 12 - prism.



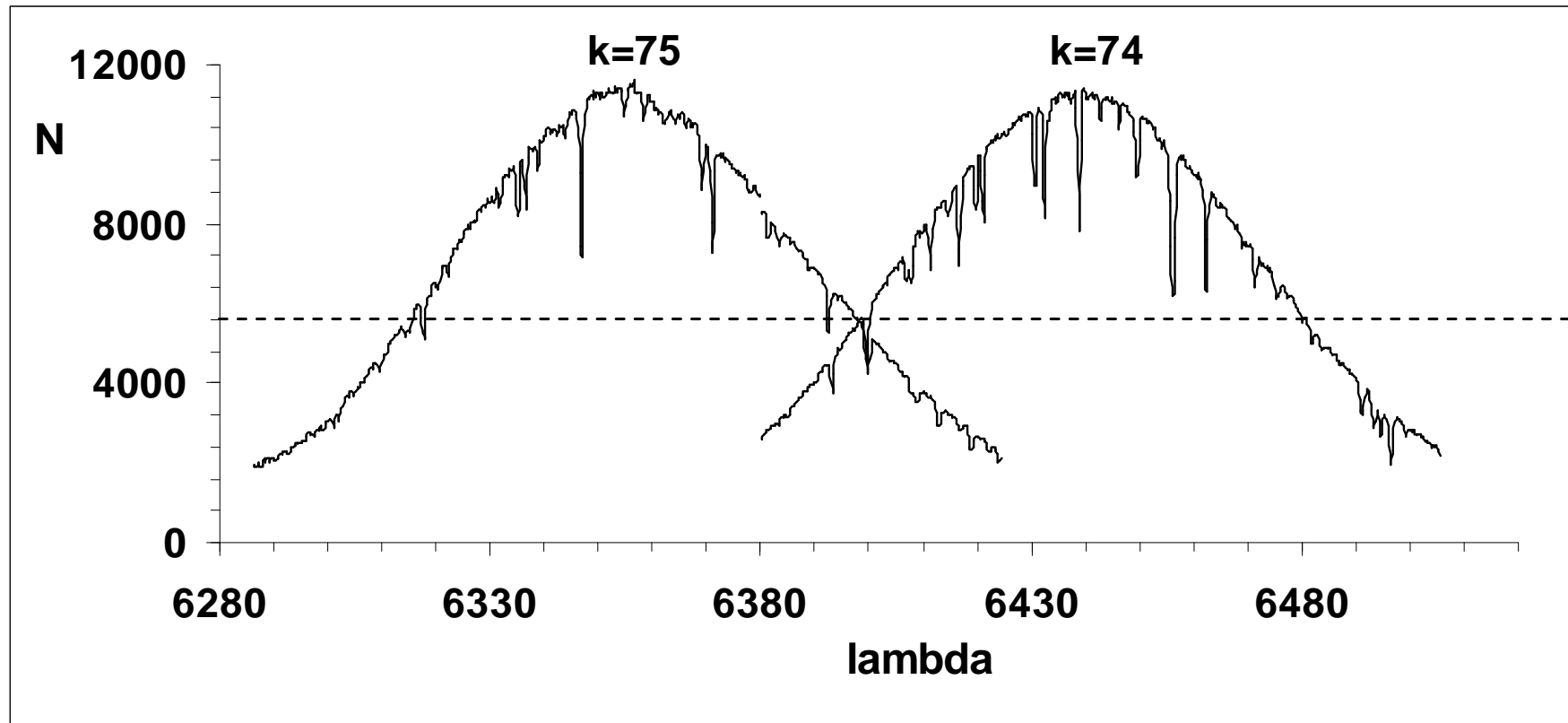
**Spectrum of star alpha-Cyg obtained in Cassegrain focus with help of CCD (left – red; right – blue part of spectra)**



