

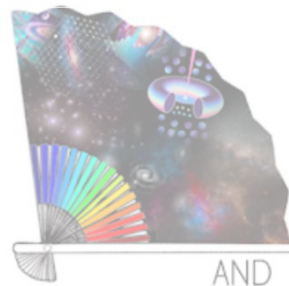
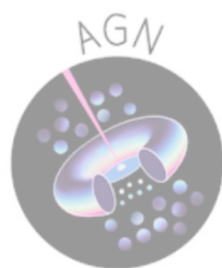
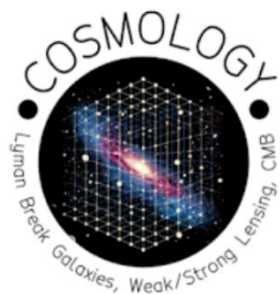
HSC-Niji

– Cosmology and Proto-cluster science –

Atsushi J. Nishizawa, **Hironao Miyatake** and Federica Tarsitano
on behalf of the HSC-Niji collaboration

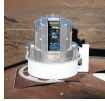
Subaru User's Meeting FY 2026@NAOJ, 2026/06/19





Wide-field galaxy surveys in 2020s

$z=0$



HSC (done in 2021)

$z=1$

$z=2$

$z=3$

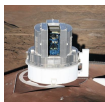
$z=4$



DESI (2021-)

Wide-field galaxy surveys in 2020s

$z=0$

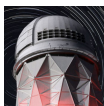


HSC (done in 2021)

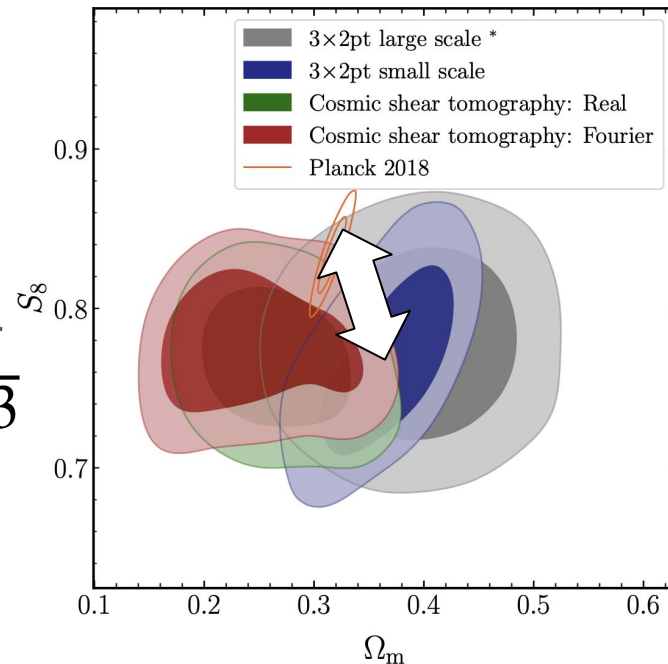
$z=1$

$z=2$

$$S_8 \equiv \sigma_8 \sqrt{\Omega_m / 0.3}$$



DESI (2021-)

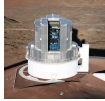


S_8 tension
Miyatake et al. (2023)

Note: HSC FY analysis is ongoing

Wide-field galaxy surveys in 2020s

$z=0$



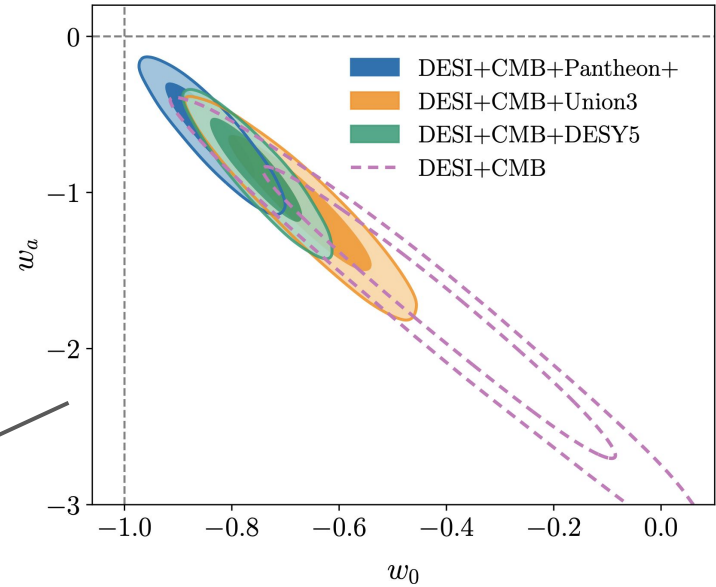
HSC (done in 2021)

