SWIMS : Simultaneous-color Wide-field Infrared Multi-object Spectrograph for TAO 6.5m Telescope



Kentaro Motohara (kmotohara@ioa.s.u-tokyo.ac.jp) [1,2], Masahiro Konishi [1], Hidenori Takahashi[3], Natsuko M. Kato[1], Kosuke Kushibiki [2], SWIMS Team and TAO Project Team

1. Institute of Astronomy, the University of Tokyo (UTokyo) 2. Advanced Technology Center, National Astronomical Observatory of Japan (NAOJ) 3. Kiso Observatory, UTokyo

1.The University of Tokyo Atacama Observatory (TAO) Project

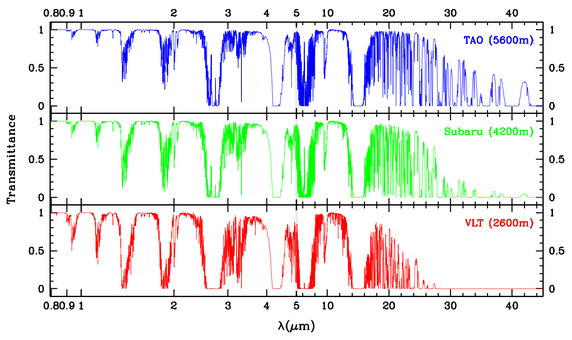
The University of Tokyo Atacama Observatory (TAO) project is promoted by Institute of Astronomy, the University of Tokyo to install a 6.5m telescope on Cerro Chajnantor (5640m altitude) in northern Chile.







Credit : TAO project



(Top-left) Cerro Chajnantor located at Atacama plateau

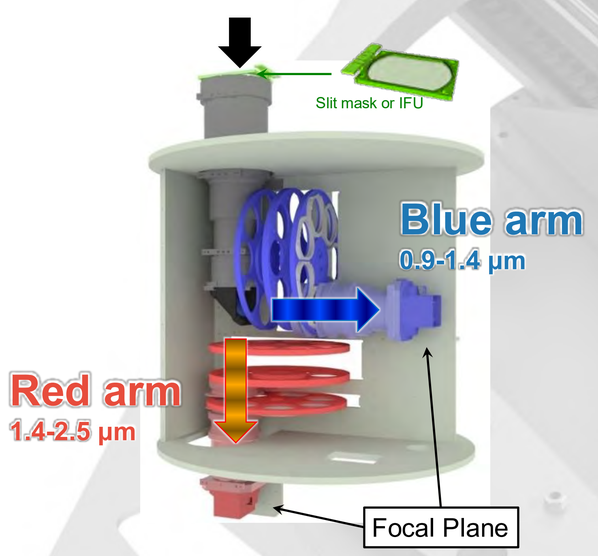
(Top-middle) Completed summit buildings

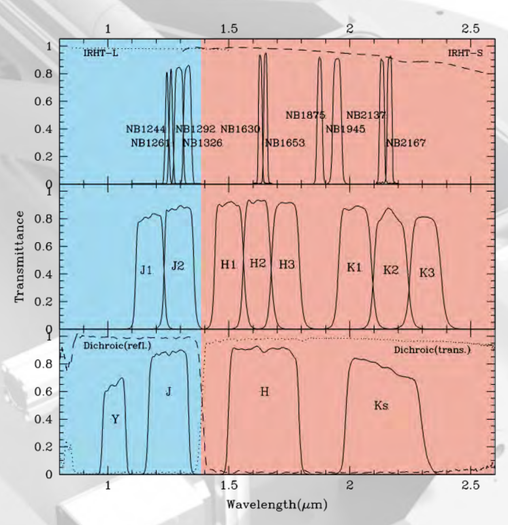
(Top-right) The 6.5m telescope preassembled in Japan

(Left) Simulated atmospheric transmittance by ATRAN, with PWV (Precipitable Water Vapor)=0.5mm (Cerro Chajnantor), 1.0mm (Mauna Kea), and 2.6mm (at 2600m altitude)

2. SWIMS Overview

SWIMS covers the whole NIR wavelength of 0.9-2.5 μm with two optical arms (*blue*: 0.9-1.4μm and *red*: 1.4-2.5μm) and is capable of two-color simultaneous imaging, λ/Δλ ~ 1000 multi-object spectroscopy (MOS), and integral field spectroscopy (IFS) at 0.9-2.5μm wavelength range with a single exposure.



