

Optical surveys of clusters of galaxies

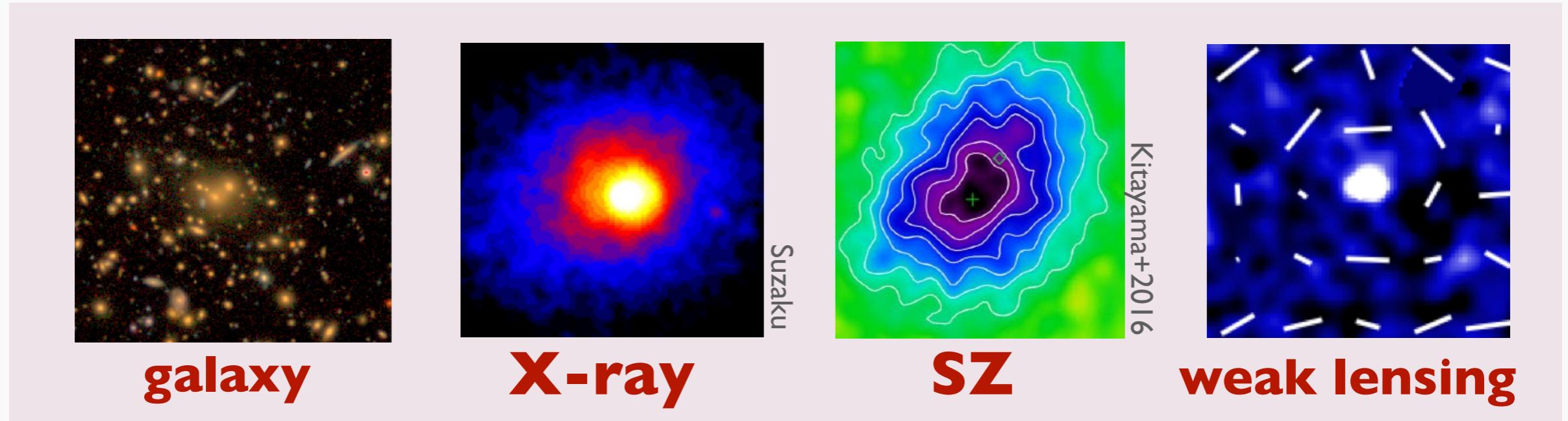
Masamune Oguri
(Center for Frontier Science, Chiba U.)



