

The Ultraviolet Near-Infrared Optical Northern Survey (UNIONS)



A union of international surveys and Hawaiian telescopes

CFIS: Canada France Imaging Survey

- CFHT/MegaCam
- u+r bands

Pan-STARRS:

- PS1 and PS2
- i+z bands

WISHES: Wide Imaging with Subaru HSC of the Euclid Sky (M. Oguri PI)

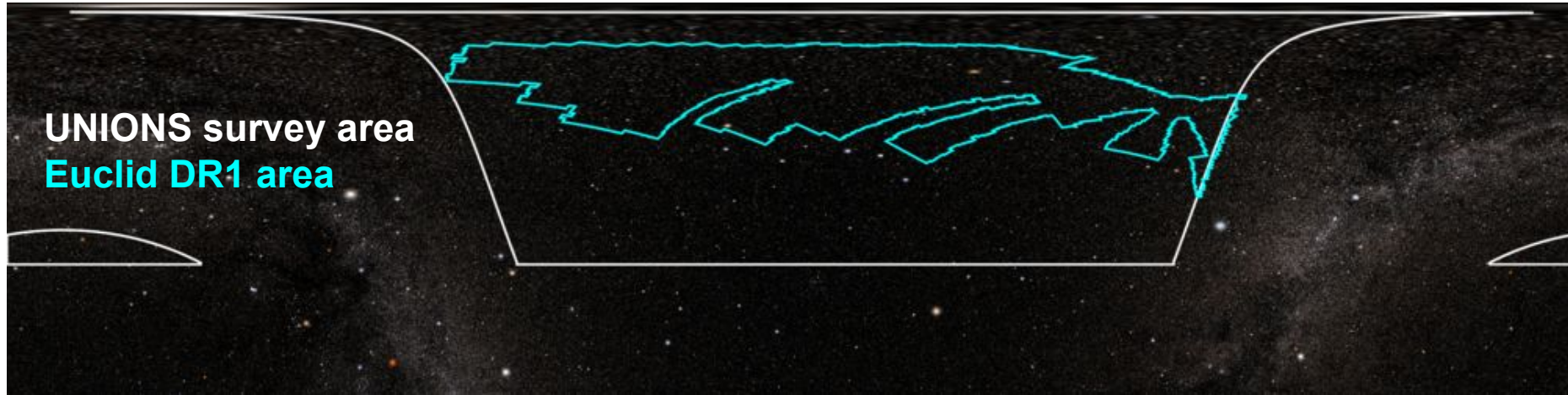
- Subaru/HSC
- z-band

WHIGS: Waterloo Hawaii IfA g-band Survey (combination of Gemini exchange time and IfA time)

- Subaru/HSC
- g-band



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- Survey area is ~5000 square degrees
- Declination >30 (avoid competition with LSST)
- Absolute galactic latitude $|b|>25$ (avoid elevated background / galactic cirrus)
- *ugriz* coverage
- Depth: 24-25 mag

