



Direct Detection of Cosmic Acceleration by TMT & High Dispersion Spectrograph

次世代超大型光学赤外線望遠鏡TMTと
高分散分光器による宇宙の加速膨張の直接検証

B04 Overview & Current Status of TMT

Tomo Usuda (TMT-J Director, NAOJ)

B04 Members

◆ **PI (研究代表者) : Tomo Usuda (NAOJ)**

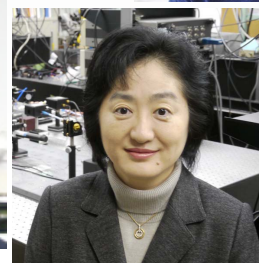


◆ **CoI (研究分担者)**

Hajime Inaba (AIST)



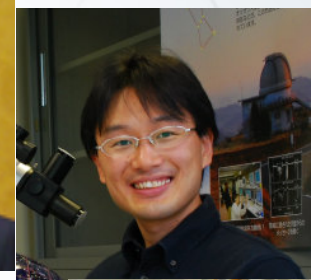
Kaoru Minoshima (UEC)



Takeshi Chiba (Nihon U)



Toru Misawa (Shinshu U)



◆ **Collaborator (連携研究者)**

Feng-Lei Hong (Yokohama Nat. U)

Nobunari Kashikawa (NAOJ)

Wako Aoki (NAOJ)



Atsushi Onae (AIST)

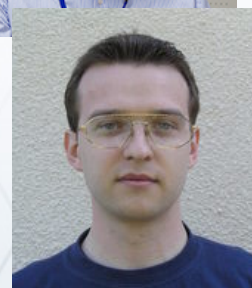


Sho Ookubo (AIST)



◆ **Others**

Malte Schramm (NAOJ)



Eiji Kambe (NAOJ)





B04 Members



◆ PI (研究代表者) : Tomo Usuda (NAOJ)

◆ CoI (研究分担者)

Hajime Inaba (AIST) **Optical Laser Frequency Comb**

Kaoru Minoshima (UEC) **Opt. Laser Freq. Comb**

Takeshi Chiba (Nihon U) Direct detection of acceleration

Toru Misawa (Shinshu U) Lyman- α forests IGM, Obs.

◆ Collaborator (連携研究者)

Feng-Lei Hong (Yokohama Nat. U) **Opt. Laser Freq. Comb**

Nobunari Kashikawa (NAOJ) TMT instruments, IGM,

Wako Aoki (NAOJ) TMT instruments, Obs.

Atsushi Onae (AIST) **Opt. Laser Freq. Comb**

Sho Ookubo (AIST) **Opt. Laser Freq. Comb**

◆ Others

Malte Schramm (NAOJ) **Opt. Laser Freq. Comb**, Obs.

Eiji Kambe (NAOJ) **Opt. Laser Freq. Comb** for OAO 188cm³

B04 Objectives

3 pillars of science (theory)