# Spectra obtained in Cassegrain focus

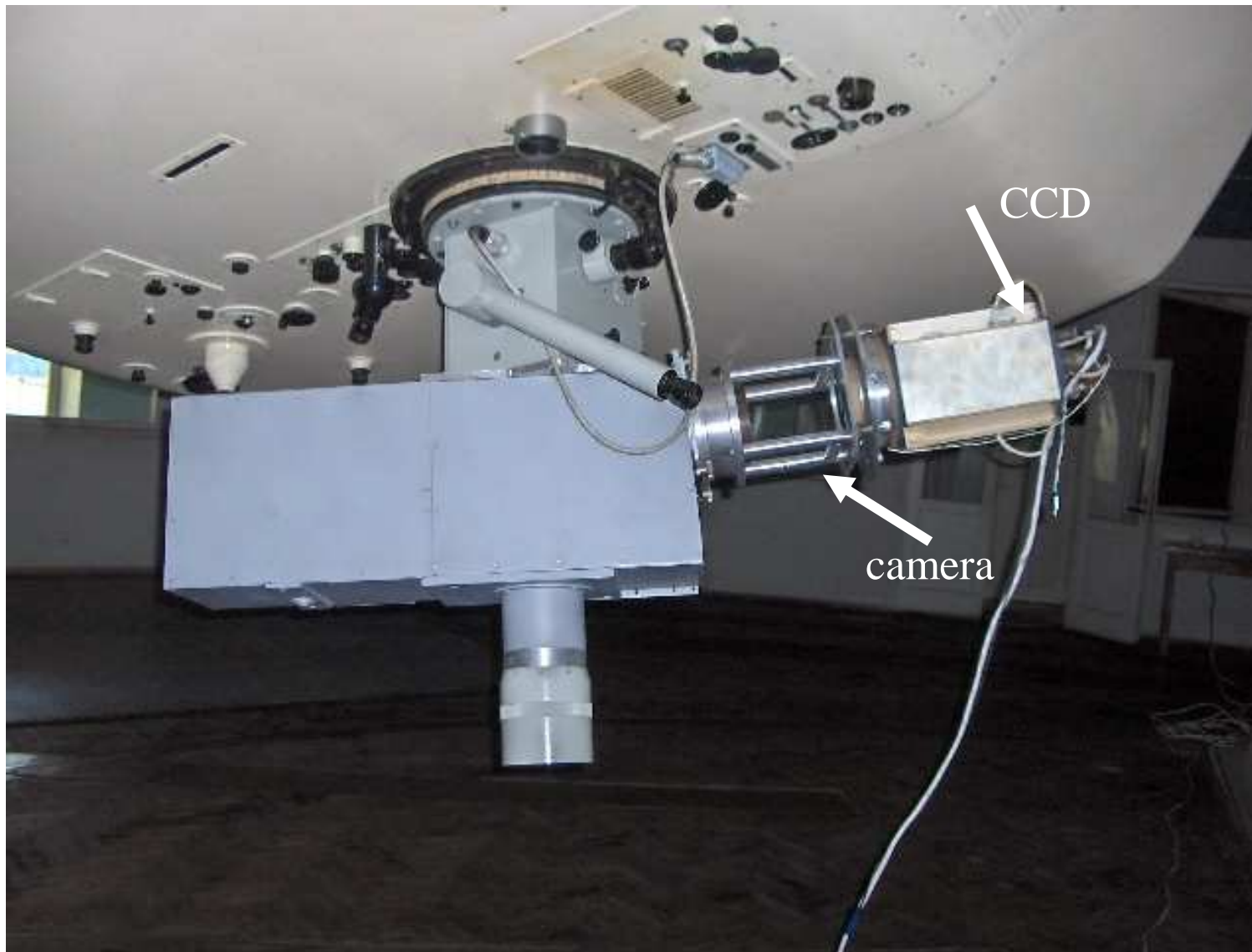


# Spectrum of star 41 Cyg

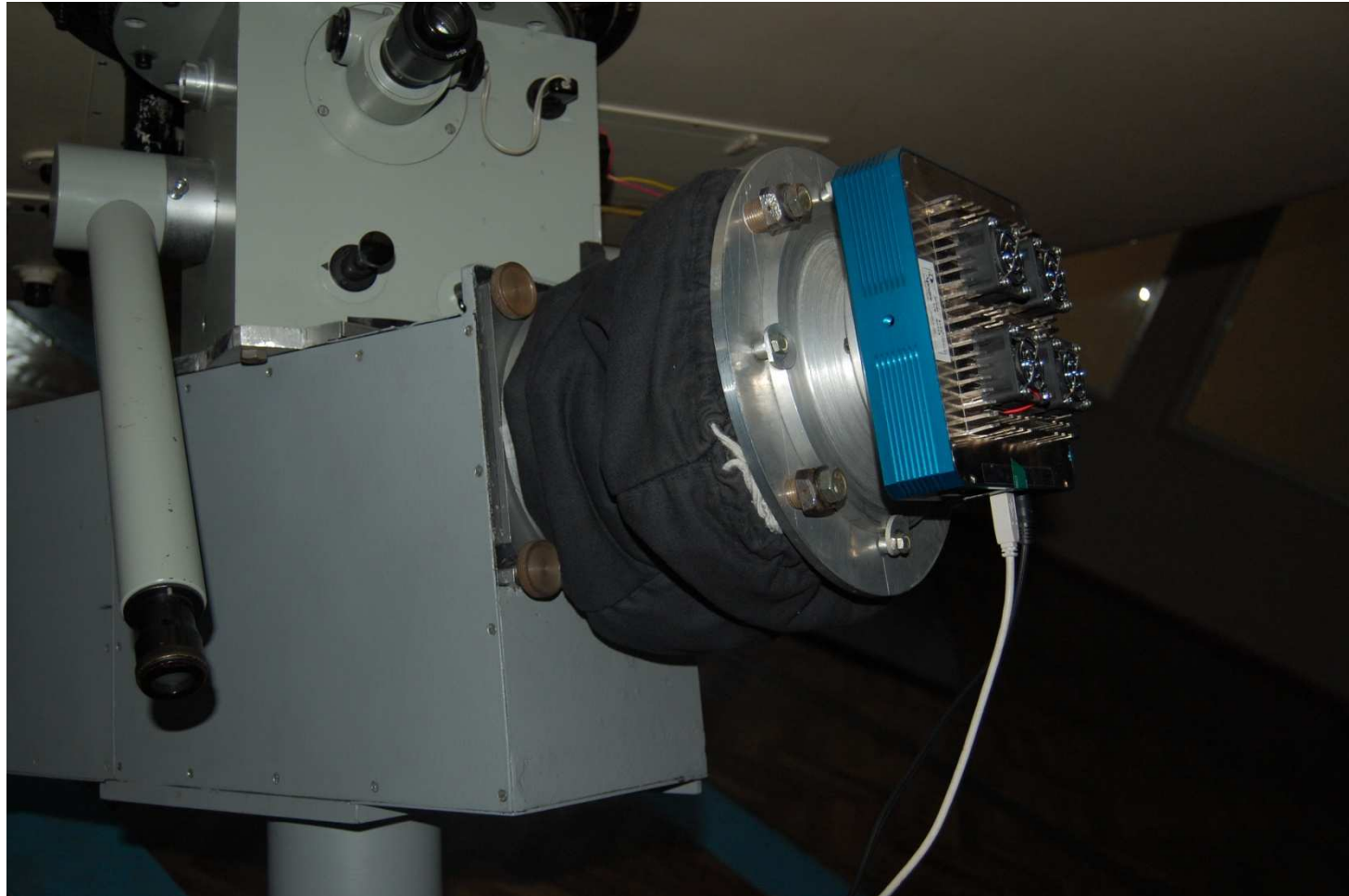




**Echelle spectrograph in Cassegrain  
focus with resolution of  $R=24\,000$   
CCD camera (530x580pix)**

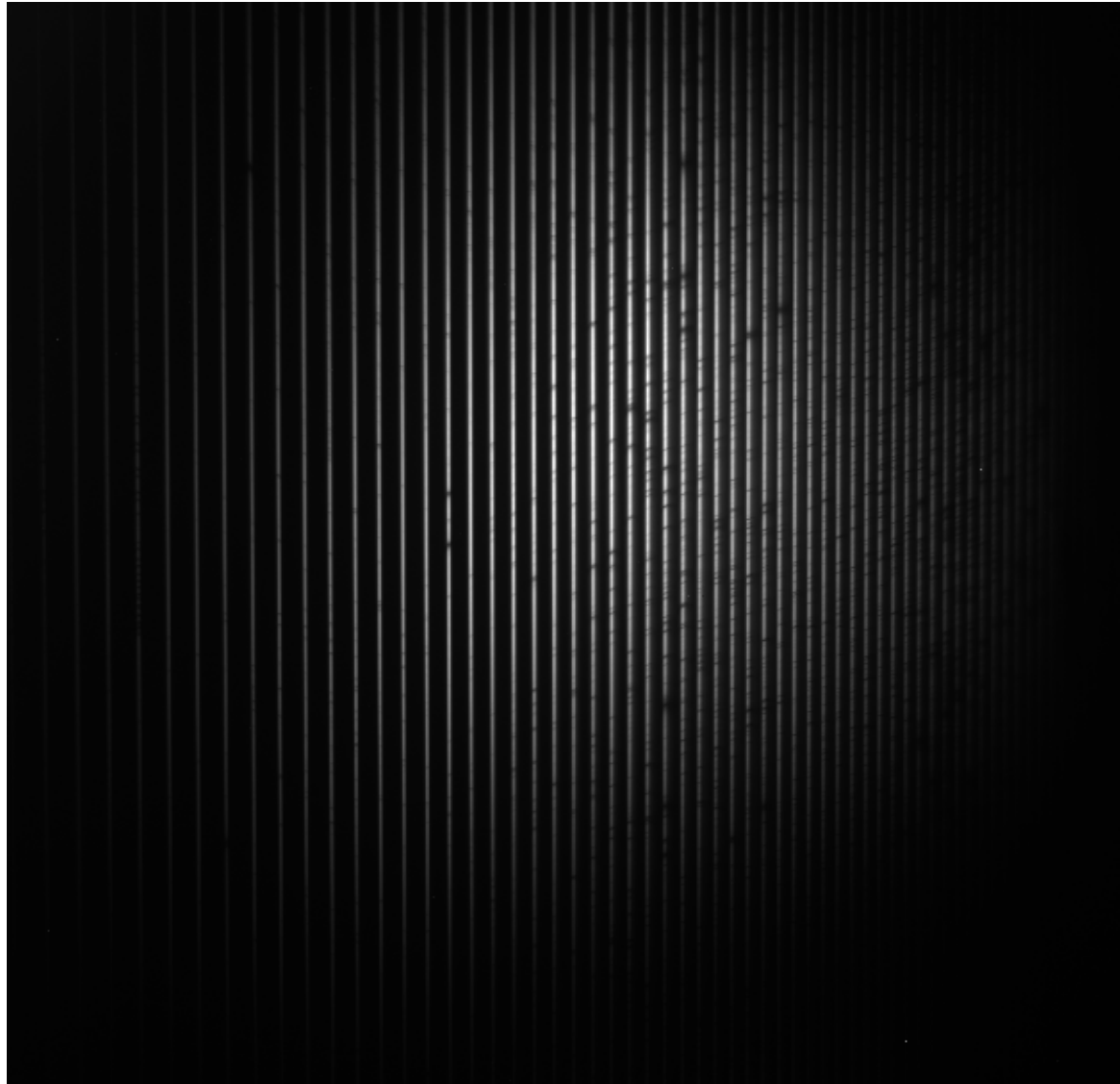


Cassegrain Echelle spectrograph-  $R=24000$ ,  
CCD camera(3056x3056 pix)



# Spectrum of the Sky

Resolution ( $R=24\ 000$ )



