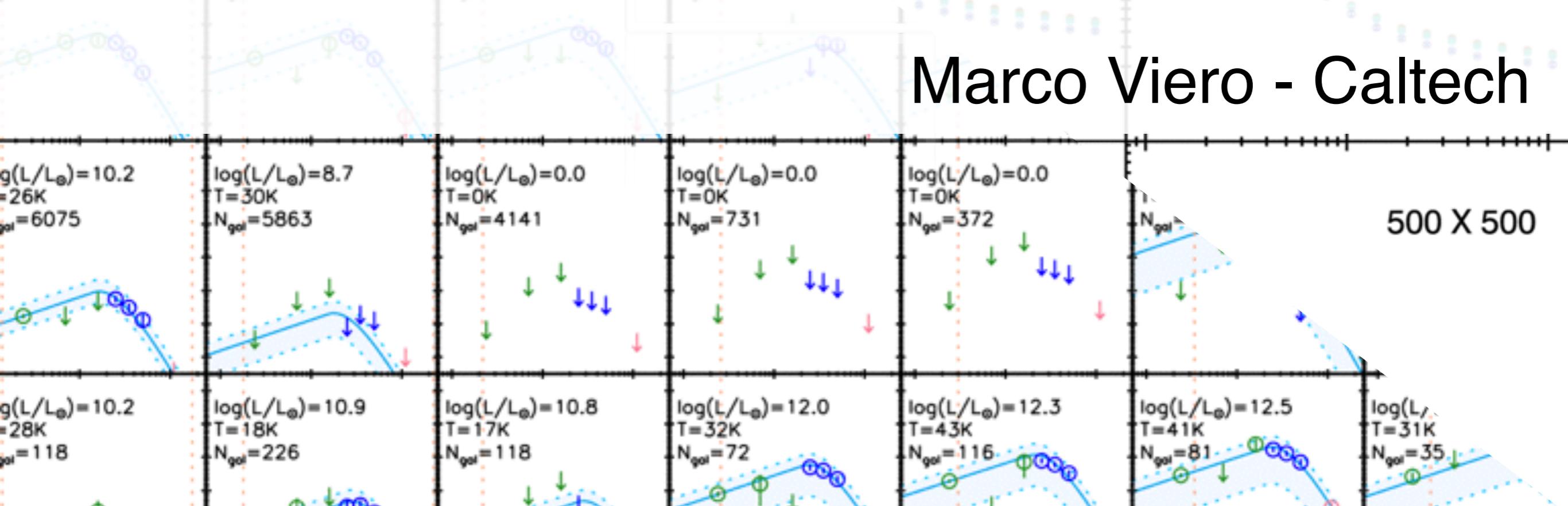
