

Present and future activities of TMT's International Science Development Teams

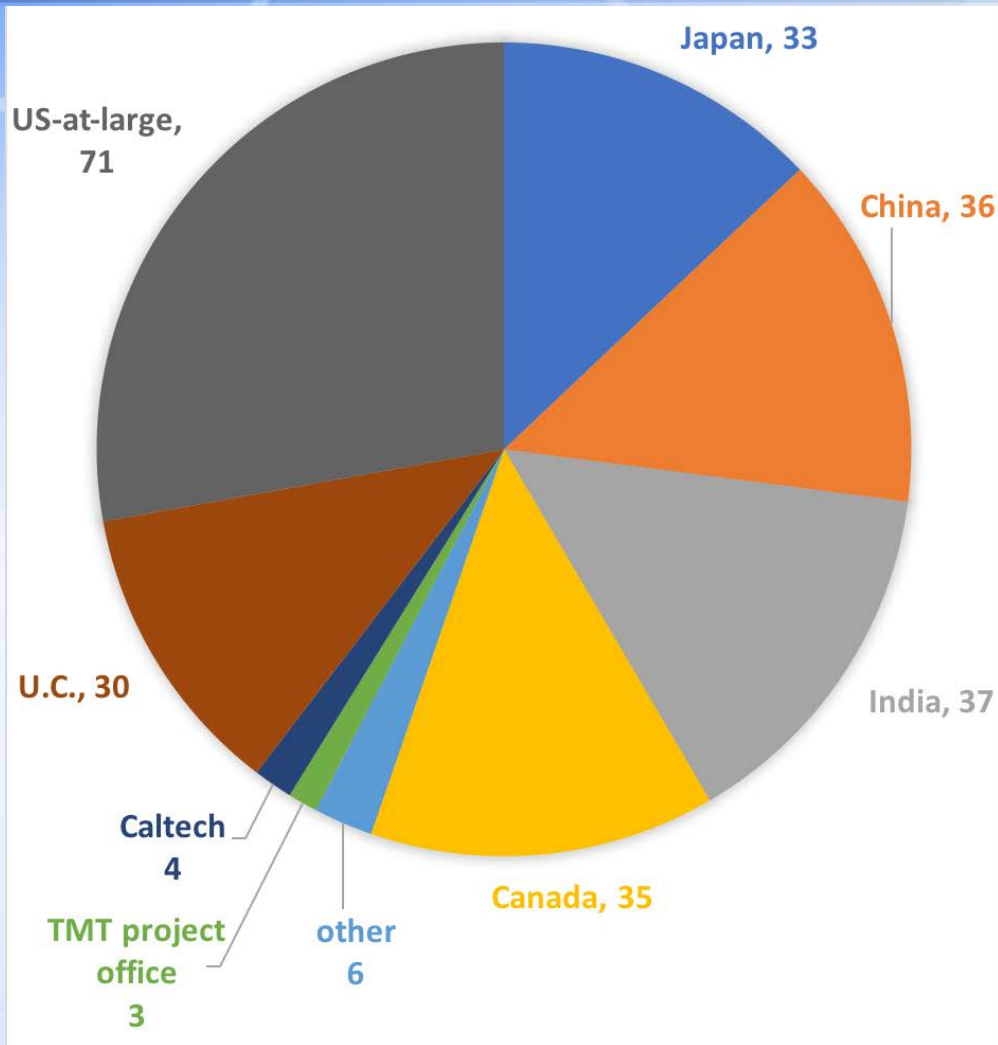
Mark Dickinson (NOAO)
and
Warren Skidmore (TMT)

TMT International Science Development Teams (ISDTs)

- Engage future science user community in TMT now
- Plan TMT science programs
- Provide scientific input & guidance to the TMT project
- Help define observatory capabilities & operations model
- Foster collaboration & cooperation between scientists in and beyond the international TMT partnership