0.8  $\mu\text{m}$

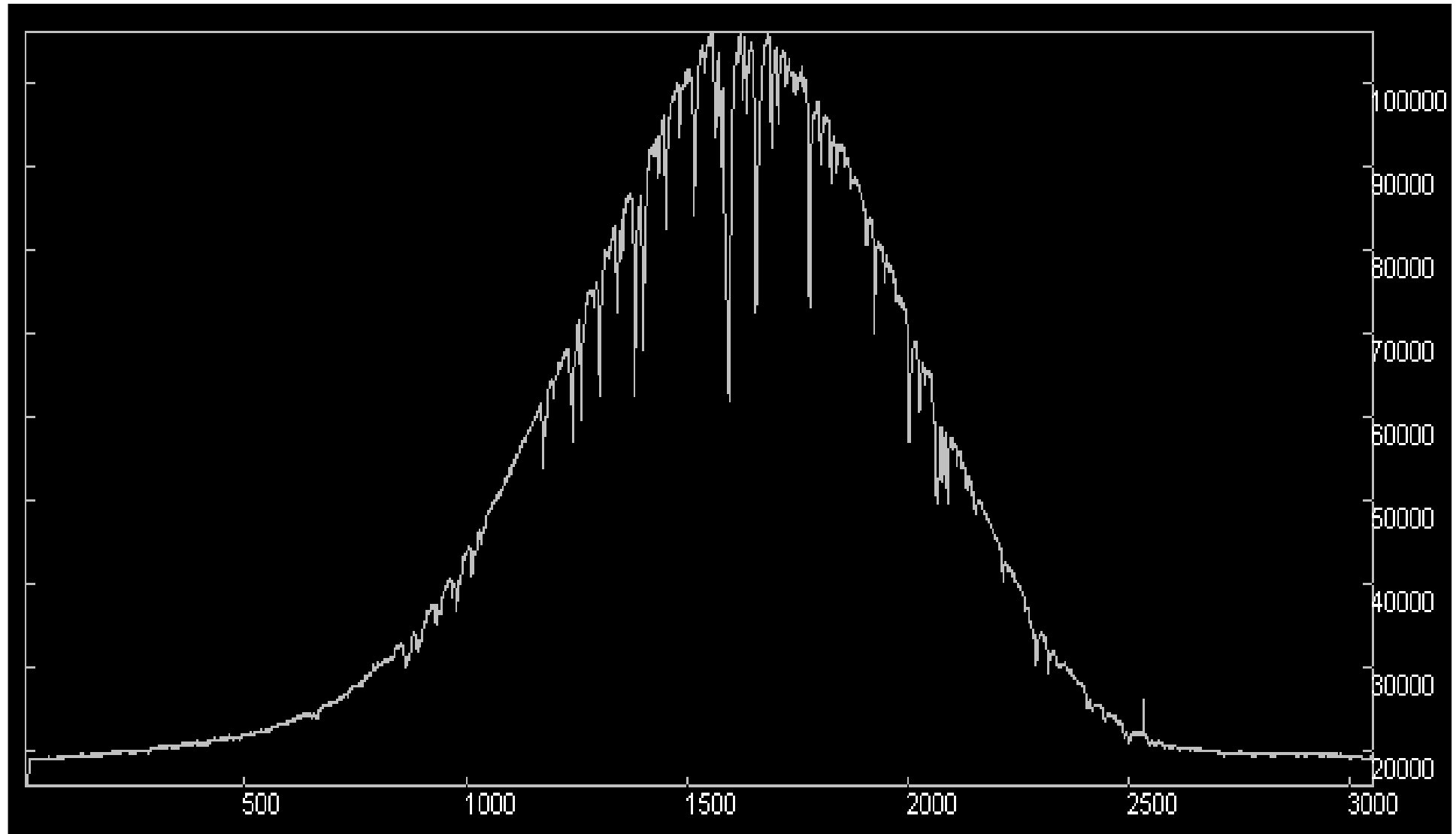


Lambda

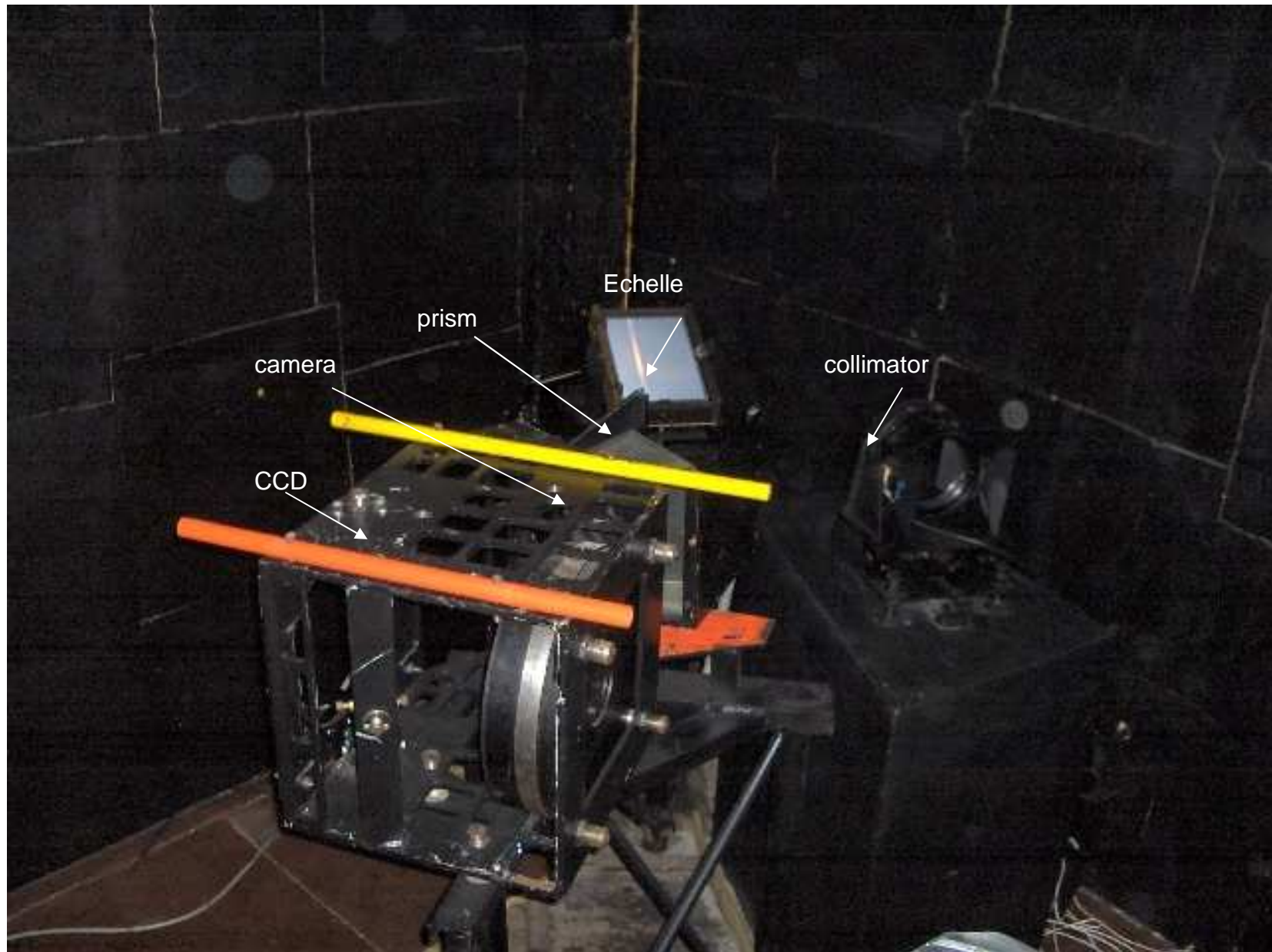
0.36  $\mu\text{m}$



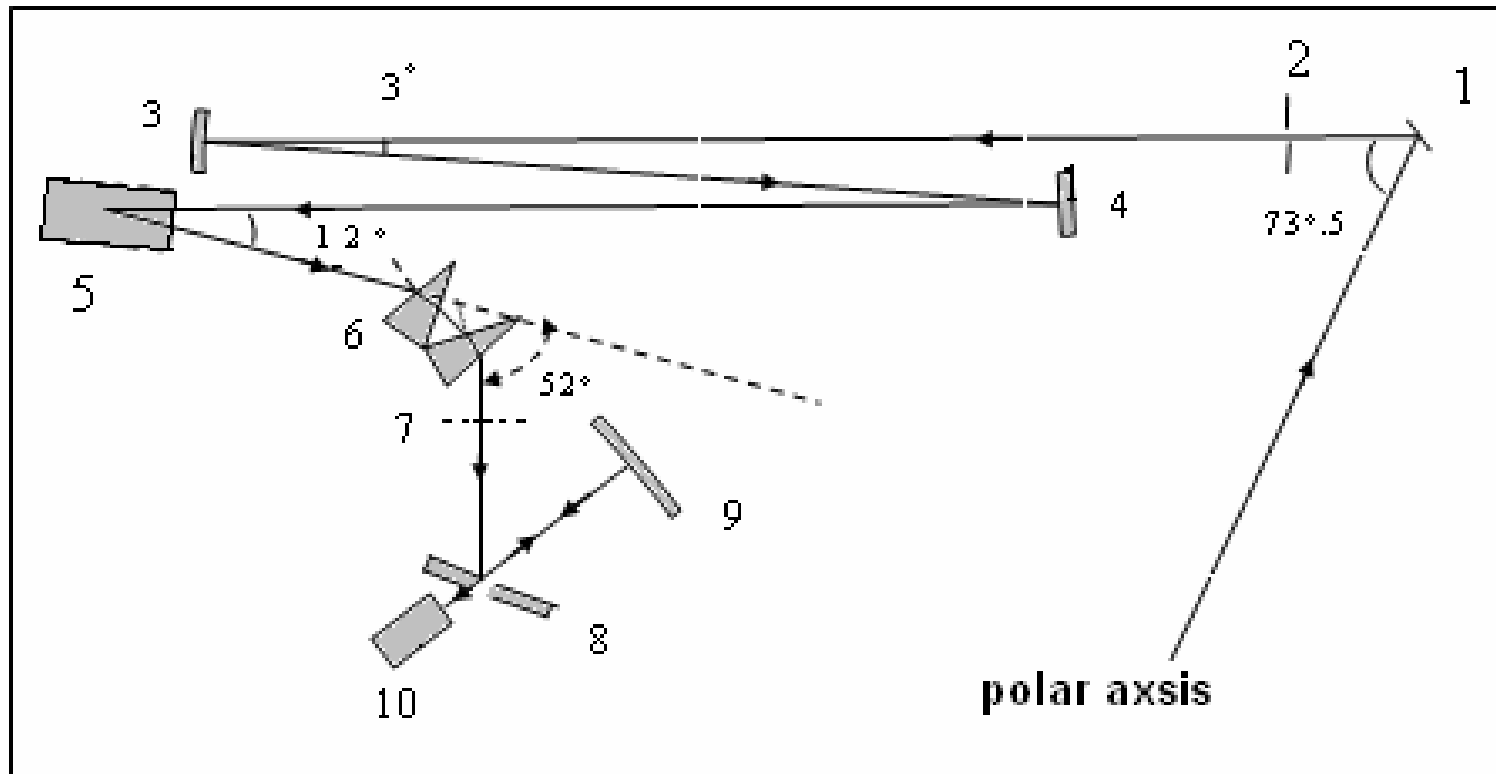
# Spectrum of the sky From order 91



# Coude – Echelle spectrograph (R=30 000)



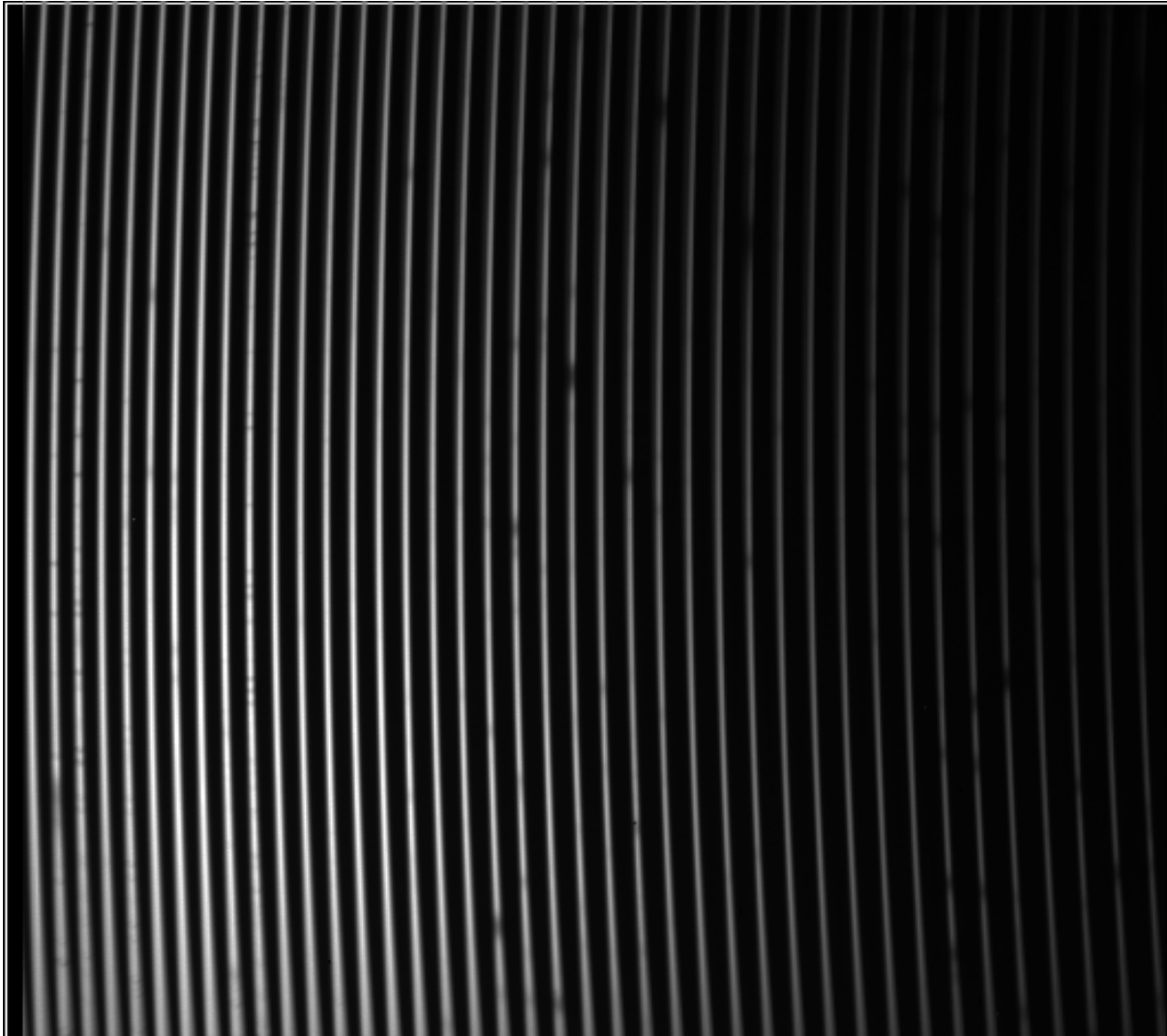
# Optical layout of Coude Echelle spectrograph ( $R=30\ 000$ )



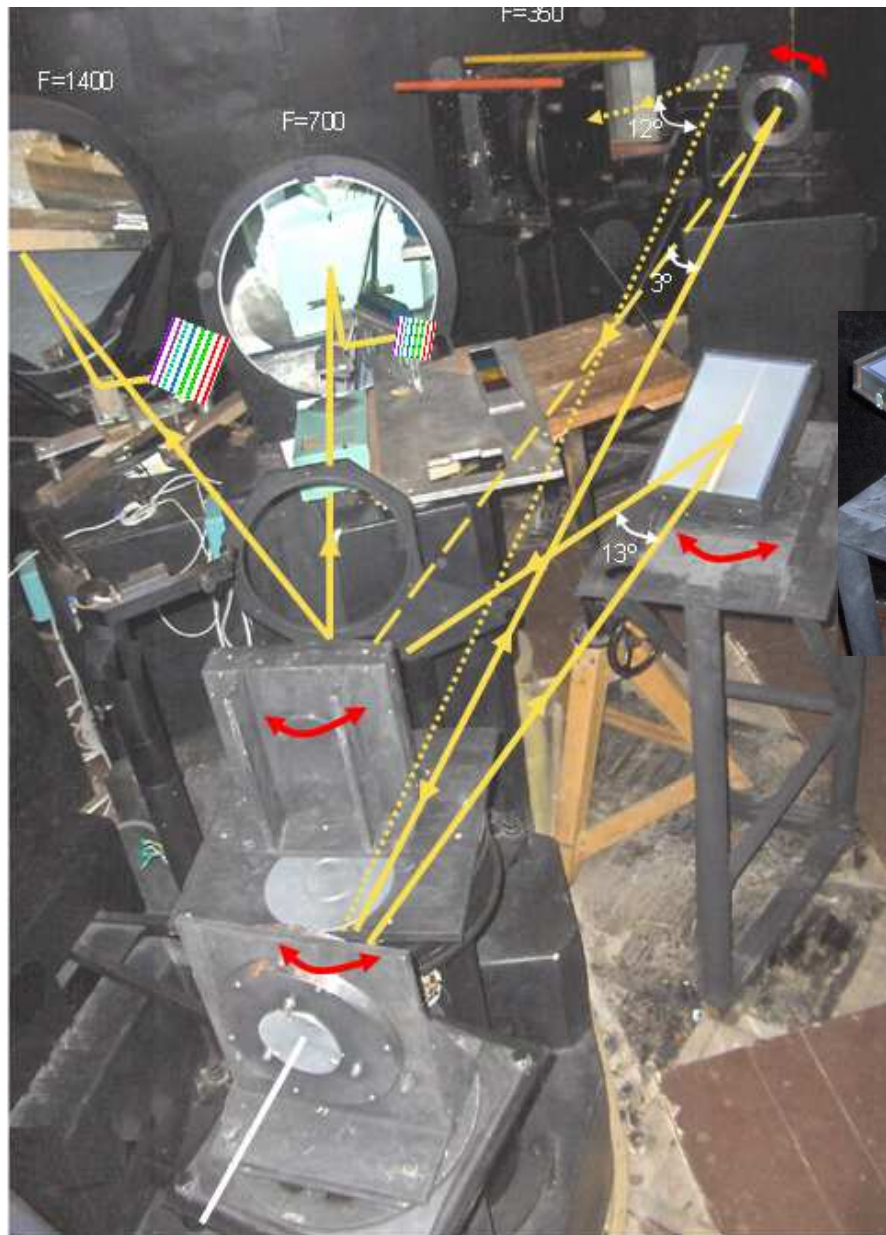
**1- inclining mirror, 2- shell, 3-collimator, 4 – plane mirror; 5 - Eschelle grid; 6 - prism systems; 7 - Schmidt corrector; 8 - plane mirror; 9 – camera; 10 – CCD camera**



**Spectrum of the star  $\alpha$  Cyg**  
**R=30 000**



# High resolution Universal Coude-Echelle spectrograph



$$R = \frac{2f_{\text{cam}} \operatorname{tg} \gamma}{b'}$$

1 pix = 24 mikron

1. Echelle grating 63.5° N=37.5 çizgi/mm

- |              |           |
|--------------|-----------|
| a) F=700 mm  | R=60 000  |
| b) F=1 400mm | R=120 000 |

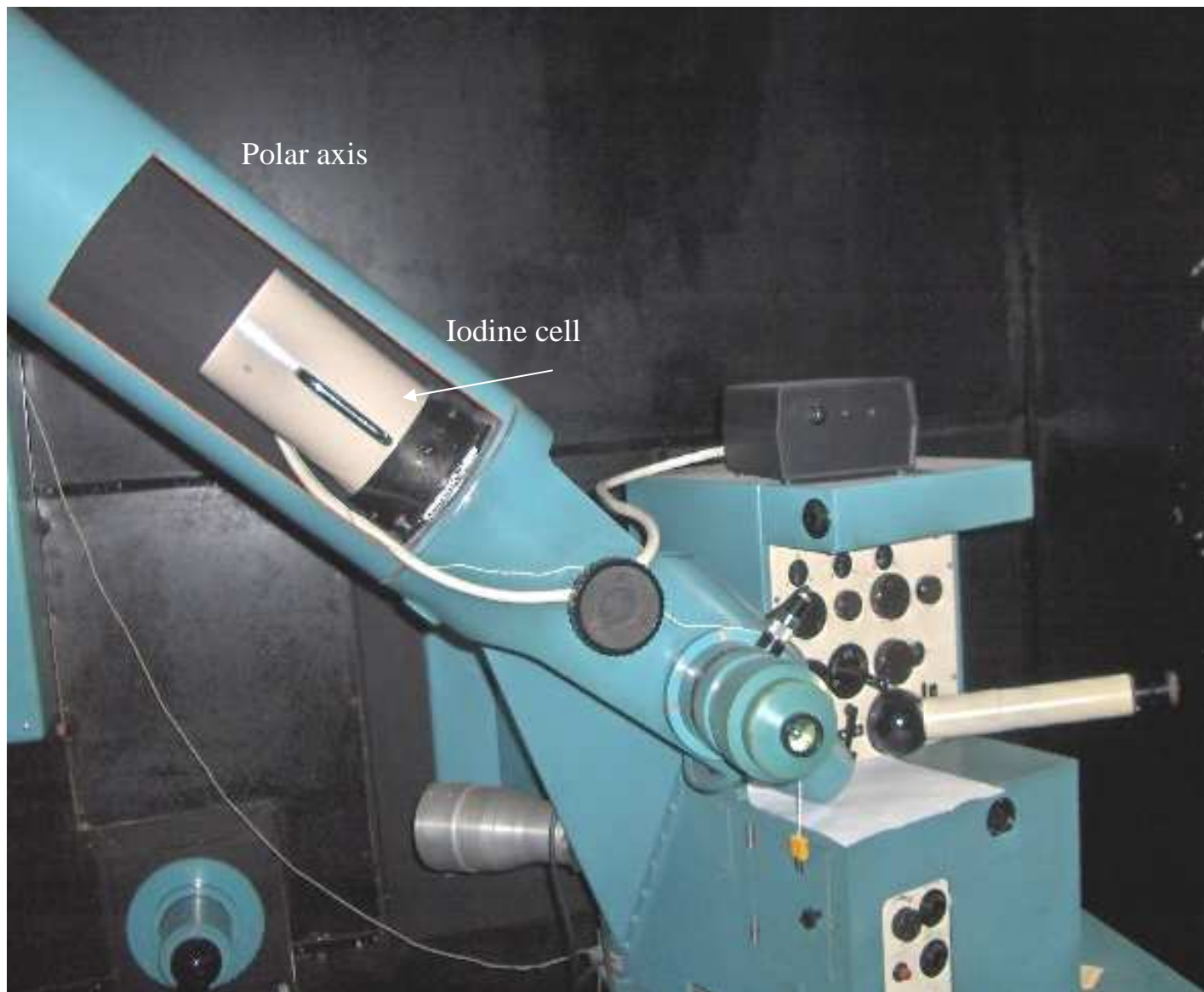
2. Echelle grating 80° N=37.5 çizgi/mm

- |             |           |
|-------------|-----------|
| a) F=700 mm | R=165 000 |
| b) F=1400mm | R=330 000 |