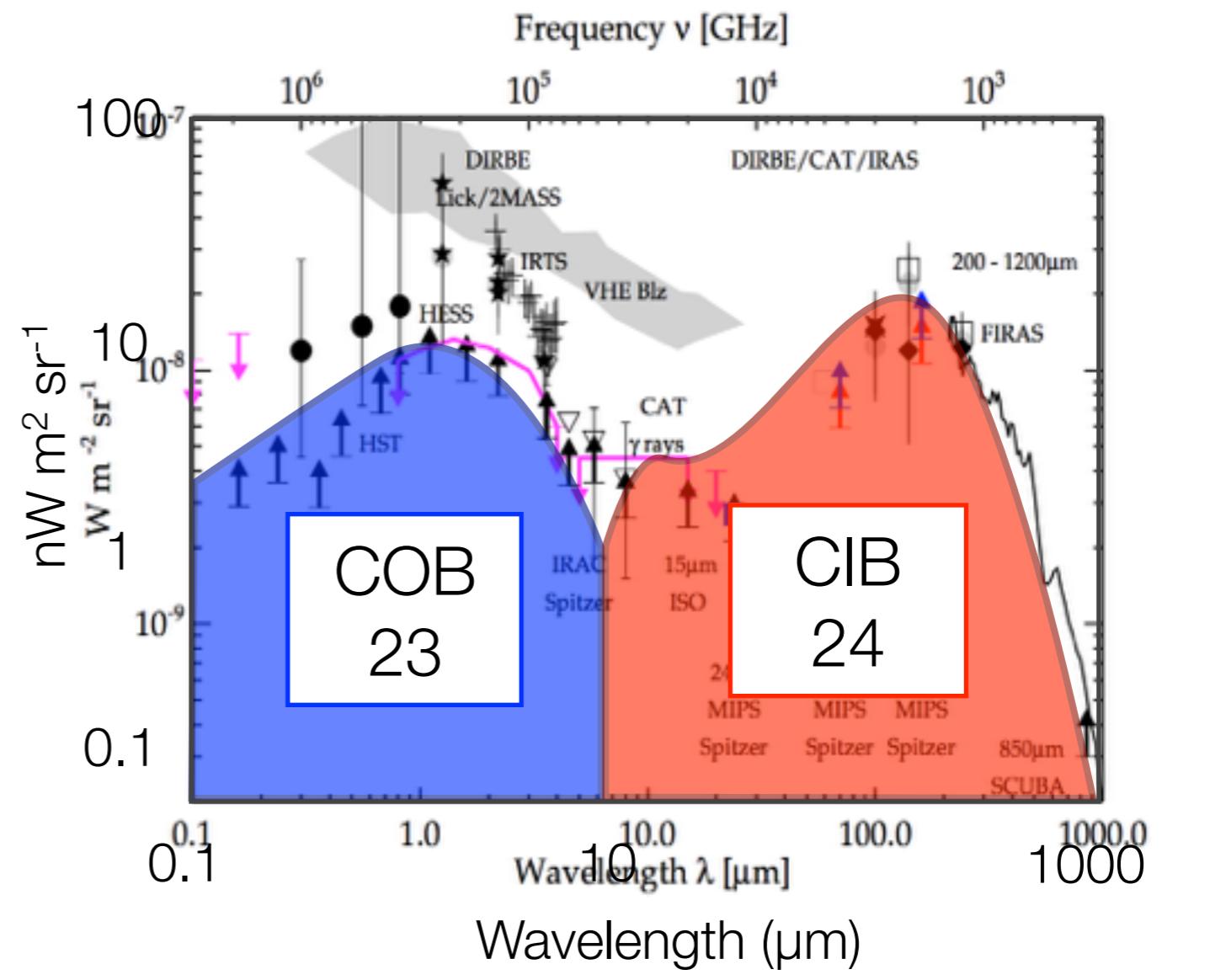