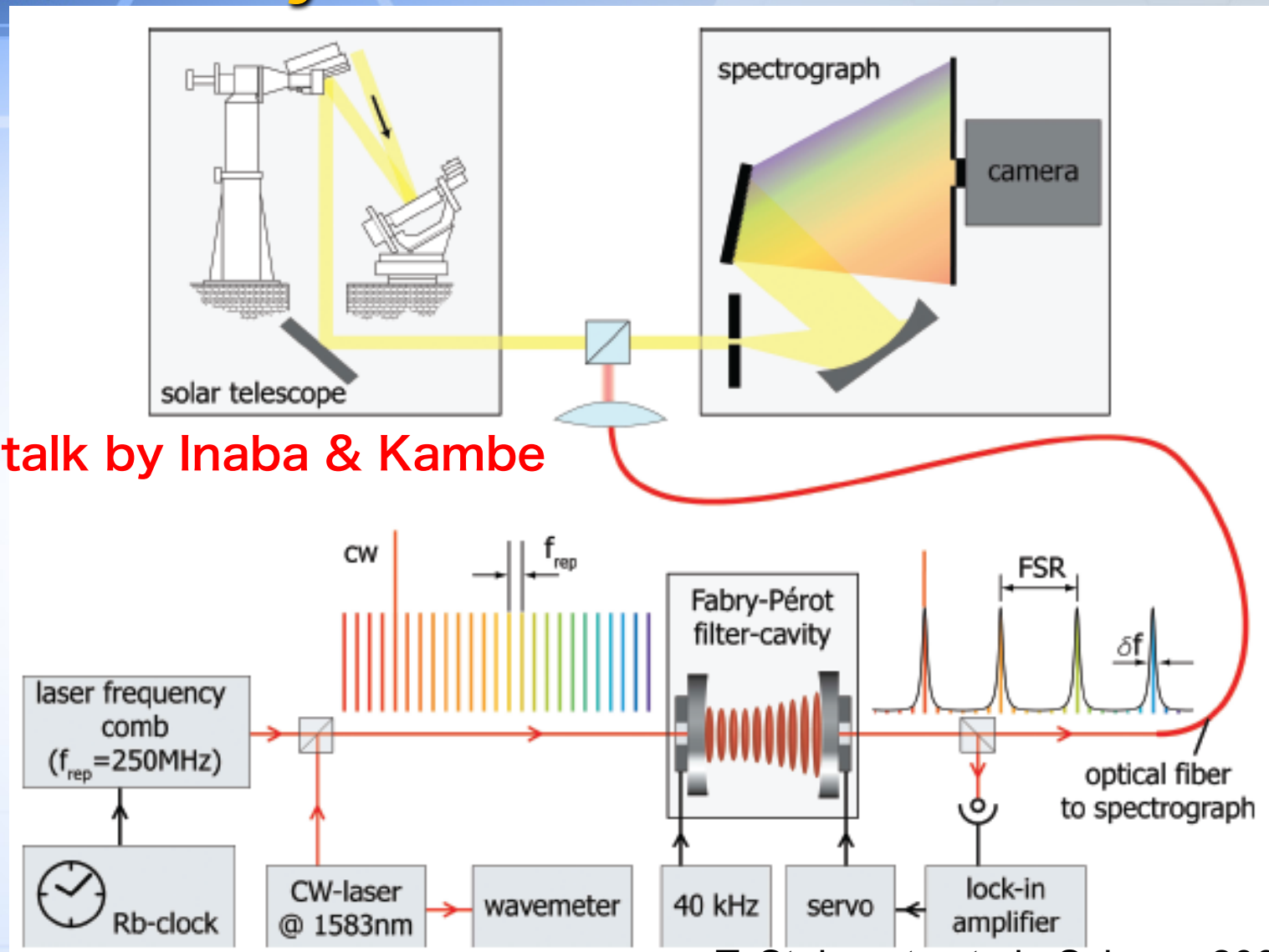


4 approaches (expt, obs)

	[A01] Inflation Sasaki (Kyoto)	[A02] fluent. & struct. Takahashi (Tohoku)	[A03] Dark Energy Sugiyama (Nagoya)
[B01] CMB polariz. Hazumi (KEK)	ζ, r, n_s direct evidence	CMB lensing isocurv. m_ν, N_ν	cosmo. params CMB lensing
[B02] Subaru galaxy imaging Miyazaki(NAOJ)	Lensing $\rightarrow b(k)$ $\rightarrow P_{\text{primod}}(k)$	weak lensing m_ν non-std. DM	weak lensing SNe, γ
[B03] galaxy spectroscopy Takada(KIPMU)	primord. NG Ω_K, n_s, α_s	isocurv. DM in dSph gals. $P(k), m_\nu$	BAO, RSD $\Omega_{\text{de}}(z), \gamma$
[B04] TMT Usuda (NAOJ)	(2) QED coupling (α) space time variation T.Chiba, Misawa	(3) Lyman- α forests IGM Misawa, Kashikawa	(1) Direct detection of Cosmic Acceleration T.Chiba

important observables at each intersection

Optical Laser Frequency Comb for very accurate λ calibrations



See talk by Inaba & Kambe



Current Status of TMT

Status of the CDUP Contested Case Hearings

- ◆ Dec 2 2015: **HSC (Hawaii Supreme Court) invalidated the CDUP (Conservation District Use Permit) issued by BLNR to the UH to build TMT at Maunakea**
- ◆ May 2016: Hearing Officer to preside over the BLNR hearing is selected.
- ◆ Sep 26 2016: Hearing Officer visits the site
- ◆ **Evidentiary Hearing concluded!** From Oct 20th to Mar 2nd in 44 days with 71 witnesses @Hilo



Hawaii
Tribune Hei



Hearing Officer
(Ms. Riki M. Amano)



Status of the CDUP Contested Case Hearings

Witnesses for UH (Oct & Nov)