Fundamental Physics & Cosmology Early Universe, Galaxy Evolution, and the IGM Milky Way and Nearby Galaxies Supermassive Black Holes Stars, stellar physics, and the ISM	Formation of Stars & Planets Exoplanets Our Solar System Time Domain Science
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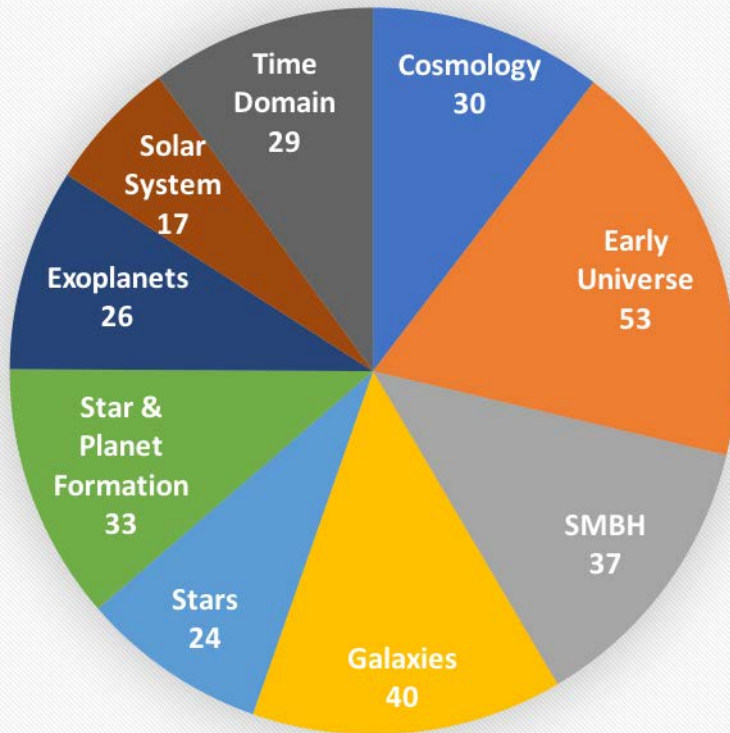
ISDT membership by TIO Partner



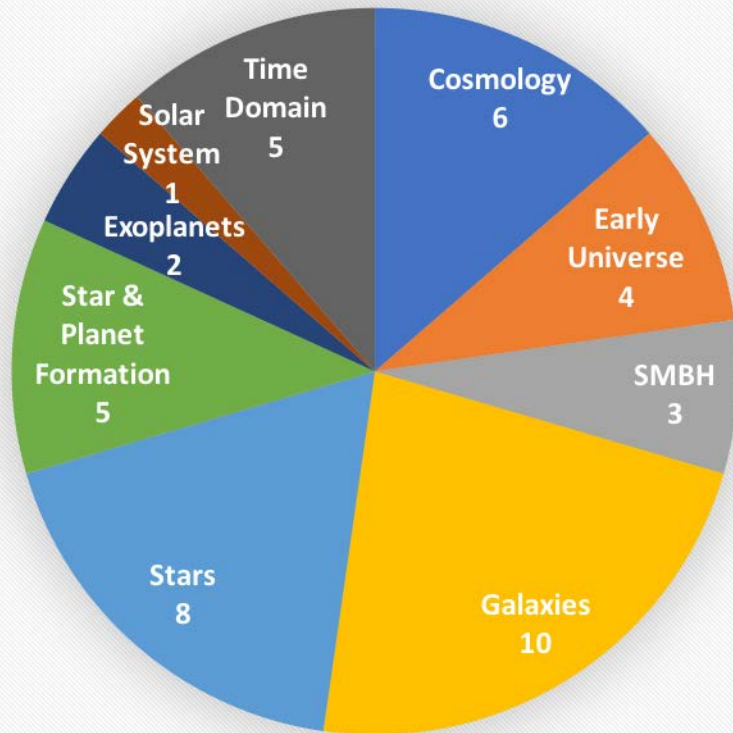
- ISDT membership is open to all PhD scientists
- Annual call for membership applications (usually due in January)
- ISDT membership requires a commitment of effort
- Current membership: 255 astronomers worldwide