Science topics and highlights from 2023

Galactic archeology

- Stellar streams
- Nearby satellites
- Stellar populations
- Milky Way dynamics

Weak lensing

- Cosmology
- Galaxy evolution
- Large Scale Structure

Support for Euclid

- Photometric redshifts
- PSF calibration

Legacy science

- Galaxy mergers
- Galaxy formation
- AGN
- Dust maps

Faintest known Milky Way satellite

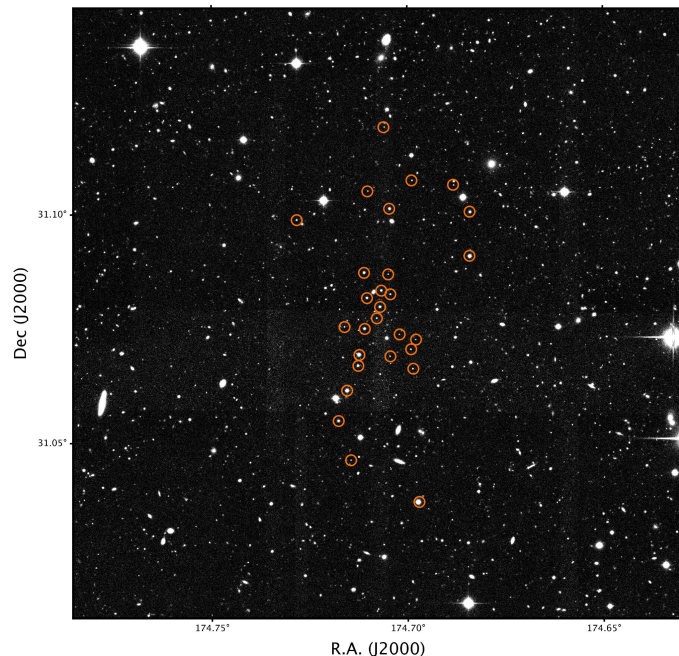
Mass: 16 solar masses

Radius: 3 pc

Metallicity: $[\text{Fe}/\text{H}] \sim -2.2$

Distance: 10 kpc

Absolute magnitude: 2.5



Smith et al. 2024

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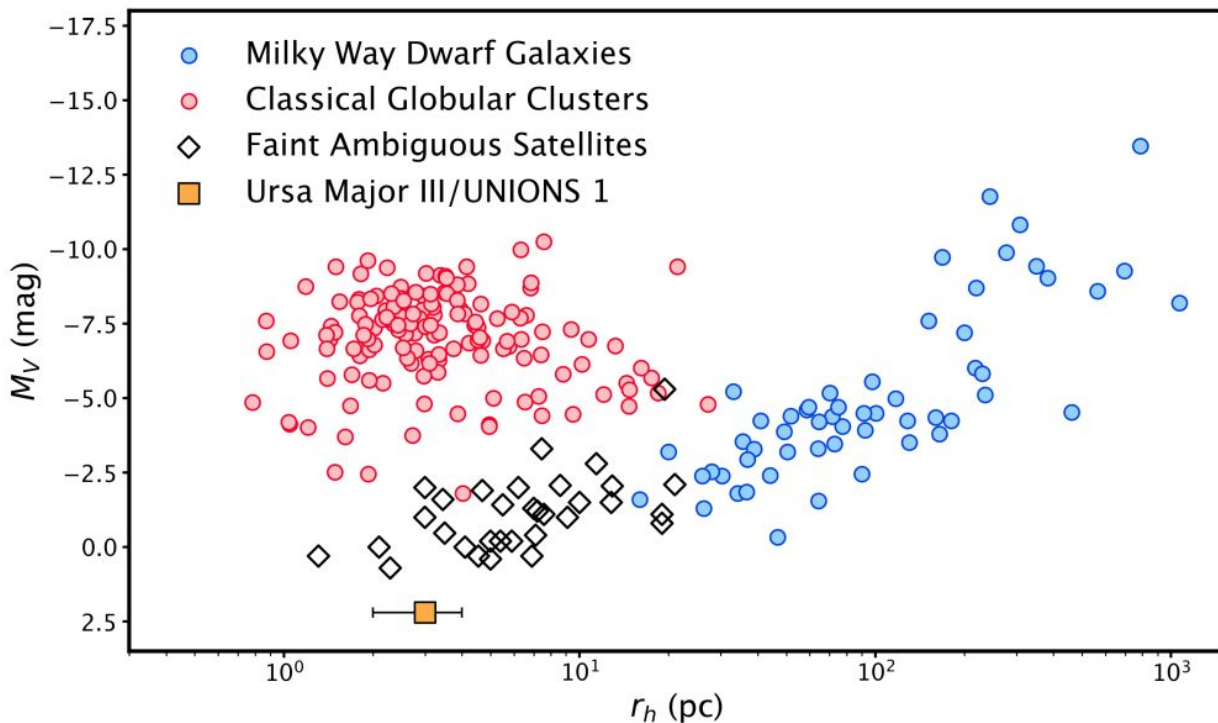
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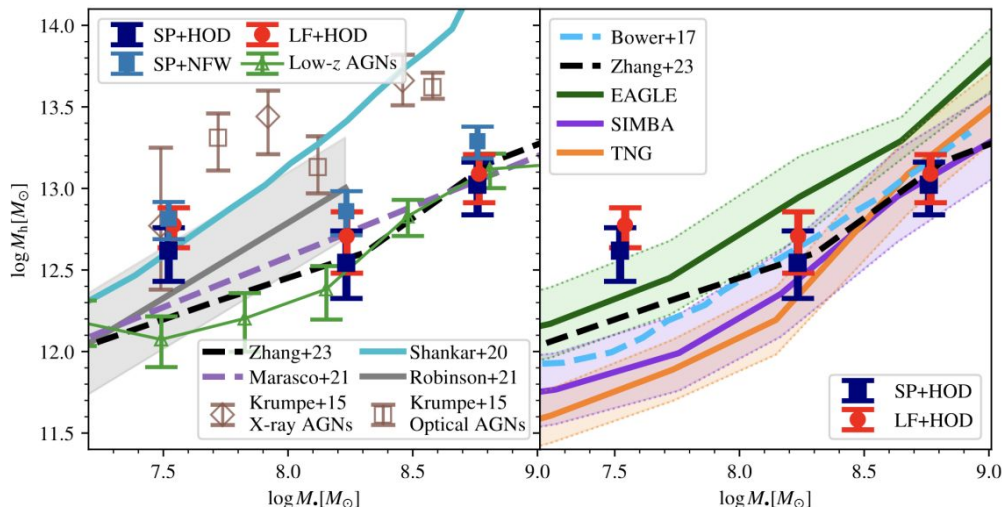
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Relationship between black hole mass and halo mass as measured by weak lensing



