

Connecting SFG and DH at $z=4-7$ by the Clustering Analysis of Subaru/HSC & Hubble Data

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+ Subaru/HSC Survey team

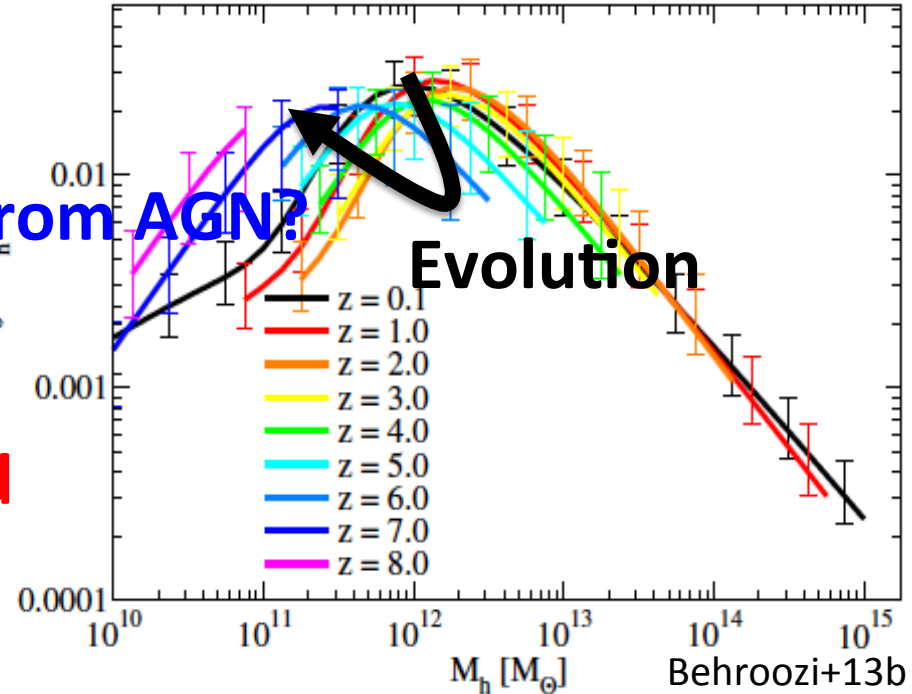
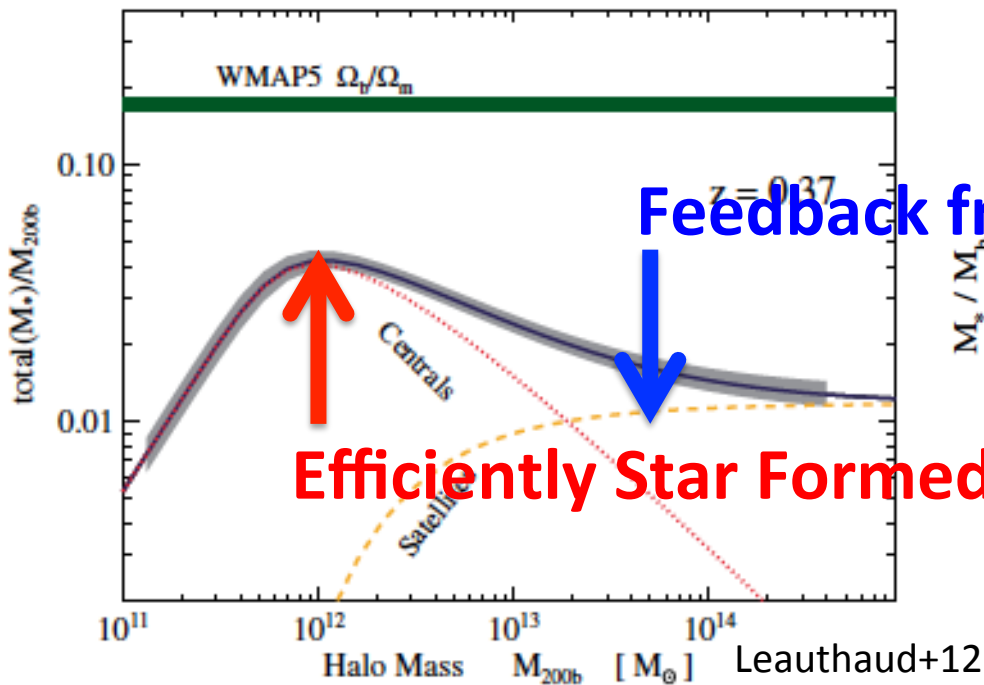
**We deleted the results of HSC data because they
are preliminary.**

