ULTRAVIOLET ASTRONOMY IN THE XXI CENTURY

e-Workshop 2020 – October 27-29

JcUVa

Spectroscopic Investigation of Nebular Gas - SING

A Dedicated NUV Spectrograph to Study Extended Objects

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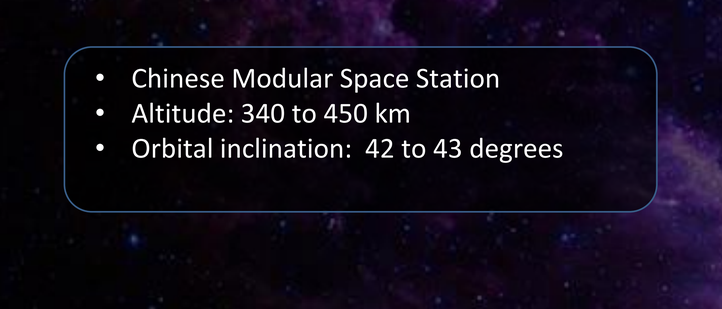
Overview

SING is a near ultraviolet (NUV) spectrograph to fly under the UNOOSA umbrella on the CSS. It will observe in the wavelength range from 1400 Å to 2700 Å with a spectral resolution of about 3 Å at 2000 Å and a spatial resolution of 11” - 20” over a FOV of 1.1° x 7.6”.

Our primary science objective is to study the physical conditions in extended regions of the sky, from hot gas in supernova remnants (SNR) to the warm gas in planetary nebulae to cold gas in molecular clouds.

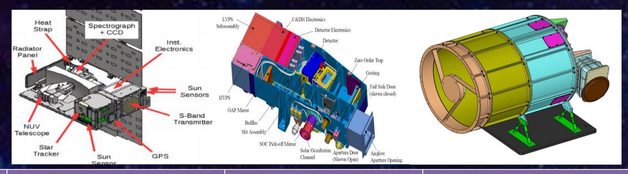


Simulated spectra of the Veil Nebula(Cygnus X-5) from SING with a resolution of 3 Å and an exposure time of 1000 seconds.

Platform

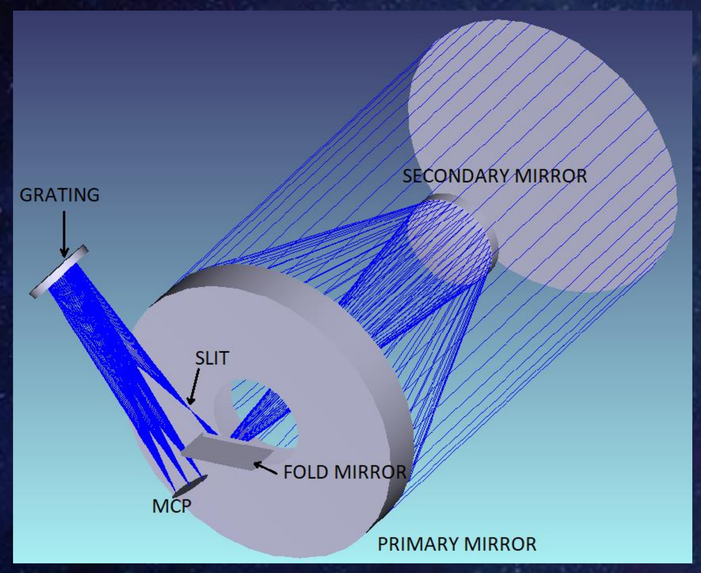
- Chinese Modular Space Station
- Altitude: 340 to 450 km
- Orbital inclination: 42 to 43 degrees

Mission Comparison



	CUTE	Alice	SING
Effective Area	28 cm^2	~0.24 cm^2	~15 cm^2
Field of view	0.38° x 80”	6° x 0.1°	1.1° x 7.6”
Operating wavelength	2515 – 3335 Å	520–1870Å	1400- 2700 Å
Wavelength resolution	1.23 Å (at 3000 Å)	9 Å	3 Å (at 2000 Å)
Spatial resolution	5.8’’	~0.6°	11’’