# Iodine cell in Coude focus

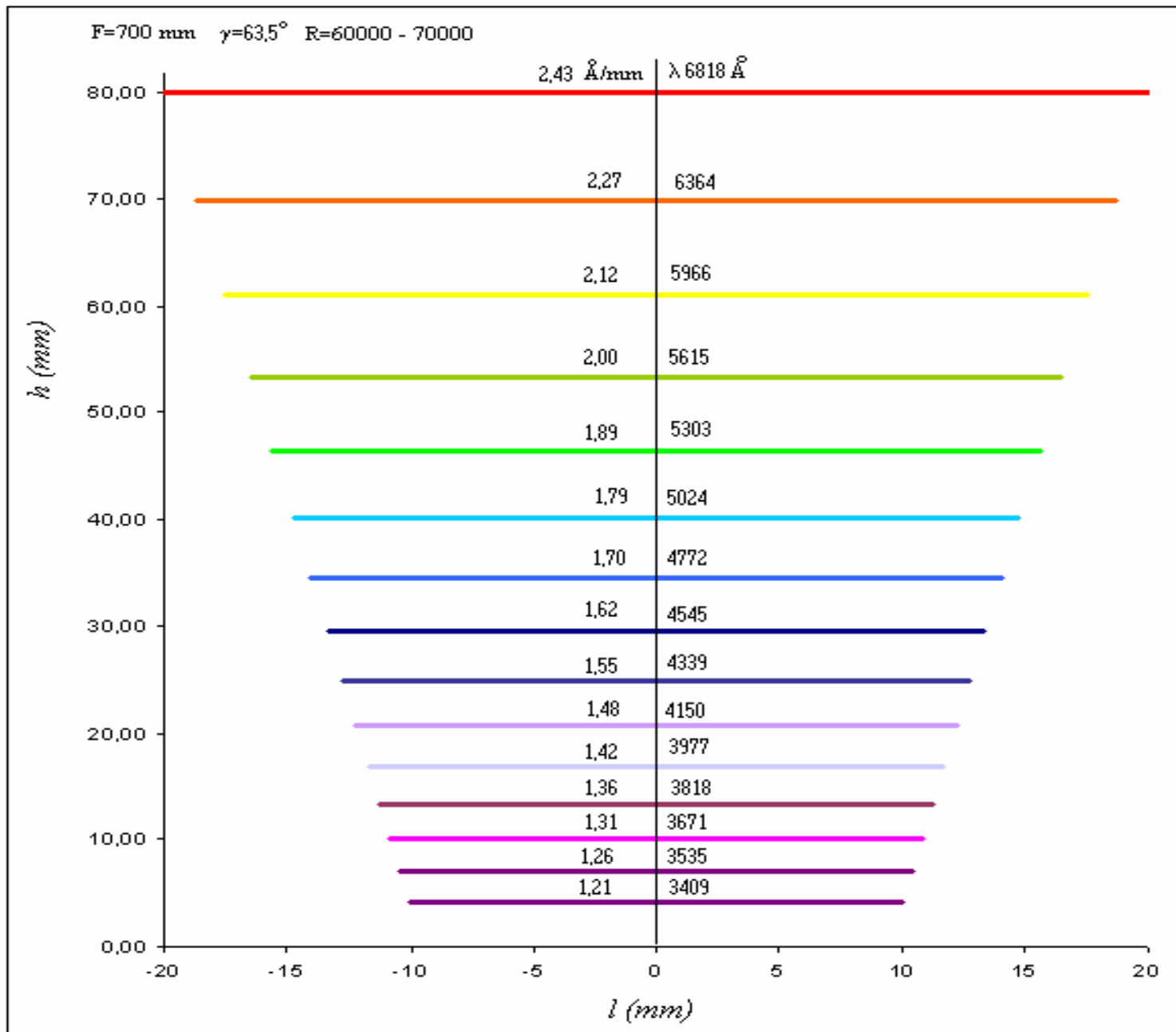


# Iodine cell

(view from different sides)