Outline

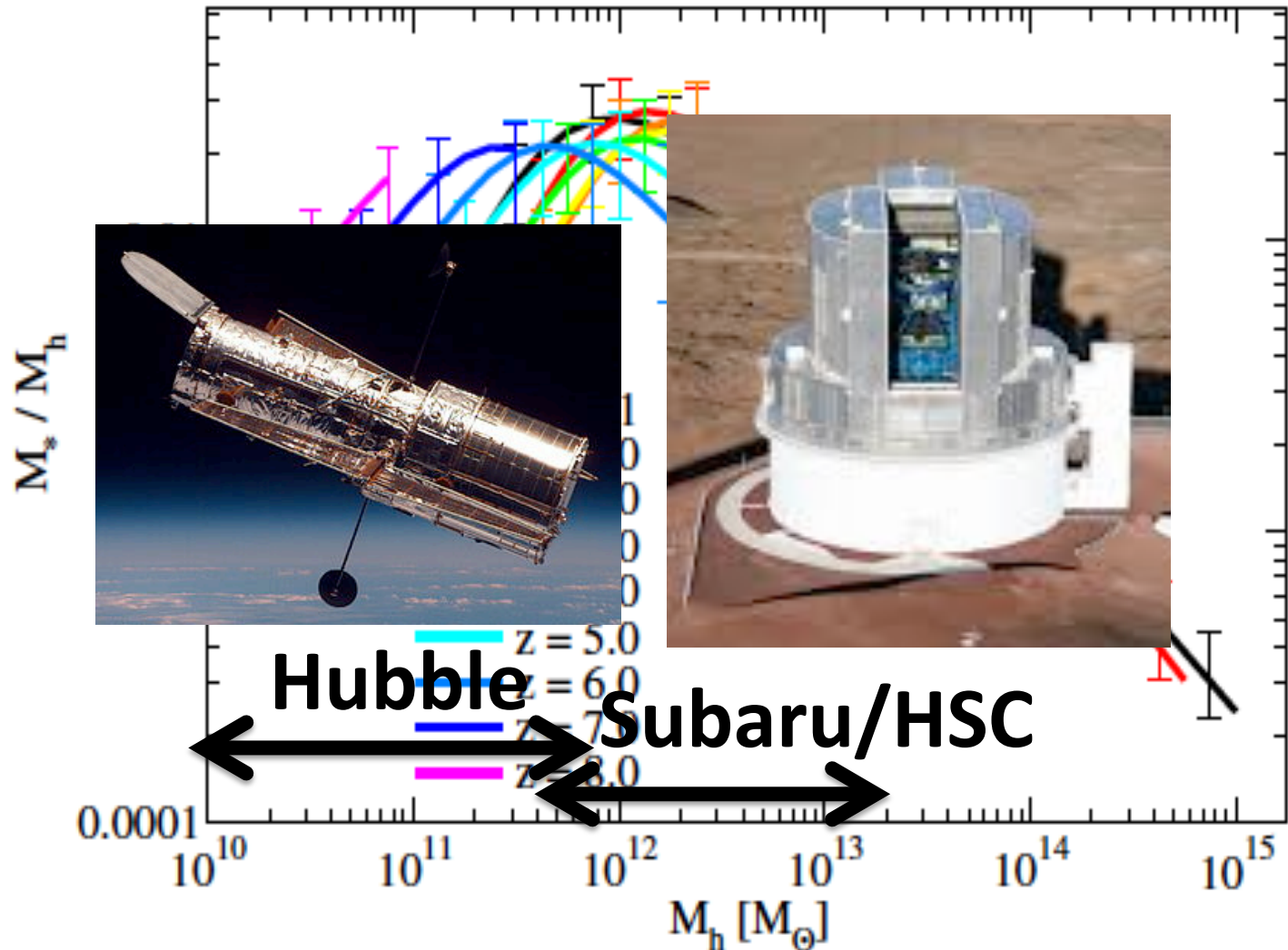
- Introduction of SHMR
- Hubble & HSC Data and LBG Selection
- Clustering Analysis with HOD Model
- Results of Halo Mass, SHMR, BCE
- Future Prospect with HSC