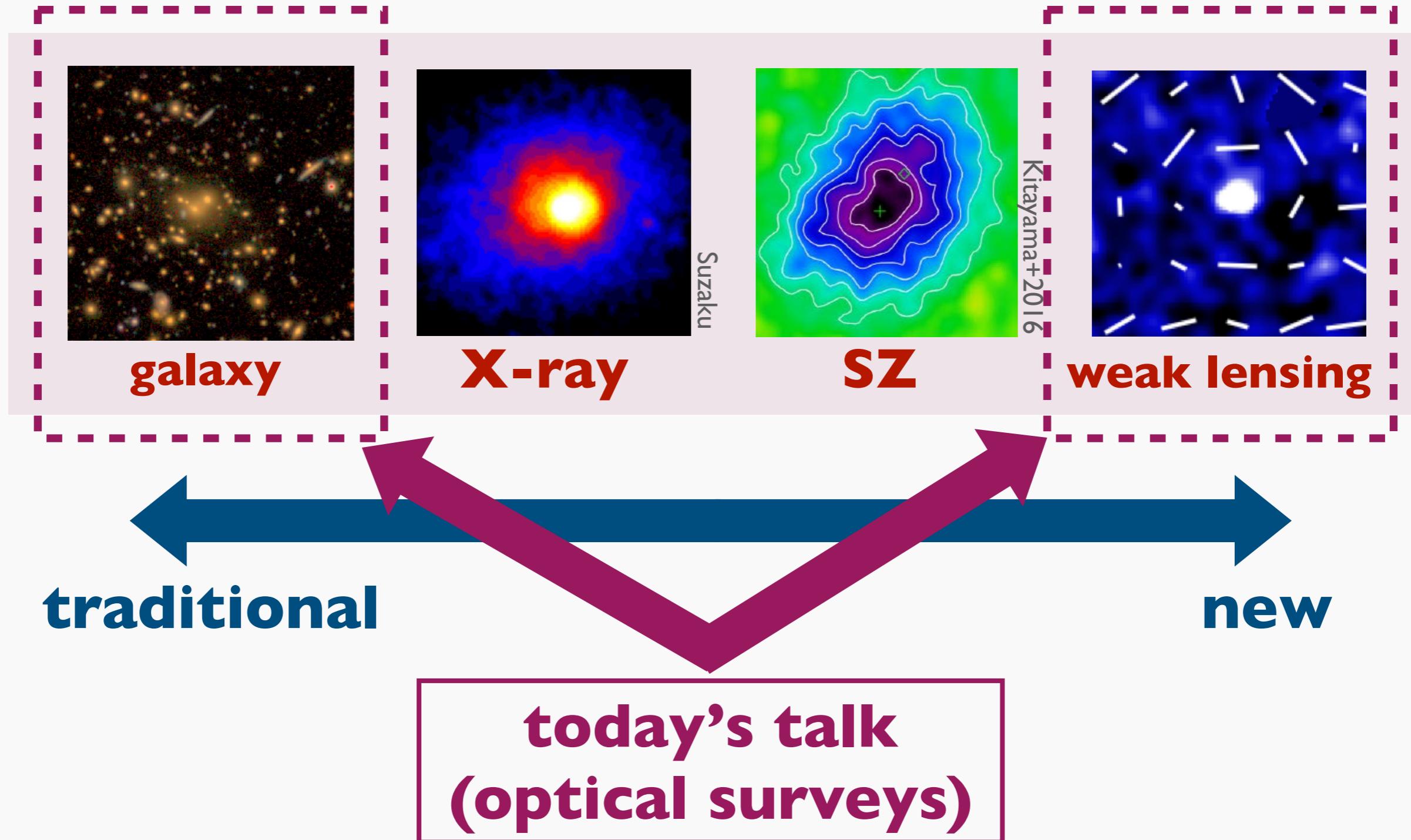
CHIBA
UNIVERSITY

2022/4/26 Galaxy Cluster 2022@STScI

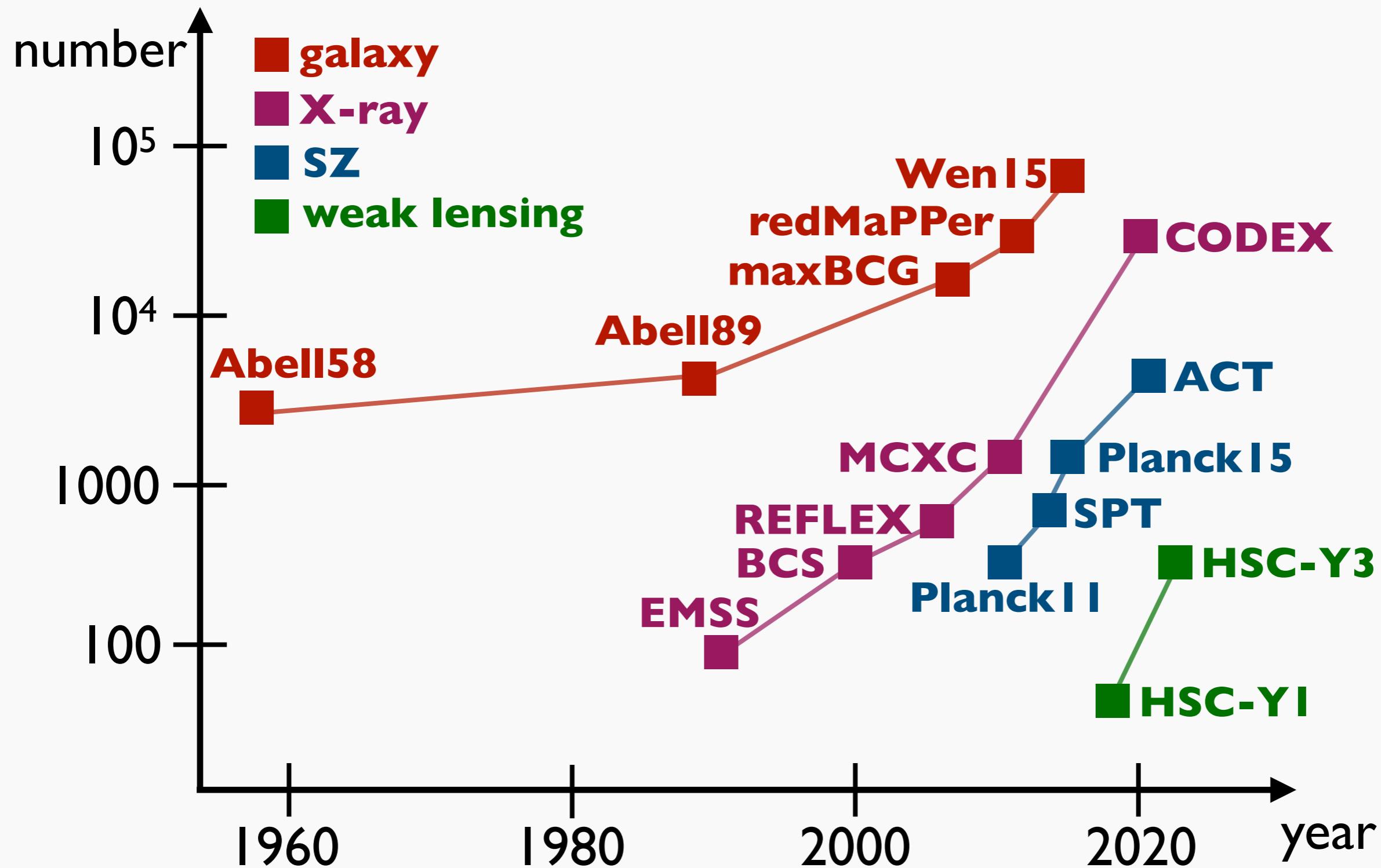
Searching for cluster of galaxies



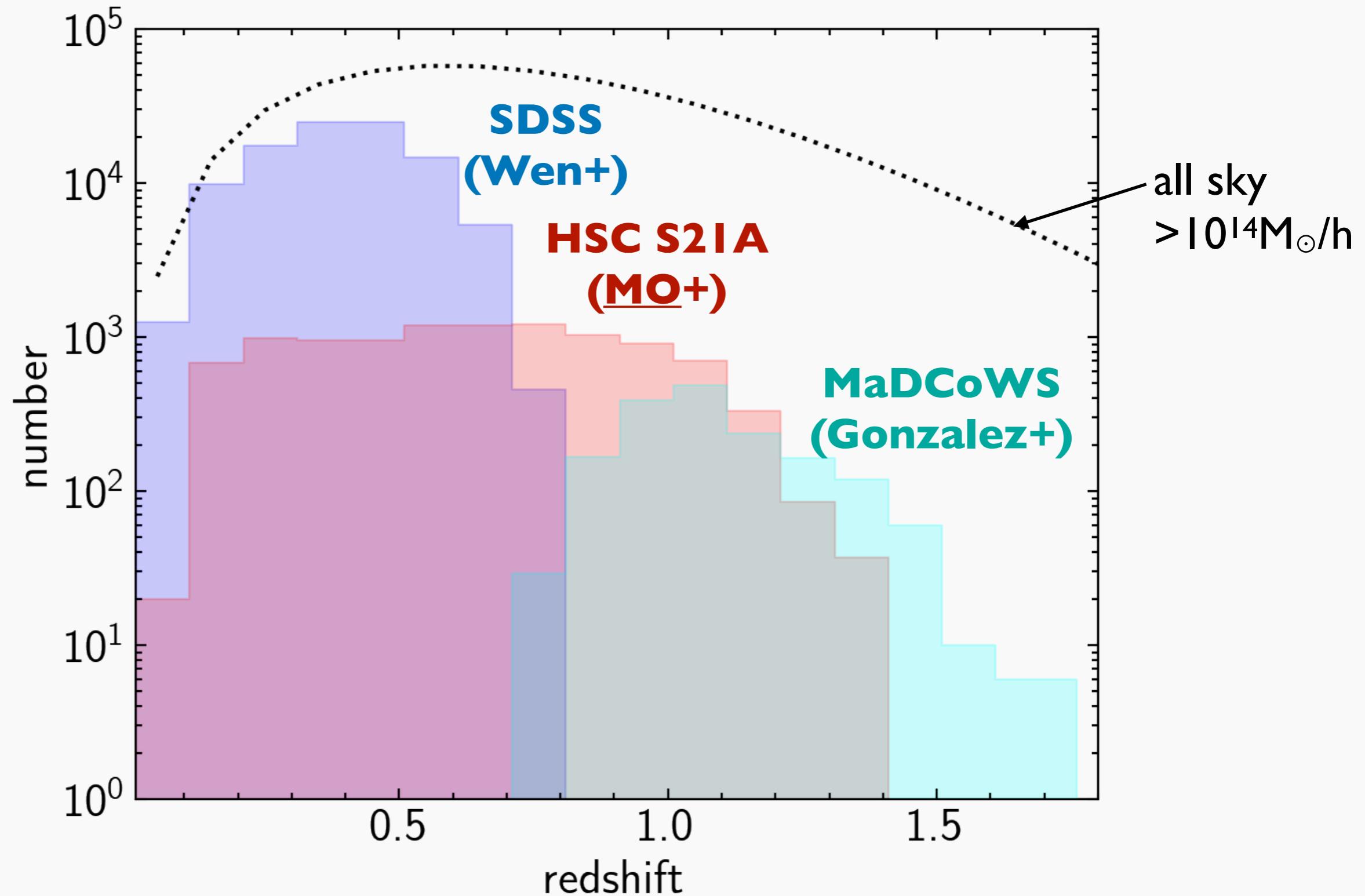
Searching for cluster of galaxies



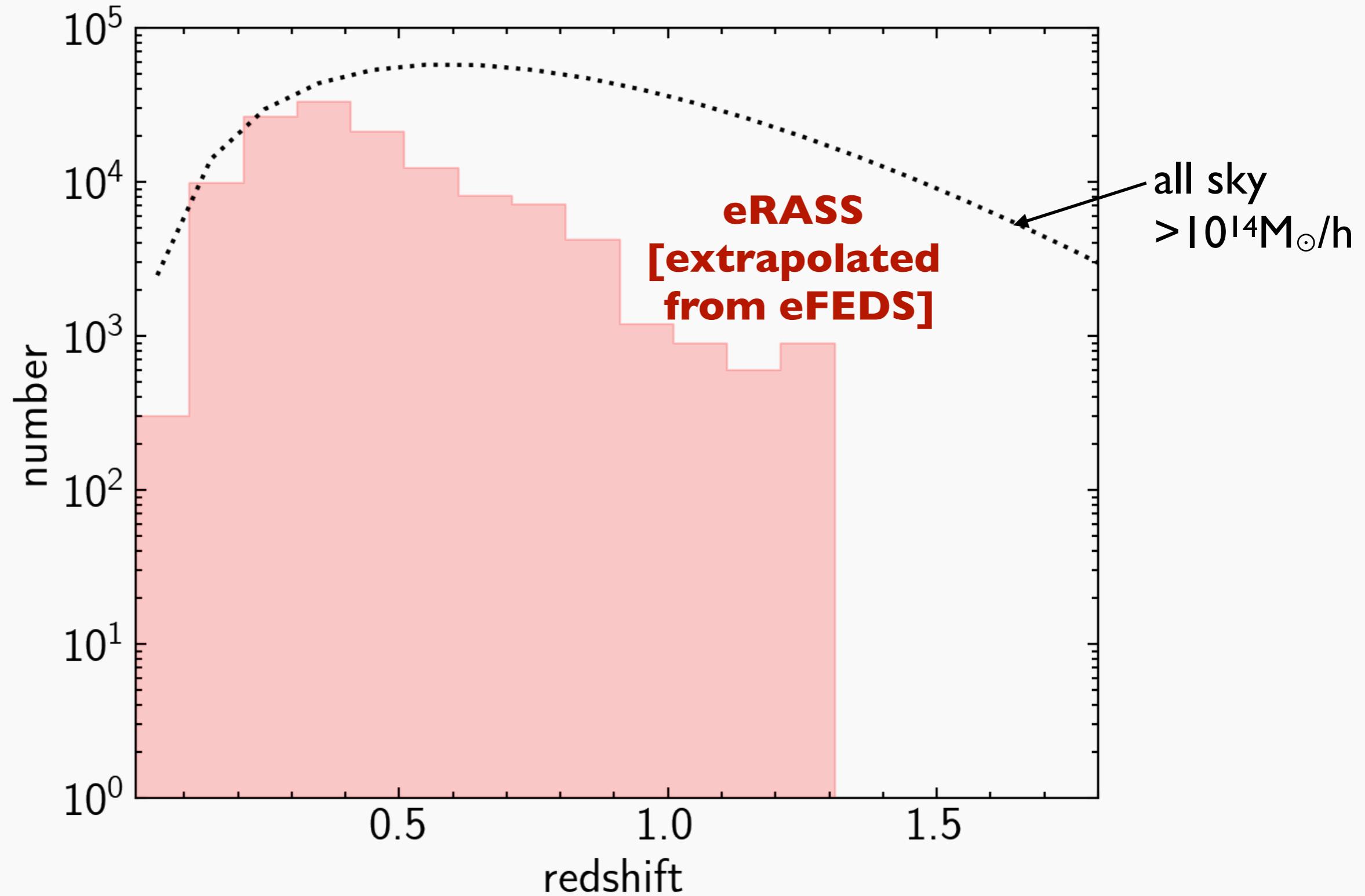
Cluster samples: history



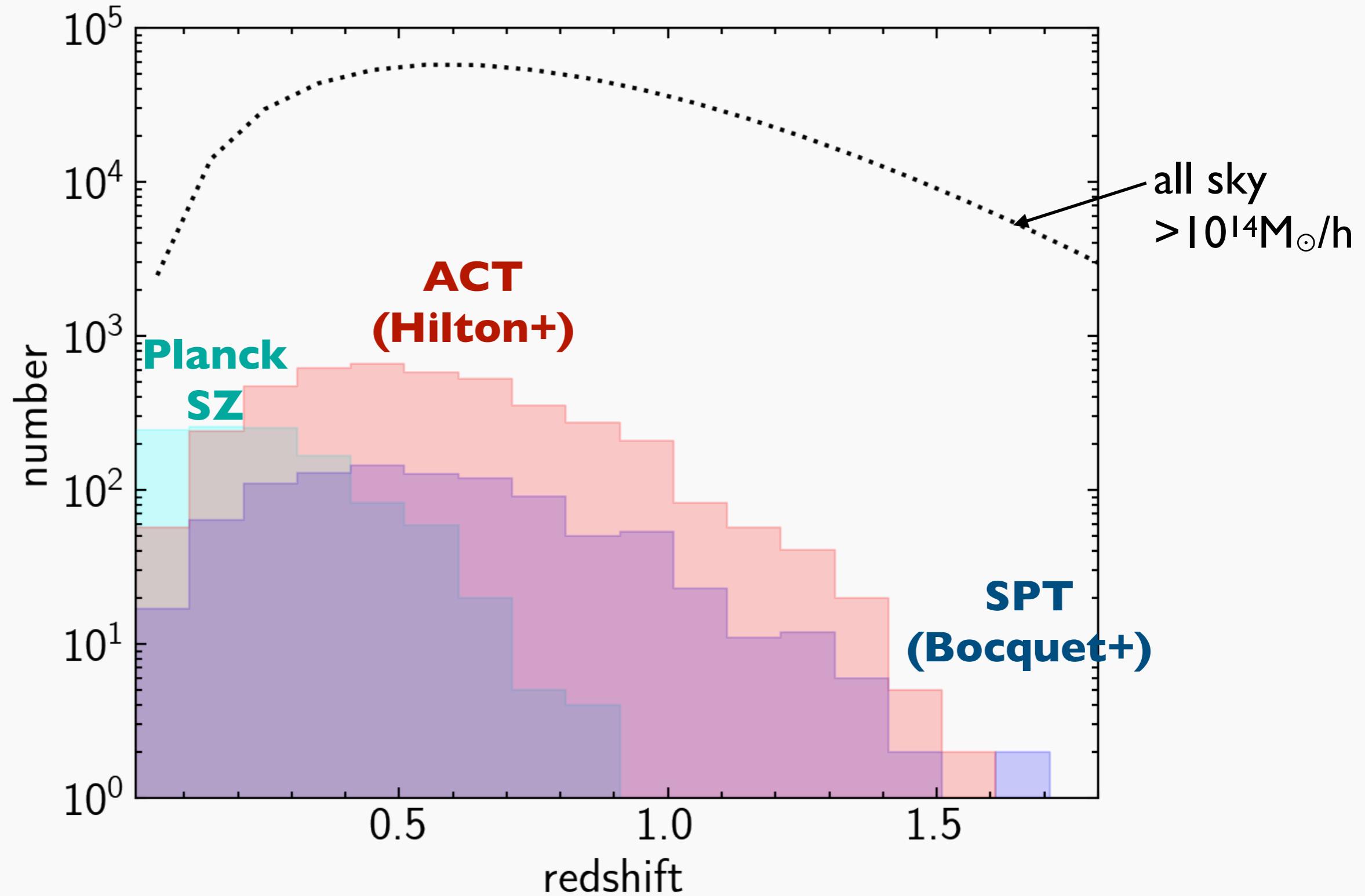