Li et al. in preparation

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Euclid launched 2023-07-01

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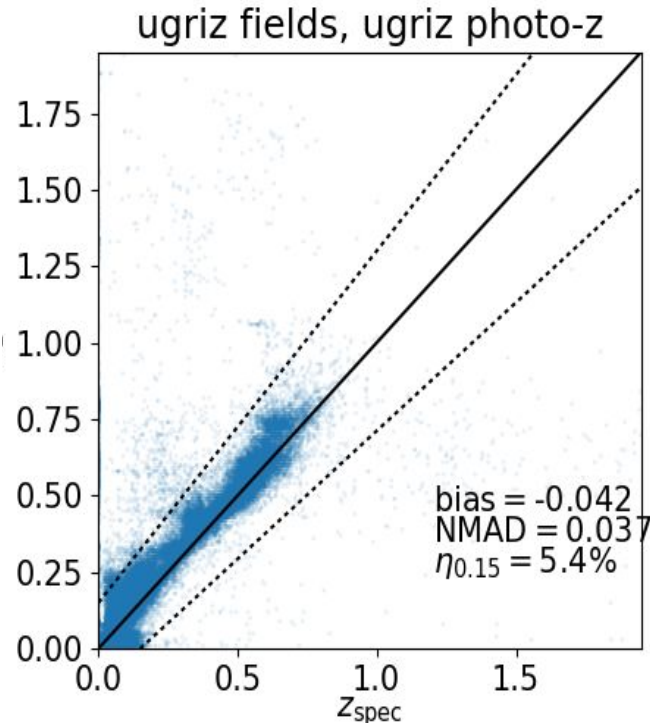
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UNIONS ugriz data needed
for photometric redshifts

Euclid VIS wideband filter
require colour information
to generate PSF models for
each source



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Fraction of Radio Loud AGN at redshifts out to $z=3$.