ISDT membership by subject

All TMT



India



[illegible]

The TMT Science Forum

International Partnership
for Global Astronomy

24-26 May 2016
Kyoto International
Community House
Kyoto, Japan

Registration Deadline:
23 April 2016

www.tmtforum.org

SESSIONS AND TALKS:
International TMT Key Project science
Cross-partnership collaboration and the International
Science Development Teams (ISDT)
Second-generation TMT instrumentation and AO
development
Effective strategies for observatory operations
Coordinating science planning with other observatories
and facilities within the TMT portfolio

SCIENTIFIC ORGANIZING COMMITTEE:
S.C. Annapurna (IAA), Nishim Aray (Virginia Tech),
M.C. Middleton (UC Santa Cruz), Kuan Chen (NACU),
Matthew Smith (ESO), S.O.C co-chair, Christine
Hahn, Dickinson (NAOAO), S.O.C co-chair, Nobuharu
Dumas (TMT), Lynne Hienbrandt (Galeos), Nobuharu
Dumas (NAOAO), Anne Marie Lagarde (Observatoire
de Bordeaux), Hiroaki Nomura (Tokyo Institute of
Technology), Eric Peng (KIAS - Peking University), Li-
tseng Tsai (TMT), R. Brummit (University of Victoria), Toru Yamada
(JAXA) S.O.C chair

TMT

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INTERNATIONAL SCIENCE DEVELOPMENT TEAM (ISDT) SESSIONS ON INSTRUMENT STUDIES

KICKING OFF NEXT-GENERATION INSTRUMENT STUDIES

BIG SCIENCE QUESTIONS FOR TMT NEXT-GENERATION INSTRUMENTS

LESSONS LEARNED FROM 1ST GENERATION INSTRUMENTS



SCIENCE
ORGANIZING
COMMITTEE:

(CO-CHAIR) CHRISTOPHE DUMAS (TMT)
(CO-CHAIR) SRIANAND RAGHUNATHAN (IUCAA)
ANUPAMA G. C. (IIA)
JUDY COHEN (CALTECH)
IAN DELL'ANTONIO (BROWN UNIV.)
MARK DICKINSON (NOAO)
HAO LEI (SHANGAI OBS.)
JESSICA LU (UC BERKELEY)
CHRISTIAN MAROIS (NRC-HERZBERG)
OI NAGISA (TOKYO UNIV. OF SCIENCE)
LUC SIMARD (NRC)
SIVARANI THIRUPATHI (IIA)
BIN YANG (YUNNAN OBS., NAOC & ESO)

NOVEMBER 7-9, 2017 - INFOSYS CAMPUS, MYSORE, INDIA

REGISTRATION DEADLINE: SEPTEMBER 18, 2017
[HTTPS://CONFERENCE.IPAC.CALTECH.EDU/TMTSF2017](https://conference.ipac.caltech.edu/tmtsf2017)



ARIES
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TMT BEYOND FIRST LIGHT

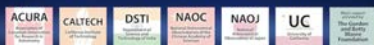
तीस मीटर दूरबीन NEXT-GENERATION INSTRUMENT STUDIES
पेगोल्गु लट्टेर टोड्डटोपे

CONTENT:

INTERNATIONAL SCIENCE DEVELOPMENT
TEAM (ISDT) SESSIONS ON INSTRUMENT
STUDIES

- Annual science conference & collaboration meeting
- Planning the future of TMT science and instrumentation
- Unique annual opportunity for face-to-face meetings of ISDT members
- ISDTs have typically organized topical breakout sessions

To request consideration for travel funding, send an email to TMT@noao.edu with your name, institutional affiliation, and areas of interest relevant to TMT.



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Topical conferences

ISDTs are starting to organize new workshops!



