V. Ambartsumian Byurakan Astrophysical Observatory

Laboratory of 2.6 m telescope

SCORPIO

Spectral Camera with Optical Reducer for Photometric and Interferometric Observations

User guide

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Fig. 1. The design of SCORPIO spectral camera

The multi-mode focal reducer SCORPIO was made to order of Byurakan observatory Special Astrophysical observatory of NAS RA (Afanasiev V.L. &Moiseev A.V., 2005, PaZh, 31, 214 (Russian PDF); English translation: 2005, Astronomy Letters, 31, 194 (English PDF).

SCORPIO is used for observations of star-like and extended objects in following observational modes at the prime focus (F/4) of the 2.6 m telescope:

- Broad, medium, and narrow-band direct imaging;
- Long-slit spectroscopy;
- Slit-less spectroscopy.

The optical part contains of the collimator (F/2.2) and the camera (F/1.8). The total focal ratio it the prime focus of the telescope is F/2.6. The optics of the reducer compensate for the

aberrations of the main mirror of the telescope, all optical surfaces have antireflecting coating in a spectral range 3500-10000 A. SCORPIO has two filter's Wheels. The Wheel 1 is located in the focal plane. It is used for the interferometric narrow-band and middle-band filters. Wheel 2 is located between the field lens and the collimator and used for broad-band filters. The dispersers (grisms or Queensgate IFPs ET-50) installed between the collimator and the camera, where the exit pupil of the optical system is located. The diameter of the collimated beam is 35 mm.

The main parameters of SCORPIO, CCD detectors, filters and grisms are presented below (Table 1 - 5).

Table 1.

The main Parameters of SCORPIO

Focal ratio at the 2.6m telescope	F/2.6
Spectral Range	3600-10000 A
Digital Quantum Effectively (DQE) (telescope+SCORPIO+CCD)	70% in Direct Image mode 30% in Long Slit mode
Limit magnitude for images	R=24.2 (S/N=5 for T_{exp}=1800 sec, seeing 1.5")
Limit magnitude for low-resolution spectra	R=20.5 (S/N=10 in continuum, T_{exp}=7200 sec)

Table 2.

CCD-Detector

Name	**TK 1024**	**EEV 42-40**
Size, pixels	1024 x 1024	2048 x 2048
Scale, arcsec/px	0.68	0.38
Field of view, arcmin	11	13
Pixel size, mkm	24 x 24	13.5 x 13.5
Quantum Eff. Max	80%	83%
Read-of-noise, e	4.0	3 - 4
Gain, e/ADU	1.1	0.6
Dark, e/min	0.1	0.03

Filters. The broad band filters include the B, V, Rc and Ic glass filters for Johnson-Cousins photometric system. Their diameter is 70 mm and thickness is 6 mm.

Table 3.

Broad band filters

Filter	**λ_{eff} (Å)**	**FWHM (Å)**	**T_{max} (%)**
B	4450	940	41
V	5510	880	49
Rc	6580	1380	53
Ic	8060	1490	38

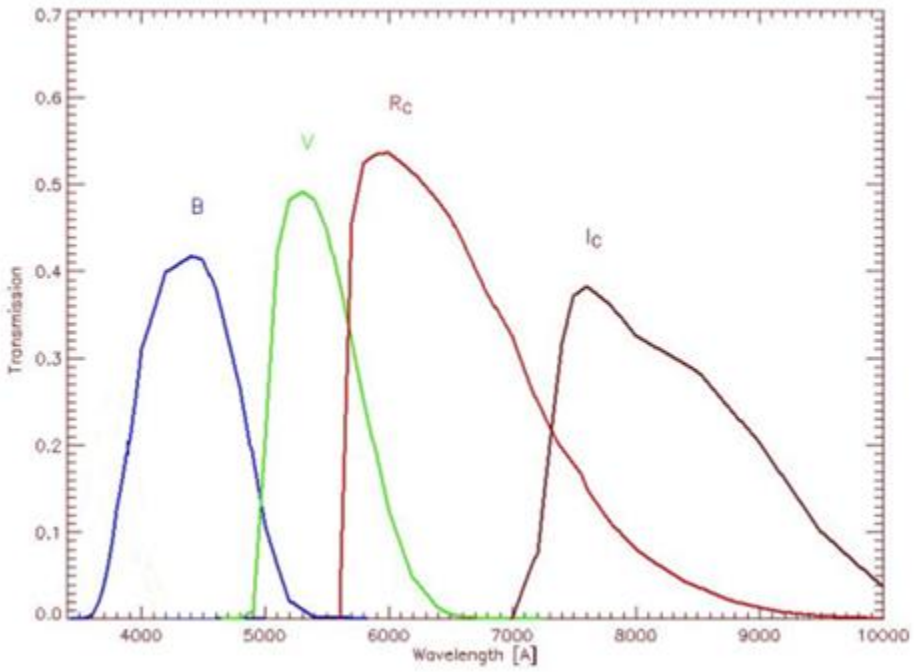

Fig. 2. Broad-band filters

Table 4.

Narrow-band filters

Filter	CWL(Å)	FWHM (Å)	T_{max} (%)
Hα	6500	100	94
[SII]	6710	100	95

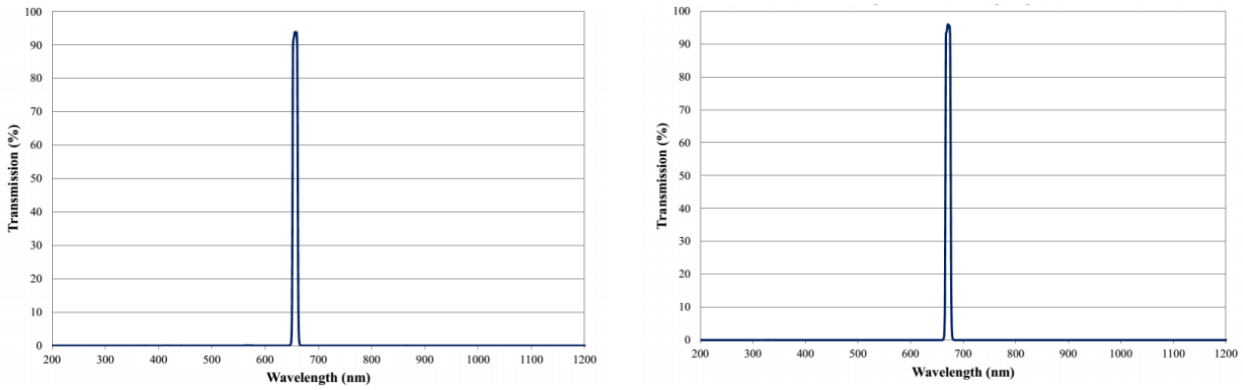

Fig. 3. Narrow-band filters: Hα - left panel, [SII] - right panel.

Table 5.

Grisms

Grism	Lines/mm	Spectral range (Å)	FWHM (Å)	Dispersion (Å/pix)
GR600	600	4000-7100	10	2
VPHG1200R	1200	5700-7500	5	0.86
VPHG1800R	1800	5800-6800	2.5	0.52

Reciprocal dispersion for CCD EEV42 is 40.