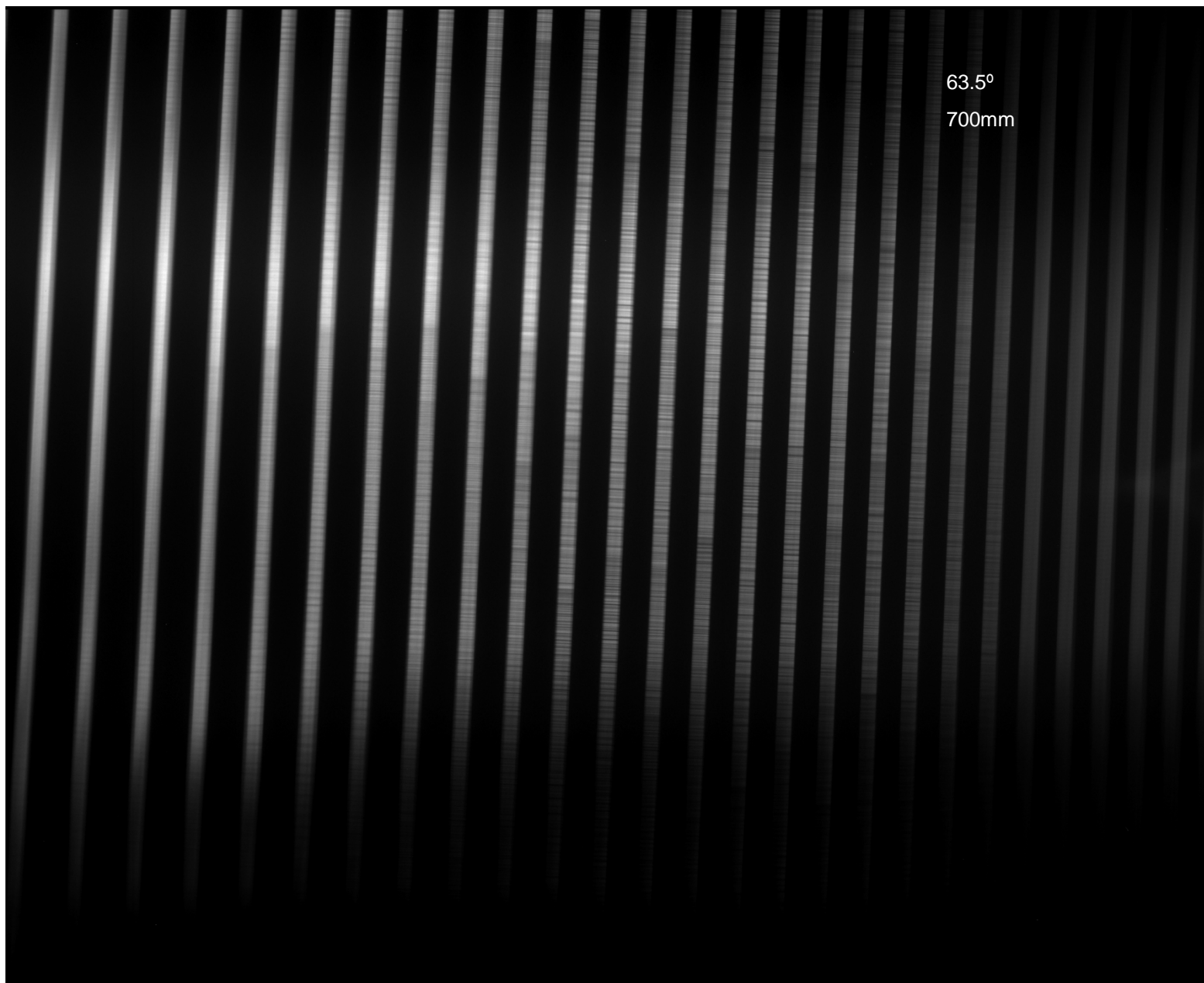


# The output format of the universal Coude Echelle spectrograph R=60000

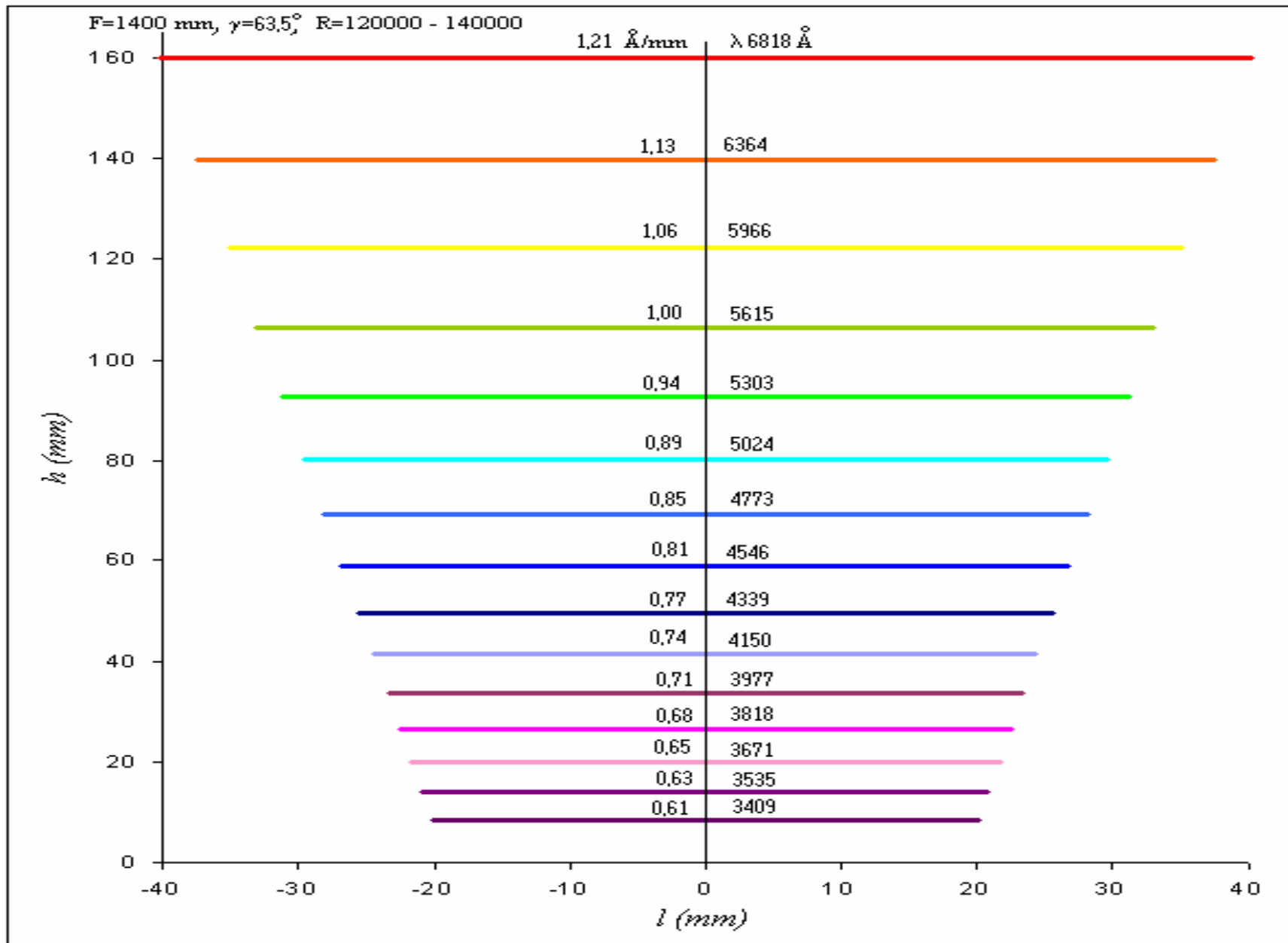




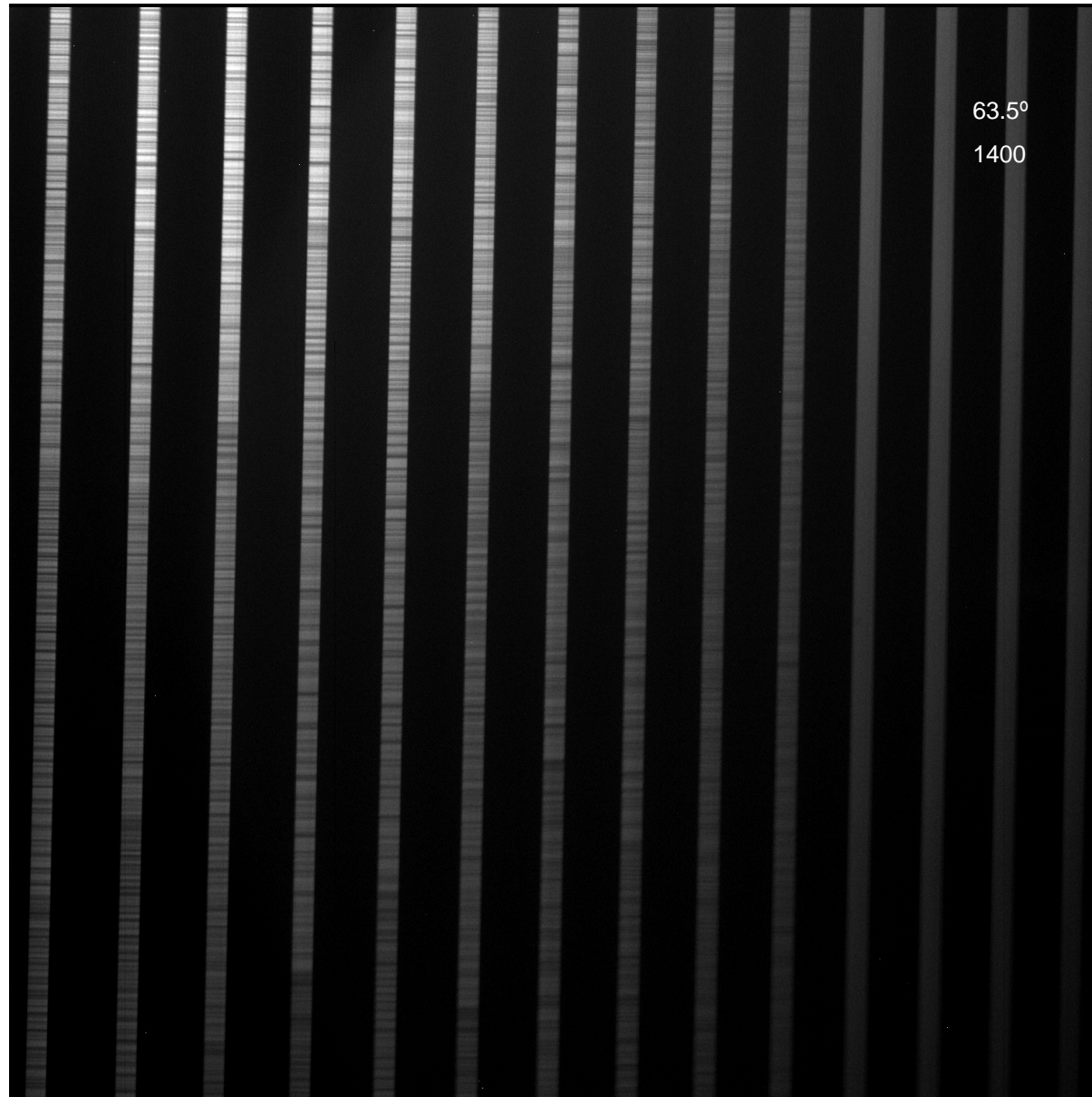
# Spectrum of Flat+Iodine, R=60 000



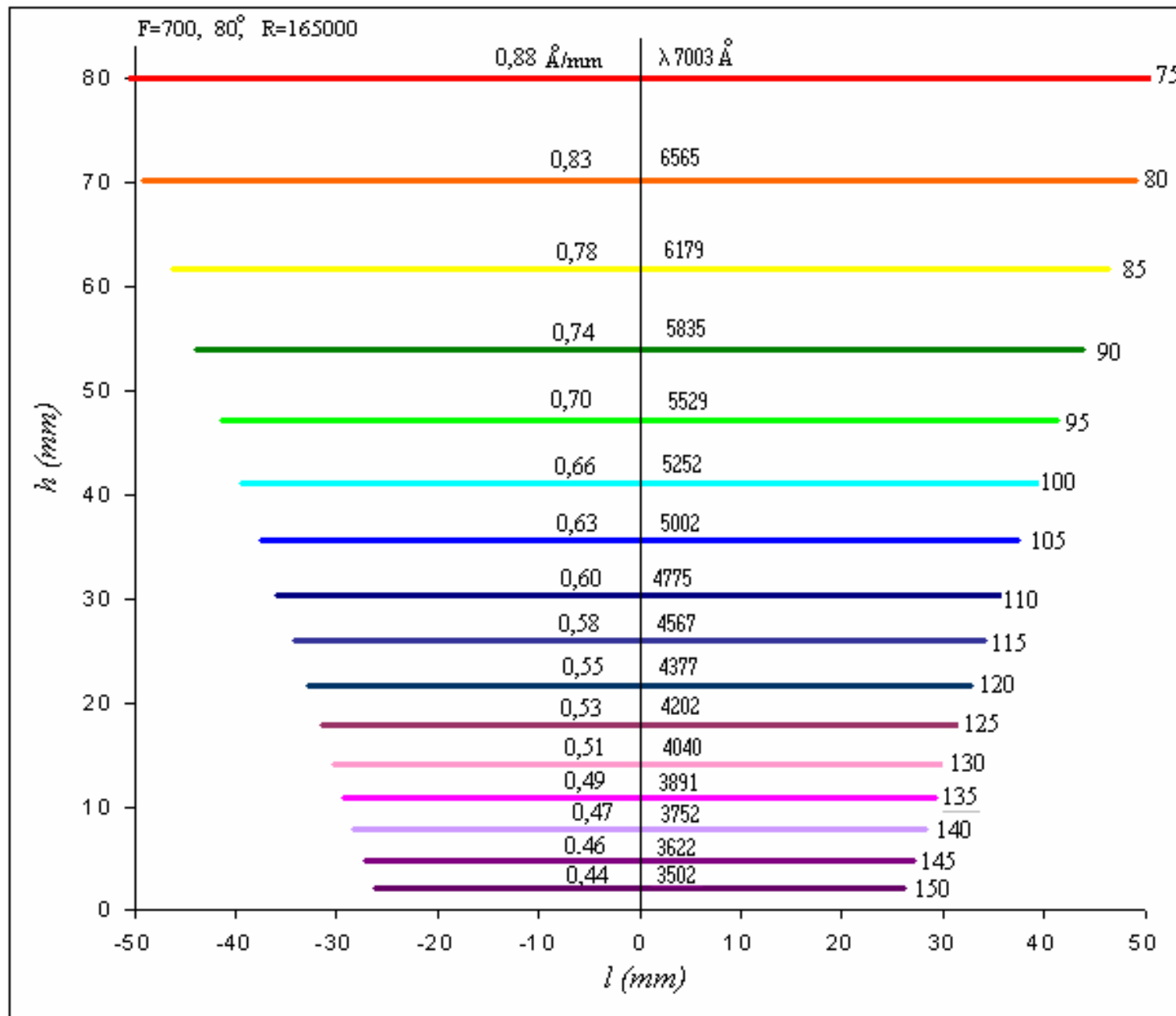
# The output format of the universal Coude Echelle spectrograph R=165000