UCLA Department of Physics & Astronomy

HOME ▾ REGISTER ▾ PROGRAM HOUSING FAQ ORGANIZERS CONTACT

Shedding Light on the Dark Universe with Extremely Large Telescopes

Asia/Australia meeting in Lanzhou, China from Aug 30-Sept 2, 2017

Americas meeting at UCLA, April 2-6, 2018

Trieste Italy, hosted by ICTP (International Center for Theoretical Physics), July 2-6 2018

Recent ISDT activities

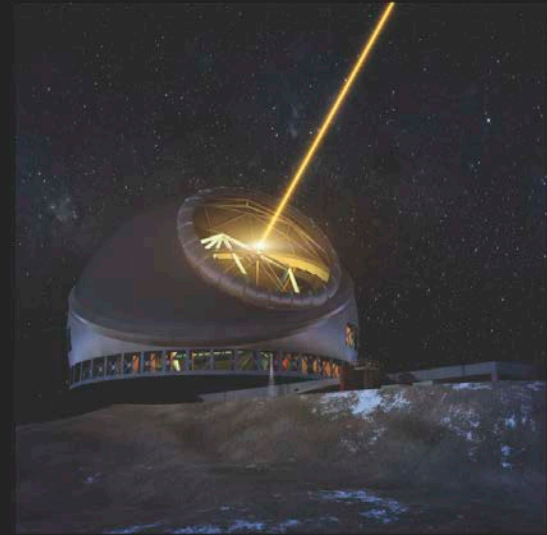
2015 TMT Detailed Science Case

Newly updated, with contributions from
150+ scientists

Skidmore et al. 2015, RAA, 15, 1945
(<http://arxiv.org/abs/1505.01195>)

Thirty Meter Telescope Detailed Science Case: 2015

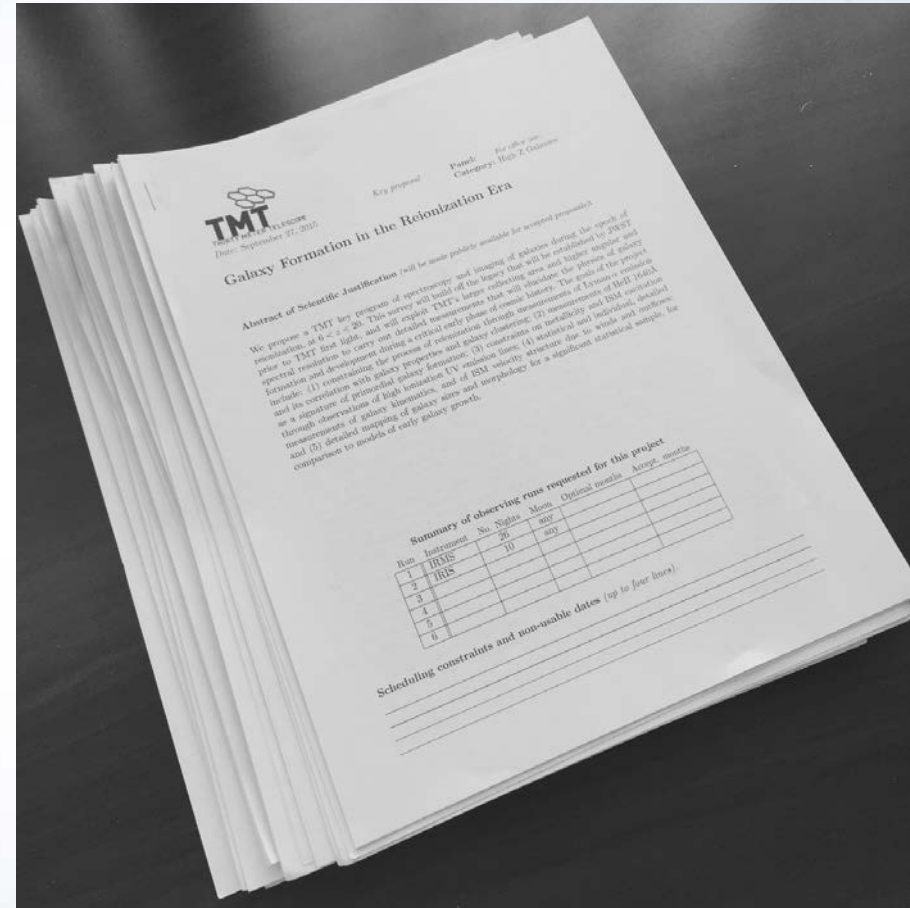
International Science Development Teams
& TMT Science Advisory Committee