Galaxy-selected clusters



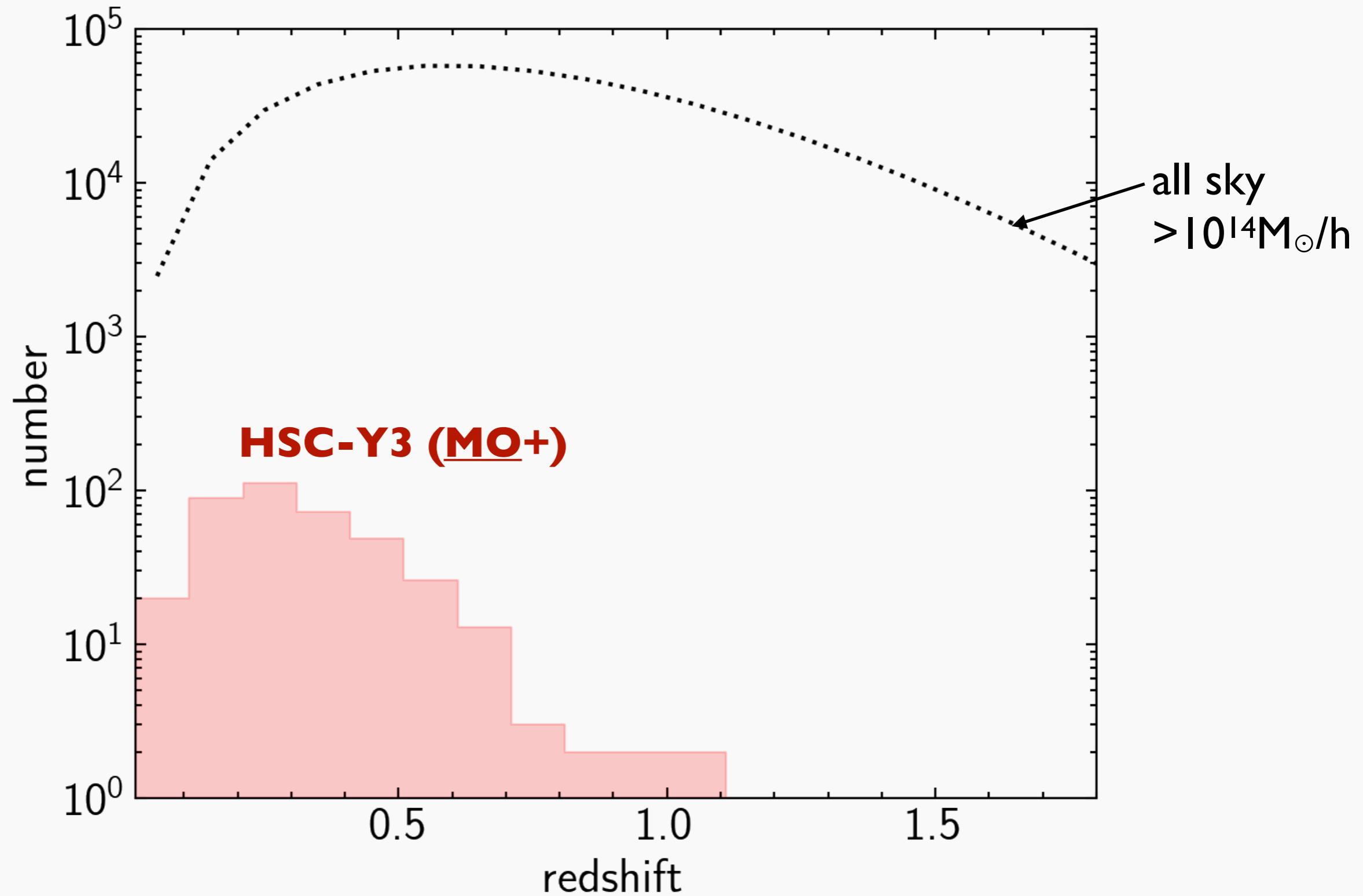
X-ray-selected clusters



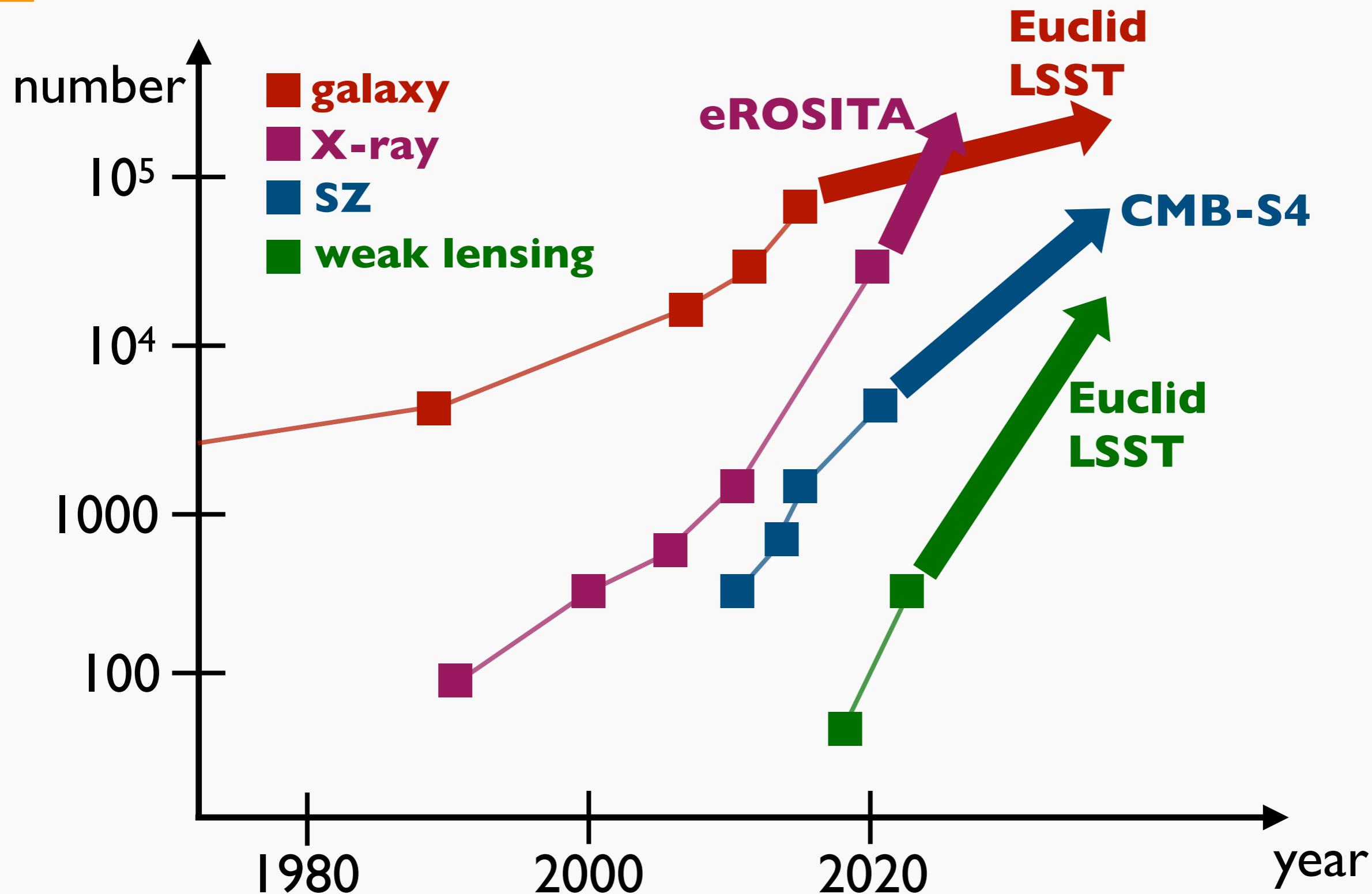
SZ-selected clusters



Weak-lensing-selected clusters



Future prospect



also talks by **Yen-Ting Lin**
and **Michael Strauss**

Subaru HSC-SSP survey

- one of stage-III dark energy surveys



KiDS (2012-2019)