$z=1$

$z=2$

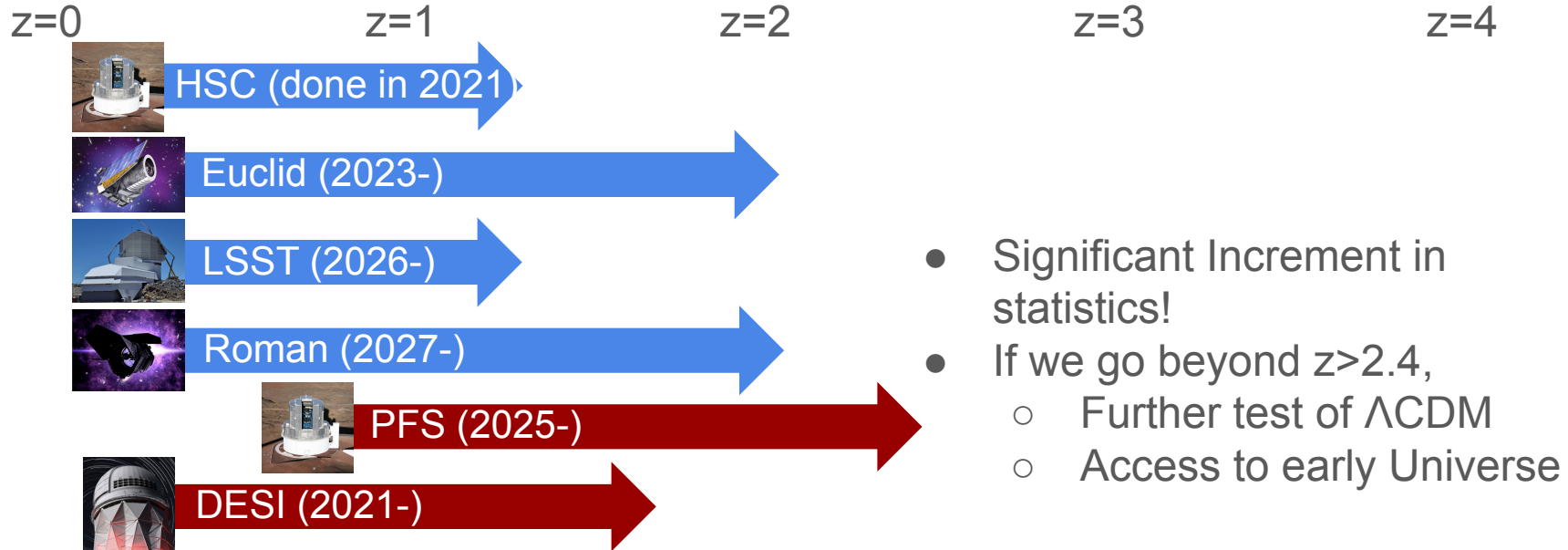


DESI (2021-)

