

# Report of Subaru3 Workshop

(Oct 15, 2021, ~60 participants)

Masahiro Takada (Kavli IPMU)

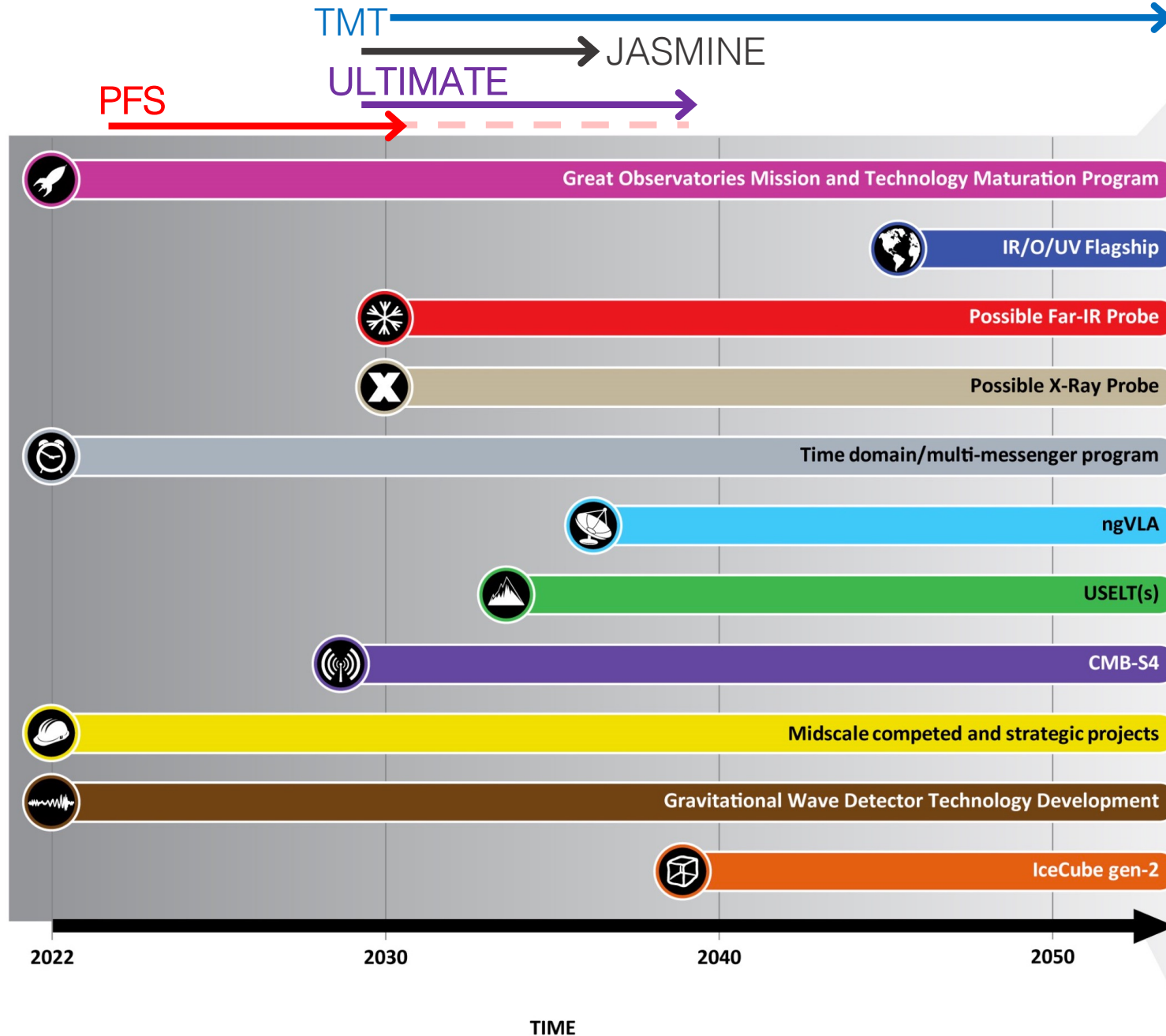
On behalf of organizers: Michitoshi Yoshida, Naoki Yasuda

Note that this workshop wasn't set by SAC/Observatory, rather was by astronomers who showed interest

Minutes of the meeting are available from

[https://www.dropbox.com/s/3gbp1ny3usltmug/Subaru3\\_minutes.pdf?dl=0](https://www.dropbox.com/s/3gbp1ny3usltmug/Subaru3_minutes.pdf?dl=0)