Recent ISDT activities

TMT “Key Project” concept proposals

- 23 proposals
- >1100 nights of observing time requested (!)
- 70% of proposals written by international teams



Ongoing / future ISDT activities

- ◆ Science flow-down from DSC-2015
 - ◇ Warren will discuss ...
- ◆ Future-generation instrumentation planning
 - ◇ TMT and SAC hopes the ISDTs will actively contribute to planning for TMT's future capabilities beyond first light
 - ◇ ISDT telecons, discussions at Forum, contributing to white papers....

Science Flowdown of technical requirements from the 2015 Detailed Science Case

TMT Future Leaders Workshop:

- Future Instrument micro-studies
- Combined DSC update and Science Flowdown process

Warren Skidmore

November 7, 2017

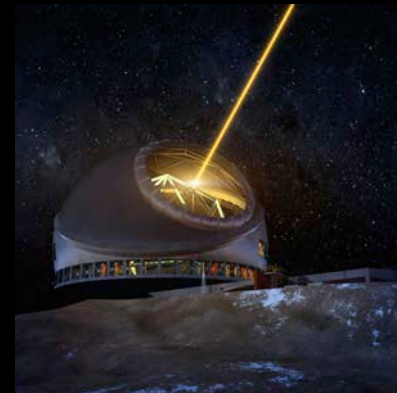
TMT Science Forum, Mysore

Science Flowdown of technical requirements from the 2015 Detailed Science Case

- 277 individual observing programs identified
- Input gathered for 214 programs from about 92 ISDT members