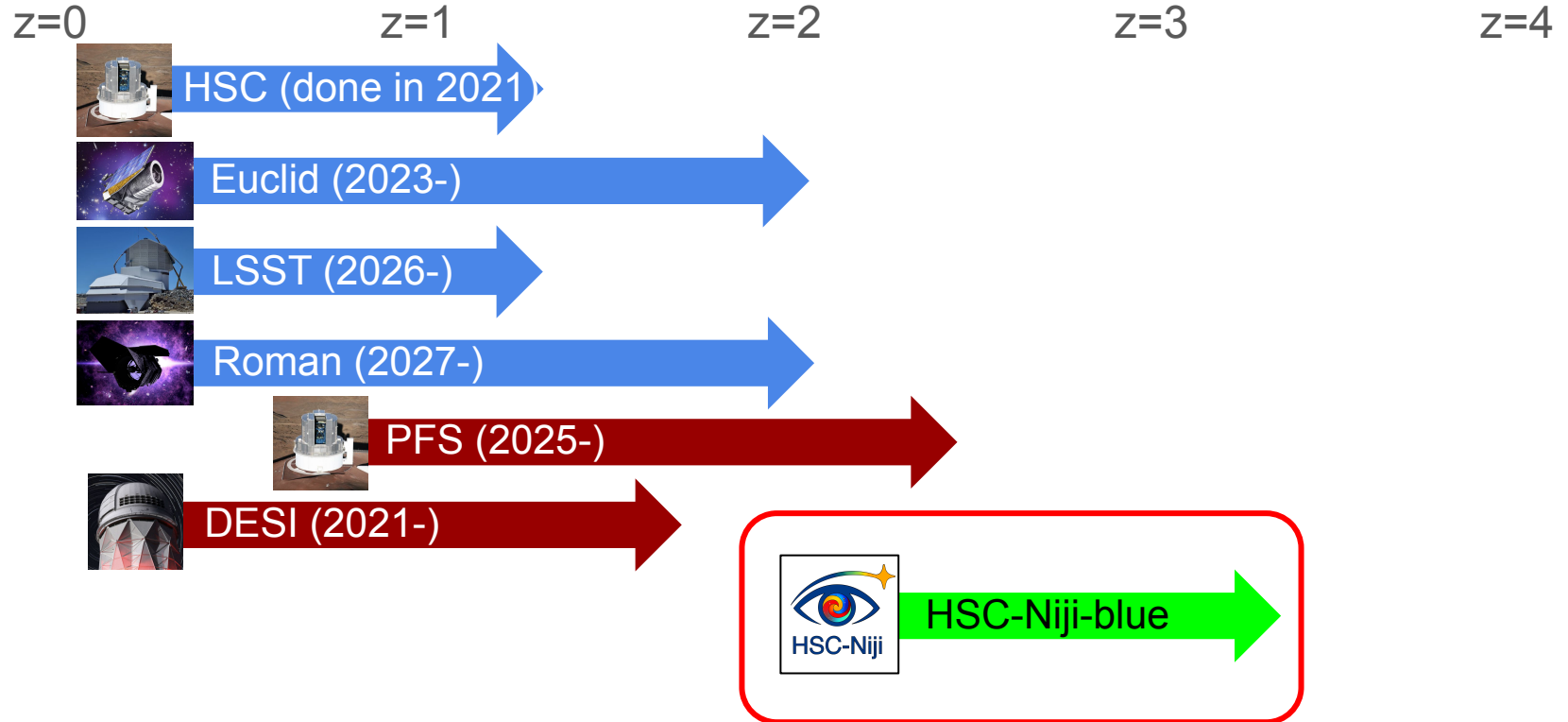


Time-evolving Dark Energy
DESI collaboration (2025)

Wide-field galaxy surveys in 2020s



HSC-Niji-blue to go to higher redshift



Cosmology with HSC-Niji x Simons Observatory

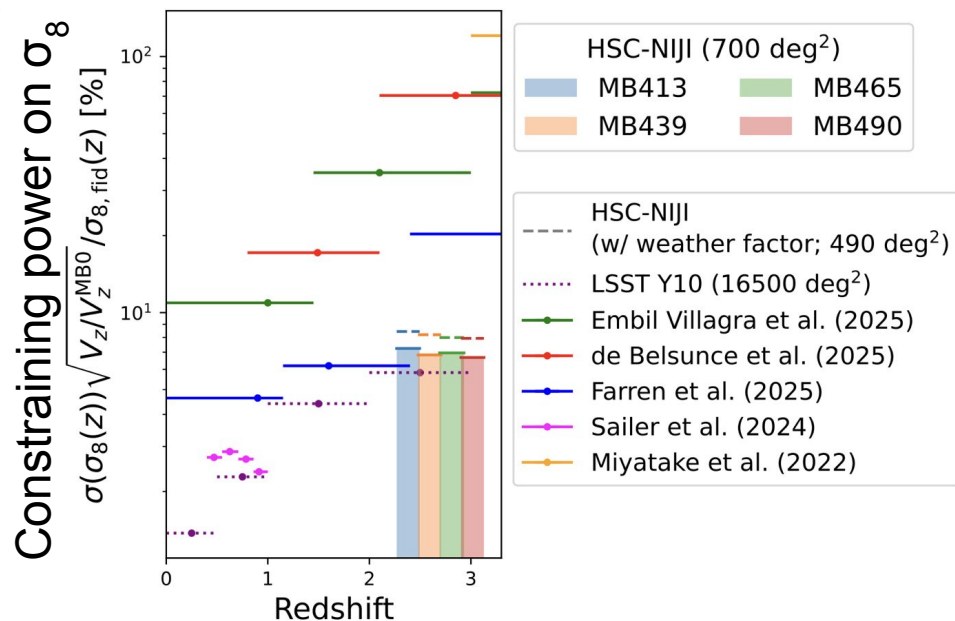


A new CMB experiment started in 2025.