Weak lensing

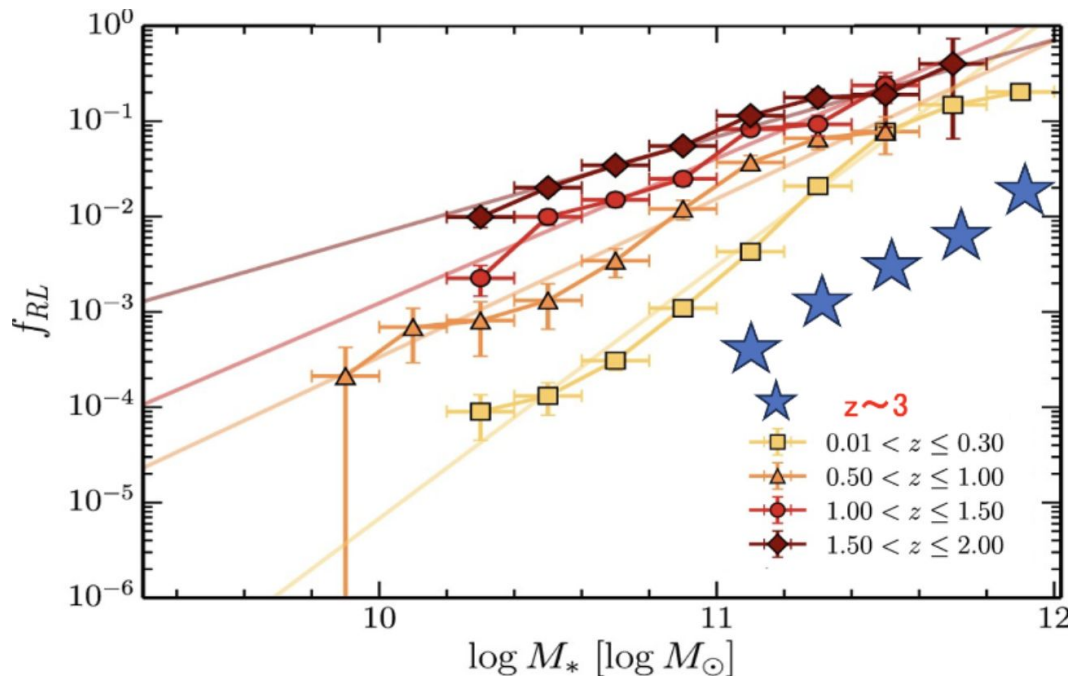
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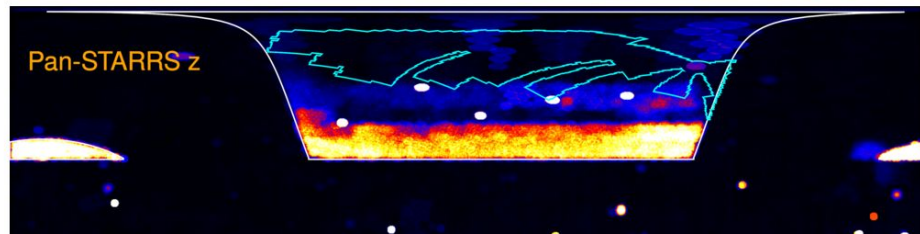
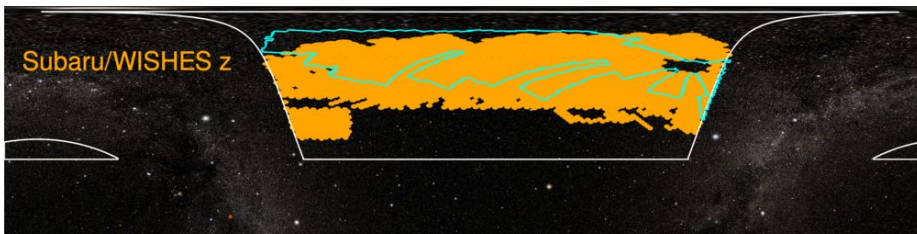
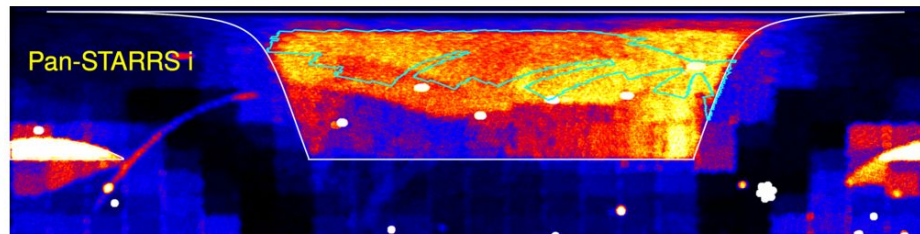
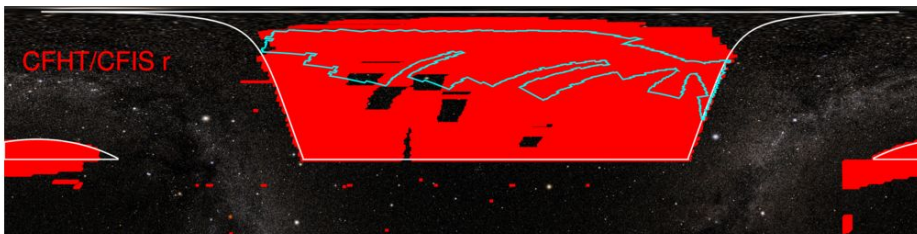
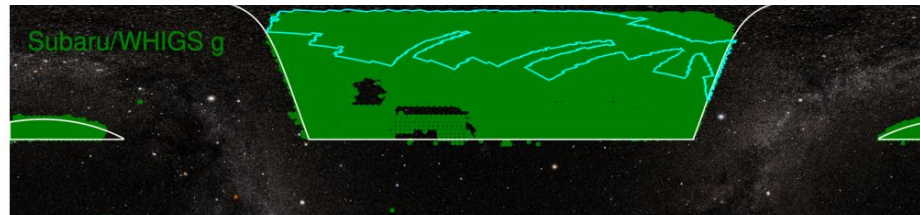
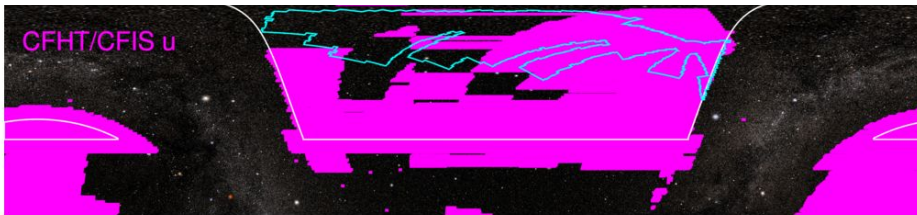
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See Poster P34, Ichikawa et al.

Data acquisition is nearing completion



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- griz should be complete in the Euclid DR1 area in 2024
- Full survey coverage is slightly further behind
- Subaru is the highest performing telescope in UNIONS
 - The Subaru/HSC surveys, despite starting last, will finish first
 - HSC data:
 - smallest as measured in terabytes
 - largest as measured in photons
 - HSC data processing closely follows data acquisition (few weeks delay)
 - CFIS data processing is annual
 - Pan-STARRS processing is once every 2 years

2024 will be the year of UNIONS

- Data acquisition is wrapping up
- Data processing for the individual surveys is very mature
- A merged catalog for the all the surveys is (very) imminent
- The number of papers is starting to accelerate
 - UNIONS overview paper in preparation
- Euclid has launched and we are the only source of multi-band optical data in the north
- LSST is still 2(3?) years away
- UNIONS team meeting this week (first time in Japan)