The Wide-Field Optical Spectrograph (WFOS)

WFOS is a UV-Near IR [0.31-1.0] µm imager and multi-object spectrograph with a 25 arcmin^2 field, and the only seeing-limited instrument available at first light. WFOS will use separate red and blue channels and will provide full spectral coverage in one single exposure with a spectral resolution of R=1500 (0.75” slit). WFOS will be the largest and most sensitive spectrograph ever built using slit-mask technology. The maximum total slit length will be 500" and up to 60 objects will be observed simultaneously.

WFOS design team is an international partnership: NAOJ (Japan), IIA (India), NAOC-NIAOT, KIAA-PKU (China), Caltech & TMT (USA)

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Notes

SCAN ME

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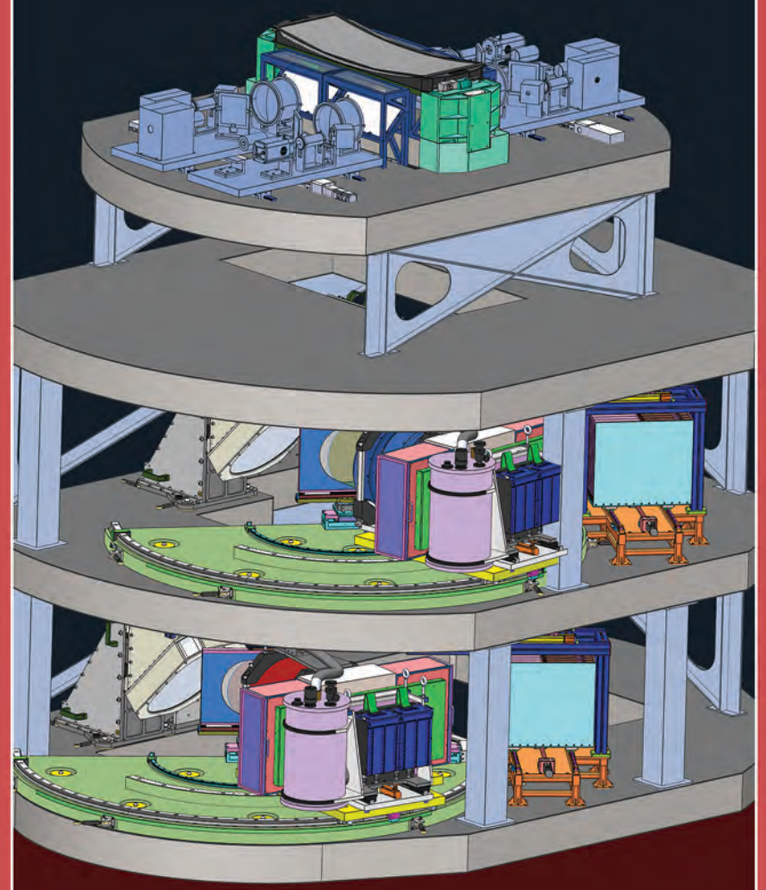
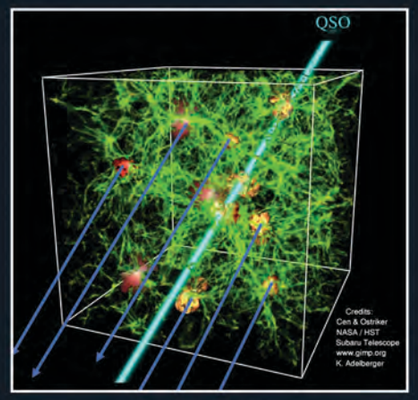


The Wide-Field Optical Spectrograph (WFOS)

WFOS scientific investigations span from the study of our solar system to the observation of the faintest and most distant galaxies in the universe. Some of the main driving science cases for WFOS are:

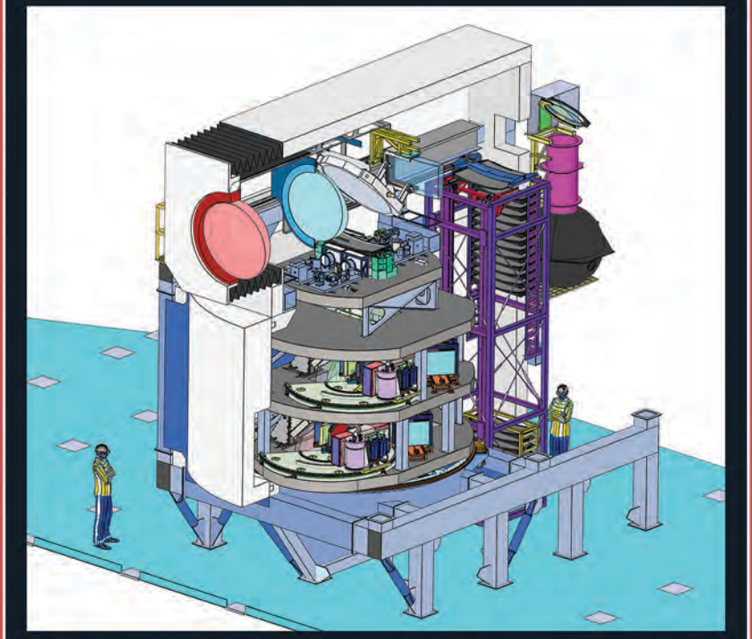
- Tomography of the intergalactic medium
- UV properties of high-redshift galaxies
- Spectrophotometric study of transient high-energy cataclysmic events
- Nature of dark energy
- Study of exoplanet atmospheres
- Optical follow-up of JWST discoveries

TMT/WFOS will provide medium-resolution spectroscopy and multi-object capabilities, ideal for investigating the Initial/Final Stellar Mass Relation and for pushing studies of stellar clusters to the lowest mass stars.