99% Invisible: Uncovering the Properties of Star-Forming Galaxies Lying Beneath the Confusion Noise Floor

Marco Viero - Caltech

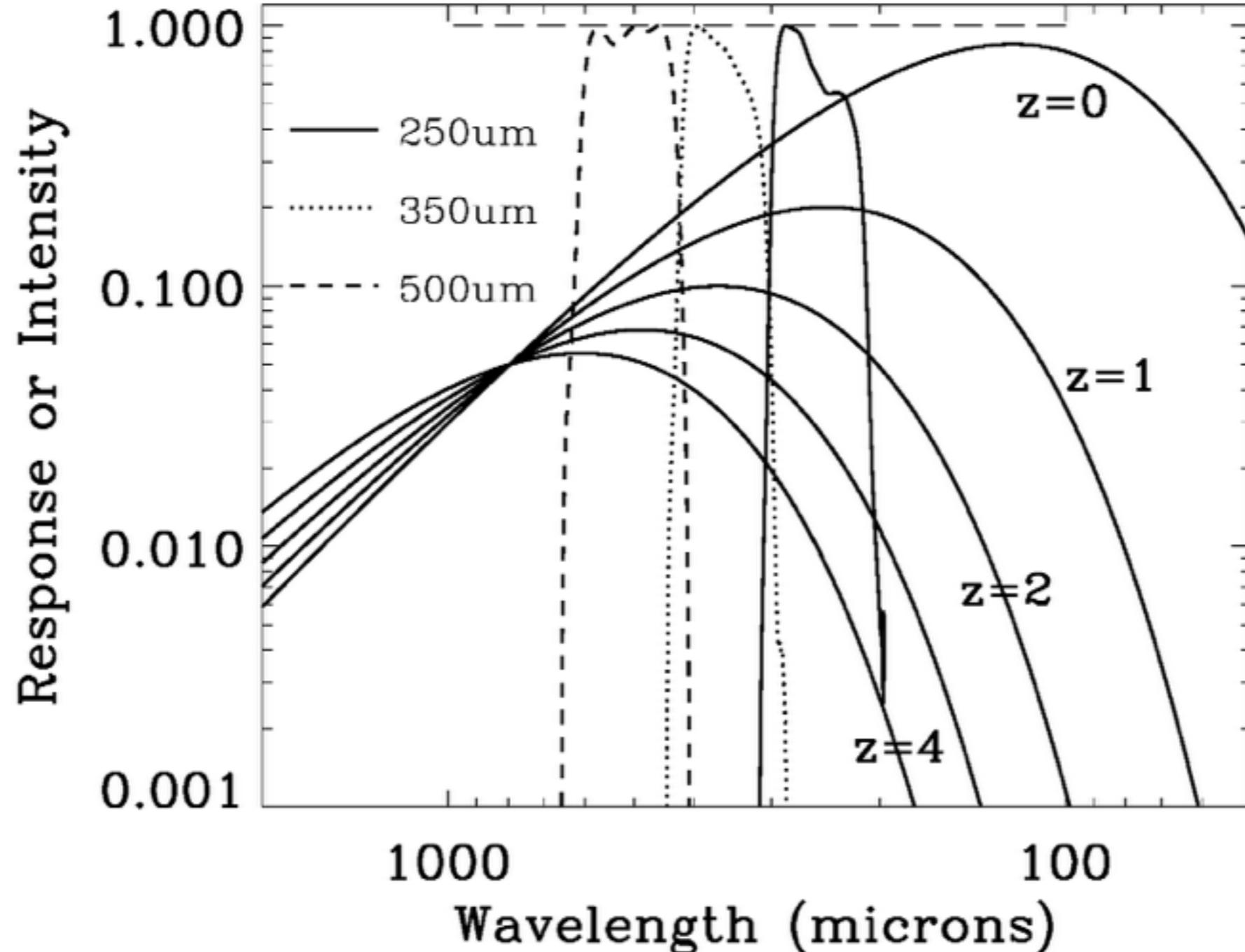




optical and infrared backgrounds

- clustering of galaxies from CIB Anisotropies (CIBA)
- properties of galaxies that make up the CIB (w. stacking)