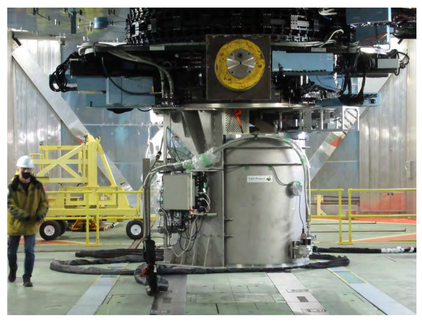


Instrument Parameters

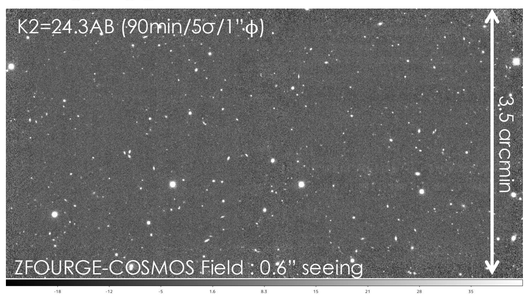
Observation Mode	Imaging Multi-object spectroscopy(MOS) Integral field spectroscopy (IFS)
Field of View (Current)	8.6'×4.3' φ (Imag.), 3.7'×4.3' (MOS), 17.2"×7.0" (IFS)
Field of View (Goal)	9.6'φ (Imag.), 3.7'×8.6' (MOS), 17.2"×14.0" (IFS)
Spatial Resolution	0.126"/pixel
Wavelength Range	0.9-1.45 / 1.45-2.5 μm (*blue* / *red* arm)
Focal Plane Detectors	HAWAII-2RG (current : 2 per arm, goal : 4 per arm)
Filters Broad-band (BB) Medium-band (MB) Narrow-band (NB)	 *Y, J, H, K_s* *J1, J2, H1, H2, H3, K1, K2, K3* *N1244, N1261, N1292 (PaB), N1326,* *N1630, N1653, N1875 (Paa), N1945, N2137, N2167*
Grism	*YJ* (2.40 Å/pix, R ~ 700 - 1100 w/ 0.5" slit) *HK* (4.57 Å/pix, R ~ 600 - 1000 w/ 0.5" slit)
MOS multiplicity	~20 objects/mask (w/ 12" length per slit)
IFS parameters	0.5" sampling/slice, 28 slicers
System Throughput	Imaging ~ 40%, Spectroscopy ~ 30%
Expected Sensitivity (1hr, 5σ) Imag. (φ1.0"aperture, 0.5" seeing) Spec. (cont., R=1000, 0.5" slit) Spec. (line, R=1000, 0.4" slit)	 *Y*=24.9, *J*=24.7, *H*=24.0, K_s=24.2 (AB mag) *Y*=19.8, *J*=20.2, *H*=20.2, K_s=20.1 (AB mag) *Y*=1.3e-16, *J*=6.6e-17, *H*=8e-17, K_s=8e-17 (erg/s/cm^2)

3. Commissioning at the Subaru Telescope (FY2018-2022)

- Test the instrument through real observations
- Accumulate experience/knowledge of operation
- Achieve early scientific results
- 2 detectors per arm (B1, B2, R1, R2)

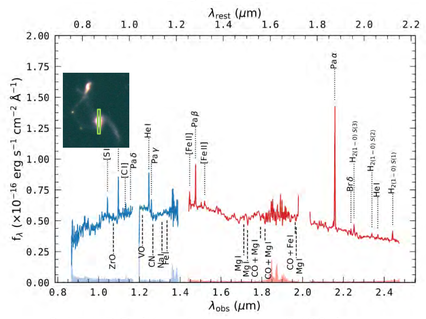


[Imaging]



Distortion free : < 0.025" RMS
Pinhole PSF ~0.1" FWHM
Best seeing PFS <0.3"

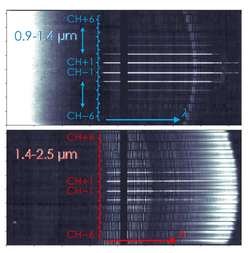
[Spectroscopy]



z=0.15 LIRG (K_s ~ 14 mag$_{AB}$, 2400s)

[Integral Field Spectroscopy]

