

Probing AGN Demographics with Roman+Subaru

Proposers (name/affiliation): Masafusa Onoue (Kavli IPMU), Kohei Ichikawa (Waseda), Yoshiki Matsuoka (Ehime), Tohru Nagao (Ehime), Yoshiki Toba (NAOJ), Masatoshi Imanishi (NAOJ), Takuma Izumi (NAOJ)

Subaru Instrument: PFS, HSC, NINJA

Number of nights (hours): 50 nights

Condition of nights: dark/grey

Time critical (year, season, date, time): N/A

Relevant CCS/other Roman program: SPQR (WFS, PI: J. Rhoads)

Category: supermassive black holes

High-redshift Quasar

Roman: HL Wide Area Survey (DEC > -30 deg) + Time Domain Survey

Subaru: PFS/NINJA + HSC

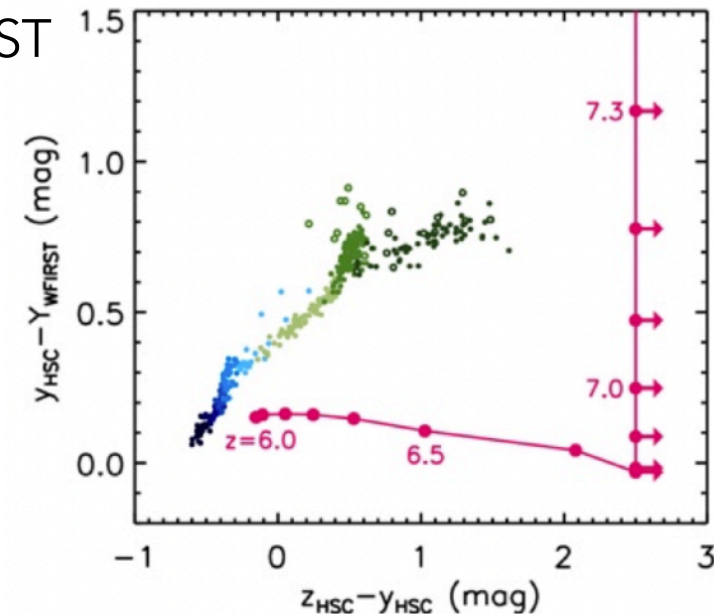
◆ Science Goals: early growth history of supermassive black holes (SMBH)

(1) Discovery of $z > 7$ quasars ($\sim 10 \text{ Gpc}^{-3}$, or several per 50 deg^2 at $Y < 25$)

- PFS confirmation of quasar candidates selected from Roman + LSST
- HSC z/y imaging (26 mag; 5σ) in Deep survey area
- PFS/NINJA also enable BH mass estimate with CIV and MgII

(2) Large-scale environments

- PFS identification of surrounding galaxies to characterize local overdensity



from 2016 White paper
(Y. Matsuoka)

Dust-reddened AGN

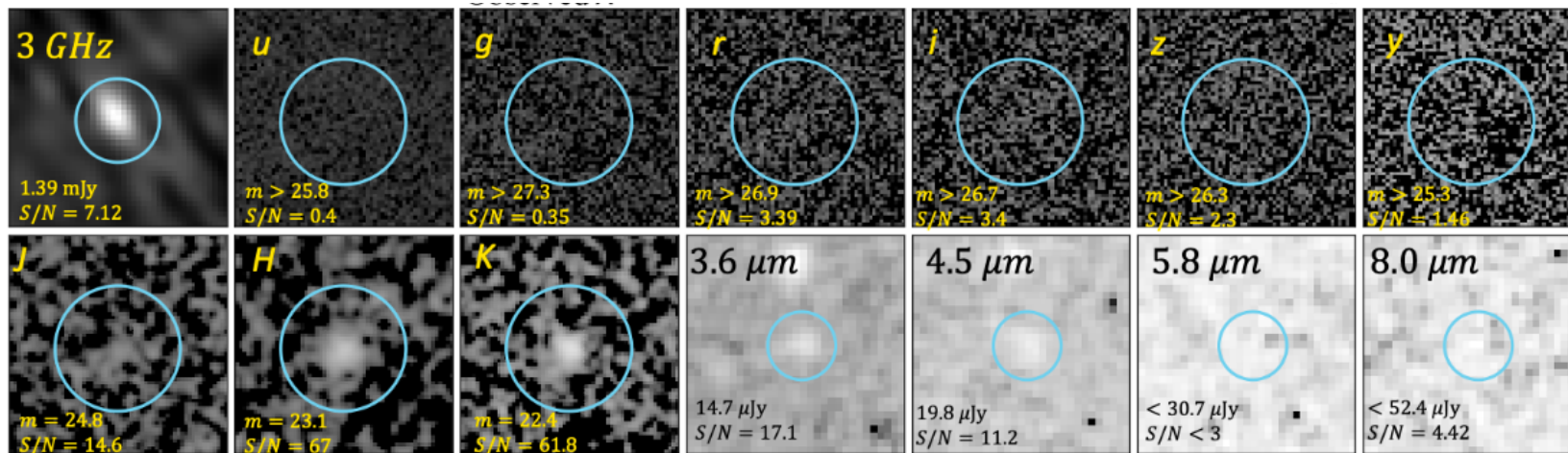
Roman: HL Wide Area Survey + Time Domain Survey

Subaru: HSC

◆ Science Goals: Role of dust obscuration for AGN, SMBH demographics

(1) NIR counterparts of optical-dark AGN

- 8 HSC-dark VLASS 3GHz sources in u2k catalog (12-17 deg²)
 - ➡ Statistical studies possible with 50-100 deg² coverage with HSC-D/UD depth
 - ➡ Roman's deep NIR imaging helps identify dusty radio AGN or very high-z AGN



Courtesy of K. Ichikawa

Quasar Host

Roman: HL Wide Area Survey + Time Domain Survey

Subaru: PFS/NINJA

◆ Science Goals: Co-evolution of galaxy and SMBH

- * Roman's image depth and quality are better suitable for imaging decomposition studies of quasar hosts than Euclid
- * Roman's wide coverage enables statistics of quasar hosts at low-mass end than JWST

(1) Stellar velocity measurements at $z < 2.1$

- Targets from Roman + LSST
- Stellar mass from Roman
- redshift, M_{BH} and σ_* from PFS

Follow-up of Prism/Grism & Narrowband sources

Roman: HL Wide Area Survey + Time Domain Survey

Subaru: PFS/NINJA

◆ Science Goals: Characterization of broad-line sources from Roman's spectroscopic data & HSC narrowband imaging survey

(1) AGN candidates from PRISM/GRISM

- Confirmation of broad-line AGN candidates
- M_{BH} through Balmer & metal line profiles

(2) AGN candidates from narrowband imaging

- AGN would dominate in luminous line emitters

➡ Contribution of broadline AGN to $\text{H}\alpha$ / $\text{Ly}\alpha$ luminosity function

Summary

Significance of Synergy:

- Subaru's wide-field survey power and the unique capability of HSC+PFS+NINJA enable discovery of rare AGN populations (high-z quasar, dusty AGN)
- With Roman's deep sensitivity and high imaging resolution, one can study quasar hosts better than Euclid