1500 deg^2 , $r_{\text{lim}} \sim 25$

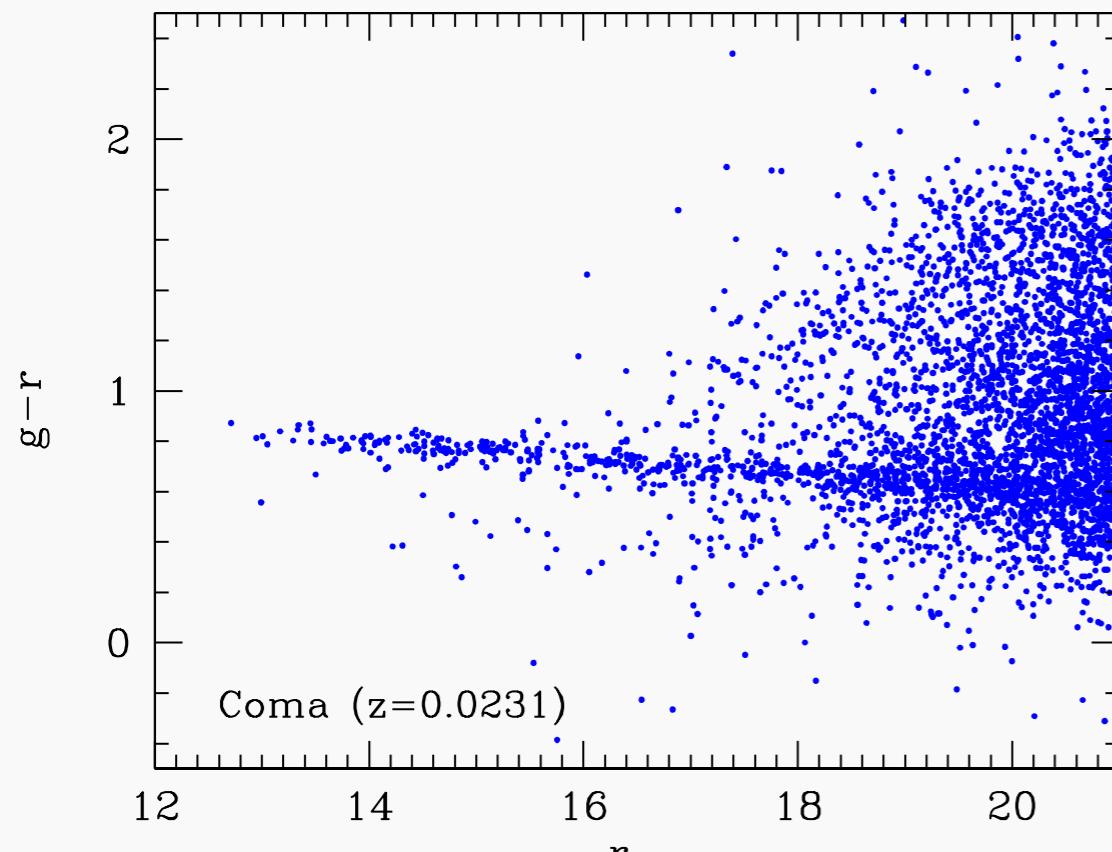
DES (2013-2019)

5000 deg^2 , $r_{\text{lim}} \sim 25$

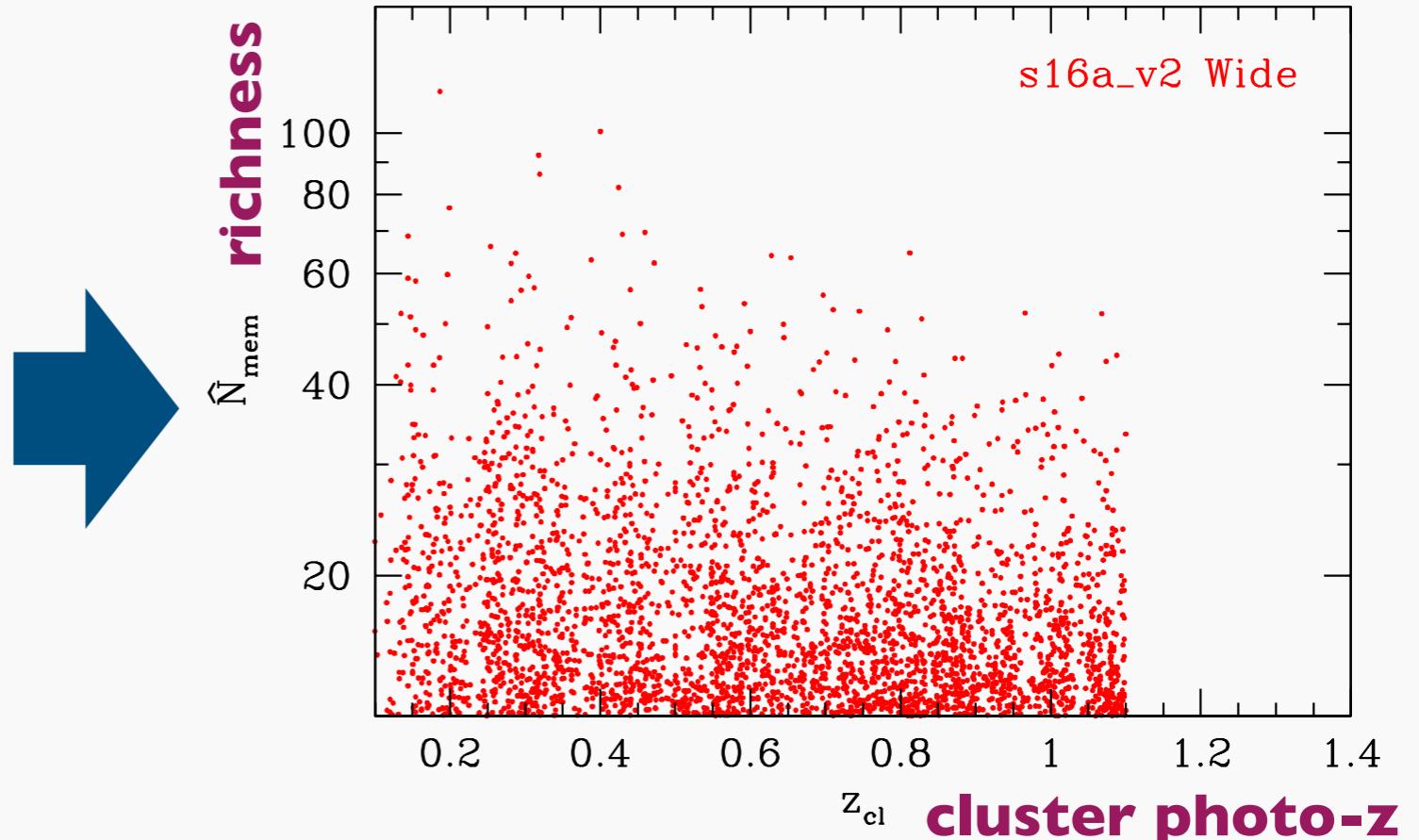
HSC (2014-2021)

1400 deg^2 , $r_{\text{lim}} \sim 26$

CAMIRA cluster finding algorithm



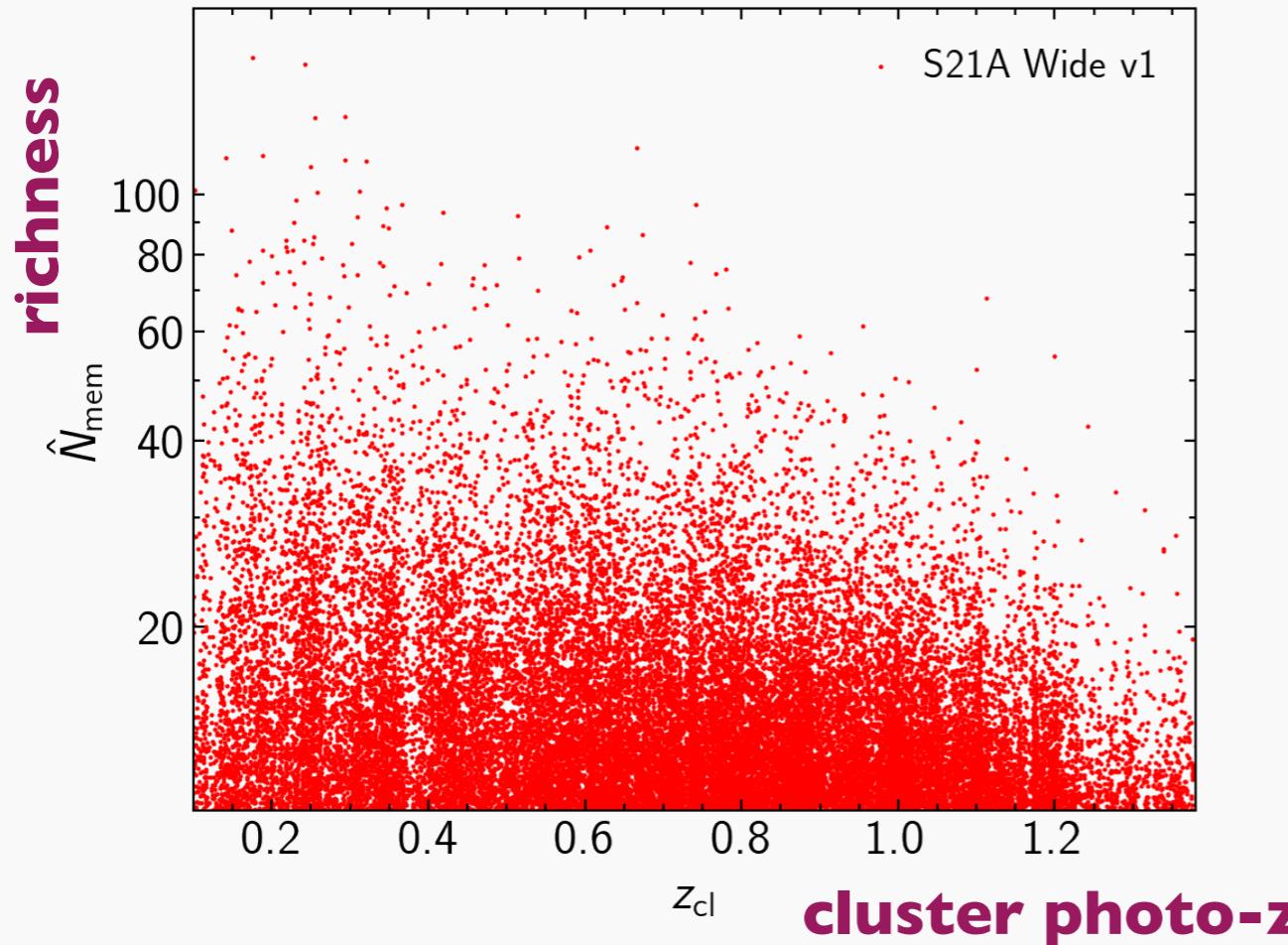
red-sequence
(find cluster, photo-z)



192 optical clusters
at **0.1 < z < 1.1**
from **HSC-SSP YI**
(**~200 deg²**)