Galaxy-Dark Matter Connection: SHMR

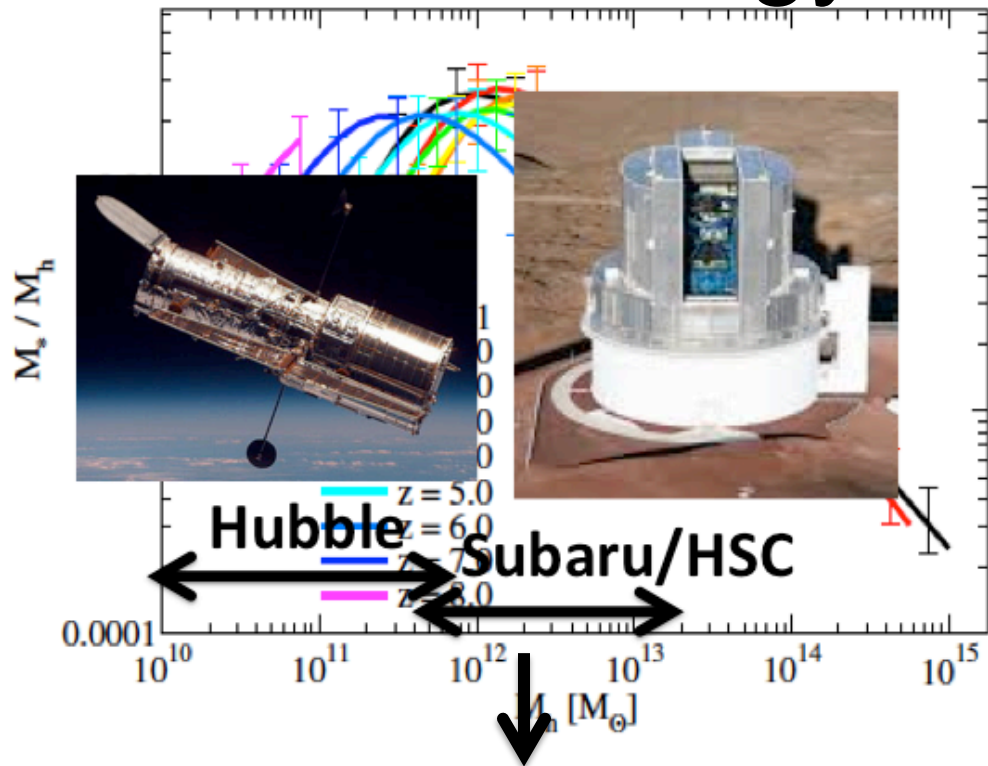
- Stellar-to-halo mass ratio (SHMR= M_*/M_h) can probe galaxy-dark matter connection.
- SHMR @ $z > 2$ is not investigated by galaxy clustering.