Thirty Meter Telescope Detailed Science Case: 2015

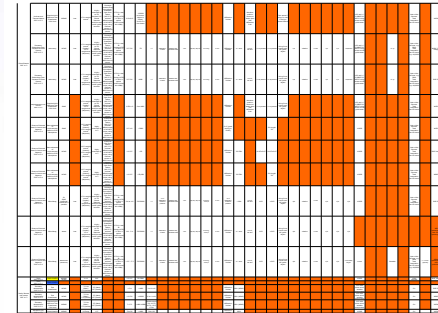
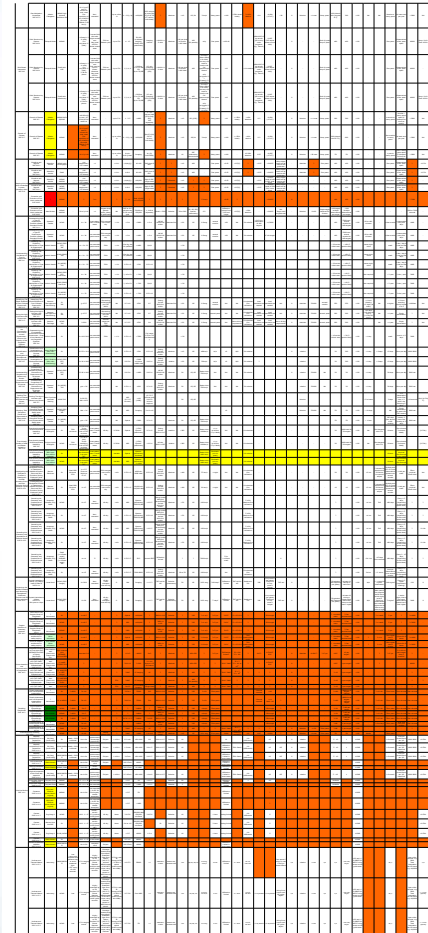
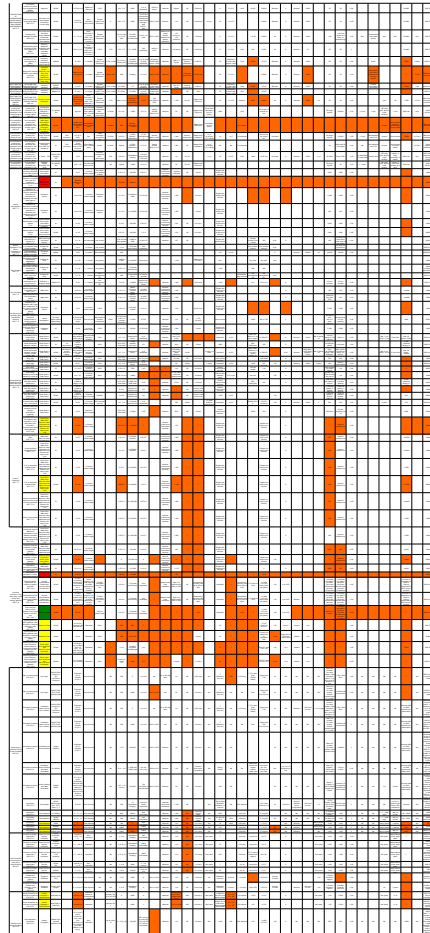
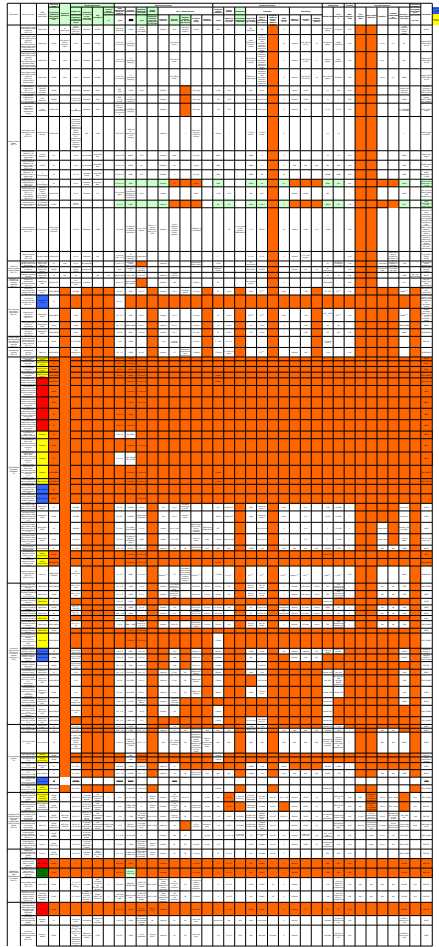
International Science Development Teams
& TMT Science Advisory Committee



Science Flowdown of technical requirements from the 2015 Detailed Science Case

DSC Section	DSC sub-section	ISDT contributor (Add name)	Observing Mode	Required efficiency	Target parameters				
			SL/SL(AcO) /NGSAO/M CAO/MOAO /MIRAO/Ex AO		Brightness	Extended (>1 arc sec) or non extended (<1 arc sec)	Sky coverage %	Level of source polarization	
					Magnitude in specified wavelength band			%	
Spectral Parameters									
Total Wavelength Range of Interest	Spectral Resolution	Required Wavelength Coverage	Image Quality	Flux / Radial Velocity					
(μm)	($\lambda/\Delta\lambda$)	(μm)	Radius for specified encircled energy (X% in Y arc sec)	Relative/ absolute	S/N per element	Analysis method AP, OP, SS, OS, CA, PA	Precision (mag, km/s)	Stability timescale	
Spatial Parameters									
Required spatial resolution	Image Quality	Photometry	Geometry				Astrometry		
(mas)	Strehl (S) /Contrast (C) ratio	% Precision (differential /absolute)	Total Areal Coverage (sq. arcmin)	Field of view / observation (sq. arcmin)	AO guide object to science target distance (arcsec)	Field overlap (0-1)	Relative/ absolute	Precision (mas)	Stability timescale (years)
Multiplexing		Tracking	Synoptic Signature					Polarimetric sensitivity	Comments
Sample Size	# of observations	Rate (sidereal = 1.00)	ToO response time	Time critical tolerance	Baseline	Cadence (observations / baseline)	Duration / observation (seconds)	Acceptable polarization error	
								%L/%C	