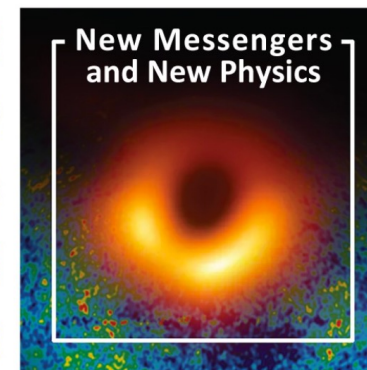




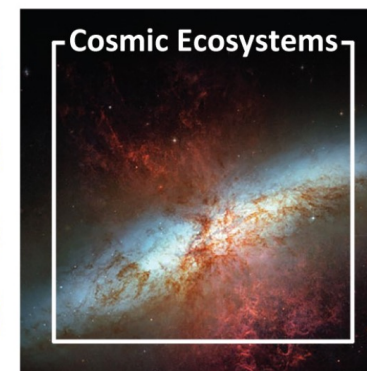
Astro2020



Pathways to Habitable Worlds



New Windows on the Dynamic Universe (multi-messenger astronomy)



Unveiling the Diverse of Galaxy Growths

We must be well prepared for the TMT era, after Subaru2

## 7.6.2 Sustaining Activities: The Astronomy Mid-Scale Programs

(\$4M-120M scale)

- **Open competition of new ideas** - activating the community's creativity with minimal restrictions on scientific focus in order to fuel new, inventive, cutting-edge approaches that respond to emerging scientific opportunities.
- **Targeted solicitations designed to advance decadal priorities** – responding to identified scientific objectives that can be achieved using mid-scale facilities.
- **Opportunities targeted at sustaining and advancing instrumentation on existing telescopes** – maintaining U.S. competitiveness in ground-based astronomy, and optimizing scientific returns from current facilities.

**Recommendation: The National Science Foundation (NSF) Division of Astronomical Sciences (AST) should create three tracks within the AST Mid-Scale Innovations Program and within (its share of) the NSF-wide Mid-Scale Research Infrastructure Program. The first track should be for regularly competed, open calls, the second track should solicit proposals in strategically identified priority areas, and the third should invite ideas for upgrading and developing new instrumentation on existing facilities. All tracks should solicit proposals broadly enough to ensure healthy competition.**

2. The strategic priorities track is an essential addition to the existing mid-scale program structure to ensure that it is responsive to decadal and community strategic priorities. The survey expects that these strategic programs will be at the larger end of the mid-scale cost range (i.e., at the ~\$100 million level). Therefore, partnerships with other organizations or agencies, **including internationally**, may be desirable or appropriate. Program directors would be empowered to weigh programmatic considerations in balance with the recommendations of external reviews. The survey has identified one top priority for this element, a time-domain astrophysics program, and two co-equal areas – highly multiplexed spectroscopy and radio instrumentation:
- c. **Highly multiplexed spectroscopy** – large surveys, such as that to be carried out by the Rubin Observatory, require extensive spectroscopic follow-up. Many of the science panels, as well as the OIR program panel, emphasized the need for new capabilities and especially those that are publicly available, to advance the survey's science priorities. Noteworthy science areas included galactic archeology and the spectroscopy of stars on a massive scale for understanding stellar abundances and evolution. In the near term, investments that provide public access to some combination of SDSS-V, DESI, and the

Subaru Prime Focus Spectrograph (**PFS**), or similar surveys, would help to advance science this decade with relatively modest funding, and later in the decade a major (MSRI-2 scale) investment could be made in a larger, dedicated facility.

Recommend Mid-Scale Program to secure, for US community, access to the cutting-edge facilities (including PFS)



Bright future (funding!) will come with our current efforts (good science)!

## MOST CITED

### Cosmology from cosmic shear power spectra with Subaru Hyper Suprime-Cam first-year data

Chiaki Hikage et al.

*Publications of the Astronomical Society of Japan*, Volume 71, Issue 2, April 2019, 43,  
<https://doi.org/10.1093/pasj/psz010>