Our Strategy



Our Strategy



LARGE sample covering **WIDE** luminosity range

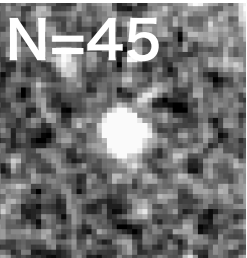
↓ ← Clustering Analysis w/ HOD

SHMR evolution

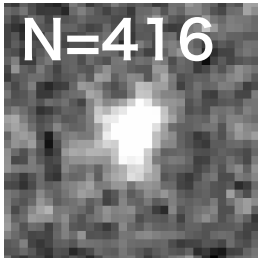
Data & Sample Selection

Lyman break galaxy (LBG) selection @ $z \sim 4, 5, 6, 7$

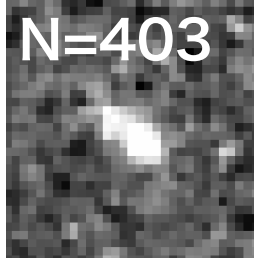
UDF12



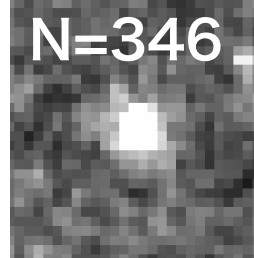
AEGIS



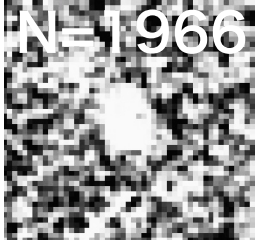
COSMOS



UDS



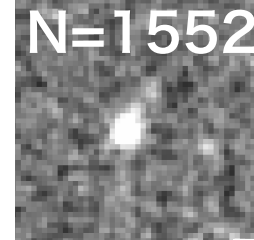
GN-Deep



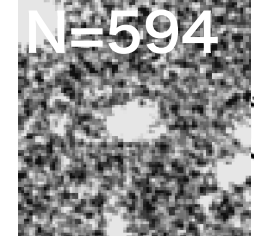
GN-Wide



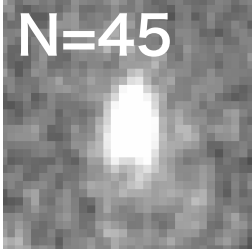
GS-Deep



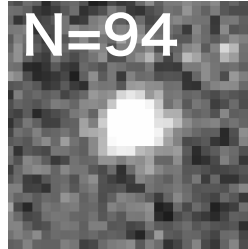
GS-Wide



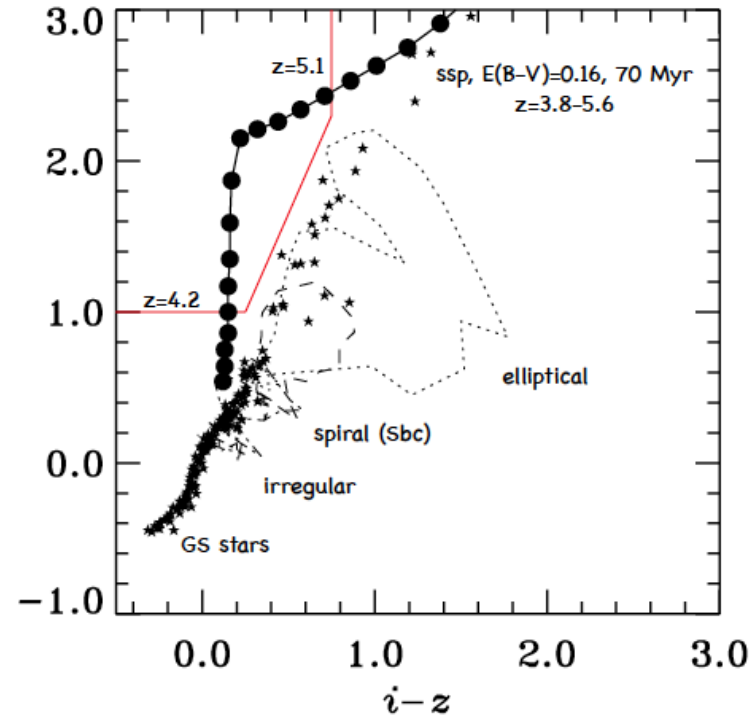
HFF-A2744P



HFF-M0416P



$z \sim 5$ selection

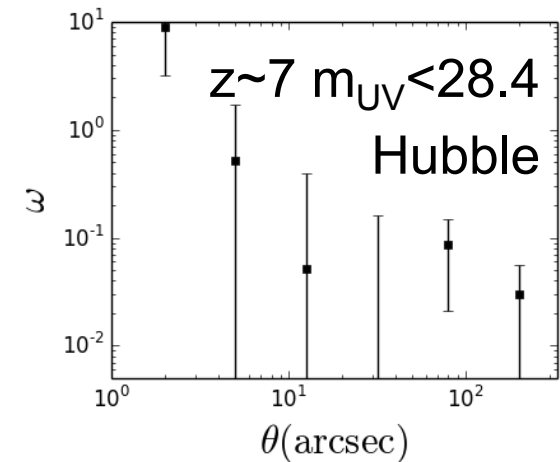
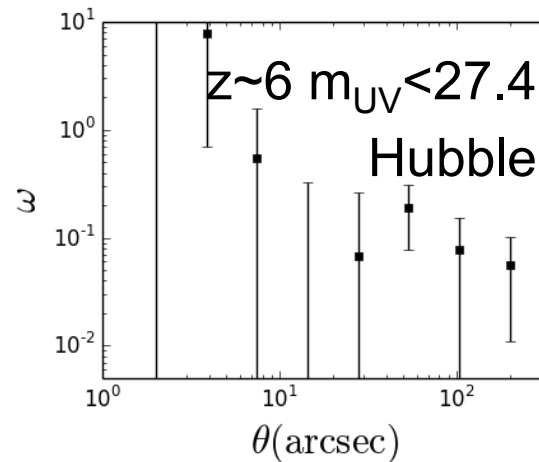
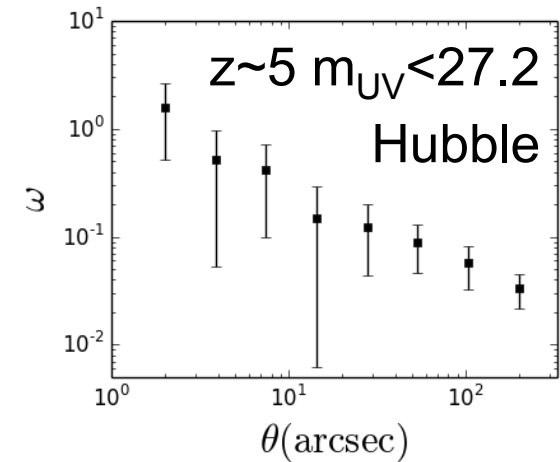
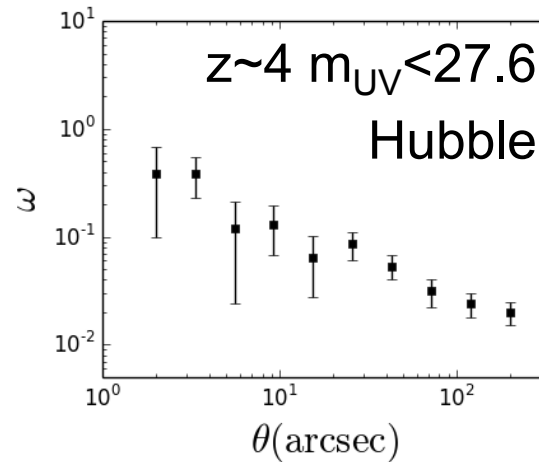


Ono, Y. in prep

Total of ~ 6500 LBGs @ $z=4-7$!!