Science Flowdown of technical requirements from the 2015 Detailed Science Case



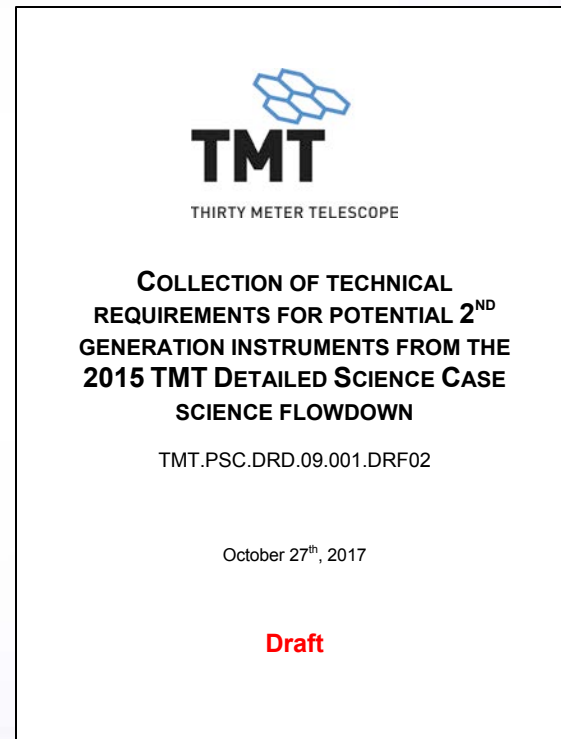
Science Flowdown of technical requirements from the 2015 Detailed Science Case

- ◆ 277 individual observing programs identified
- ◆ Input gathered for 214 programs from about 92 ISDT members
 - ◇ ~9x increase in information compared to 2009
 - ◇ Need to gather more information
 - ◆ Turn orange cells to white
 - ◇ Continuing communication with some ISDTs and with individuals

Science Flowdown of technical requirements from the 2015 Detailed Science Case

- Developed document to support development of ideas for 2nd generation instruments

Instrument capability	Number of programs
IRIS imager	36
IRIS IFU	63
WFOS	46
IRMS	22
IRMOS	19
HROS	45
MICHI	30
PFI	14
Others	22



- Informing WFOS slicer/fiber downselect process

TMT Future Leaders Workshop

Future Instrument micro-studies

- ◆ Develop instrument ideas
 - ◇ 6 teams of 7 people developed instrument science cases and architectures
- ◆ Downselect by the SAC
 - ◇ Mini-SAC of 7+ establish science priorities and carry out instrument downselect
- ◆ Feasibility, requirements and science cases
 - ◇ Teams reformed to develop 3 selected ideas
- ◆ A lot of overlap and ideas that mesh with 2nd Generation Instrument White Paper development

TMT Future Leaders Workshop

Future Instrument micro-studies

- **MPICS** – Multi-Purpose Infrared Configurable Spectrograph
 - 30" FOV@0.01", $R \sim 5000$, 0.7-2.4 μm , IFU fiber bundle + single fibers
- **HRNII Spec** – High Resolution Near-IR Imaging Spectrograph
 - 1.5"x1.5" IFU@0.01", $R \sim 75,000$, 1-2.5 μm , exAO coronagraph, high throughput
- **MOHRIS** – Multi-object Optical High Resolution Imaging Spectrograph
 - 0.3-1 μm , many-IFUs 1'x1' FOV@0.01", $R \sim 5000$, optical AO
- **TREXS** – TMT high Resolution EXoplanet Spectrograph
 - 0.8-5 μm , $R \sim 100\text{K}$ (3km/s), 10"x10" FOV with 0.05" fibers
- **Wide Coverage Spectrograph for Transient Objects**
 - 0.3-2.4 μm , 8"x8" IFUs with $\sim 0.3''$, multiple spectroscopic channels, ~ 1 min cadence
- **UFS** – Ultra-Fast Spectrograph
 - 0.3-1 μm , $R \sim 5000$, \sim few ms cadence, set up < 10 min, single object, no AO