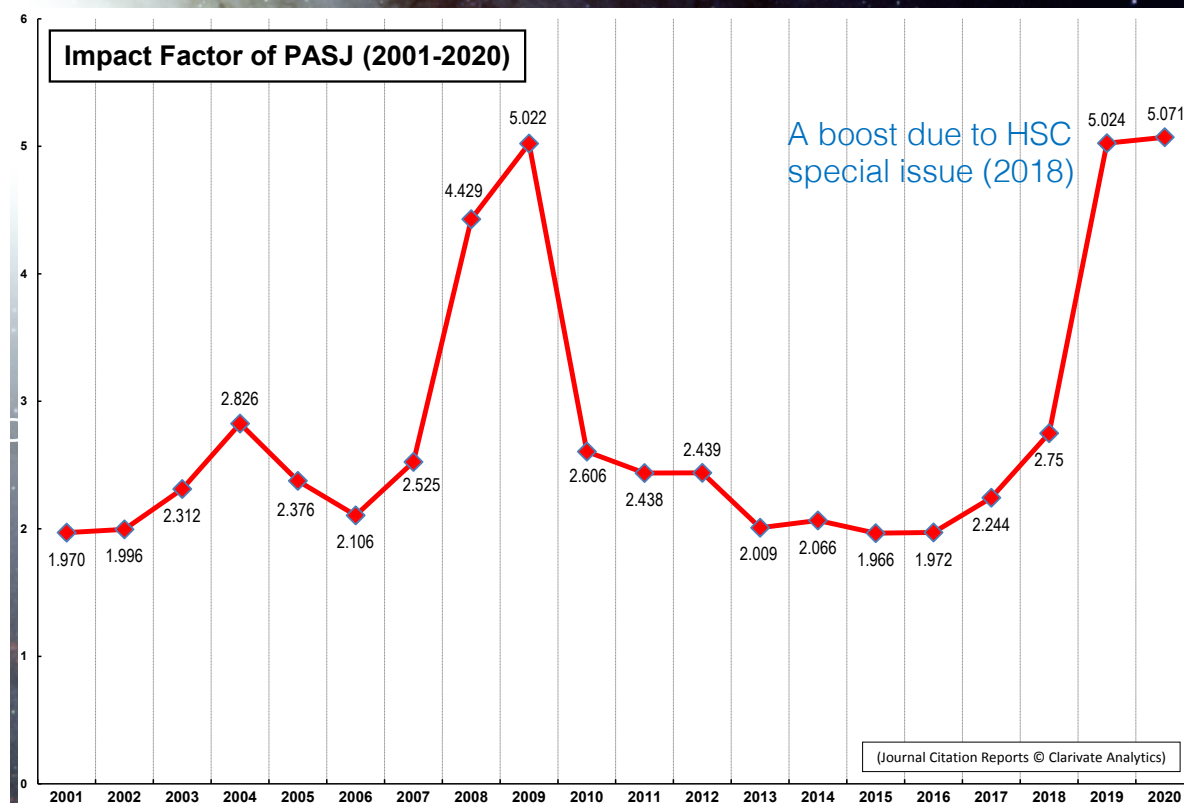
We measure cosmic weak lensing shear power spectra with the Subaru Hyper Suprime-Cam (HSC) survey first-year shear catalog covering 137 deg<sup>2</sup> of the sky. Thanks to the high effective galaxy number density of  $\sim 17$  arcmin<sup>-2</sup>, even after conservative cuts such as a magnitude cut of  $i < 24.5$  and photometric redshift cut of  $0.3 \leq z \leq 1.5$ , we obtain a high-significance measurement of the cosmic shear...

### Second data release of the Hyper Suprime-Cam Subaru Strategic Program

Hiroaki Aihara et al.

*Publications of the Astronomical Society of Japan*, Volume 71, Issue 6, December 2019, 114,  
<https://doi.org/10.1093/pasj/psz103>

This paper presents the second data release of the Hyper Suprime-Cam Subaru Strategic Program, a wide-field optical imaging survey using the 8.2 m Subaru Telescope. The release includes data from 174 nights of observation through 2018 January. The Wide layer data cover about 300 deg<sup>2</sup> in all five broad-band filters (grizygrizy) to the nominal survey exposure...



# Many ideas/stimulating discussion!

- A new legacy-type survey (after PFS-SSP?)
  - Legacy survey of Gaia stars with PFS (Galactic Archaeology) (Takada/Chiba)
  - Strategic survey of Galactic bulge region, with PFS, JASMINE and ULTIMATE
  - Multi-messenger astronomy (Tanaka/Moriya/Tominaga)
- Upgrading existing instruments (capable with reasonable funding, say <\$10M?)
  - IFU and/or high-resolution ( $R \sim 40,000$ ) spectrograph to PFS (Takada/Chiba/Aoki/Yasuda...)
  - Narrow/Intermediate-band filters with HSC (galaxy evolution/GA) (Nishizawa/Chiba)
  - CMOS HSC: install CMOS into HSC (no 8m-class CMOS project so far, enabling cadence <1sec) + NIR HSC (Miyazaki-san/Tominaga/Moriya/Tanaka)
  - Multi-IFUs for ULTIMATE (Akiyama)
- Strategic instrumentation plan for exoplanet science, before TMT/Space (LUVOIR/HabEx)
  - Direct imaging of exoplanet systems with REACH (Kawahara)
  - NIR HSC, for observing a star cluster (M. Tamura)
  - High-resolution spectroscopy/Fourier spectroscopy (Omiya/Kotani)
- MKID instrument? (M. Tanaka)