outline

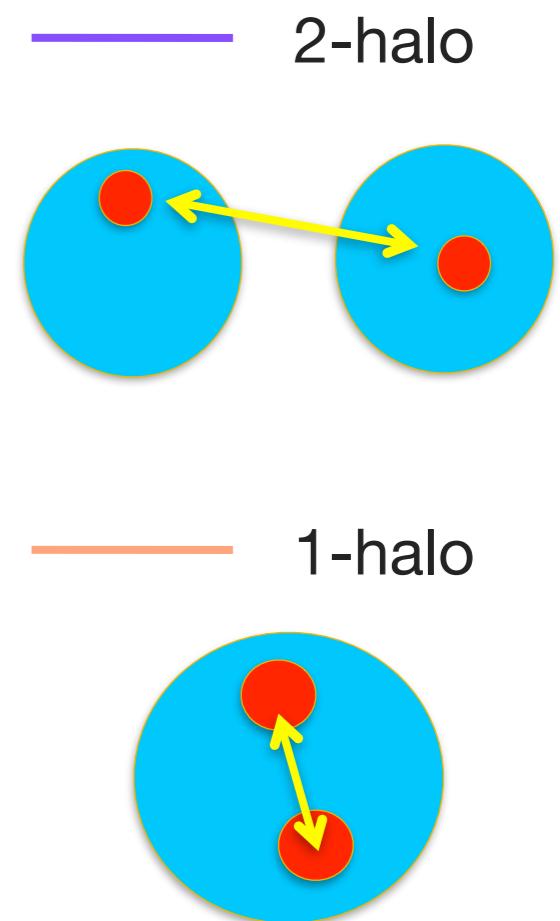
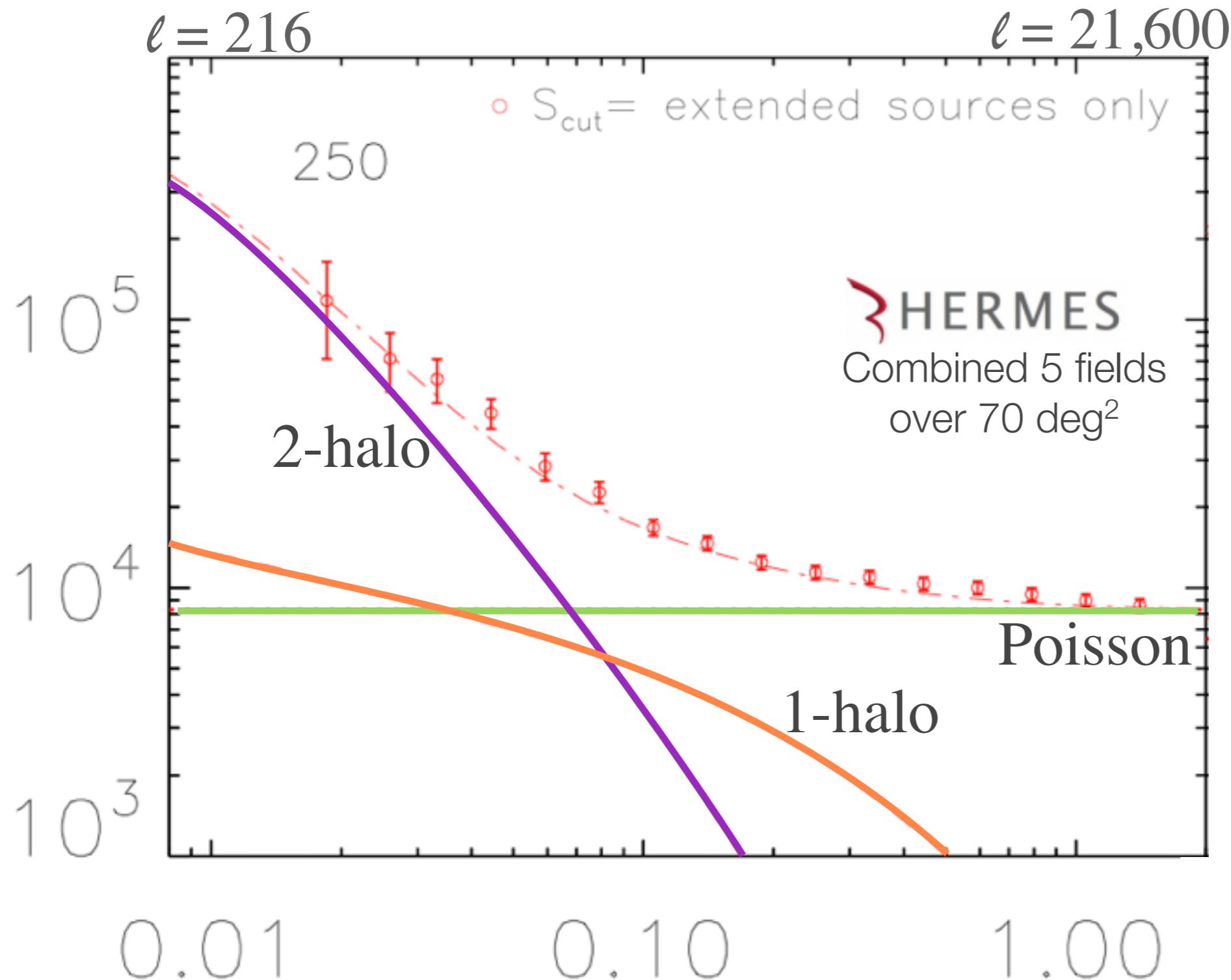