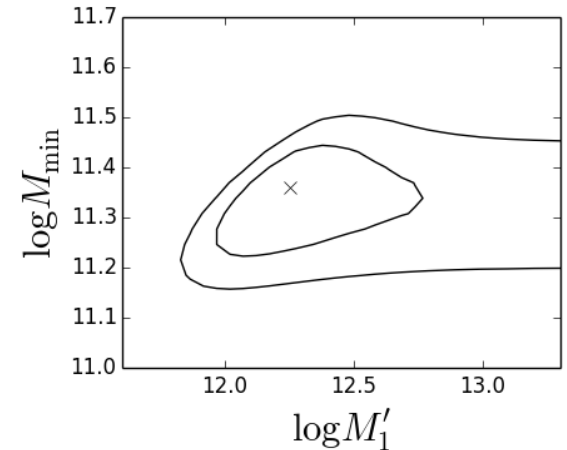
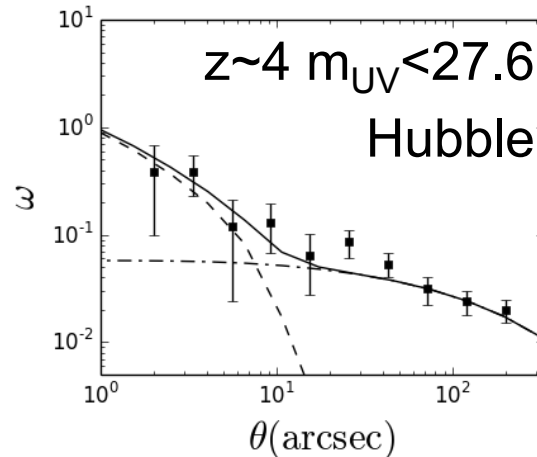
Clustering Analysis w/ HOD Model

Calculate Angular Correlation Function in Each Sample Bin



Clustering Analysis w/ HOD Model

Calculate Angular Correlation Function in Each Sample Bin



Fit w/ Halo Occupation Distribution (HOD) Model Prediction



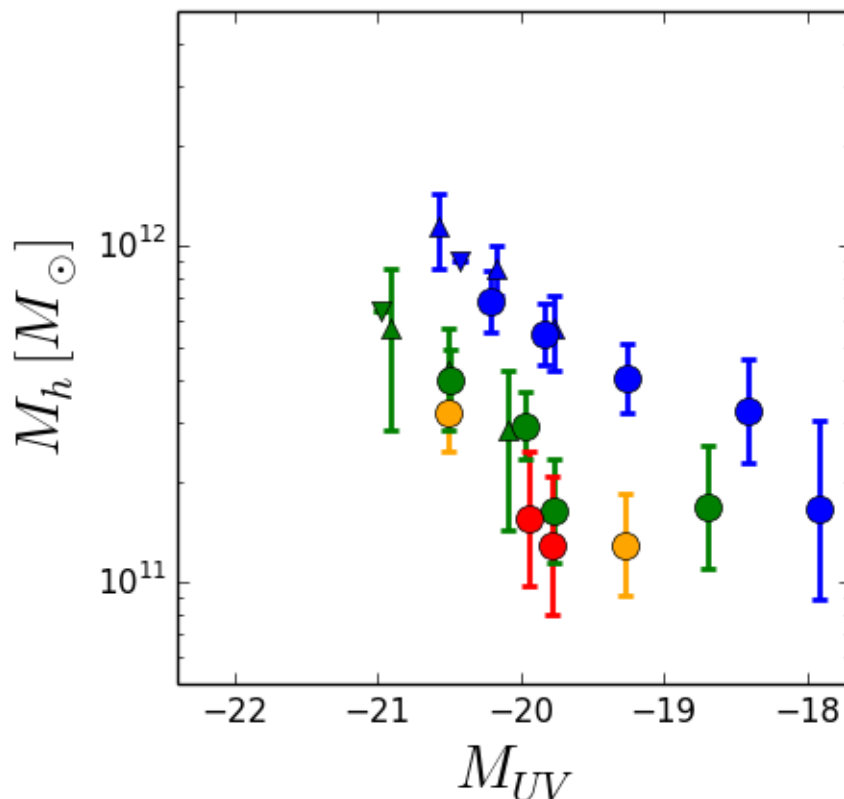
$$P_g^{1h} = \frac{1}{n_g^2} \int dM \left[N_s(M)N_s(M)u^2(k, M) + 2N_s(M)N_c(M)u(k, M) \right] \frac{dn}{dM}(M, z)$$

$$P_g^{2h} = P_m(k, z) \left[\frac{1}{n_g} \int dM N(M) \frac{dn}{dM}(M, z) b_h(M, z) u(k, M) \right]^2$$