Latest HSC-SSP cluster catalog

(~1090 deg²)



| 028 | optical clusters
at 0.1 < z < 1.38

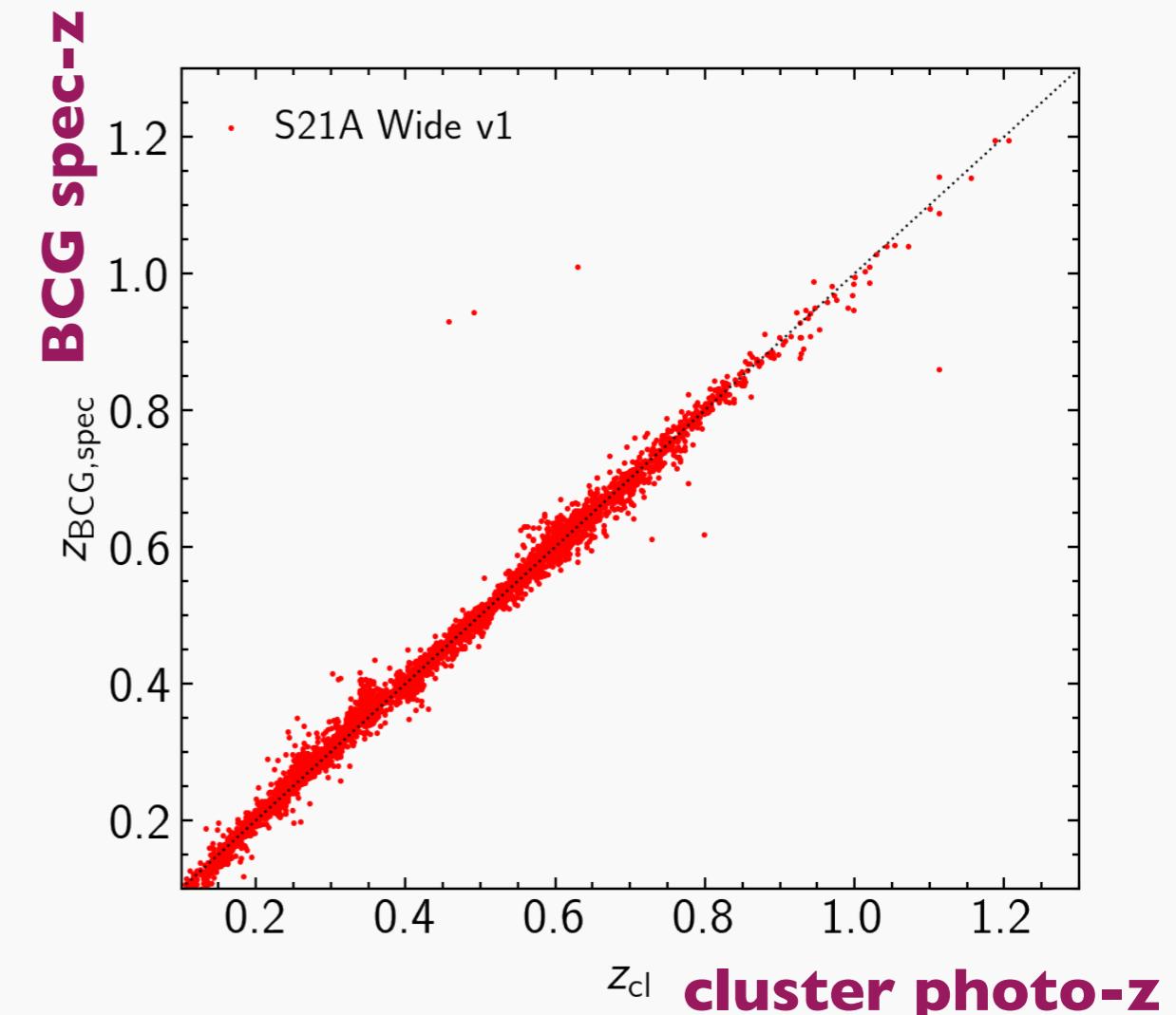


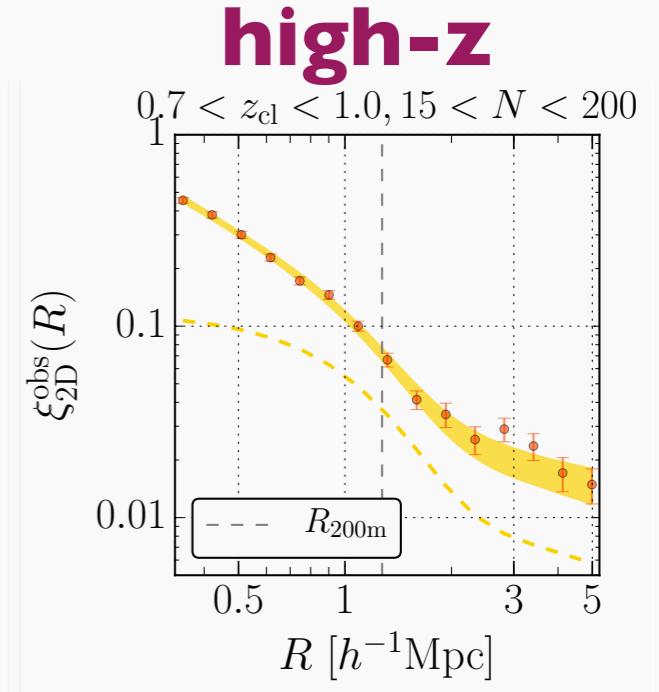
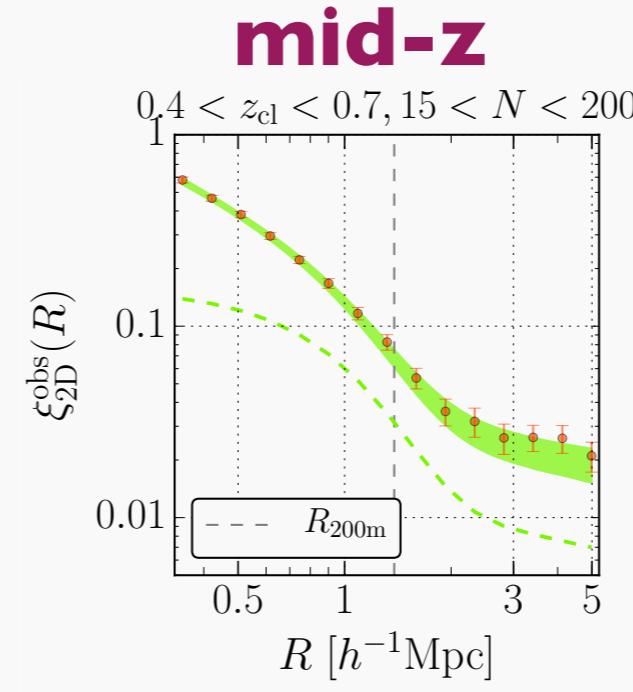
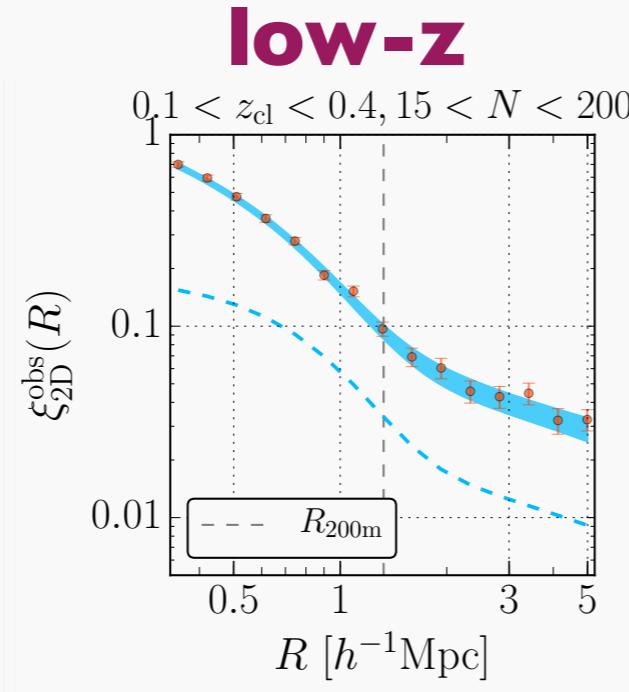
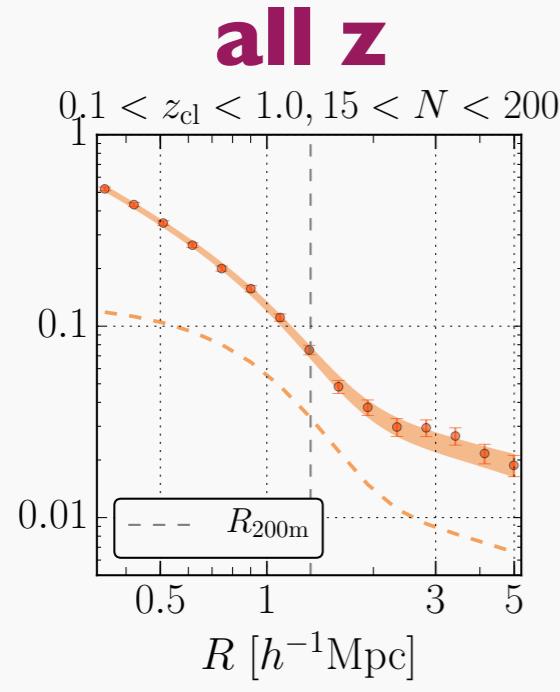
photo-z accuracy
 $\sigma_z/(1+z) \sim 0.01$

wide range of applications!