ERMES

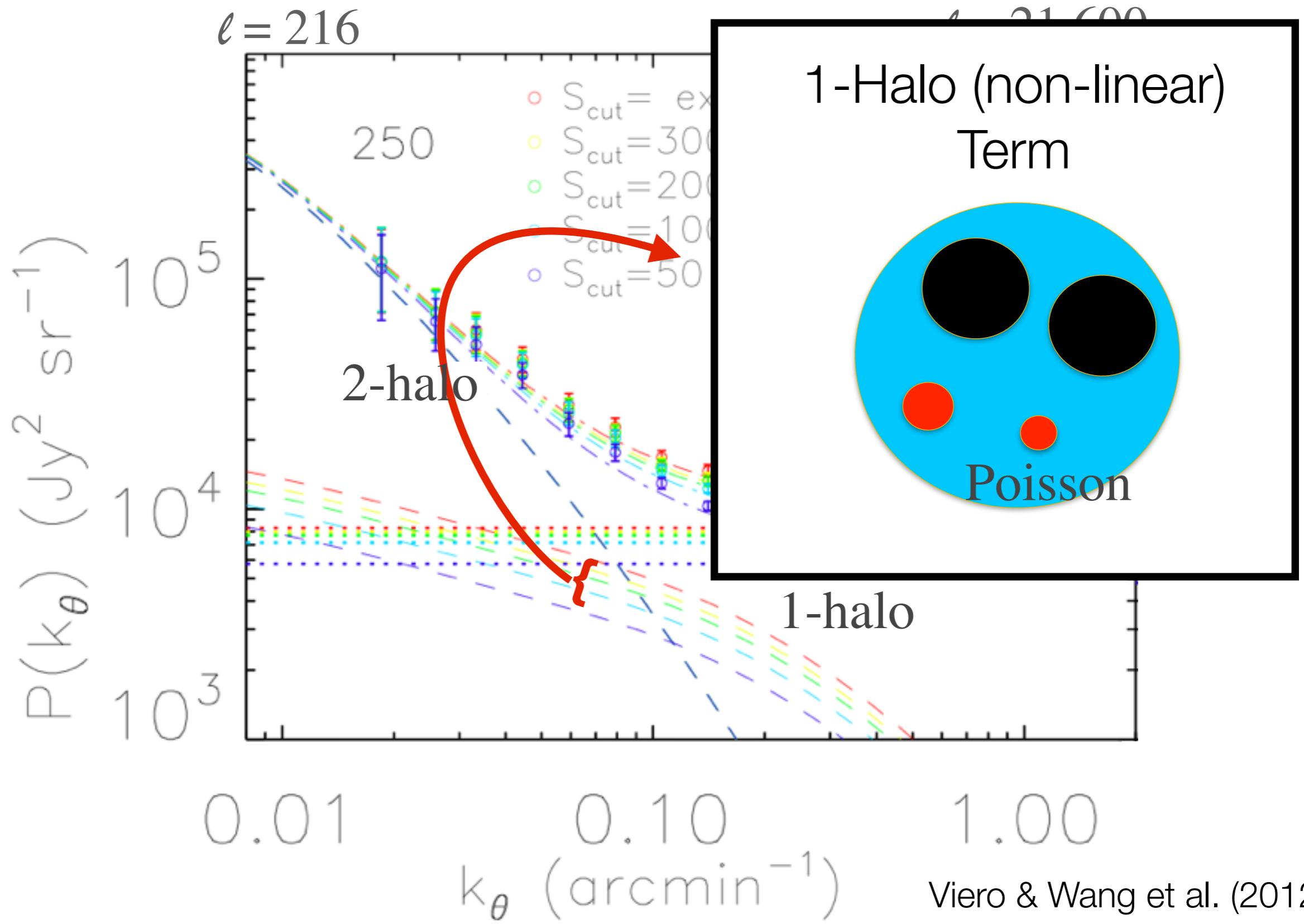
IAP Team
Alex Conley
Levenson
Ben Marsden
Hard Schulz
Marco Viero
Ondre Zemcov