Estimate Dark Halo Mass

Results: Dark Halo Mass

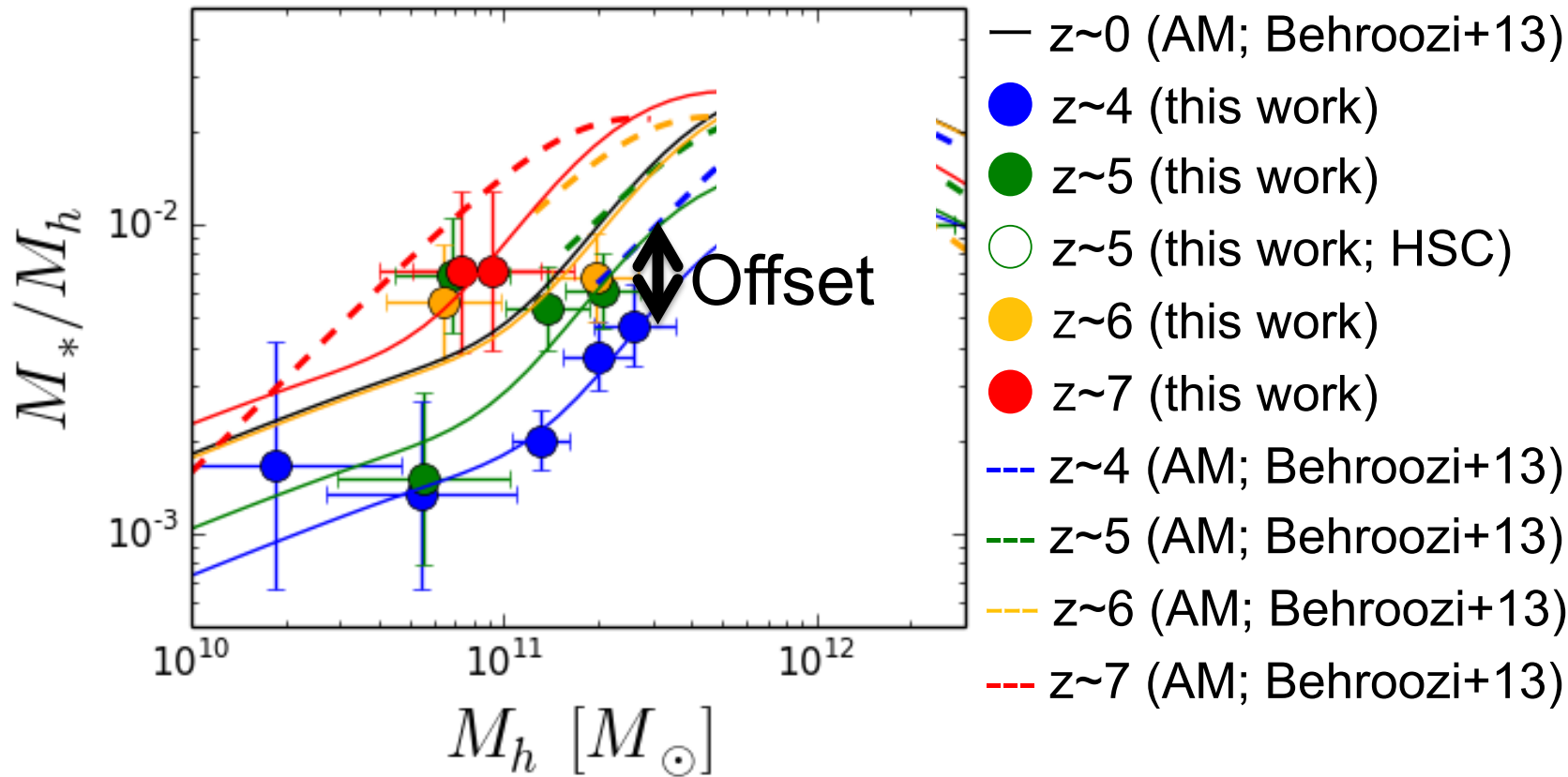
- Dark halo mass is consistent with previous clustering results (Lee+06, Hamana+04).