# Other discussion points we had

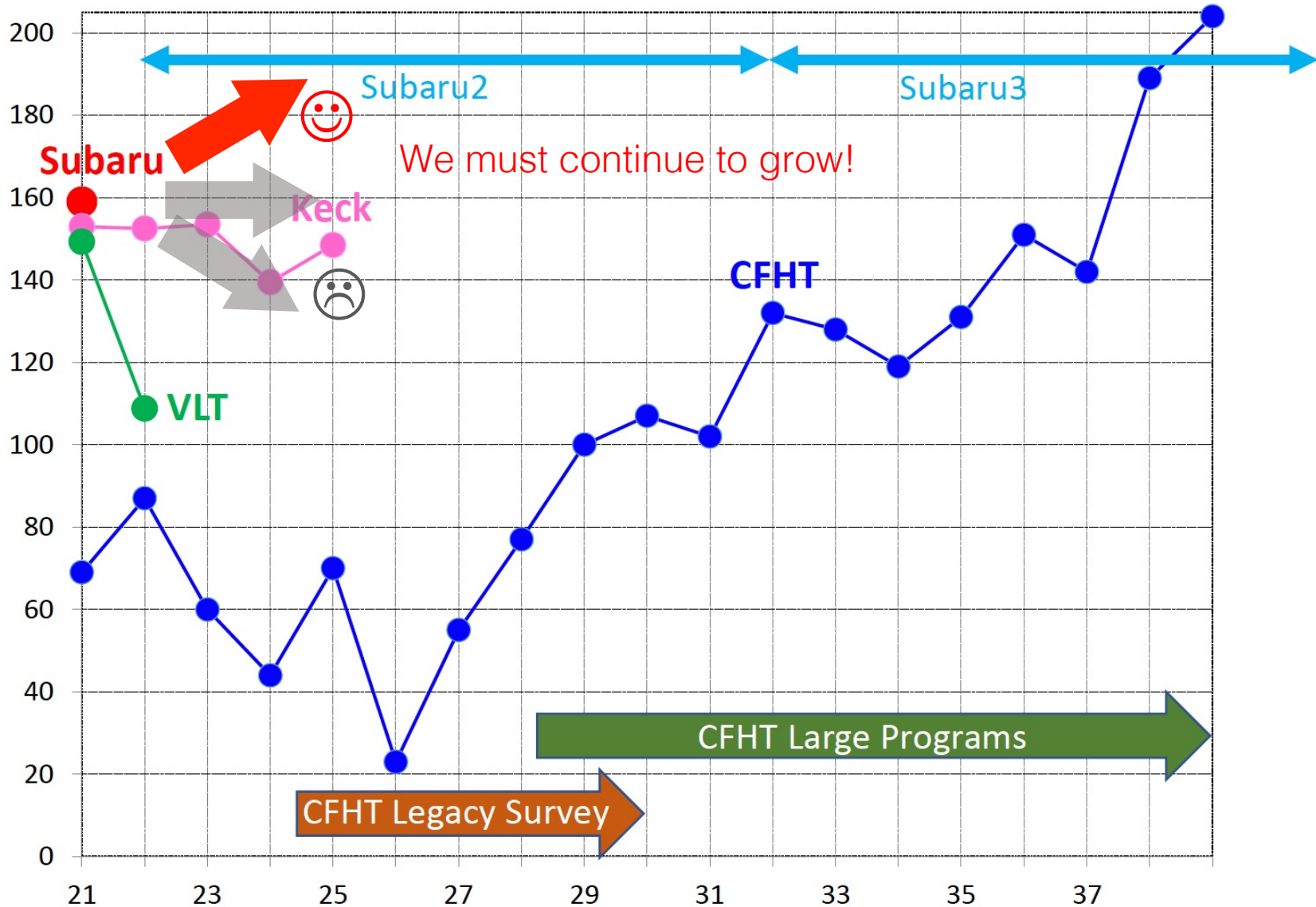
- What is an optimal operation scheme of Subaru, in 2030's?
  - What is an optimal fraction of survey- vs. PI-type observations?
  - Legacy-type data (e.g., SDSS/Gaia/HSC-SSP/PFS-SSP, what is the next?)
  - What is the unique role of Subaru, in era of LSST, Euclid, Roman and TMT?
- Need more involvement of students and younger-generation scientists (many participants expressed concerns on a fewer students for Subaru)
- Agreed to have the 2<sup>nd</sup> Subaru3 meeting, within this year





# 建設後40年を超えた望遠鏡の活躍

From Yoshida-san's slide



# What is next? Looking to the future

- Need follow-up discussion involving SAC and the future planning committee of Gopira (光赤天連2030年代将来計画WG: chair Ouchi-san)
- According to Yasuda-san (SAC chair), we, as the community, need a strategic, long-term plan for Subaru in 2030era, in 2-3 year timescale
  - Need to write up a white paper?
- Eventually will make efforts to get the funding, among scientists who agree and want to get involved
- We have to work together “NOW”, very seriously
- Any thought?





# Subaru Instrumentation Plan