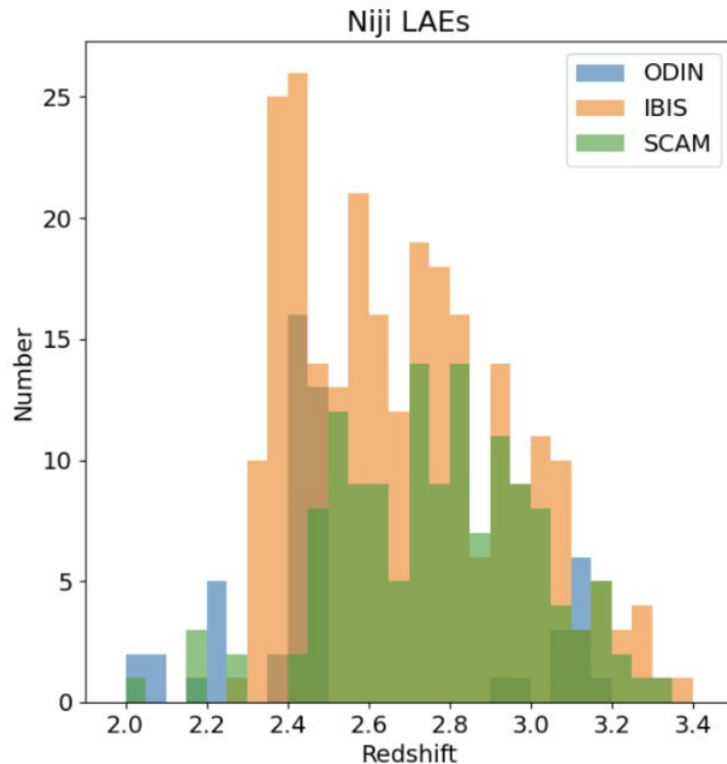
G. Farren (LBNL)

- We can obtain $\sim 1.1\text{M}$ Lyman- α emitter (LAE) through HSC-Niji-blue WIDE (700 deg²) at $2.3 < z < 3.1$.
- To constrain cosmological parameters, we need to measure matter distribution.
- Weak lensing does not work since we won't have enough number of galaxies behind LAEs.
- Instead, we use lensing of CMB photons (CMB lensing).