- z~4 (this work)
- z~5 (this work)
- z~5 (this work; HSC)
- z~6 (this work)
- z~7 (this work)
- ▲ z~4 (Lee+06)
- ▲ z~5 (Lee+06)
- ▼ z~4 (Hamana+04)
- ▼ z~5 (Hamana+04)

*Hamana+04 provides no error about M_h in paper

Results: SHMR



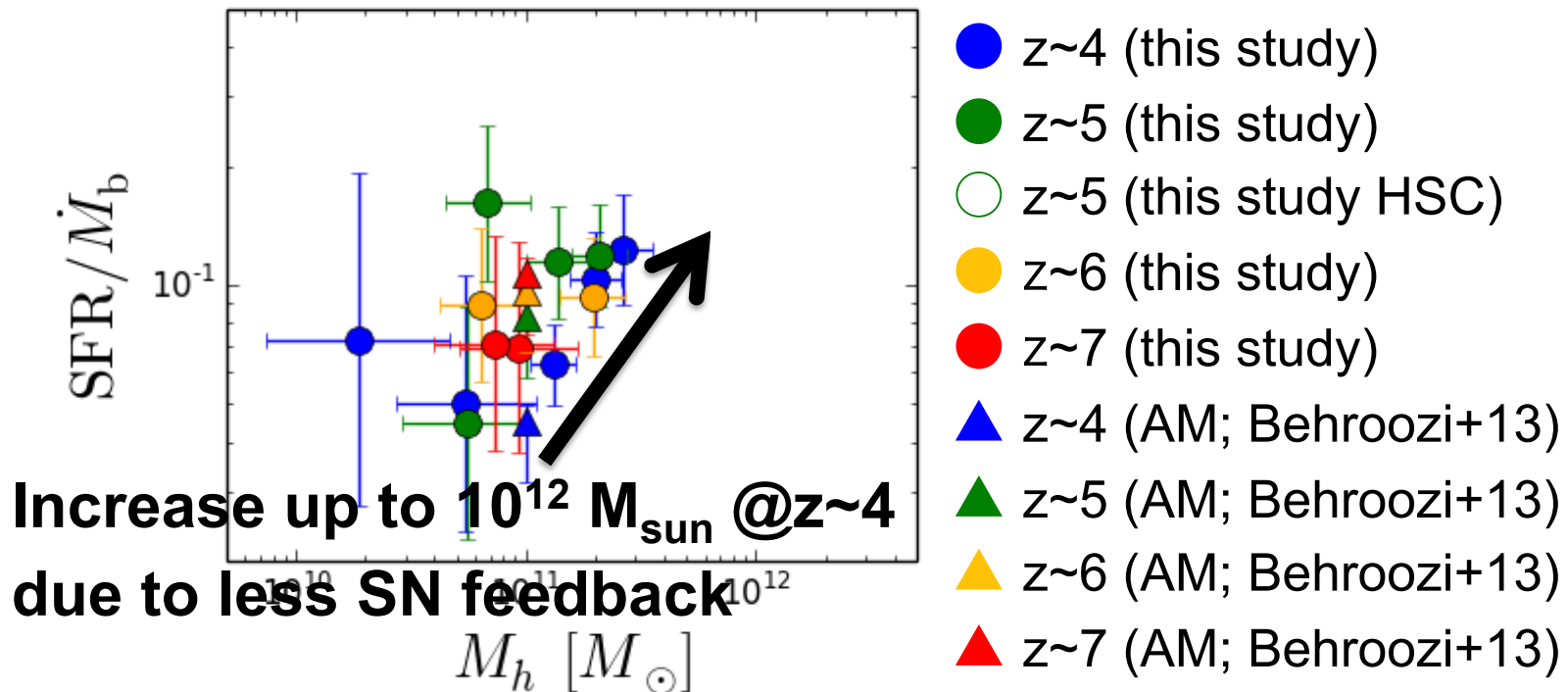
- Decrease from $z \sim 0$ to $z \sim 4$.
- Increase from $z \sim 4$ to $z \sim 7$?
- SHMR evolution confirmed by clustering.
- Offset: cosmological parameter, stellar mass estimate

Results: Baryon Conversion Efficiency

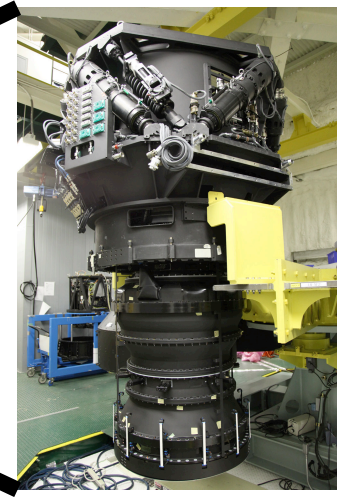
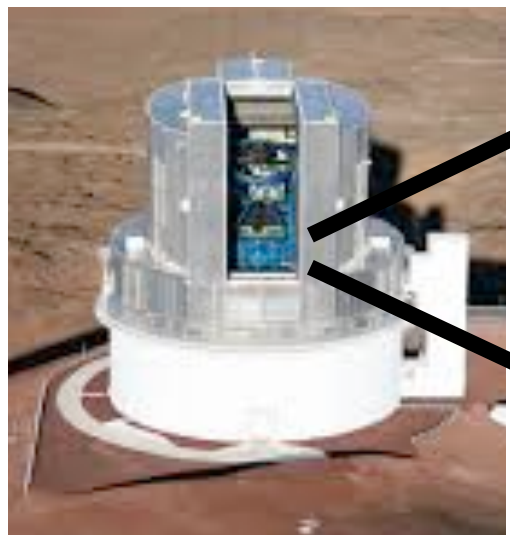
Baryon conversion efficiency (BCE) = SFR/\dot{M}_b

$$\dot{M}_b = f_b \dot{M}_h \quad f_b = \Omega_b / \Omega_m$$

\dot{M}_h is calculated by N-body simulation results
(we use the formulation in Behroozi+13).