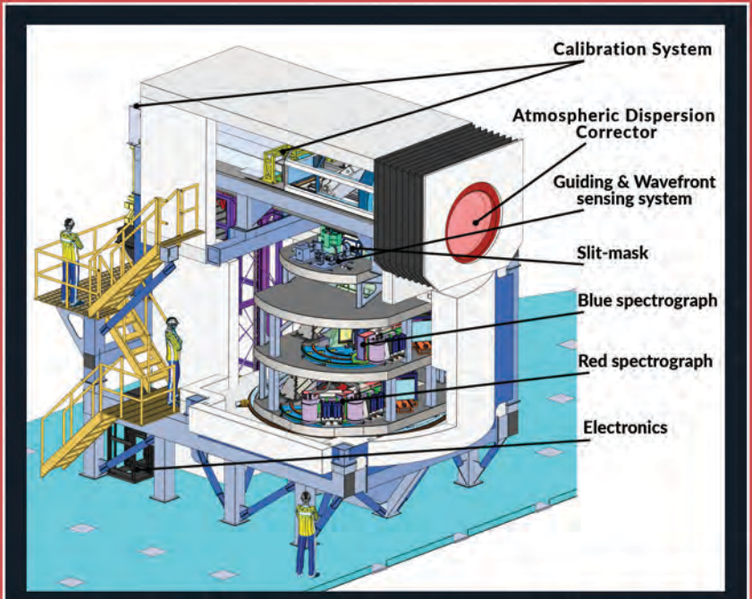
TMT/WFOS will sample multiple sight lines using background galaxies as sources, to probe galaxy environments at key formation epochs (z~3-5). This will provide a deeper understanding of the interaction between galactic baryonic matter and intergalactic medium.

Description	Requirements
Wavelength	[0.31 – 1.0] µm (full coverage in one exposure possible for R=1500)
Spectral Resolution	R = 1,500 - 3,500 with a 0.75" slit (higher resolutions possible; Ground-Layer AO for future upgrade)
Image quality: Imaging/Spectroscopy	≤ 0.2" FWHM in each band/at any wavelength
Field of View/total slit length	8.3' x 3' / 500" (e.g. up to 60 targets with 8" long slits)
Spatial Sampling	0.05" per pixel
Throughput	≥ 25% over [0.31 - 1.0] µm, ≥ 30% over [0.35 - 0.9] µm
Sensitivity	Photon noise limited for exposures > 60 s. Background subtraction errors « photon noise for 100 ksec exposures. Nod and shuffle desirable.

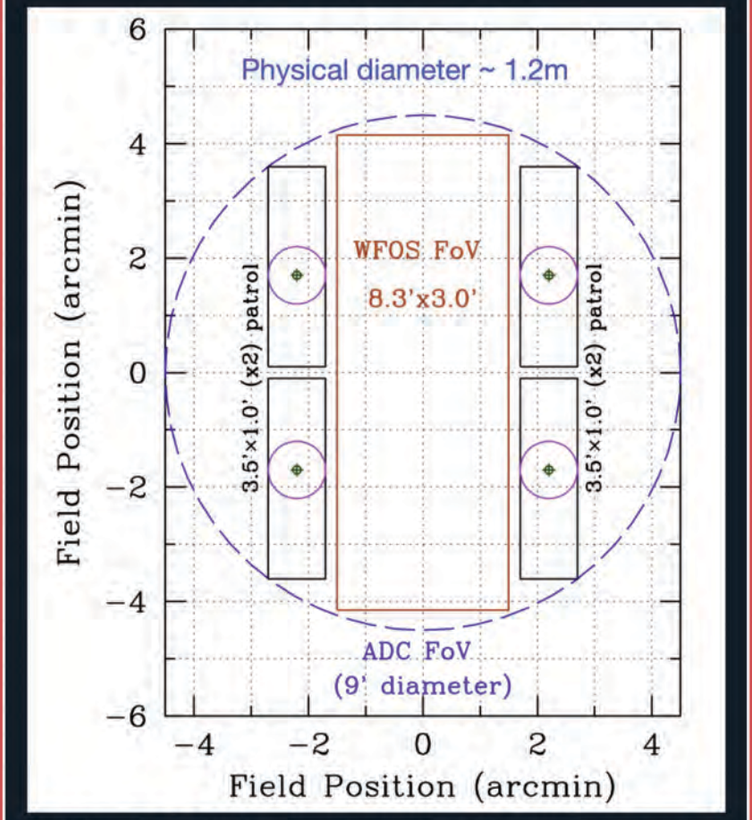


The light beam from the telescope goes first through the Atmospheric Dispersion Corrector (ADC) before being directed towards the science spectrographs. One of the main advantage of WFOS design is that the instrument is gravity invariant, with its parts rotating around its vertical optical axis. WFOS spectrograph channels are visible in the image, with the blue and red channels shown respectively on the middle and lower optical benches.

WFOS Specifications and Optical Path



Cross-section of WFOS installed on its Nasmyth platform. The four grey benches house WFOS's optics, the blue/red cameras and detectors, as well as the instruments slit mask and acquisition, guiding and wavefront sensors cameras. This assembly forms the gravity invariant rotating portion of the instrument. The external structure provides space for the ADC, steering mirror, calibration unit and slit mask exchange systems.



WFOS uses a 8.3' x 3' rectangular portion of the total 1.2m diameter ADC corrected field (dashed circle) and is surrounded by 4 patrol regions for guide star acquisition. Up to 60 targets will be able to be observed in multi-object spectroscopic mode using slit masks pre-manufactured at sea-level.