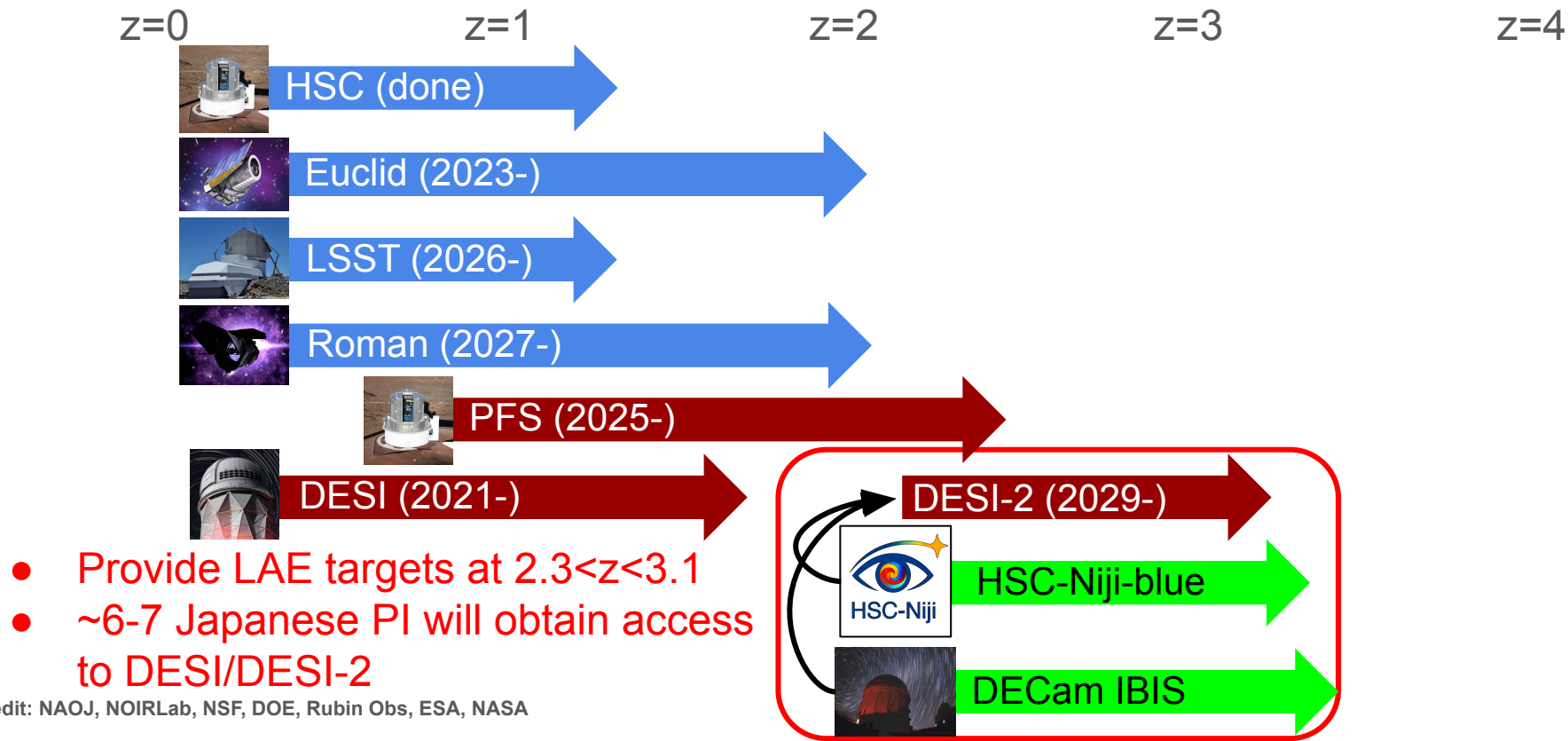


Preliminary LAE selections from HSC-Niji February run

- We select LAE candidates based on the MBQ1 filters.
- Matched with ODIN (DECam NB survey), IBIS (DECam MB survey), and Supreme-Cam LAE samples that have DESI spectroscopic redshifts.