TMT Future Leaders Workshop

Future Instrument micro-studies

◆ Science priorities

- Exoplanet atmospheres with IFUs, surface mapping of hot Jupiters, cloud structure and biomarkers and biosignatures of exoplanets around M stars
- Globular clusters and dwarf galaxies through the nearby universe, resolved stars in the nearby systems, the bulk properties of distant unresolved systems in environments different than the nearby volume
- Are GCs in the local group the same as those in the very local volume and can GCs give us information on the conditions in the primordial universe and early universe?
- Galaxy formation and evolution for $z \sim 1-2$, decomposing the bulge and disk for low surface brightness targets
- Gas outflows and inflows, the relation to AGN activity and star formation and enrichment of the CGM for galaxies at redshifts of $z \sim 1-4$
- Stellar evolution and the lives of stars. Dust production around stars, star formation
- Time domain faint transients

◆ Notably missing from these priorities

- Properties of Dark Matter and Dark Energy, Evolution of the Fundamental Constants, Solar System Science

TMT Future Leaders Workshop

Future Instrument micro-studies

● Fast-SHOOTER

- 1ms (optical), 1s (NIR)
- 0.3-2.4 μ m, R~5000 (goal 10,000)
- GLAO ready for single object

● MOHRIS

- 0.3 - 1 μ m MOAO, 1000 R~5000 IFUs
- FOV: 1'x1', ~0.01" spatial resolution

● TREXS

- exAO, 0.8-4 microns
- R ~ 100,000 (~3 km/s) echelle
- 10" diameter FOV seeing limited
- single and multimode fiber bundles combinations

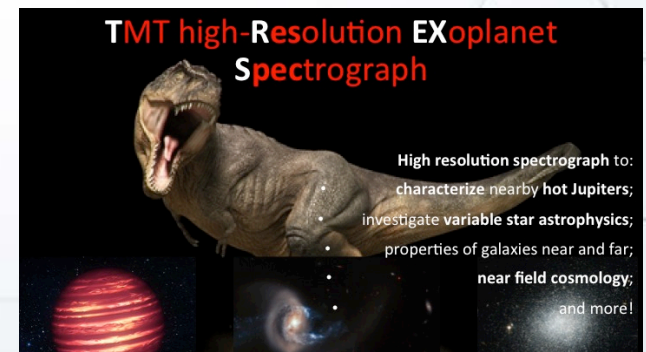
Splinter
session



MOHRIS

(Multi-Object High-Resolution Imaging Spectrometer)

Instrument Team: Marziye Jafari, Sonali Sachdeva, Lu Shen, Nathalie Thibert,
Wei Sun, Simon Birrer, Monica Imanishi, Ji Wang, Gautam Saikia, Cheng Feng,
Abhimat Gautam, Trupti Ranka



TMT Future Leaders Workshop

Combined DSC update and Science Flowdown process

- Design a template to collect science case and technical requirements
 - ◊ Web based wiki for DSC text and structure, including drop down menus for technical parameters
- Devise a process to develop a science case that includes equitable input from across the partnership
 - ◊ Process preparation includes:
 - ISDT recruitment across the partnership, science areas and career levels
 - Prepare supporting descriptions of instruments, operations, etc.
 - Each partner produces internal science case and cases brought together at a cross partner meeting or forum
 - Tools to support activities by each ISDT
 - Tiered reviews – each chapter by the relevant ISDT, cross ISDTs, instrument teams, SAC and Board
- Ideas that are being considered by the project office