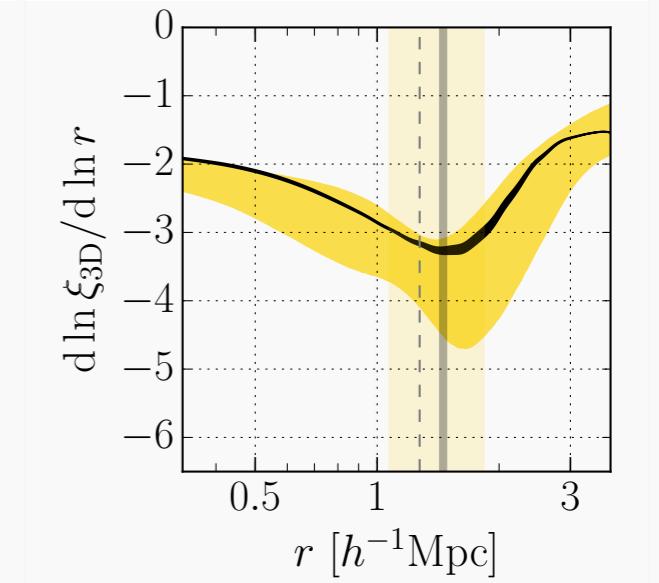
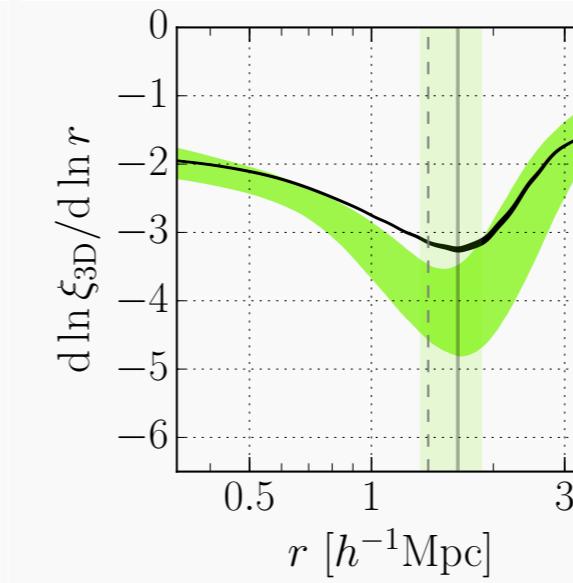
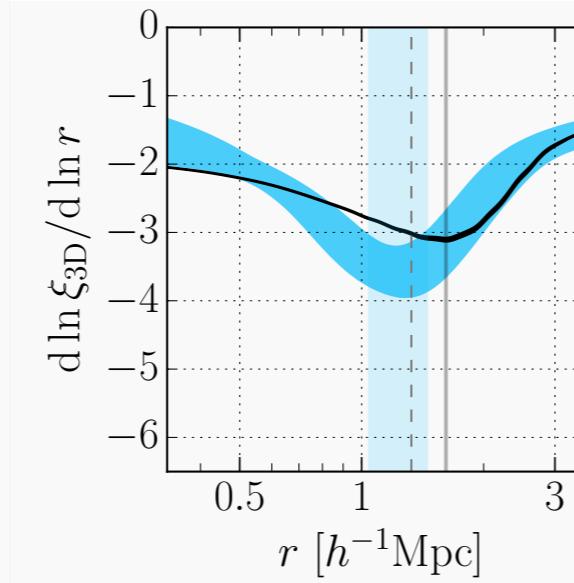
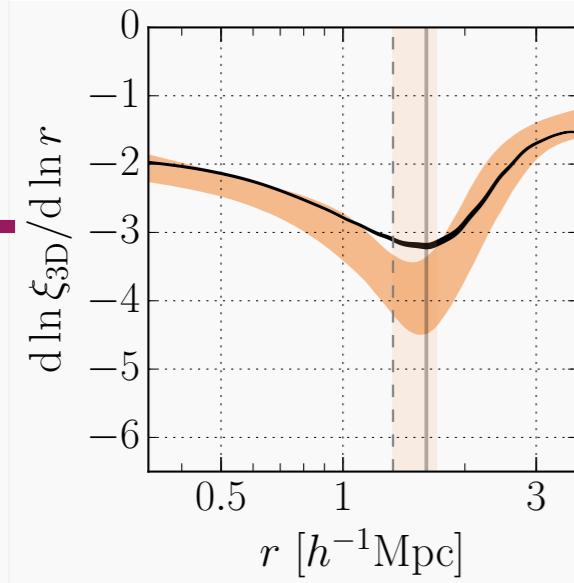


Splashback radius

cluster-gal 2PCF



slope



- detection at highest-z!
- consistent w/ theoretical prediction (cf. More+2016)

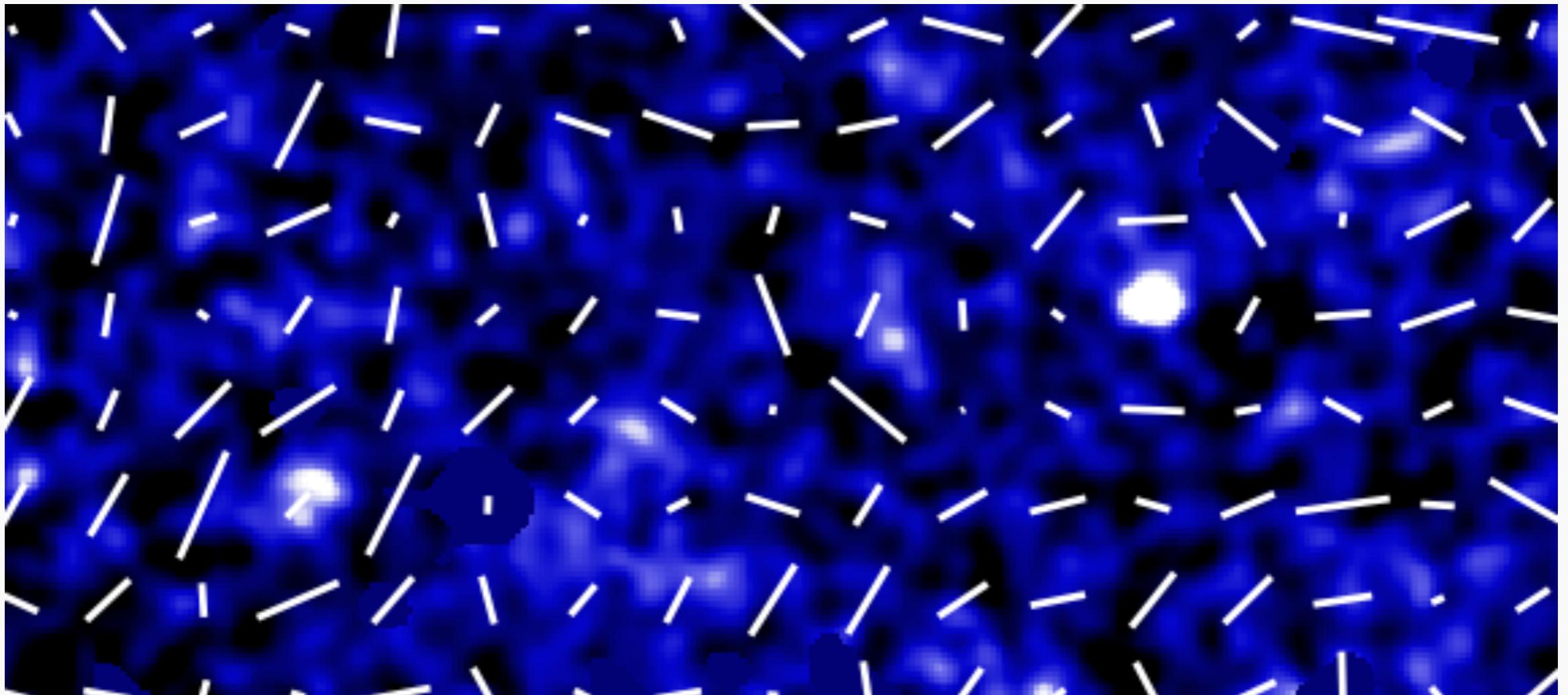
Public release

- CAMIRA cluster catalog in HSC-SSP PDR3 ($\sim 800 \text{ deg}^2$) was released in 2022 March

https://hsc-release.mtk.nao.ac.jp/doc/index.php/camira-cluster-catalog_pdr3/

- if you are interested in a large homogenous cluster catalog out to $z \sim 1$, please check!
(e.g., poster by **Roohi Dalal** for BCG study w/ CAMIRA)

WL mass map

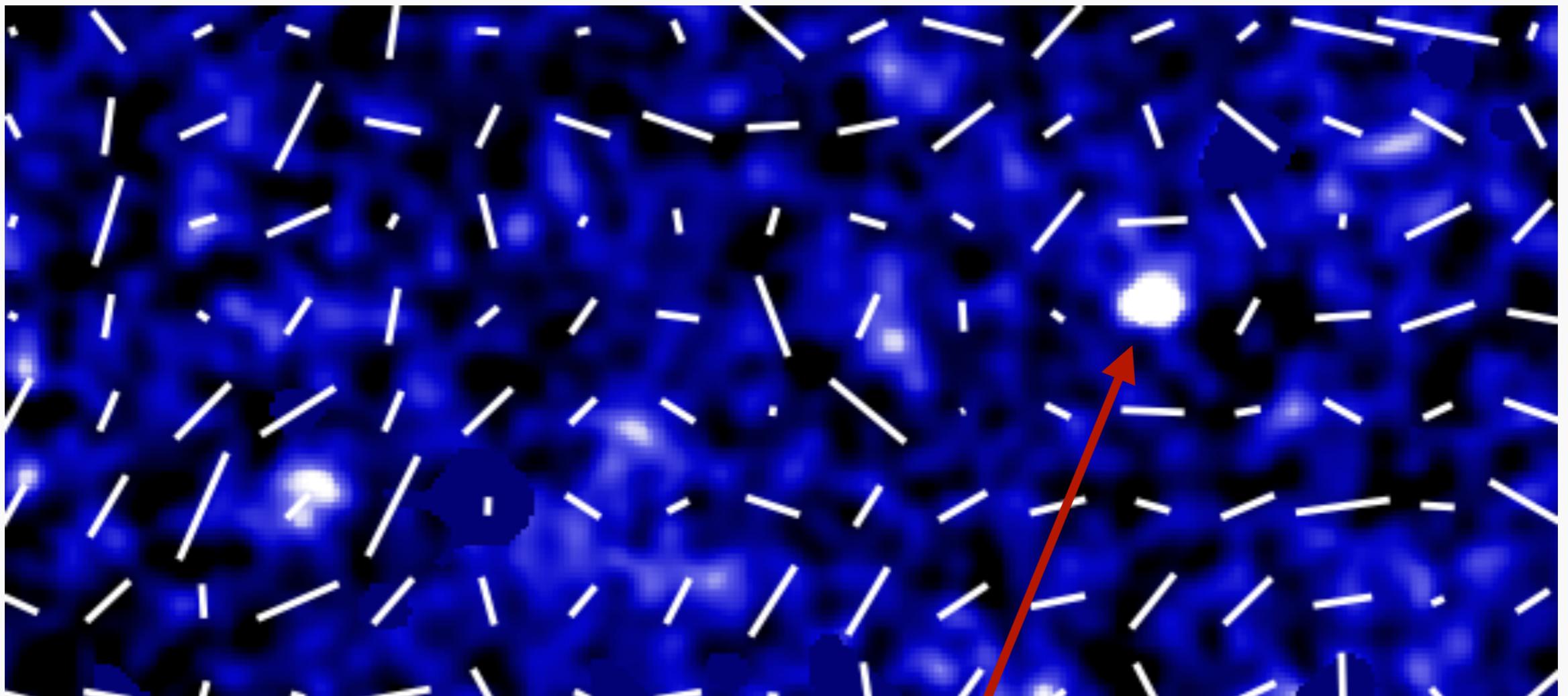


bars: observed galaxy distortion (shear)

color: reconstructed mass map

(e.g., Kaiser & Squires 1993; Schneider 1996; ...)