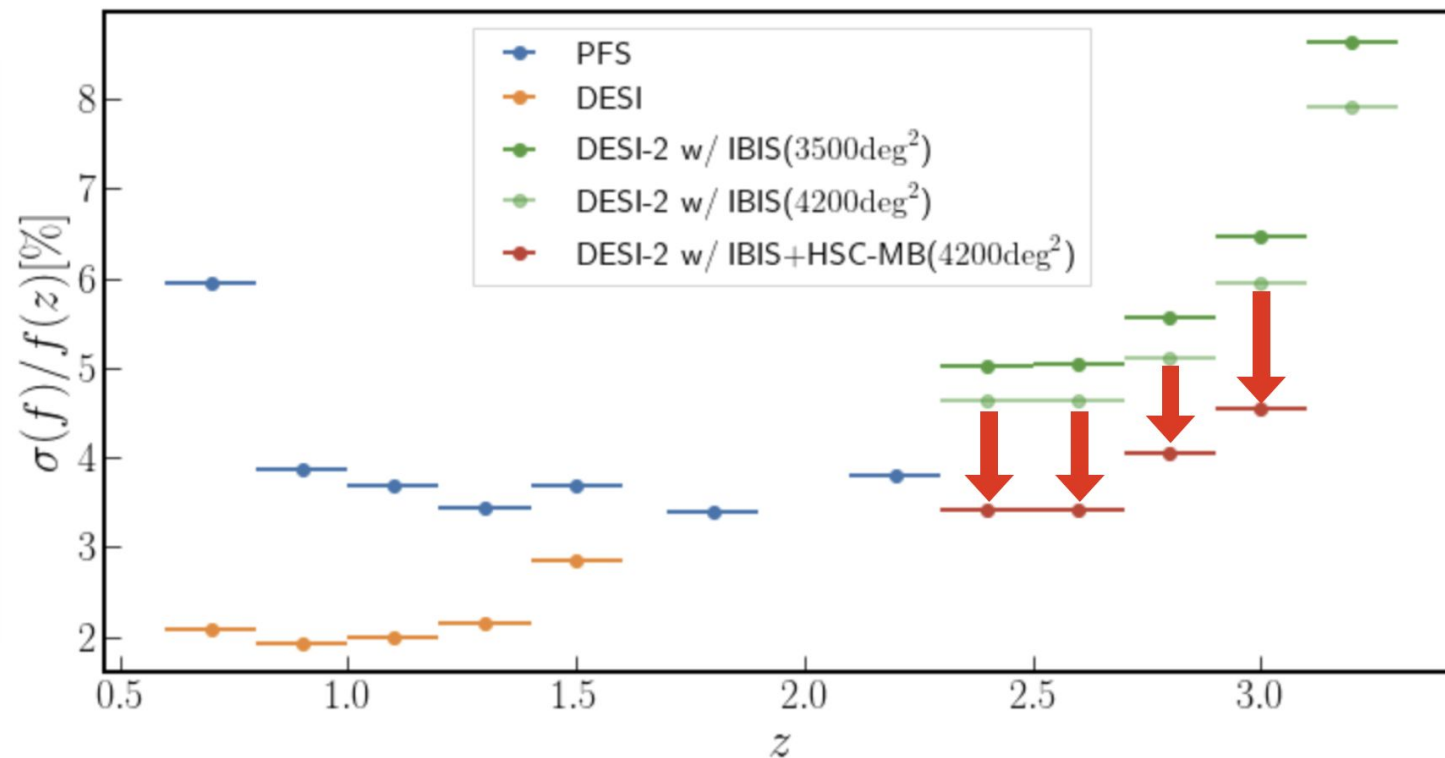
DESI-2



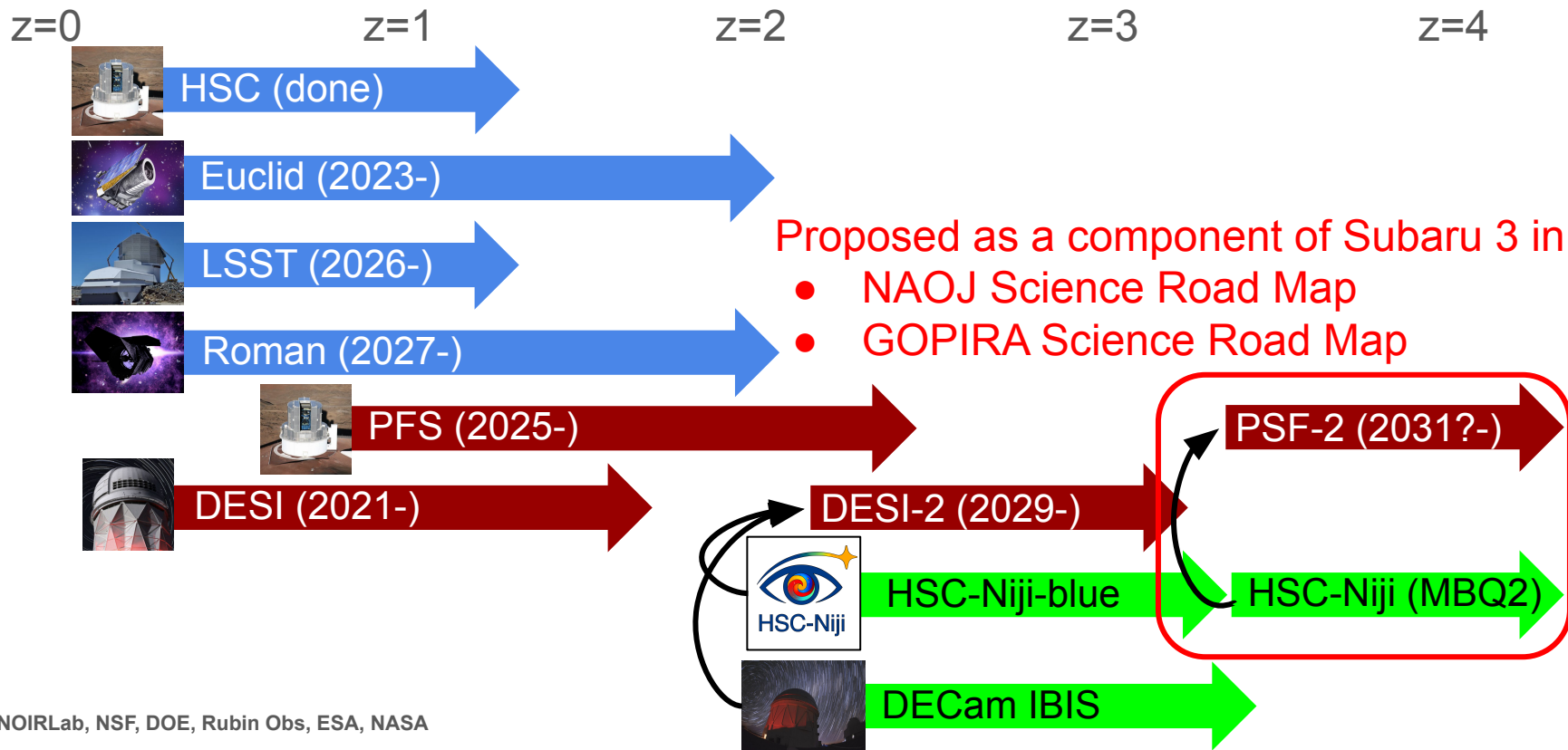
Expected constraints from RSD



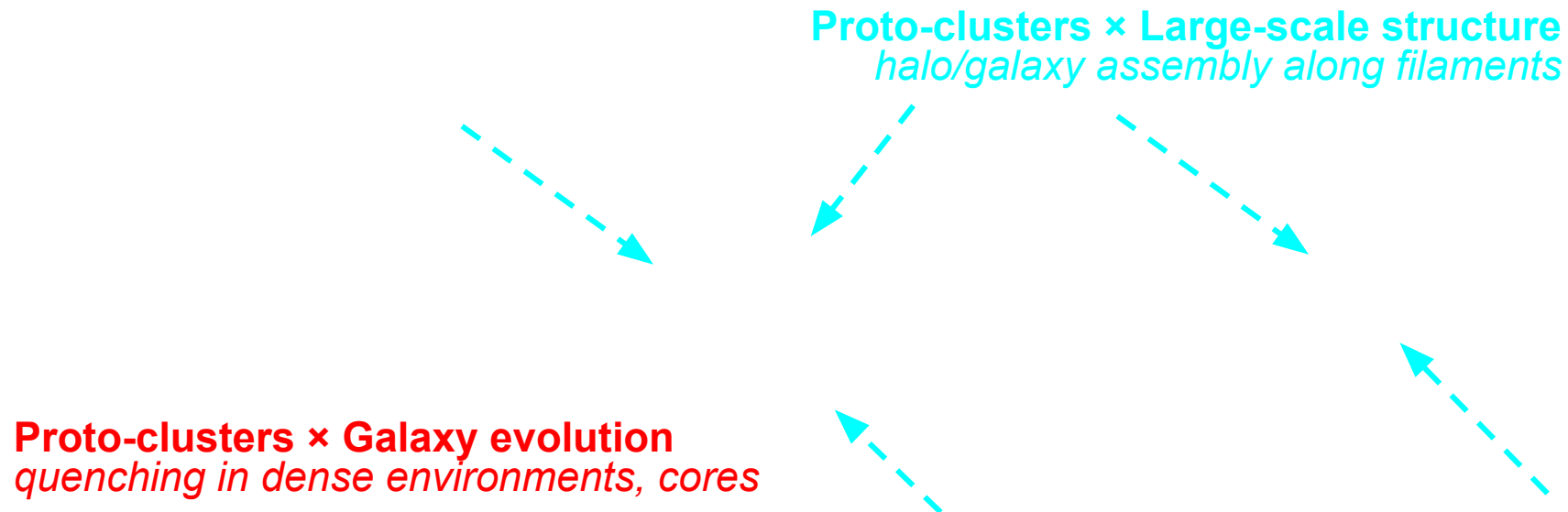
T. Sunayama (ASIAA)



Go beyond $z \sim 3$



Cluster formation across cosmic time