Spectrum of Flat+Iodine, R=120 000

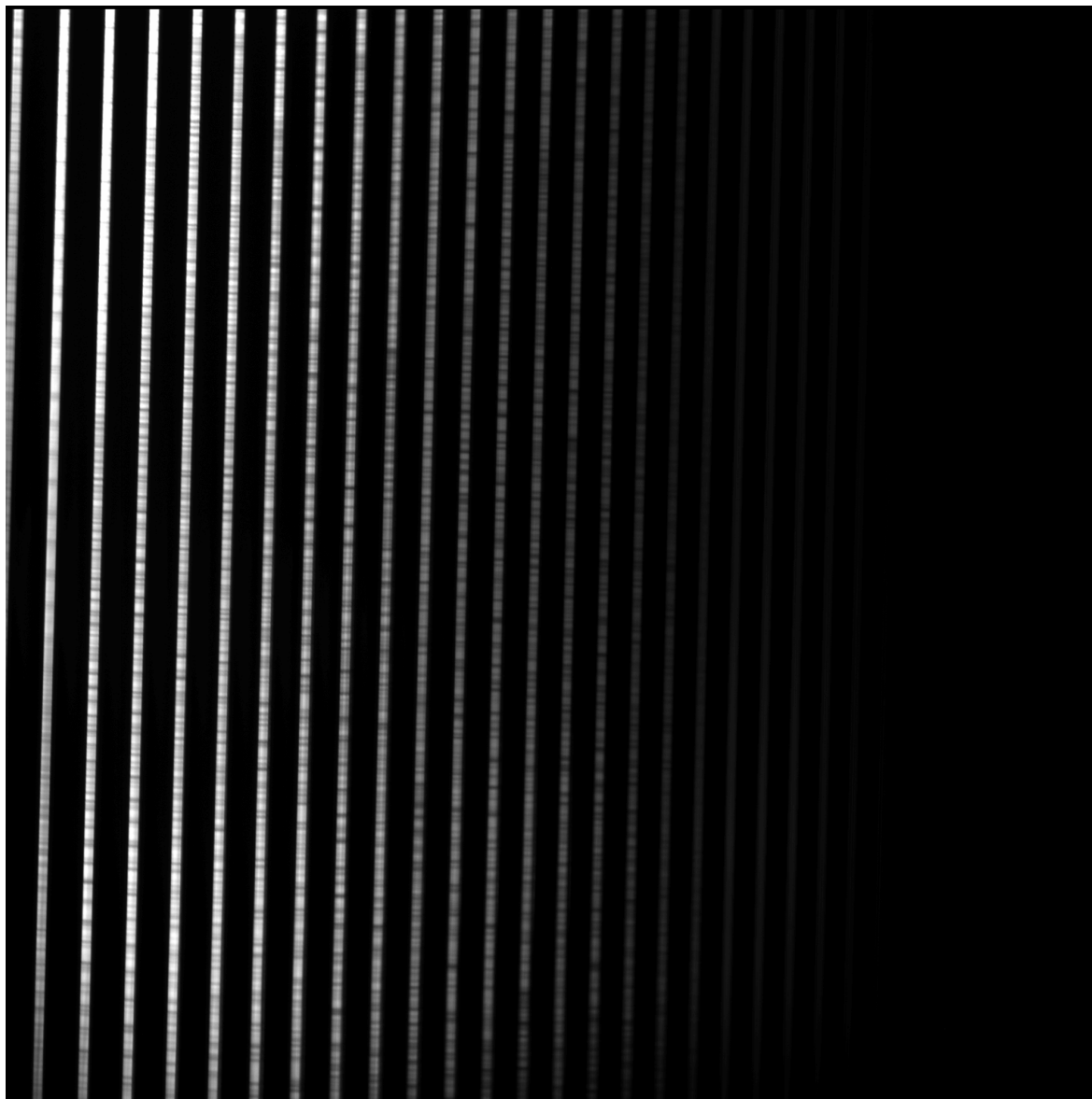


# The output format of the universal Coude Echelle spectrograph R=165000

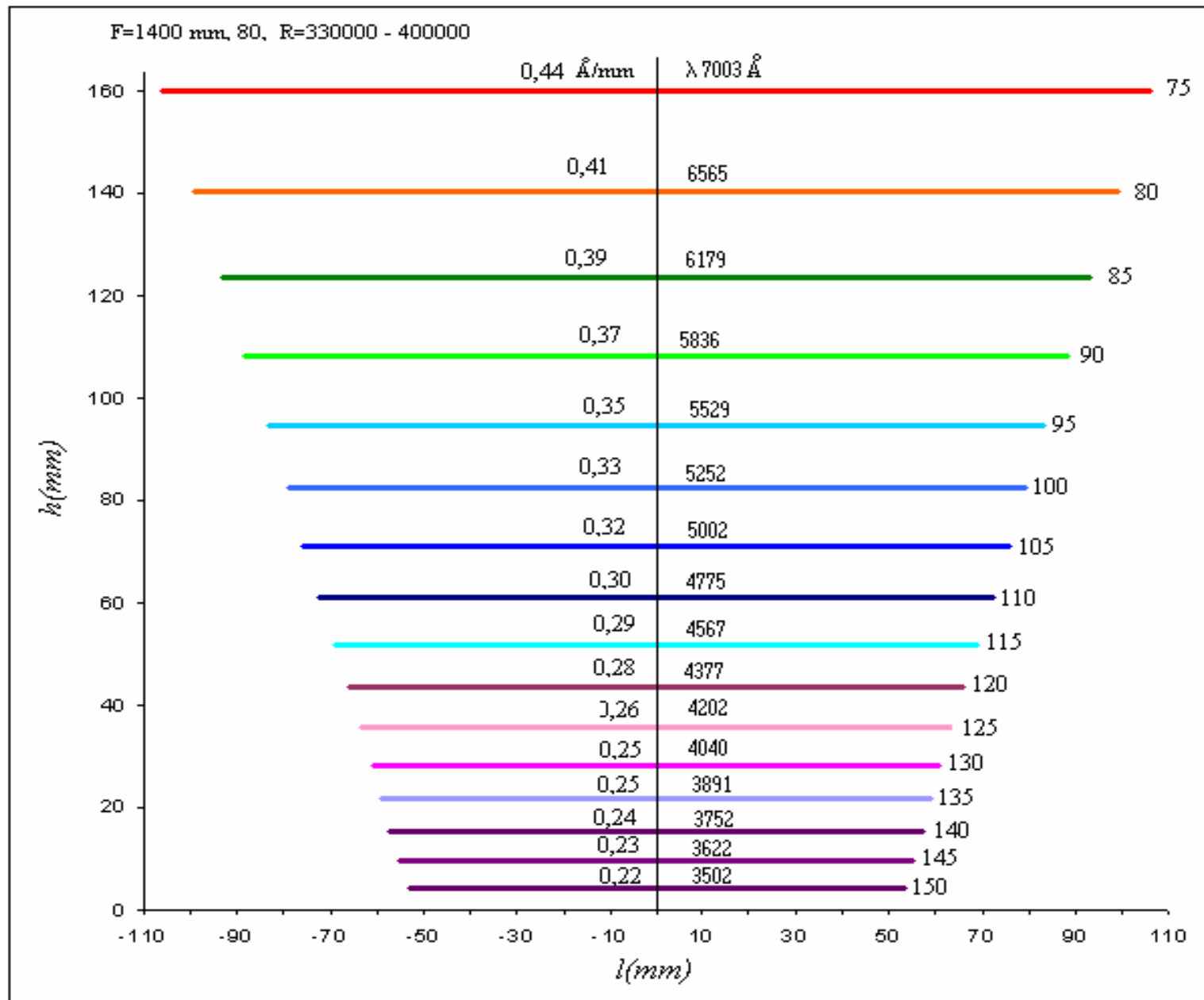




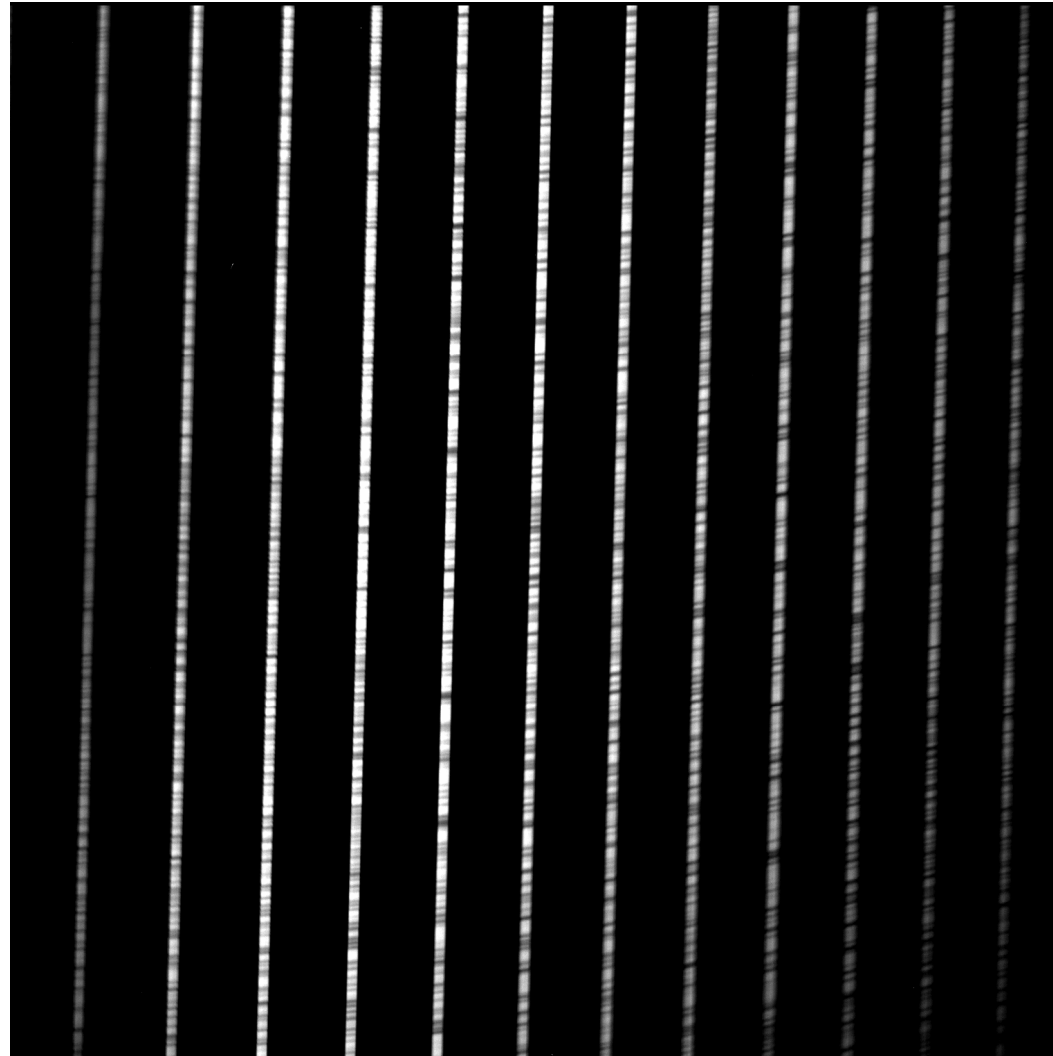
Spectrum of the Flat+Iodine, R=165 000



# The output format of the universal Coude Echelle spectrograph R=330000



# Spectrum of the Flat+Iodine, R=330 000

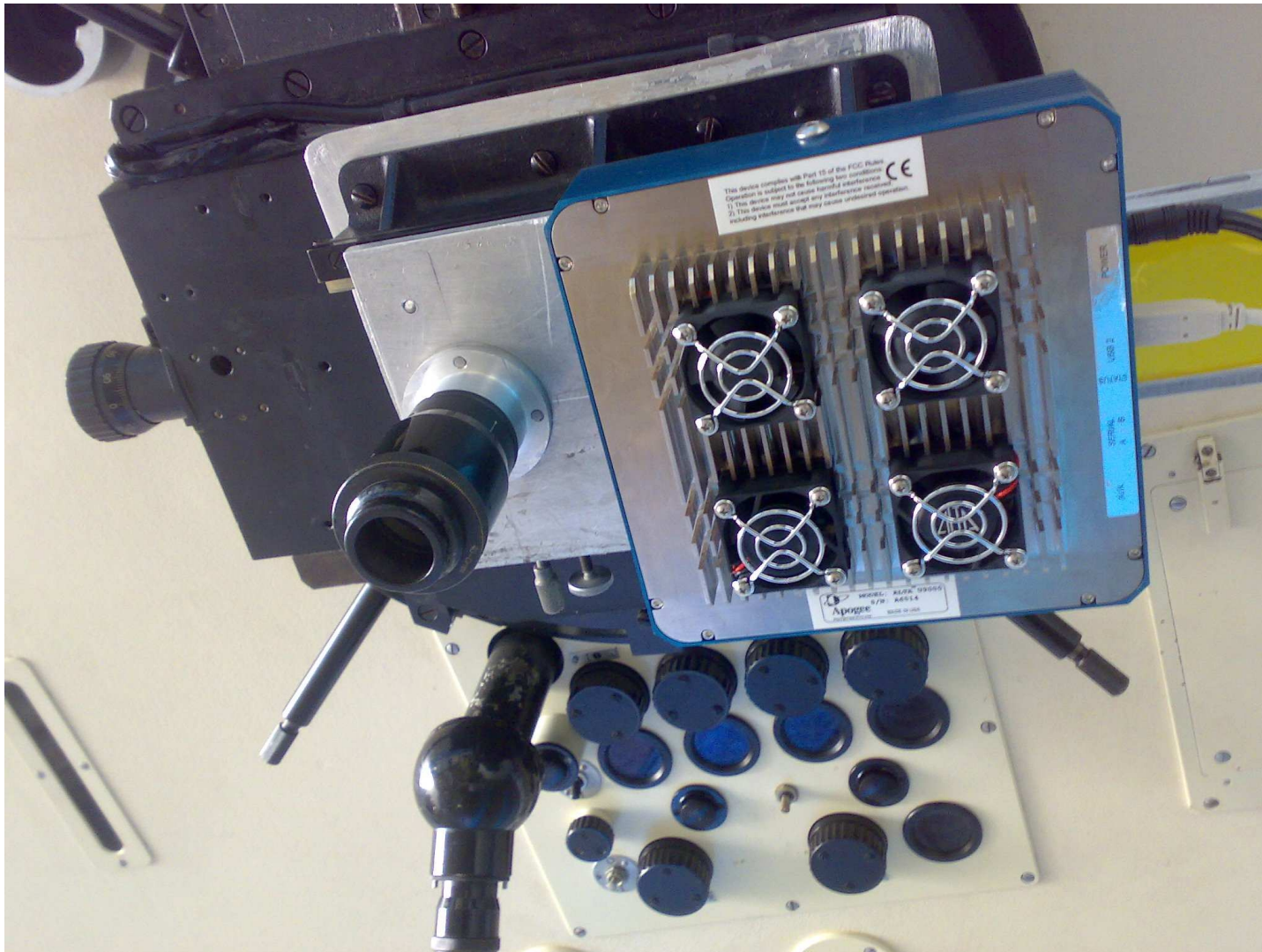


# CCD + photo-equipment in Cassegrain focus





# CCD-camera in 2m telescope



Moon's surface (obtained in 2m telescope)



Moon's surface (obtained in 2m telescope)



Moon's surface (obtained in 2m telescope)