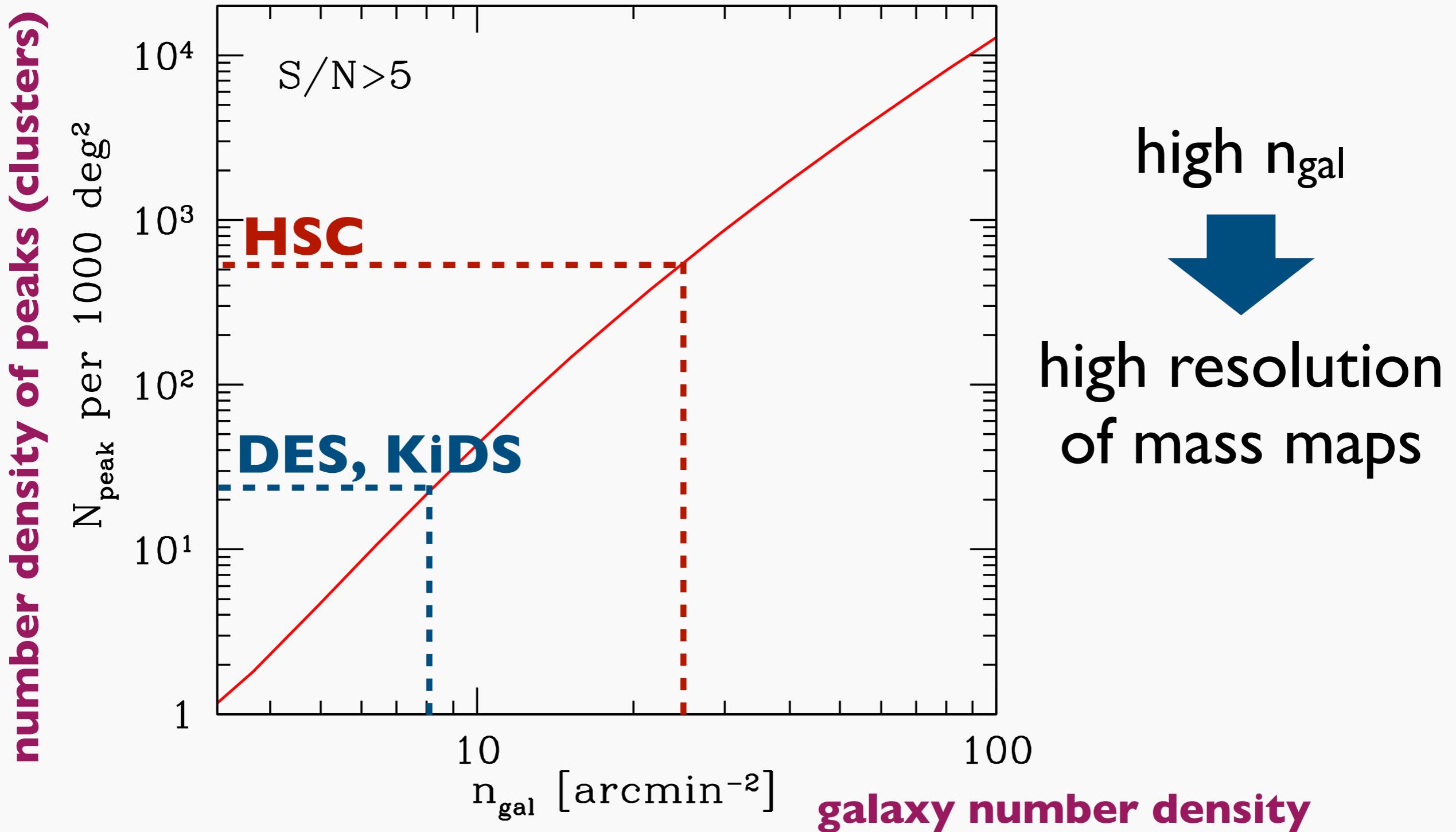
WL selected clusters



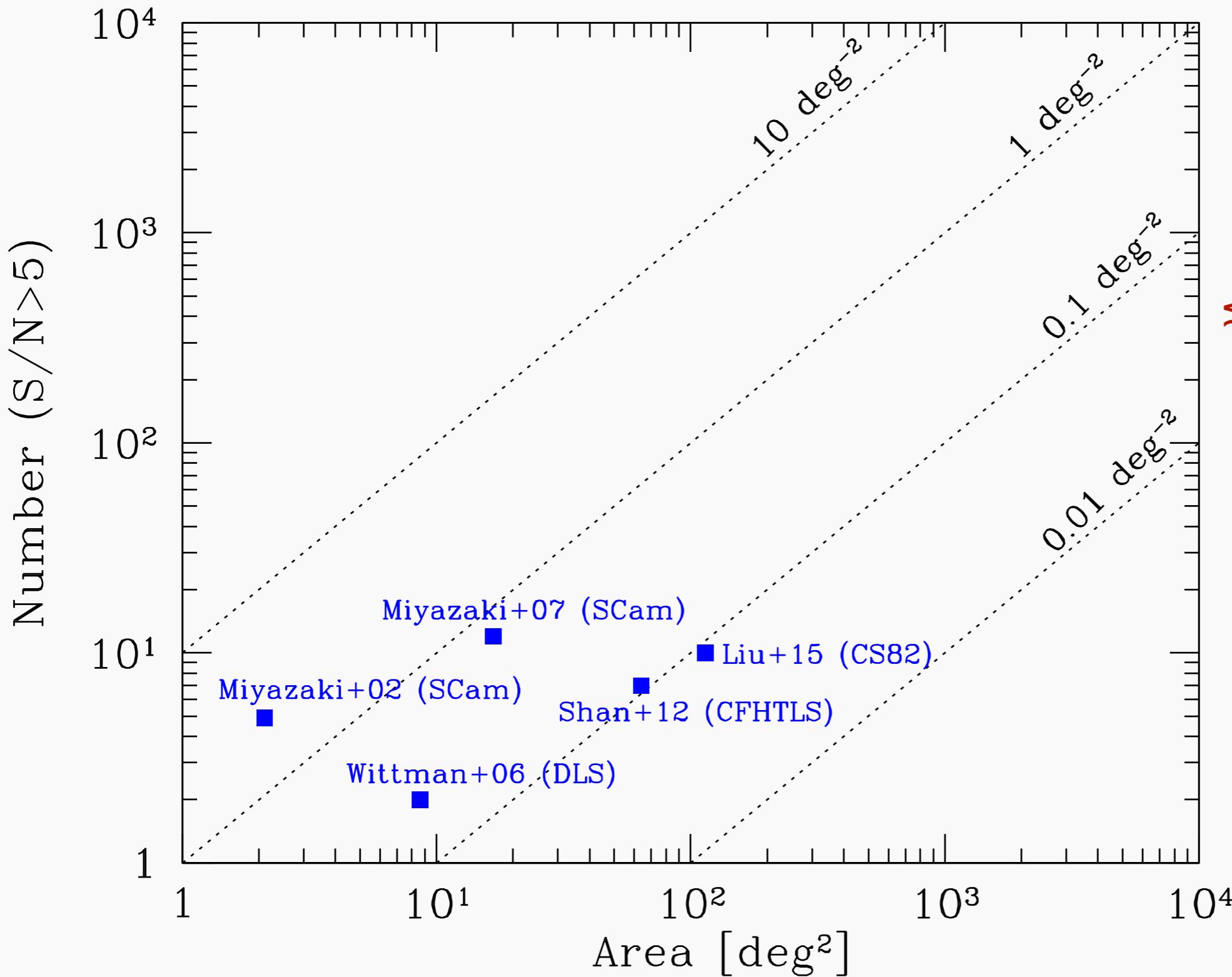
clusters from **peaks** in mass map
[purely gravitational selection!]