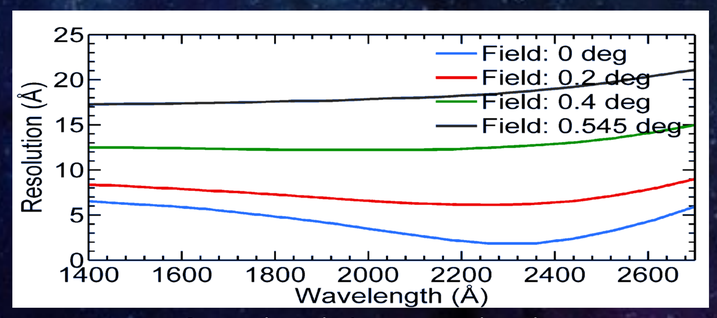
Optical Design



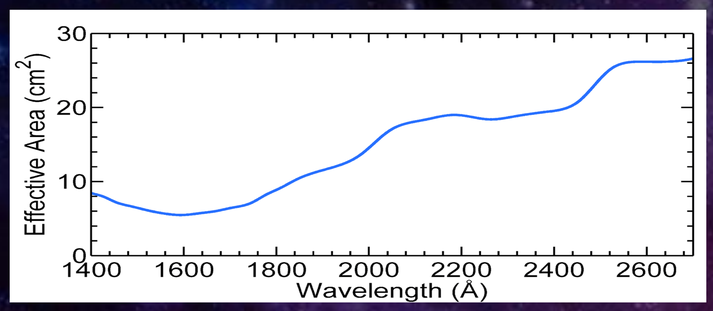
3D optical layout

- Effective area : 15cm^2 at 2000 Å
- Coating: Al+MgF2

Optical Performance



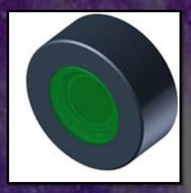
Spectral resolution vs. wavelength



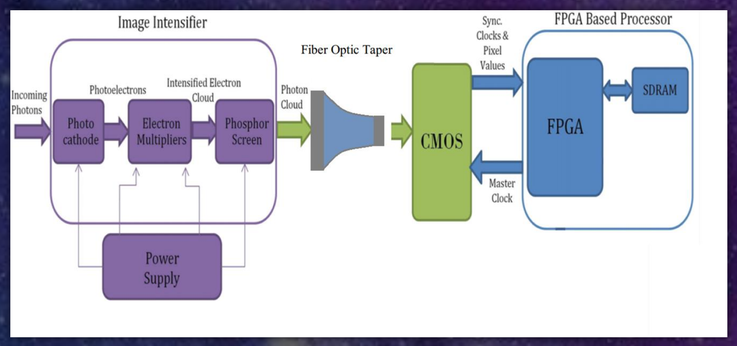
Effective area plot

Detector

Photek MCP-based detector with FPGA based readout operating in photon counting mode. The photocathode is solar-blind CsTe.

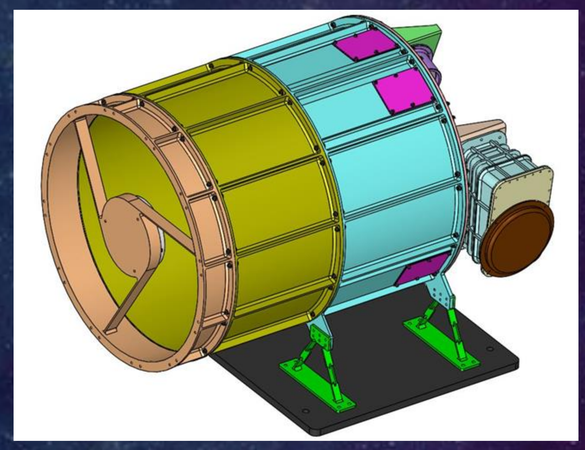


Photek MCP Detector



Flow chart of Photon counting mode operation

Mechanical Design



3D mechanical model of SING

- CFRP Body
- Invar mounts

Instrument Specification

SING Specification	
Focal ratio	F/6.92
Passband	1400 – 2700 Å
Plate scale	2.42’’/pixel
Spectral Resolution (@2000 Å)	3 Å
Effective area (@2000 Å)	15 cm^2
FOV	1.13° by 7.6’’
Mass	< 25 kg
Instrument size	500 × 400 × 400 mm^3
Telescope	
Primary mirror size	300 mm
Secondary mirror size	94 mm
PM radius of curvature	937.5 mm
SM radius of curvature	418.182 mm
PM conic constant	-1
SM conic constant	−3.645
Detector	
Type	MCP-based
Diameter	40 mm
Photocathode	Cesium Telluride
MCP pore size	10 μm
Sensor format (H × V)	1675 × 1675 pixels

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