Advantage of MBs in proto-cluster search

PCs are rare → larger survey volume
Projection effects dilute overdensity
→ thinner redshift slice

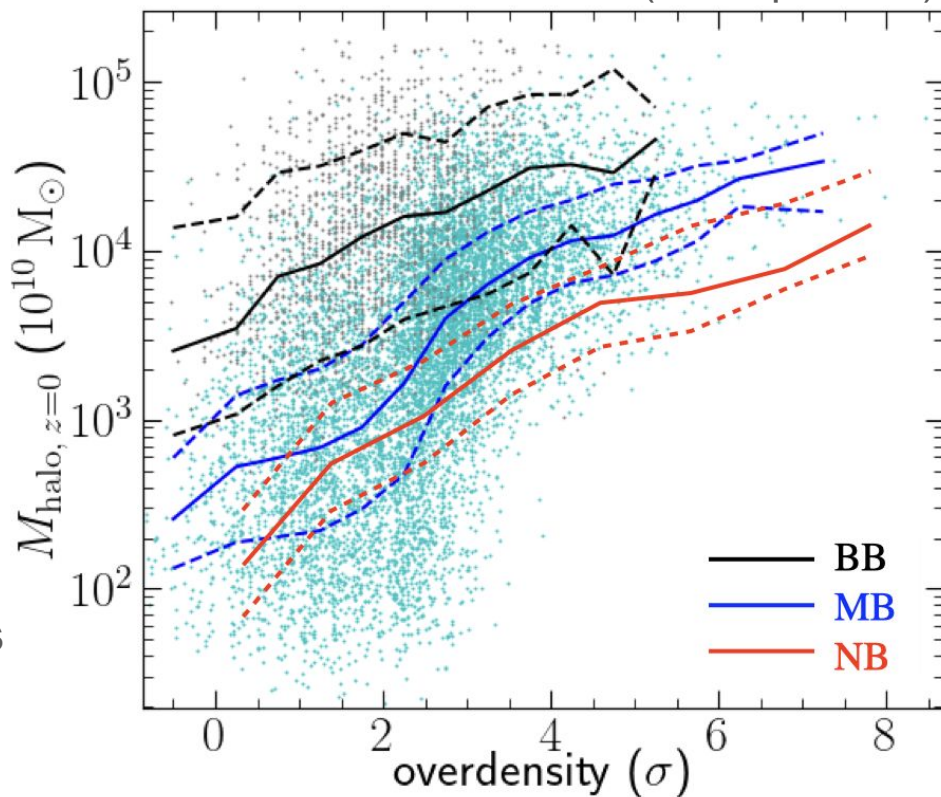


MBs are sweet spots to meet both requirements.