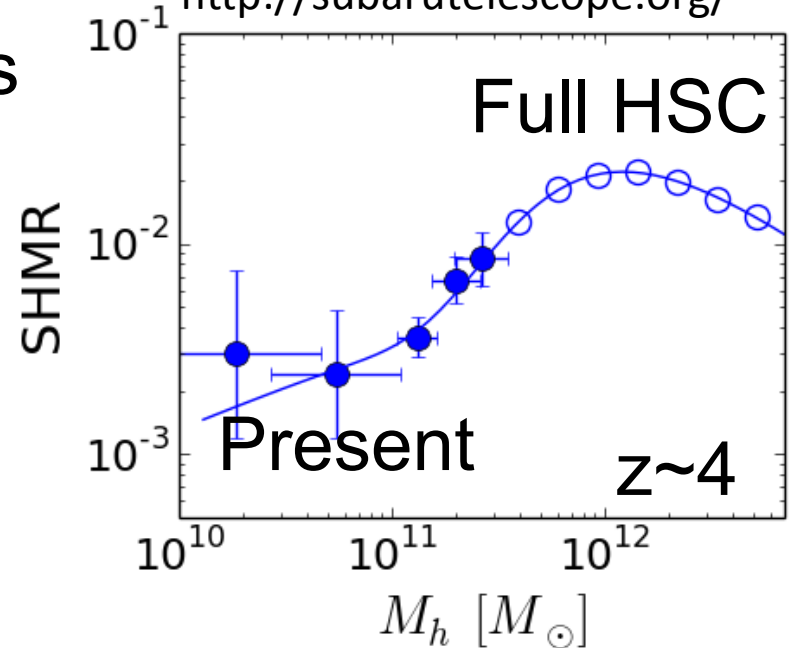
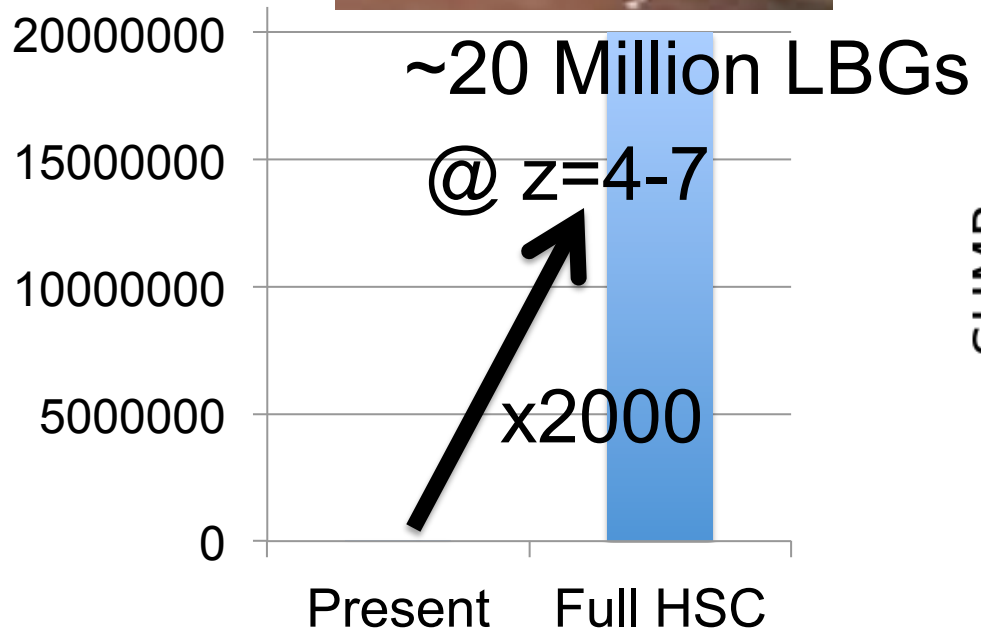


Future Prospects



HSC

<http://subarutelescope.org/>



Summary

The SHMR evolution is confirmed by the clustering.

SHMR decreases @ $z \sim 0 \rightarrow 4$ and increases @ $z \sim 4 \rightarrow 7$.

BCE increases with increasing M_h up to $10^{12} M_{\text{sun}}$ $z \sim 4$.

Star formation is more efficient at higher halo mass due to less SN feedback.

