

TMT Instrument Suite (as of 2014.03.31)

Instruments	IRIS	WFOS-MOBIE	IRMS
	IR imager and integral field spectrograph	Wide-field multiobject optical spectrograph	IR multi-slit spectrograph and imager
Wavelength	0.83-2.4 μ m	0.31-1.0 μ m	0.8-2.5 μ m
Spec. res.	4000 – 10000	1000, (2500), 5000, 8000	2000 - 10000
Mode	Lenslet IFU Image slicer (90 slices)	Single order MOS \sim 100 multiplicity Multi-order MOS \sim 10 multiplicity (R= 5000/8000)	46 moving slits
FOV	$\leq 2''$ IFU	8.3 \times 3 arcmin ² for imaging, R \sim 1000 6.9 \times 3 arcmin ² for R \sim 5000 3 \times 3 arcmin ² for R \sim 8000	2.'3
Imaging	16.''4 FOV w/4mass	8.3 \times 3 arcmin ²	2.'3 (NFIRAOS field)
Plate scale	4-50 mas for IFU 25, 50 mas for Image slicer	52 mas	4, 9, 22, 50 mas
Sensitivity	Spec. (R=4000, 4mas, snr=10, 3600sec): J=24.1, H=23.7, K=22.9 Imag. (snr=100, 3600sec): J=27.3, H=26.2, K=25.5	(in the case of RGB chemistry/dynamics) slit 0.''8, seeing 0.''8@0.52 μ m+0.''6@0.85 μ m R \sim 7800, snr \sim 40/ \AA , 4hrs, I=21.3 R \sim 5000, snr $>$ 5/ \AA , 1hr, I $<$ 23	(predicted, snr=10, 1000sec, R=3270) ABmag (0.''23 slit): Y=24.0, J=23.9, H=22.7, K=21.2 line flux between OH lines: Y=7, J=7.4, H=4.7, K=8.5 ($\times 10^{-19}$ erg/s/cm ²)
Key science	Assembly of galaxies at large redshift Black holes/AGN/Galactic Center Resolved stellar populations in crowded fields	IGM structure and composition @2 < z < 6 High-quality spectra of z>1.5 galaxies suitable for measuring stellar pops, chemistry, energetics Epoch of peak galaxy building Astrometry	Early light Epoch of peak galaxy building JWST followups
Note			Clone of Keck/MOSFIRE
URL	http://irlab.astro.ucla.edu/iris/index.html		http://irlab.astro.ucla.edu/mosfire/

Table 1: TMT First Light Instruments

Instruments	MICHI	TMT-AGE	SEIT
	MIR Camera, High-disperser, & IFU	TMT Analyzer for Galaxies in the Early universe	Second-Earth Imager for TMT
Wavelength	7.5-25 μ m	0.8-2.4 μ m	0.95-2.4 μ m
Spec. res.	250(IFU), 810-120000@N 1100-60000@Q	\sim 3000	5-100
Mode	Longslit, IFU	Multi-IFU (20 IFU units)	Photon-counting imaging (APD-array) Photon-counting spectral imaging (MKIDs)
FOV	30''-1'	5' ϕ w/MOAO 10' ϕ w/GLAO	0''.3 (Goal: 0''.5)
Imaging	FOV 27.''5 \times 27.''5 0.''08@10 μ m, 0.''16@20 μ m	0.''02@2 μ m	Requirement: Contrast (I< 6, 1hr) 3×10^{-9} @10mas, 1×10^{-9} @50mas
Plate scale	27.5-35 mas	0.''05 \times 0.''05, FOV=2.''2 0.''2 \times 0.''2	1 mas
Option	IFU(22slices)		
Sensitivity	(1 σ , 1sec, point source) Imag.: 1-3mJy@N, 5-20mJy@Q Spec(R=250): 10-30mJy@N, 50-200mJy@Q	Imag. (AB, 1hr, point source): J=25.7, K=24.7 Spec. (AB, 1hr, R \sim 1000, point source): J=22.7, K=21.9	28.5mag@J, 28 mag@H, TBD@K for 1hour
Key sciences	Dynamics and chemistry of PP disk High-R spec. for biomarkers	Galaxies in formation-phase at $z > 7$ Galaxies in growing-phase at $2 < z < 7$	Terrestrial planets imaging and characterization
Note	Collaboration w/UH and U.of Texas	Collaboration w/Victoria HIA MOAO team	Collaboration w/SCEXAO and PFI