MBs are sensitive not only to rich but also low-mass proto-clusters.

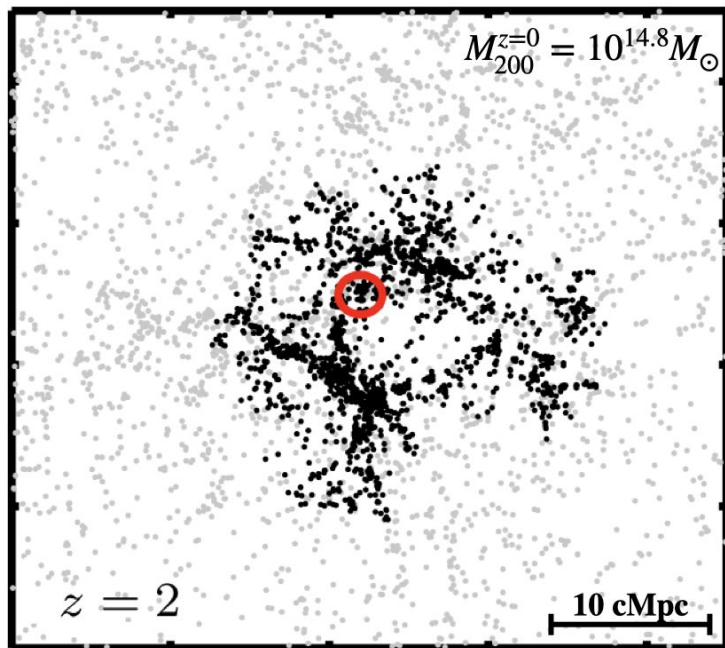
Representative sample of proto-clusters

Model prediction based on
Millennium simulation (Henriques+17)

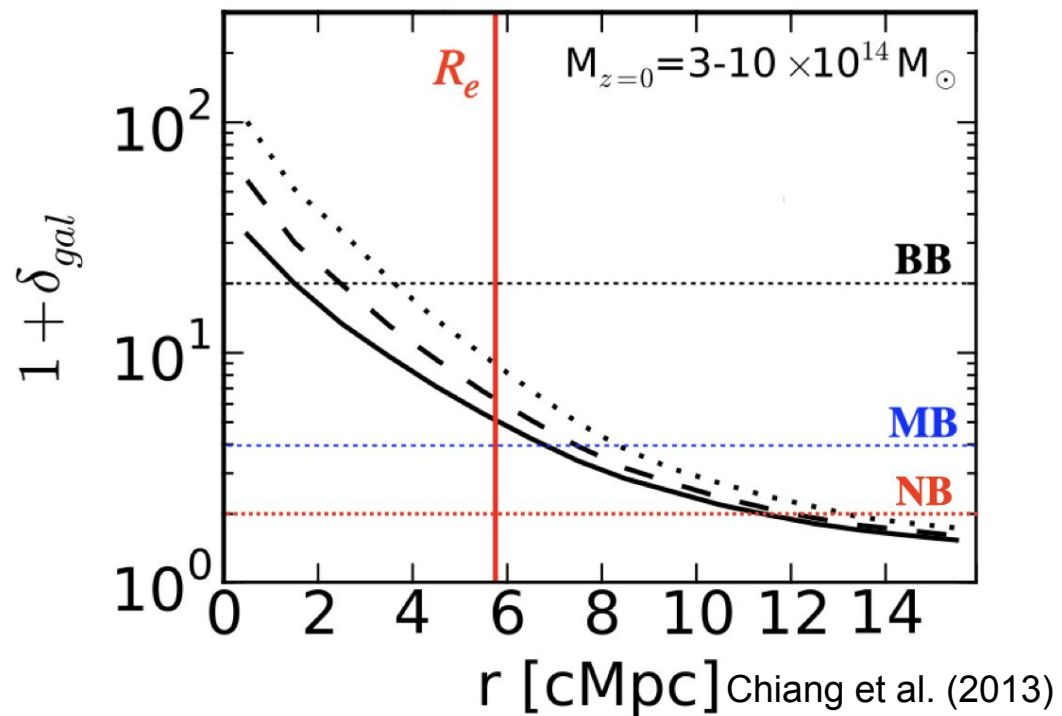


Shape, size of proto-clusters

Member galaxies are still widely distributed, and PCs exhibit unique morphology. Size/shape are key parameters to predict M_{halo} at $z=0$ and developmental phase. Reducing projection effects by MBs enables to trace the outskirts, filaments of PCs.



Muldrew et al. (2015)



Chiang et al. (2013)