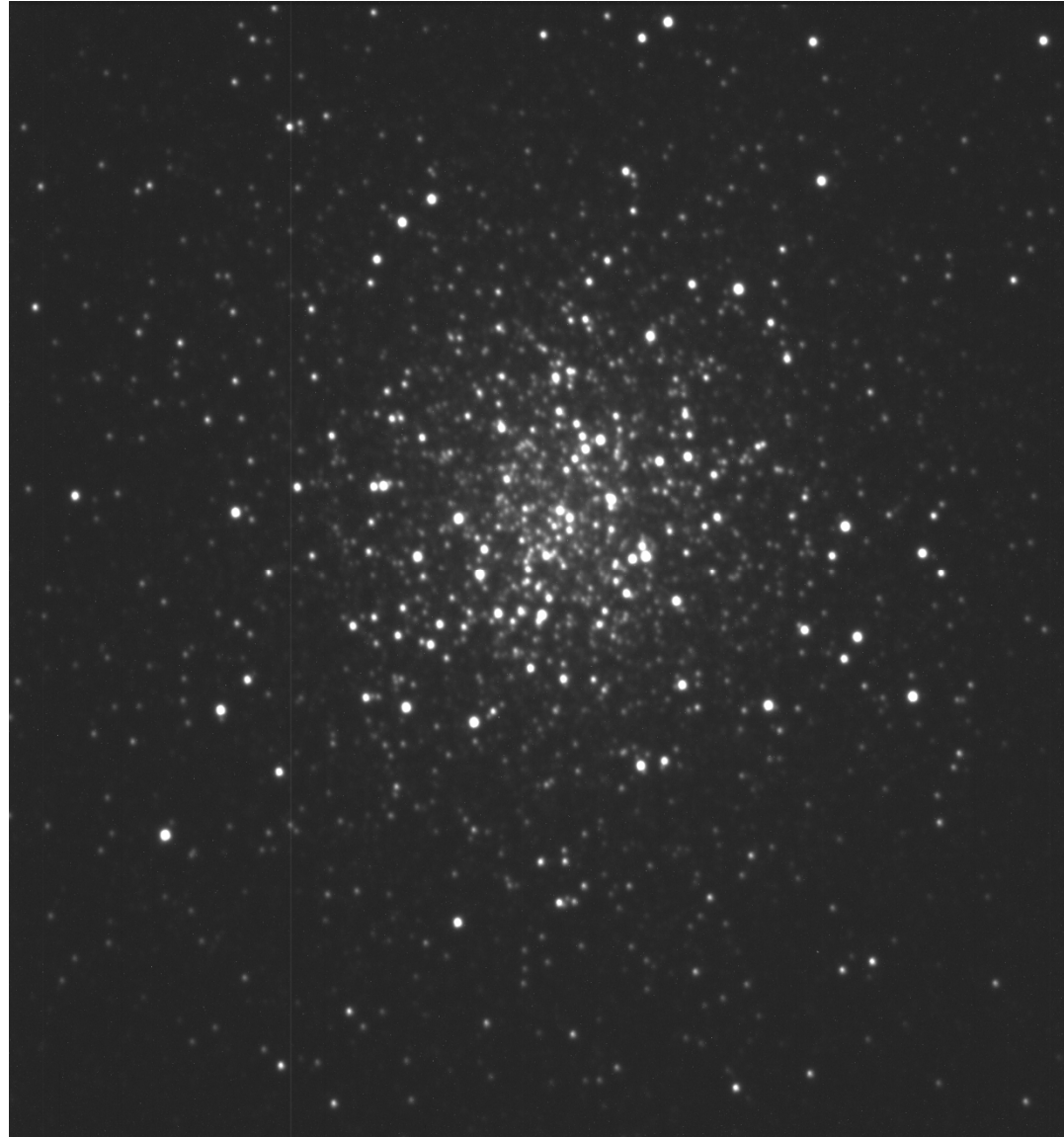




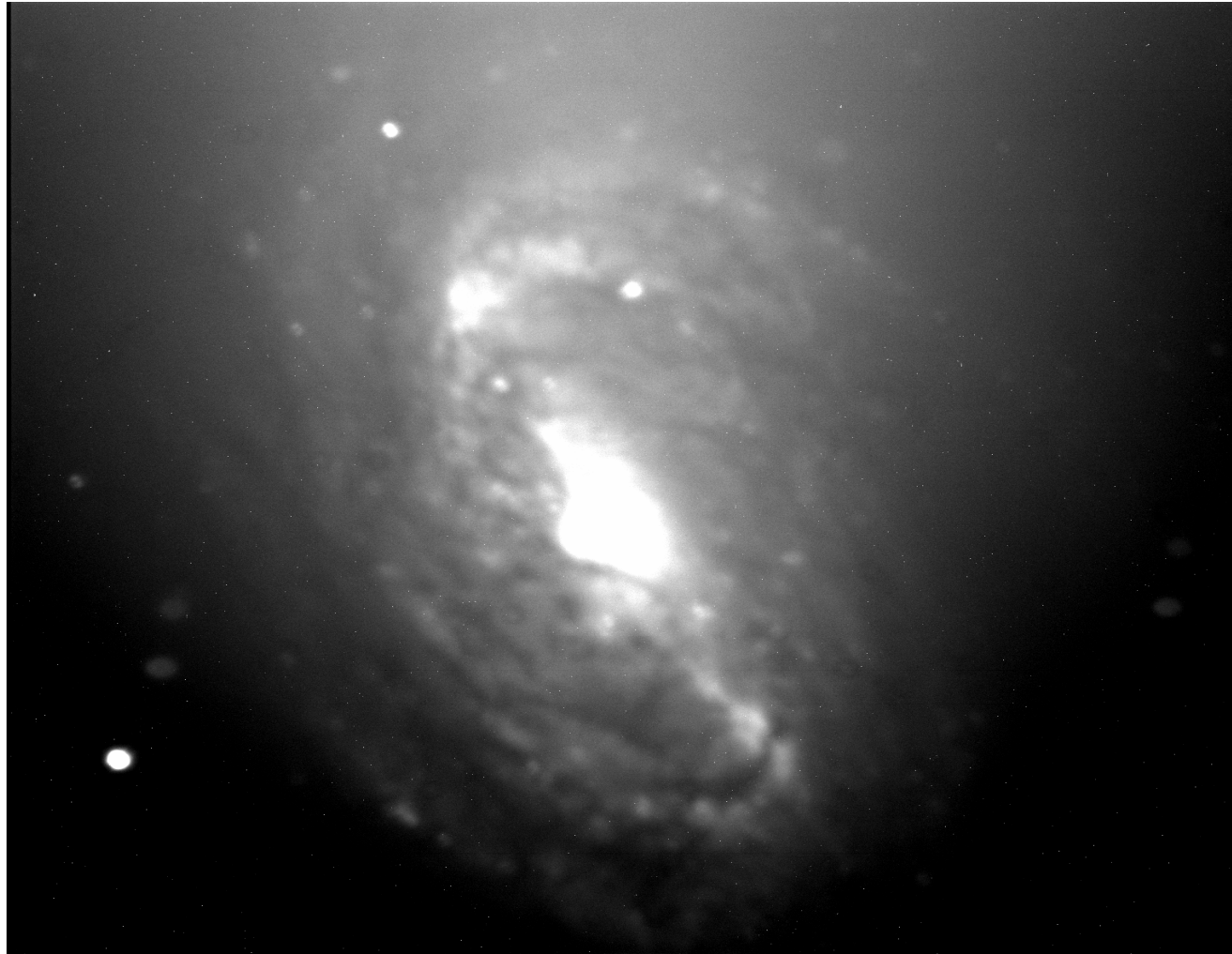
# Moon's surface (obtained in 2m telescope)



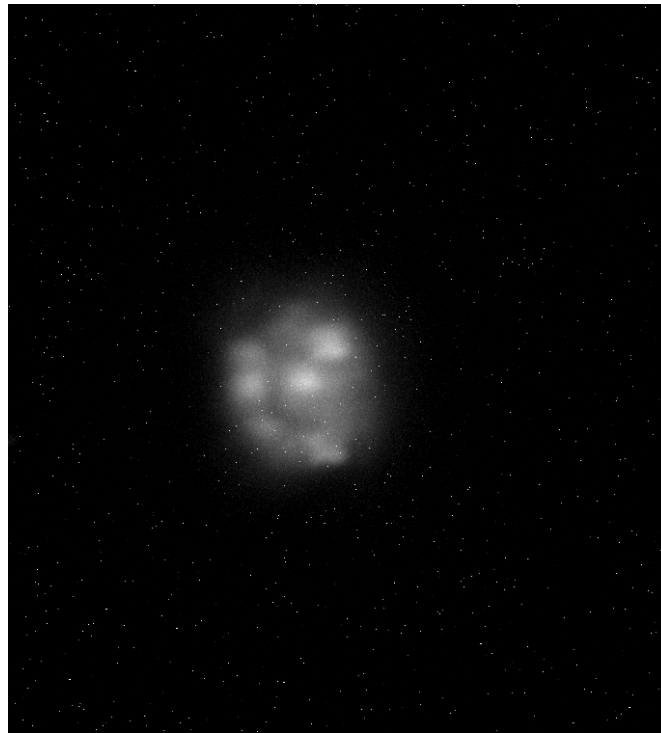
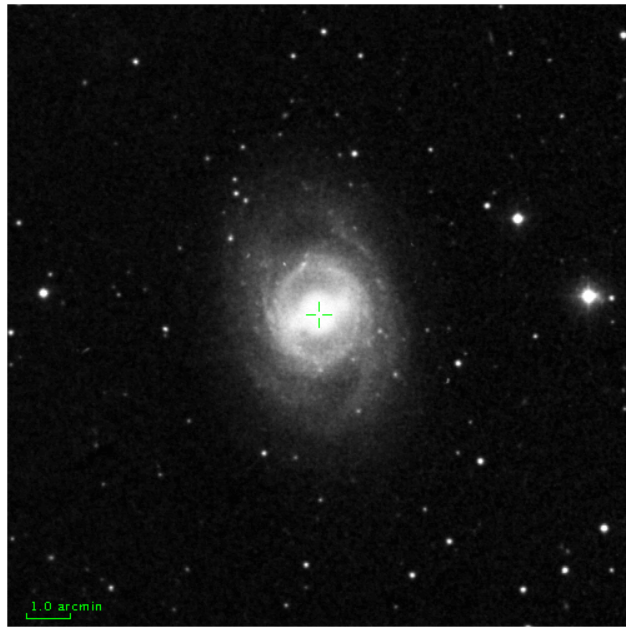
# NGC 5272 (2m telescope)



# NGC 2903 (2m telescope)



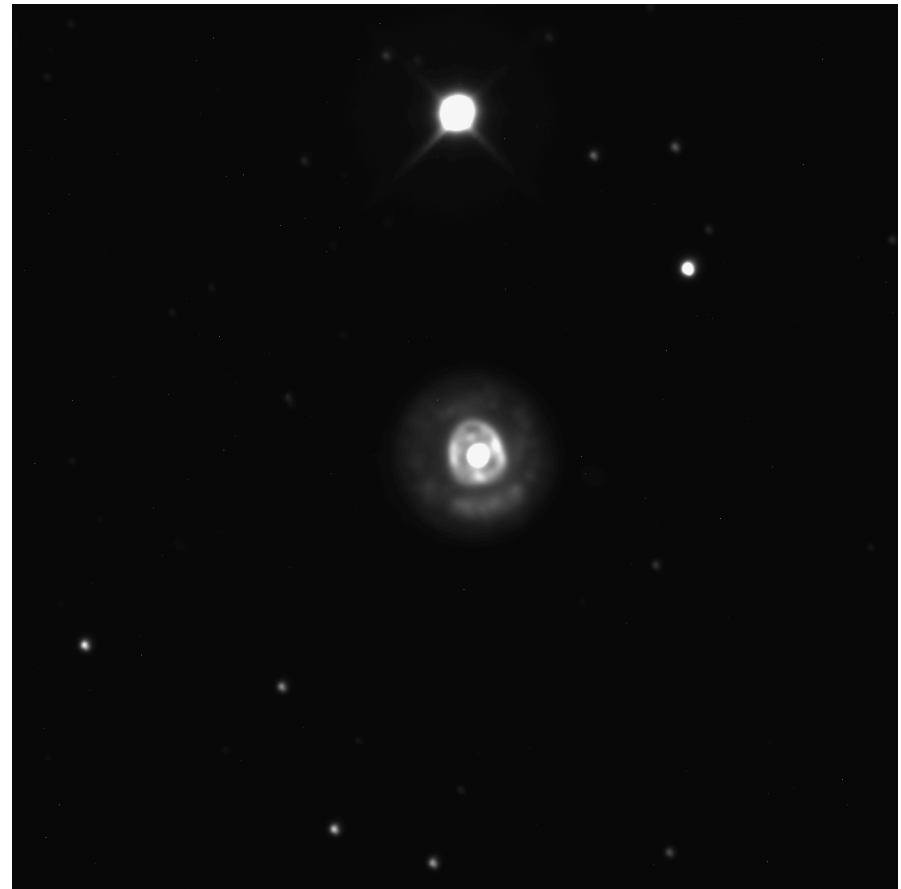
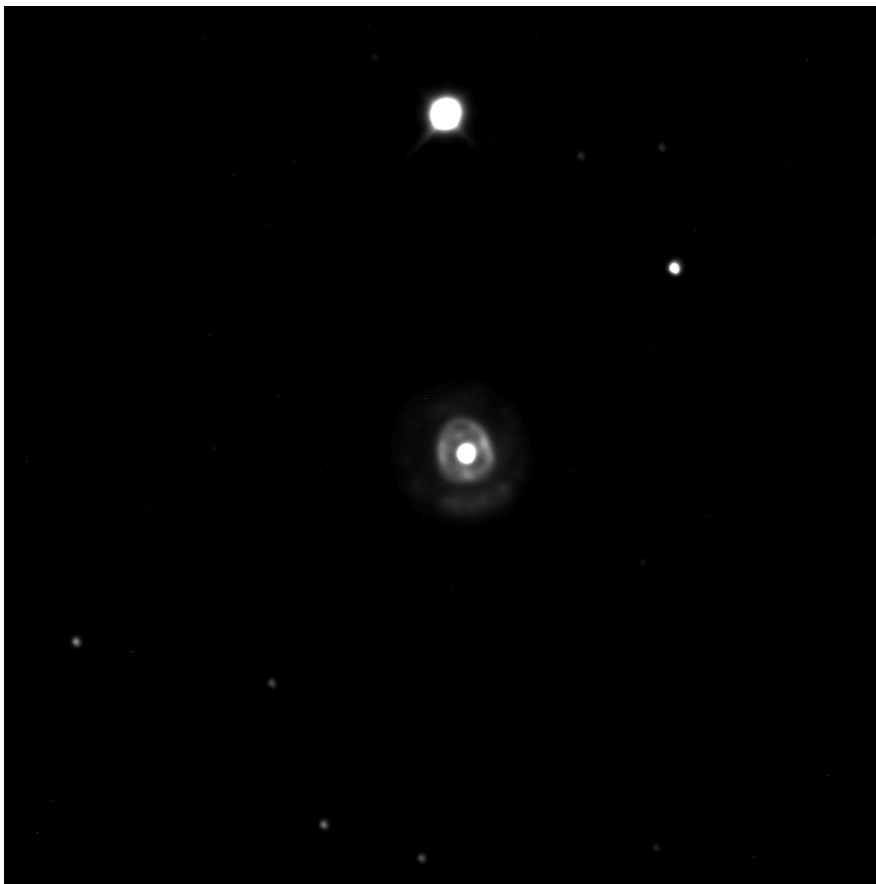
# NGC 3351 (2m telescope)