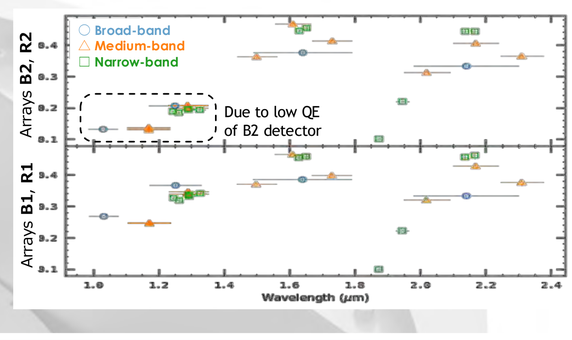




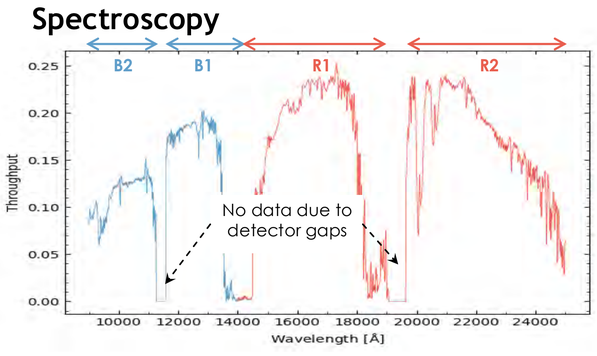
Prototype IFU
IFU throughput : 70%

[System Throughput]

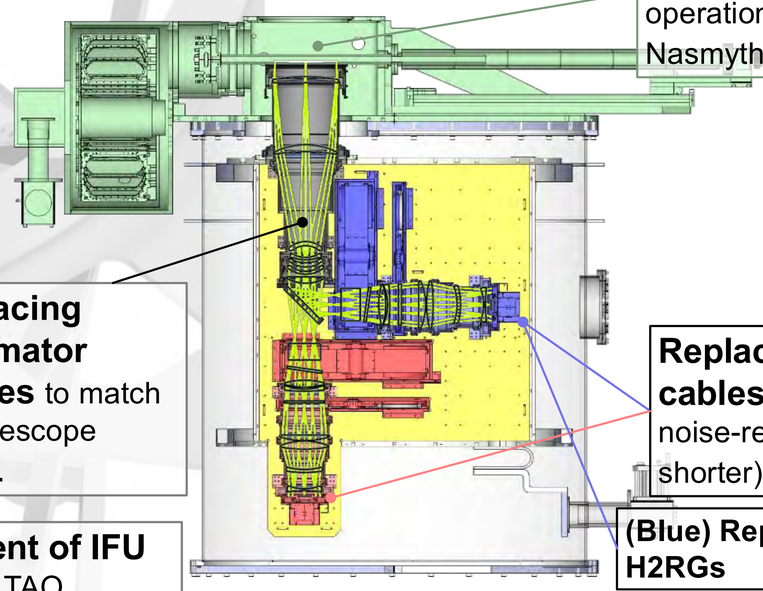
Imaging



Spectroscopy



4. Ongoing Upgrade Works



Adopting the focal plane mechanics for operation on the Nasmyth platform.

Replacing Collimator Lenses to match the telescope optics.

Replacing read-out cables with more noise-resistant (and shorter) ones.

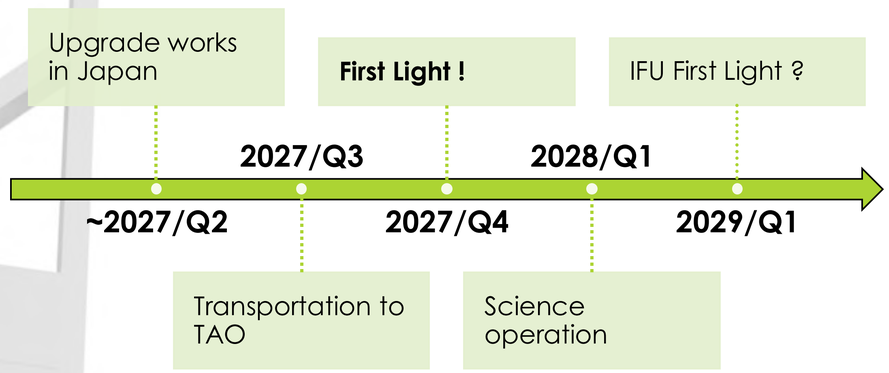
(Blue) Replacing two H2RGs

Development of IFU optimized for TAO

Development of Echelle Grism to achieve R=5000

Replace JADE2 with MACIE and get rid of Windows 7 PCs

5. Schedule



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東京大学 大学院 理学系研究科·理学部 SCHOOL OF SCIENCE, THE UNIVERSITY OF TOKYO

TAO PROJECT The University of Tokyo Atacama Observatory