Photo-z Calibration of Weak Lensing Cosmology with Nancy Grace Roman Space Telescope

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on behalf of Roman cosmology SIT

Weak Lensing Cosmology

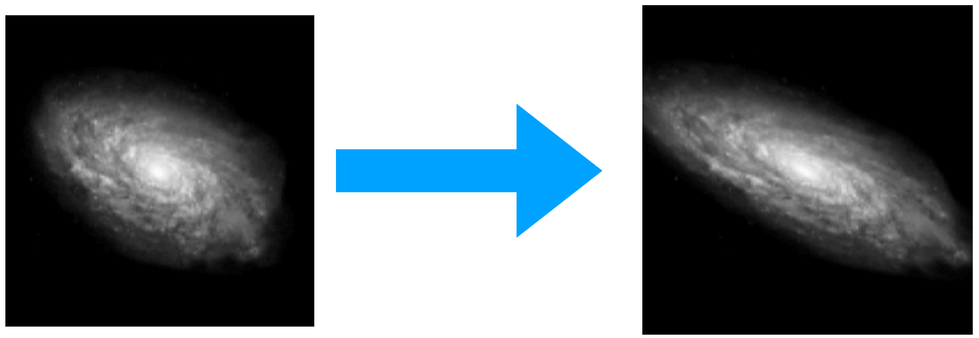
Weak lensing is one of the most powerful probe of cosmology because of its sensitivity to dark matter distribution.

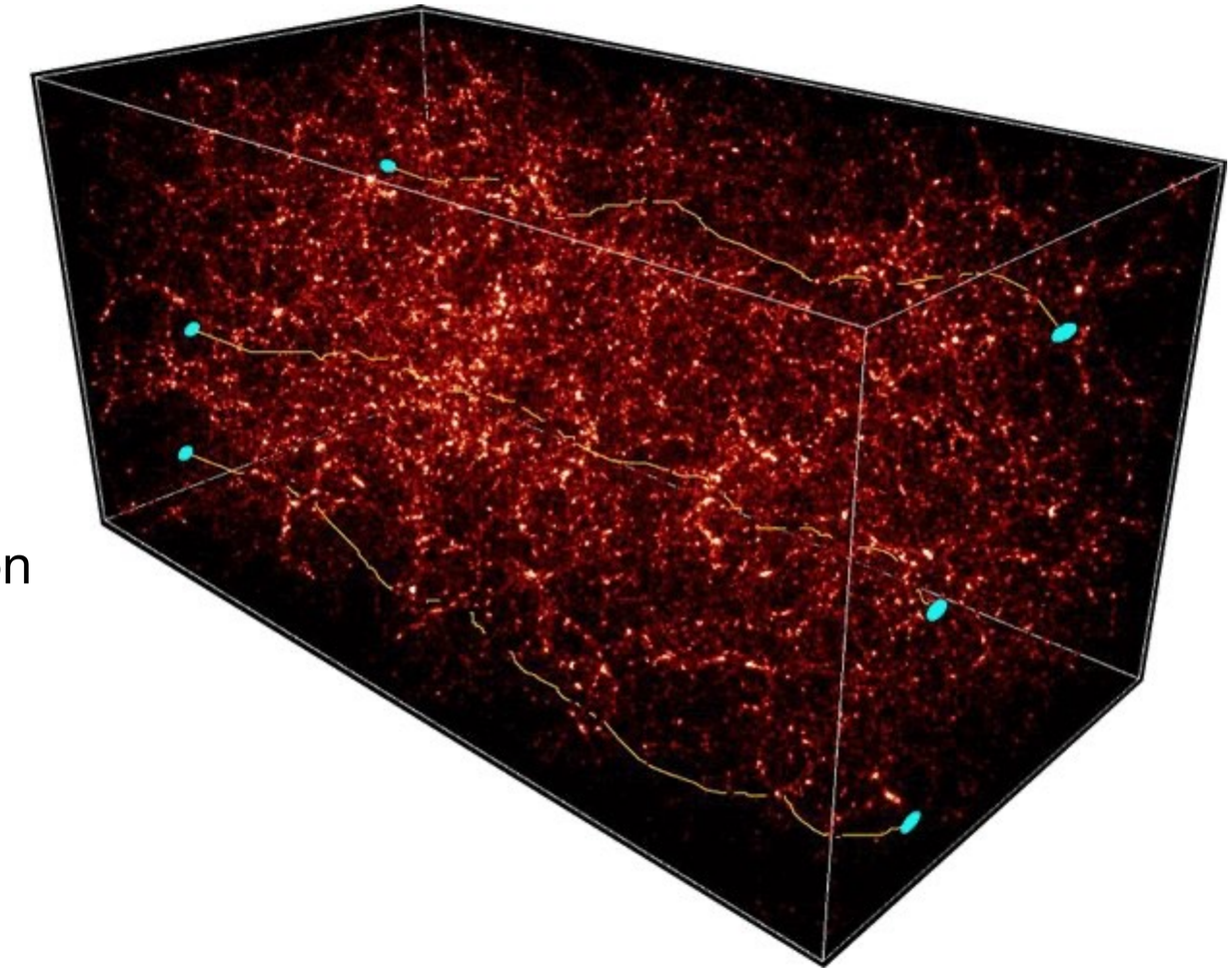
$$\gamma \propto \frac{D_A(z_l, z_s) D_A(z_l)}{D_A(z_s)} \delta(z_l)$$