Table 2: TMT JPN 2nd gen. Instruments

Instruments	(J-NIRES)	(J-HROS)
	NIR High Dispersion Spectrograph	Optical High Dispersion spectrograph
Wavelength	0.9-5.5 μ m	0.3-1.0 μ m
Spec. res.	40000 (80000max)	50000 (100000 max)
Mode	Short arm (0.9-2.5 μ m) Long arm (1.9-5.5 μ m)	Echelle + Image slicer
FOV	0.''02 \times 0.''5-1''	0.''12 \times 5''-10''
Imaging	None	None
Plate scale	8 mas	
Option	Long slit \sim 30'' MOS 5-10 fiber/10 \times 10sqsec	MOS High speed readout
Sensitivity	J \sim 20, H \sim 20, K \sim 19.5 (10 σ) @R \sim 50000, 1hr, short arm	Throughput \sim 15% Velocity measurement accuracy \sim 10cm/s
Key sciences	IGM at 2.5 < 6 (metallicity) IGM at z > 6 (reionization) Atmosphere of exoplanets	Terrestrial planets around solar-type stars Direct measurements of cosmic expansion
Note	Collaboration w/UH NIRES team	

Table 3: TMT JPN 2nd gen. Instruments (as of 2010.07.26)

Instruments	(MIRES) Mid-IR Echelle Spec- trometer & Imager	PFI Planet Formation In- strument	HROS High Resolution Opti- cal Spectrograph	WIRC Wide field IR imager	NIRES NIR, DL Echelle spec- trometer	IRMOS Multi-IFU, near-DL, near-IR Spectrometer
Wavelength	8-18(4.5-28) μm	1-2.5(4.0) μm	0.3-1.0(1.3) μm	0.8-2.5(0.6-5.0) μm	1-2.5 μm (NIRES-B) @2.9-5.0 μm (NIRES-R)	0.8-2.5 μm
Spec. res.	5000 - 100000	50(100)(full FOV) 500(1000)(partial FOV)	50000 (slit) 90000 (image slicer)	5 - 100	5000 - 30000 (B) 2000-10000 (R)	2000-10000 2-50(imaging)
FOV Requirements	10'' See MICHI	1.''4(4.0) ϕ contrast (I<8, 2hr) 10 ⁻⁸ @50mas (10 ⁻⁹ @100mas) contrast (H<10, 2hr) 10 ⁻⁶ @30mas (2 \times 10 ⁻⁷ @30mas) Polarimetry ~10% accuracy	10'' Radial velocity mea- surement repeatability and accuracy of 1m/s over 10 years	30'' 0.''004 sampling	10'' 0.''05 \times 0.''05arcsec pix Each IFU 2''FOV	10> IFUs over 5arcmin
Sensitivity	See MICHI	NA	(snr=100,6hr, R=10000, 0.''5seeing, Dark) AB=18.9 (snr=100, 6hr, R=5000, 0.''5seeing, Dark) AB=19.4	NA	(B, 1hr, 10 σ , R=50000) J=20.88, K=20.28 (Vega), J=6.82, K=3.07 (10 ⁻¹⁸ erg/cm ² /s) (R, 1hr, 10 σ , R=100000) L=16.28, M=14.05(Vega), L=5.92, M=24.2 (10 ⁻¹⁹ erg/cm ² /s)	(10 σ , 1hr, 24mas, R~7900) Y=22.3,J=21.3, H=23.7, K=22.9
Key science	- Physical structure and kinematics of protostellar envelopes - Physical diagnos- tics of circumstel- lar/protoplanetary disks: where and when planets form during the accretion phase Merged w/MICHI	- Direct detection and spectroscopic charac- terization of extra-solar planets	- Stellar abundance studies throughout the Local Group - ISM abun- dances/kinematics, IGM characterization to z~6 - Extra-solar planets	- Galactic center as- trometry - Stellar populations to 10Mpc	- Precision radial ve- locities of M-stars and detection of low-mass planets - IGM characteriza- tions for z>5.5	- Near-IR spectro- scopic diagnostics of the faintest objects - JWST followup
Note			MTHR (UC San- taCruz) + CU-HROS (Colorado)	IRIS	Merged w/J-NIRES	TiPi (caltech) & UF (Florida)

Table 4: TMT First Decade Instruments (as of 2006)