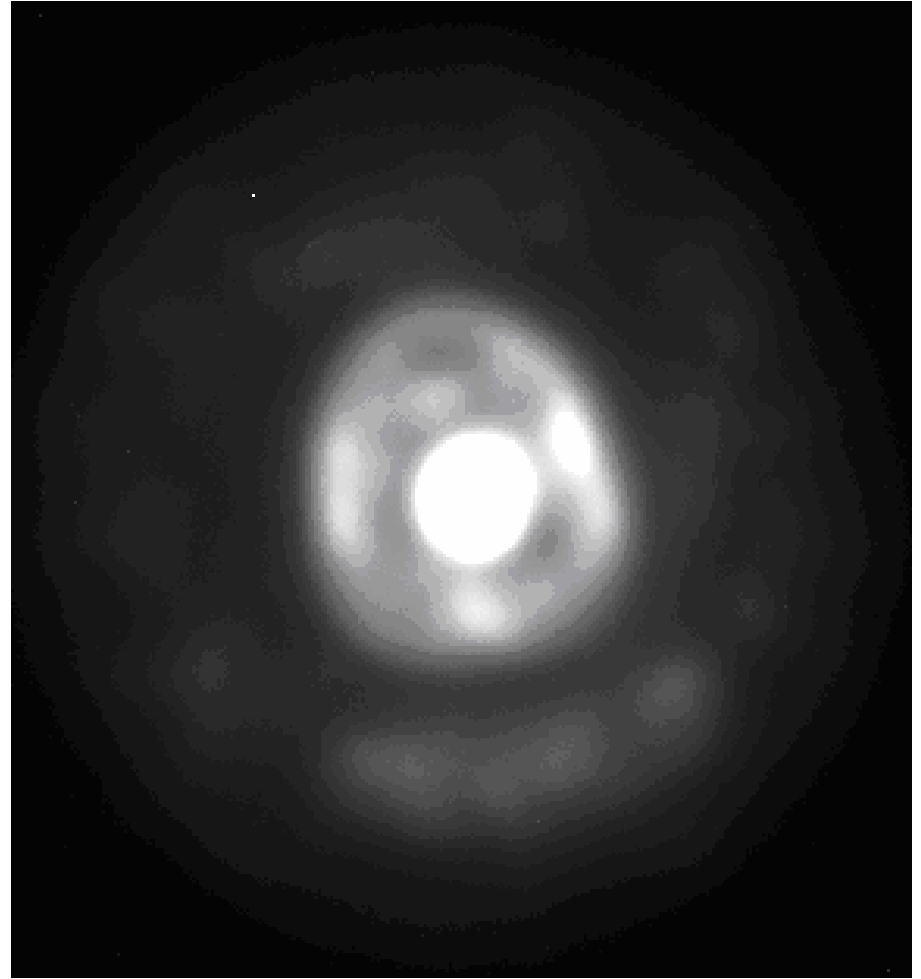
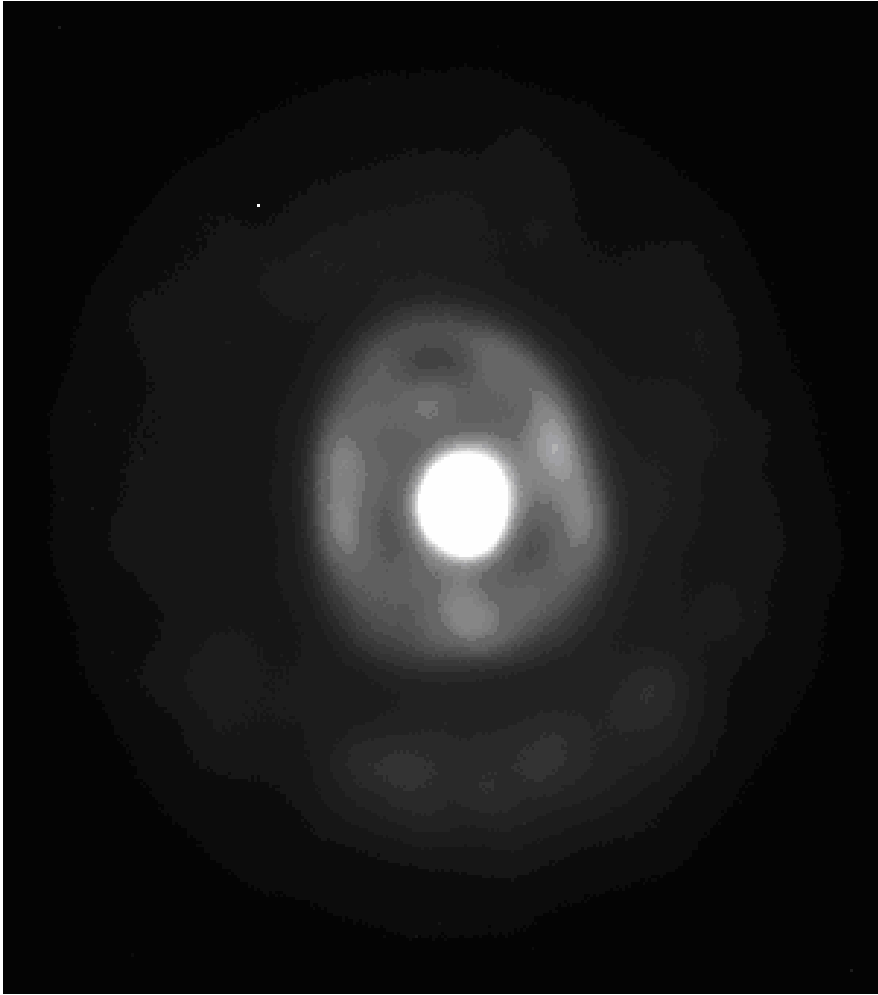




# Area near NGC 2392

04-02-2008





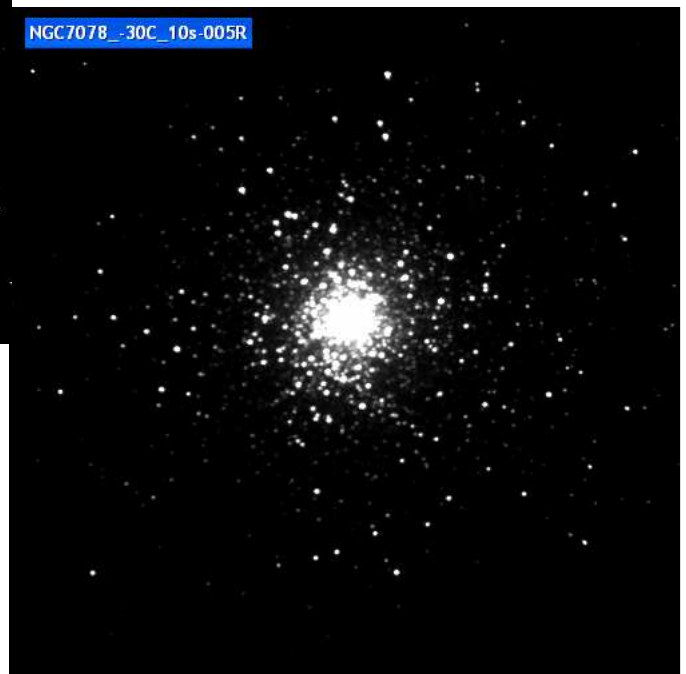
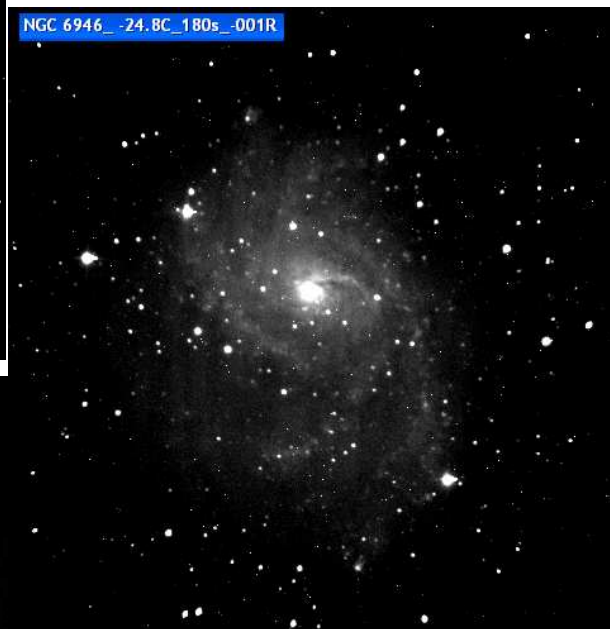
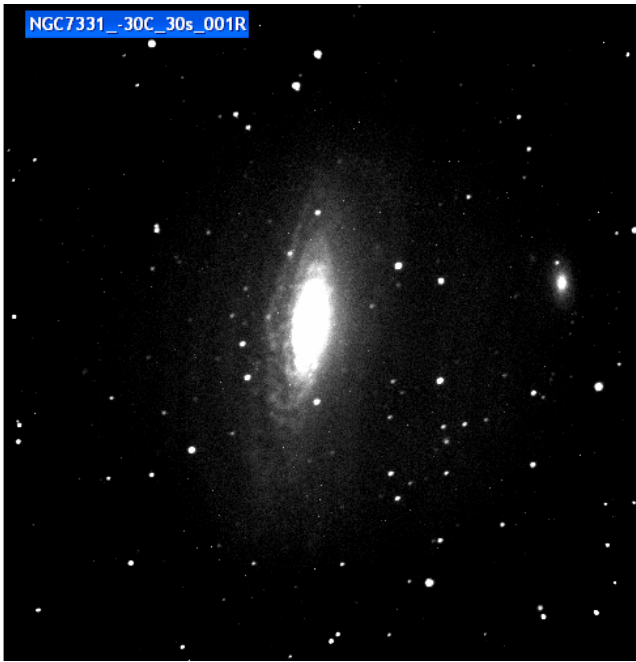
# Telescope Zeiss-600



Zeiss-600 (10'x10', F=4500) with  
CCD(1024x1024pix) and UBVRI-photometer







# Telescope AZT-8 with UBVR- photometer



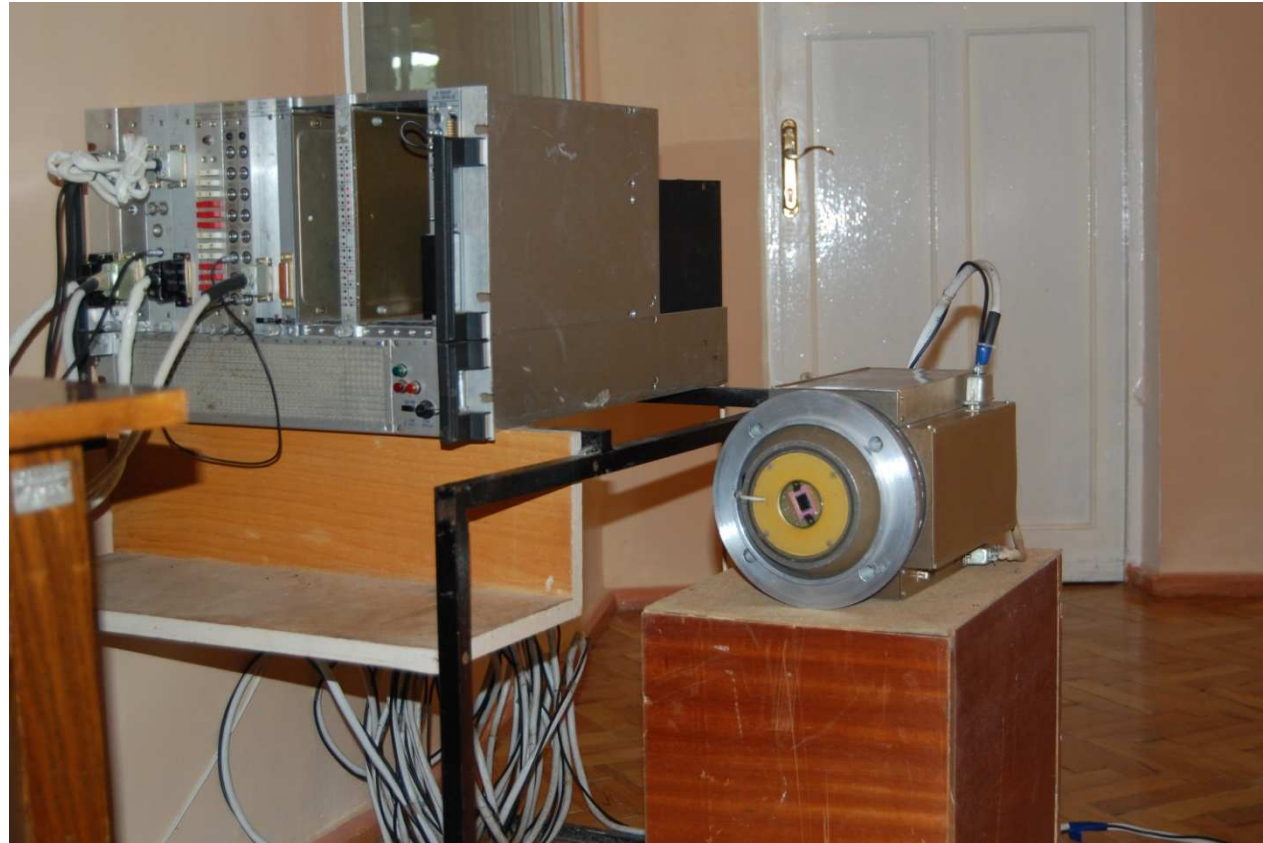








# Professional CCD-camera 530x580 (1 pix=24x18mcr)





**U-2**



**U-9000**



**U-55**









**LNP20**



Description

**Produces 20 liters of liquid nitrogen per day.**





# PUBLICATION of SHAO

- Azerbaijani Astronomical Journal
- Sun and Geosphere

THANKS

[www.shao.az](http://www.shao.az)