Weak lensing shear

Geometry of the Universe

Matter density fluctuation



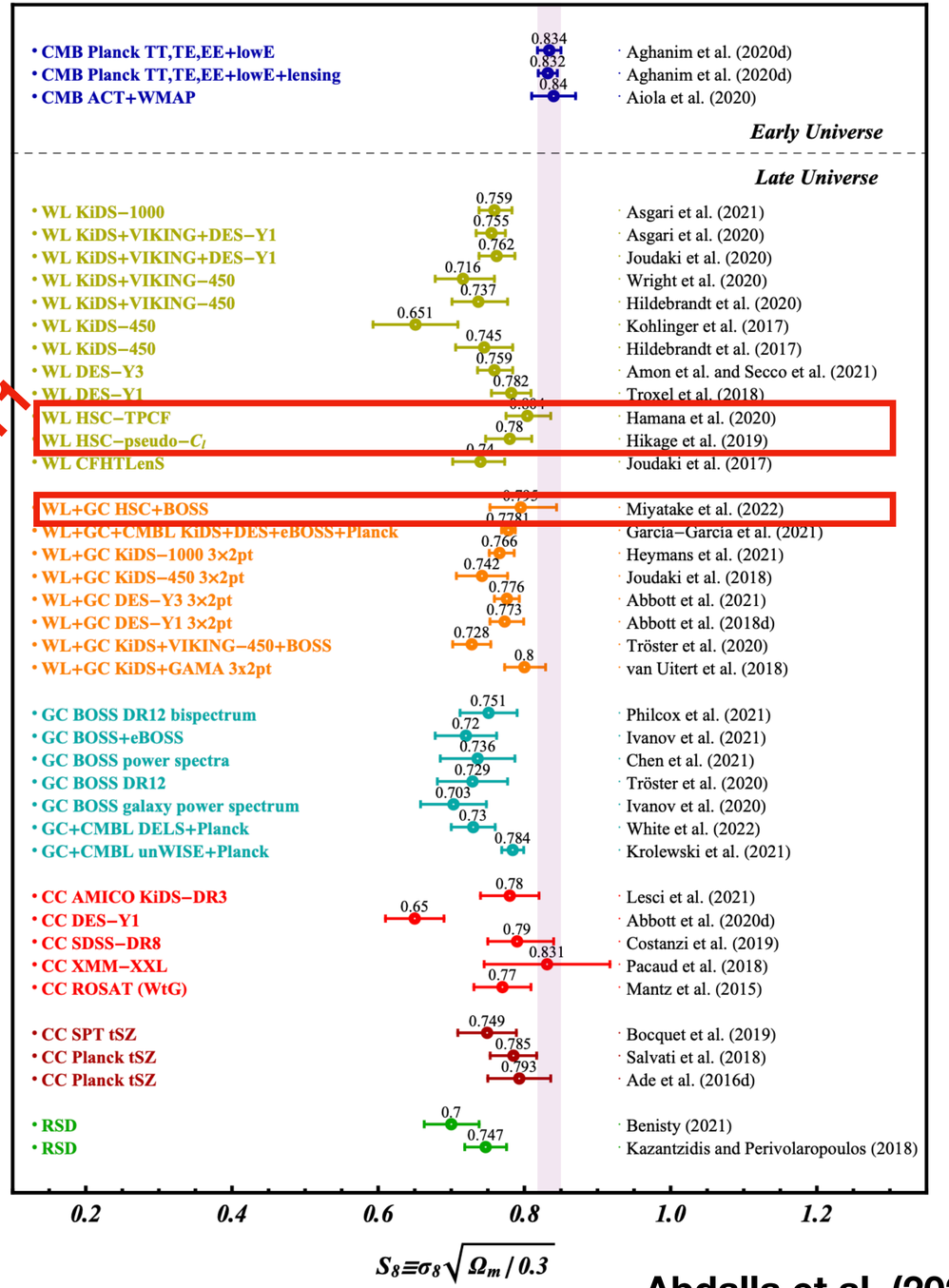


S_8 Tension

Late universe (z<~1) probes (weak lensing, galaxy clustering, cluster count, RSD) consistently