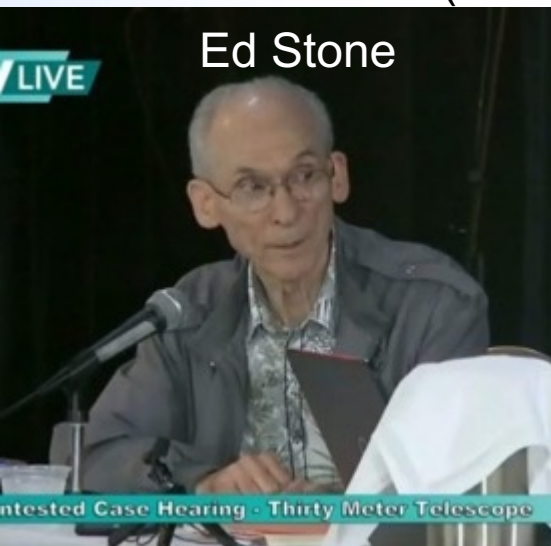
Chad Kalepa Baybayan



Bob McLaren



Witnesses for TIO (Dec & Jan)



Gary Sanders



Heather Kaluna



1/5 NATIVE HAWAIIAN
ASTRONOMERS GIVE
THEIR TESTIMONY



Status of the CDUP Contested Case Hearings



- ◆ Dec 2 2015: Hawaii Supreme Court invalidated the CDUP (Conservation District Use Permit) issued by BLNR to the UH to build TMT at MK
- ◆ May 2016: Hearing Officer to preside over the BLNR hearing is selected.
- ◆ Sep 26 2016: Hearing Officer visits the site
- ◆ Evidentiary Hearing concluded! From Oct 20th to Mar 2nd in 44 days with 71 witnesses @Hilo
- ◆ June 2017: Decision by Hearing Officer (Ms. Riki M. Amano)
- ◆ July~Aug 2017: Decision by BLNR → CDUP approval
- ◆ Onsite construction expected to resume in 6 months following CDUP approval. **Expected resume date is April 2018**
- ◆ 2025: Telescope test & AIV
- ◆ 2027: First Light

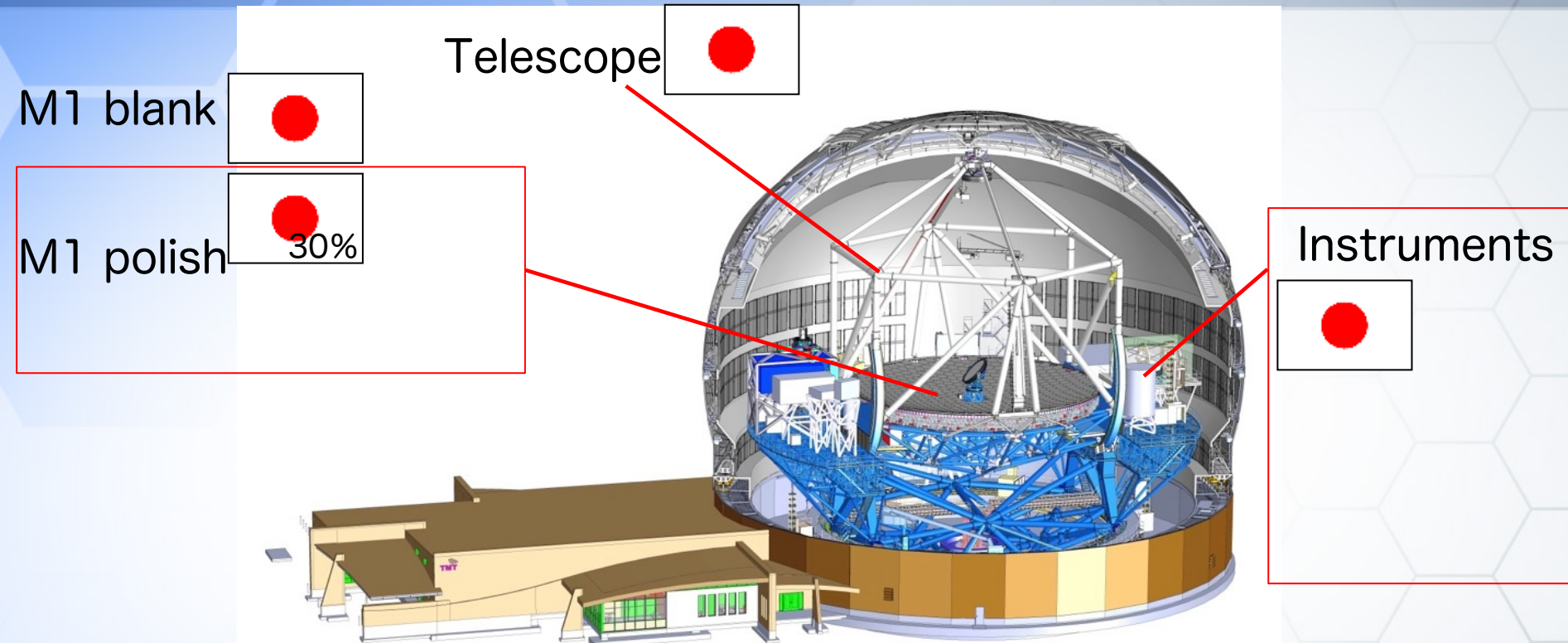
TMT Backup Plan Site Other than Hawaii

- ◆ Maunakea (Plan A) remains the first priority site.
- ◆ Oct 26~27, 2016 Board meeting: ORM (La Palma @Spain) as an alternate site → Use permit process is started