Depth is important

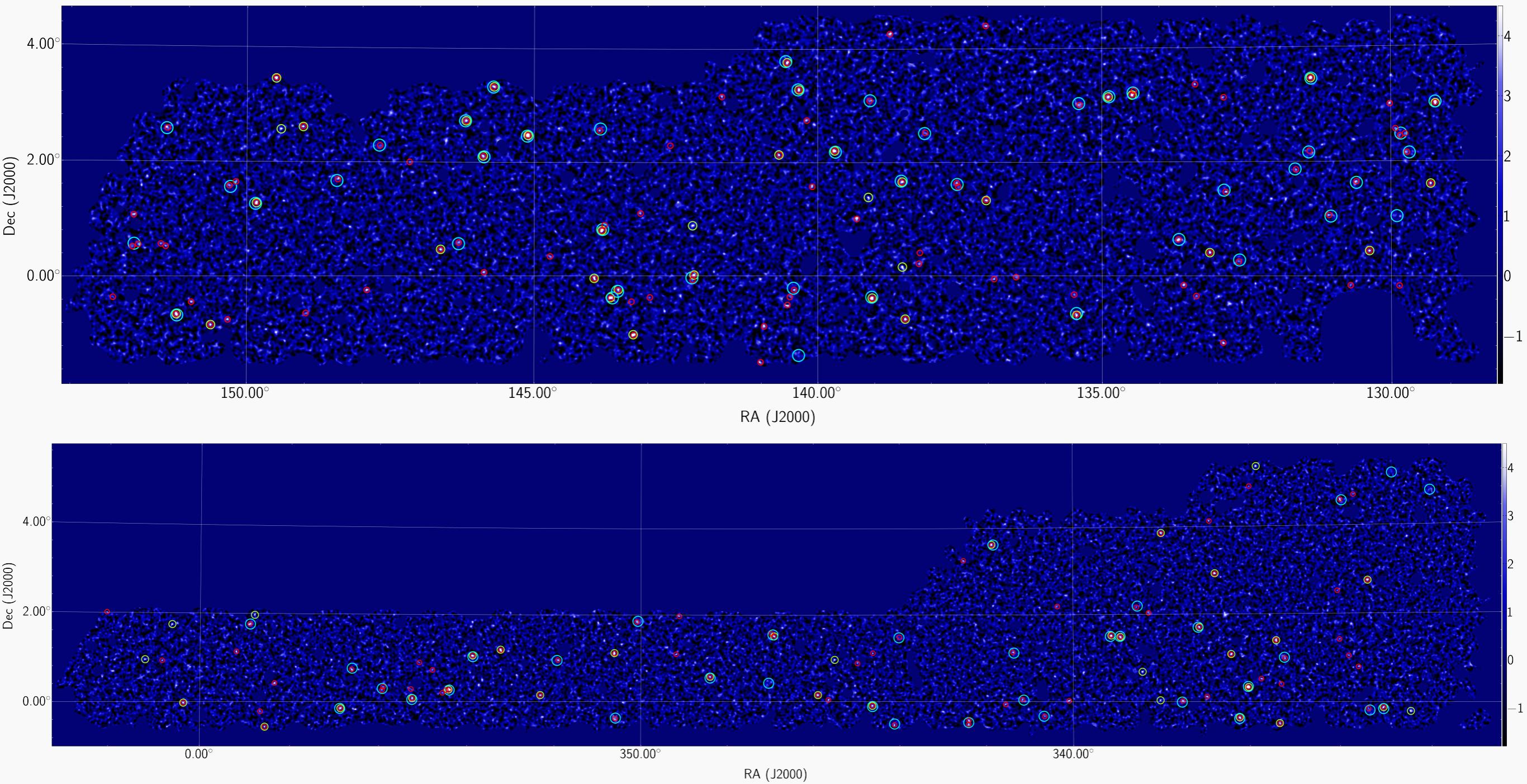


Challenge: deep *and* wide imaging

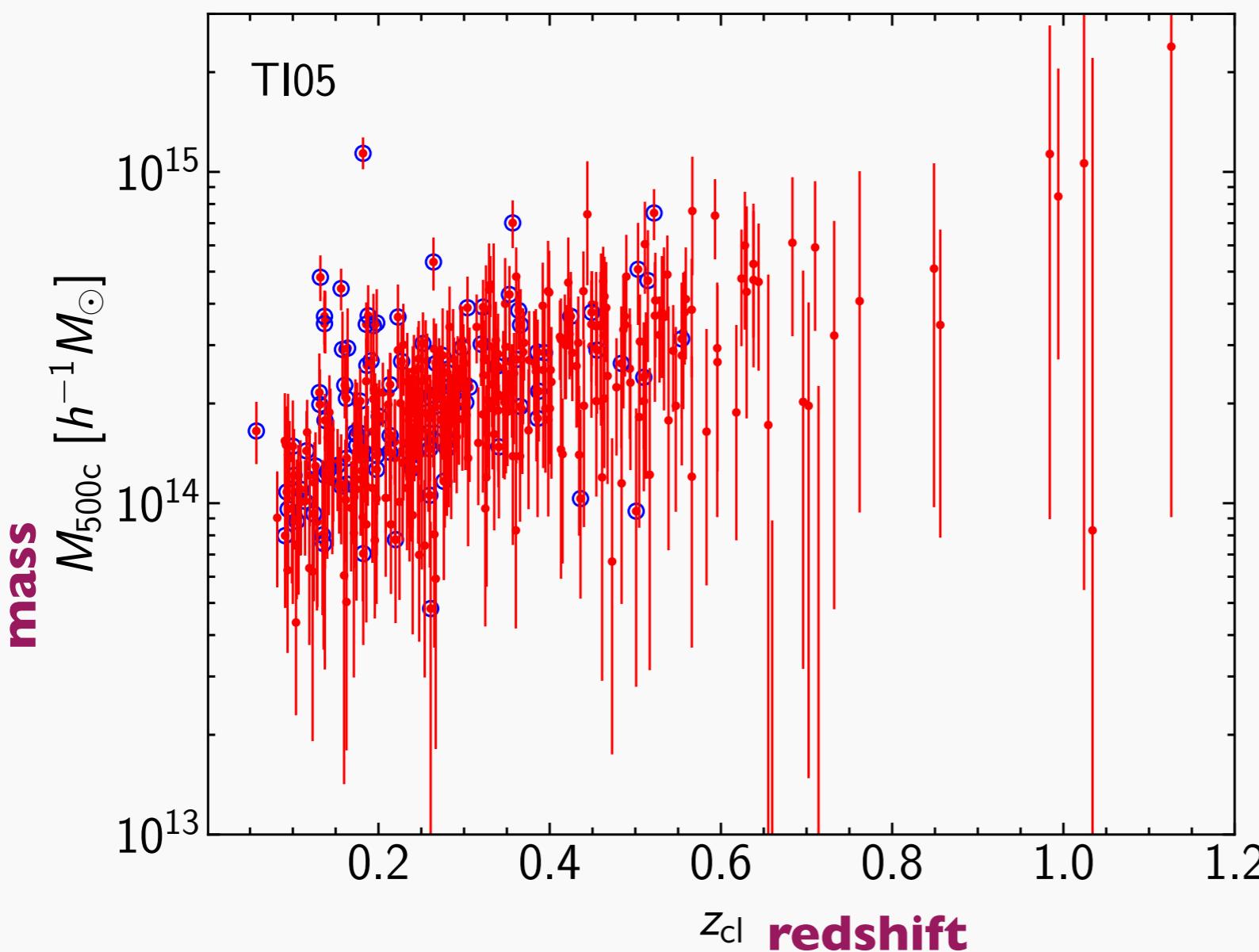


**≤ 10 clusters
before
HSC-SSP**

Three year WL selected clusters



Three year WL selected clusters



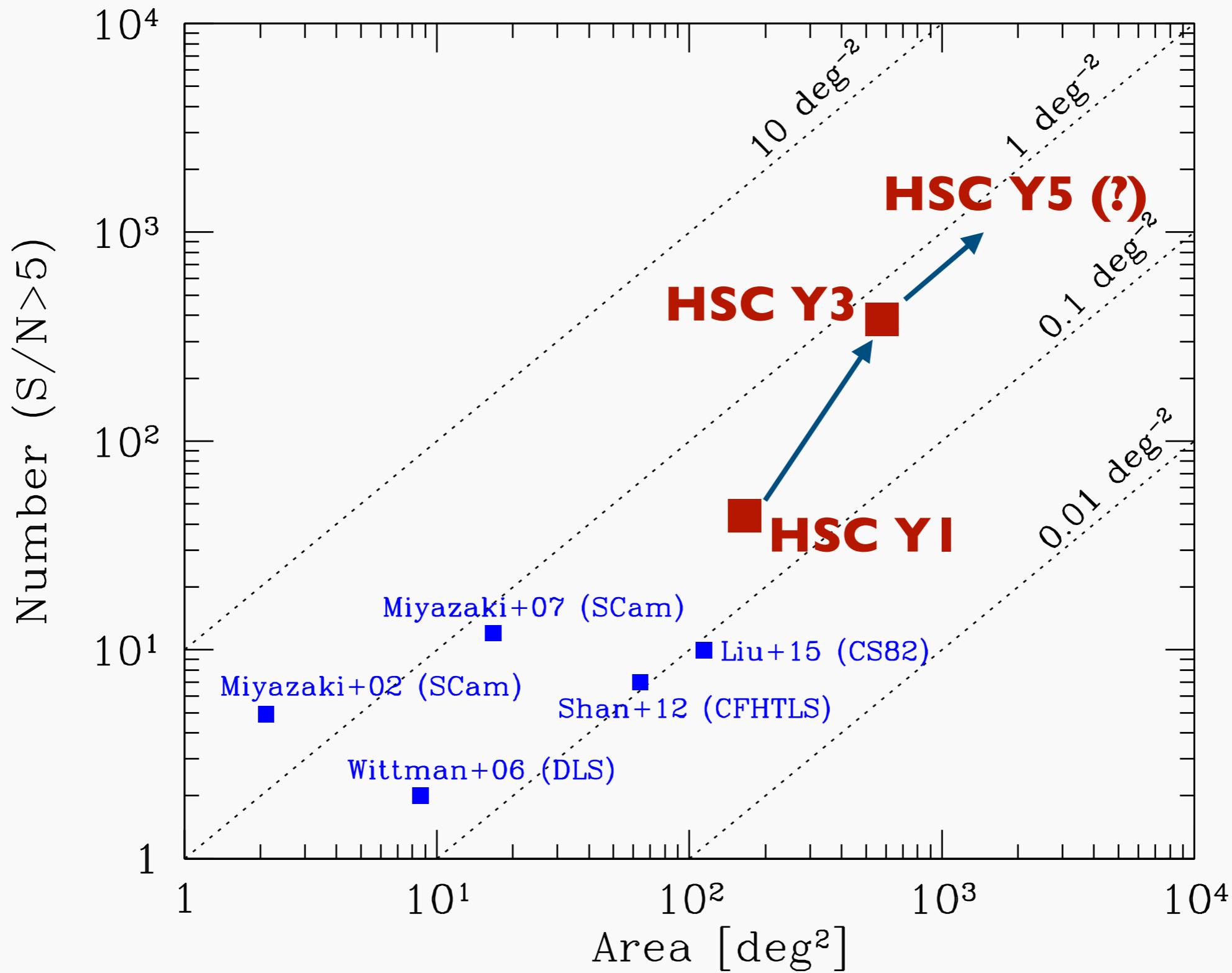
418 clusters

with

S/N > 4.7

significantly large
sample for
statistical studies!

WL selected clusters



Applications

- clean and well-understood selection function enables *accurate* cluster cosmology
(talk by **Kai-Feng Chen**)
- testing selection effects of X-ray (eROSITA) selected clusters, and searching for X-ray underluminous clusters
(talk by **Miriam Ramos-Ceja**)

Summary

- unique samples of clusters from HSC-SSP!
- CAMIRA algorithm provides a large homogeneous sample of galaxy-selected clusters out to $z \sim 1$
- HSC-SSP begins to provide a significant sample of weak lensing shear-selected clusters