yield S_8 (clumpiness of the cosmic structure) smaller than an early universe probe (CMB).

Smoking gun of
the breakdown of ΛCDM?

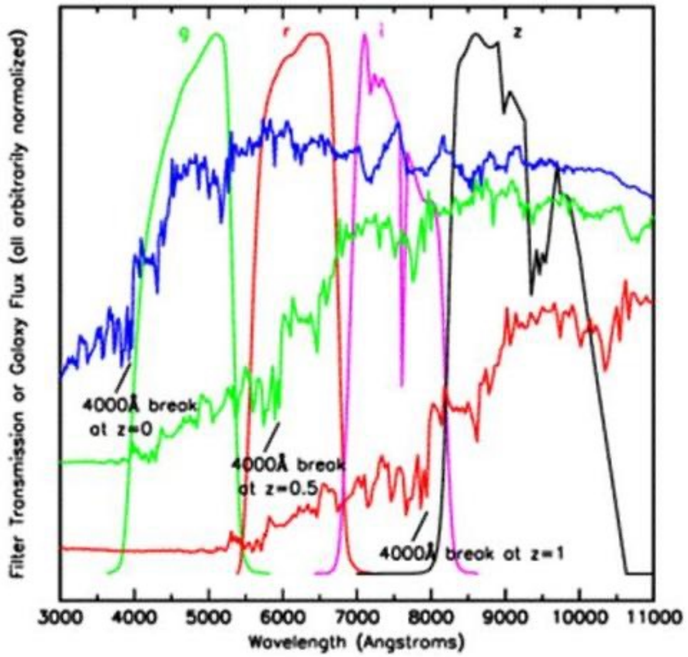
HSC-Y3 cosmology results will be out on Apr 4 JST