TMT Alternate Site Investigations Observatorio del Roque de los Muchachos



Site Perspectives



- 1) Design fabrication / installation of the telescope structure,
- 2) Providing all the primary mirror segment blanks,
- 3) Polishing 30% of the primary mirror blanks,
- 4) Developing part of the First Generation Instruments, and
- 5) Cash contributions to cover common expenses etc.

TMT-J activities: M1 Blank & Polishing

Process of works	FY2013	FY2014	FY2015	FY2016	total
M1 Blank (plano-plano)	60(29)	39(0)	65(31)	49(21)	213(81)
Spherical Grinding	12(0)	19(0)	63(29)	60(52)	154(81)
Aspherical Grinding	12	16	33	8	69
Aspherical Polishing		Numbers	6	5	11
		() for partners			



50th Blank backside Polished



107 Blanks produced (2015 Oct)

TMT-J activities: M1 Blank & Polishing

1st 7 blanks @ Fremont in Dec. 2016



2nd 36 blanks from
Canon @Utsunomiya





TMT 4th Science Forum



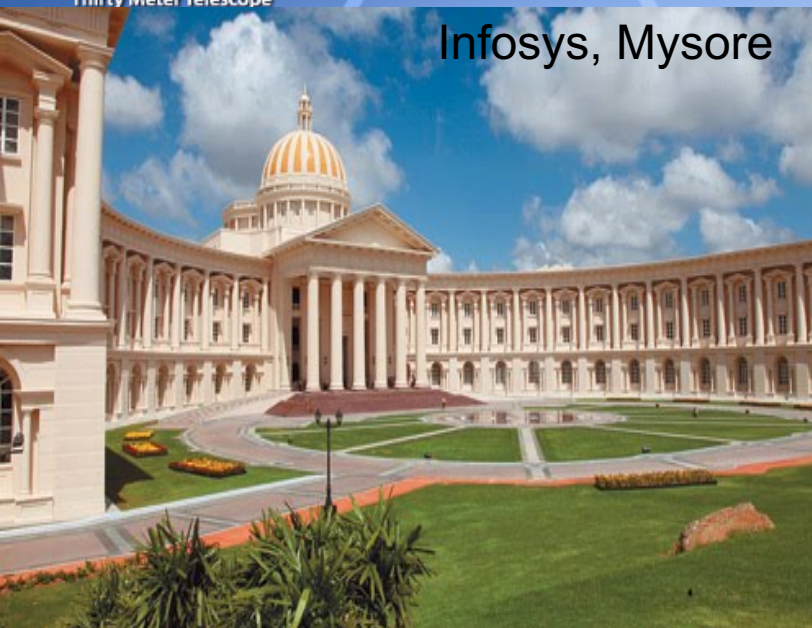
- ◆ Kyoto, Japan, 24-26 May 2016
- ◆ First TMT Forum in Asia
- ◆ A great success! Total 136 participants (Japan 52)
- ◆ <https://conference.ipac.caltech.edu/tmtsf2016/>



京都大学
KYOTO UNIVERSITY



TMT 5th Science Forum



Infosys, Mysore

- ◆ TMT annual Science Forum will be held either in Oct ~ Dec, 2017
- ◆ Three venues are short listed: Goa, IUCAA (Pune), Infosys campus (Mysore)
- ◆ SAC will decide in Apr



IUCAA, Pune





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

Europe/Africa meeting location and dates TBD

Summary

- ◆ Developing Optical Laser Frequency Comb is going well at AIST & NAOJ
- ◆ Feasibility study for future scientific observations is also on going.
- ◆ CDUP Contested Case Hearing concluded.
- ◆ Onsite construction expected to resume in April 2018
- ◆ The first light is delayed to 2027 from 2024
- ◆ Japan's contributions (Primary Mirrors, Telescope Structure, Sci. Instruments, etc.) are on going well.



- Developing going well
- Feasibility is also on
- CDUP C
- Onsite co 2018
- The first
- Japan's Structure

*Speed
Success*

加速成功

願望を短期間で達成する魔術

ミリオネアコンサルタント

道幸武久

Doko Takehisa

We need magic for success!

サンマーク出版

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ded.

e in April

024

Telescope
going well.