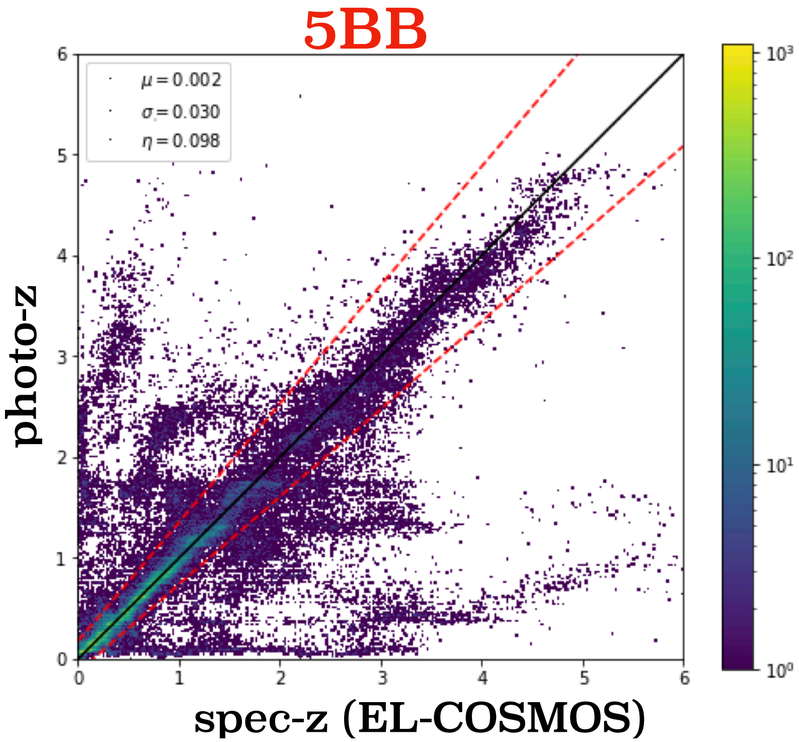


Abdalla et al. (2022)

Photometric Redshift

$$\gamma \propto \frac{D_A(z_l, z_s) D_A(z_l)}{D_A(z_s)} \delta(z_l)$$

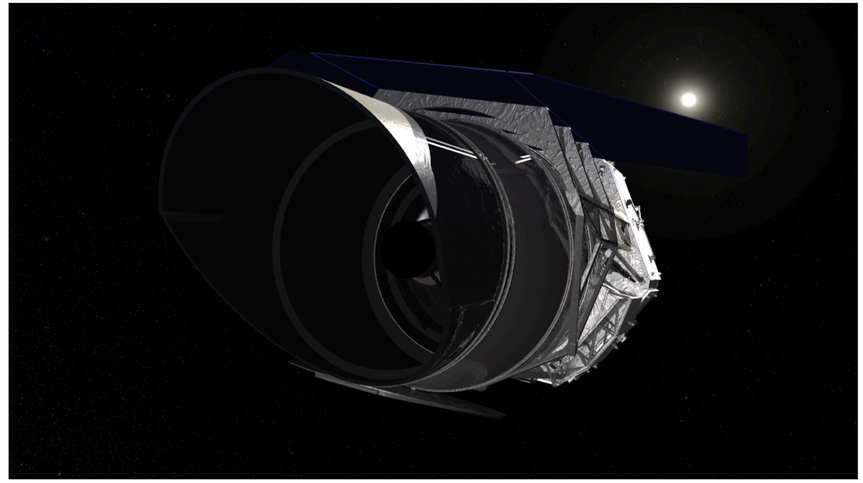




Photometric redshift (photo-z) is one of the largest systematic uncertainties in weak lensing cosmology with Roman HLIS.

Roman-Subaru Synergetic Survey for Photo-z calibration

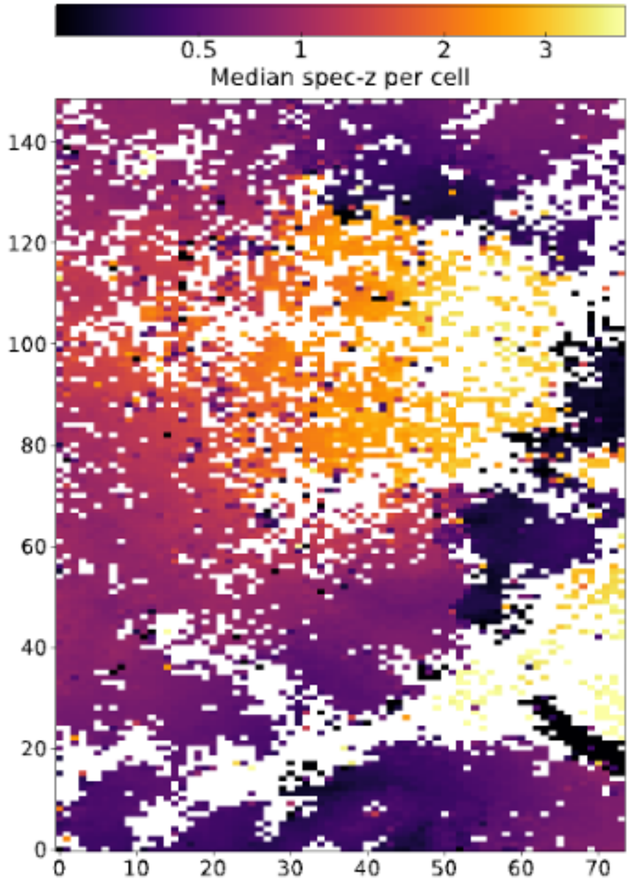
- Having a spec-z calibration sample is crucial for accurate photo-z.
- Currently we are lack of spec-zs in
  - some regions in color space, and
  - faint galaxies.
- Both PFS and HSC can help the calibration.



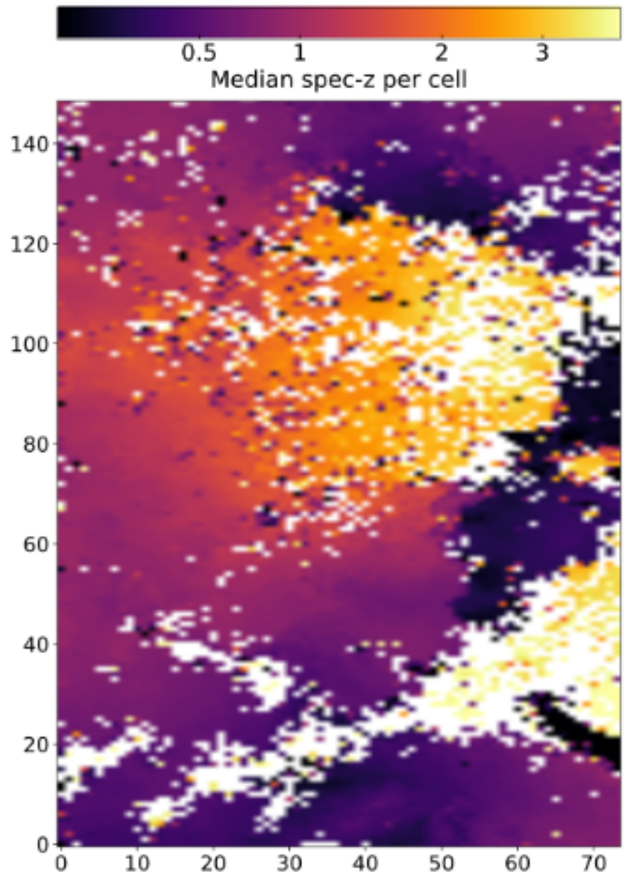
Filling Out Color Space

D. Masters

7 color space (from u to H) reduced in 2-D map by self-organizing map



C3R2 Survey



C3R2 provided spec-zs down to Euclid depth (i~24.5), but Roman is deeper!

Masters et al. (2015, 2017, 2019)

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Summary

- Photo-z calibration is crucial for Roman.
- PFS is the best instrument to obtain spec-z of many faint galaxies because of the light collecting power and high multiplexity.
- HSC-MB can be an alternative to obtain calibration sample for fainter redshift.
- We need to study what is the optimal combination of PFS and HSC-MB.