- SPIRE maps at **250, 350, and 500 μ m** (i.e., 1200, 870, 600 GHz)
- FWHM = 0.25 to 0.5 arcmin
- Modes $>\sim 0.5$ deg filtered

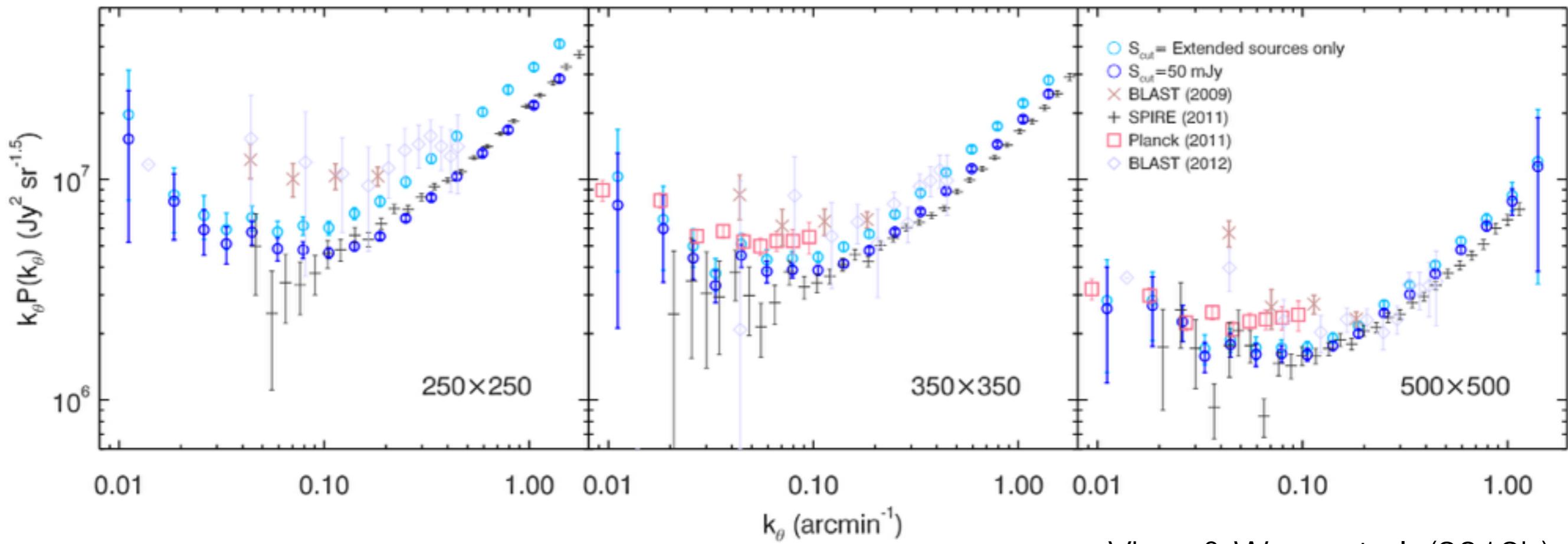
Clustering of DSFGs



Clustering of DSFGs

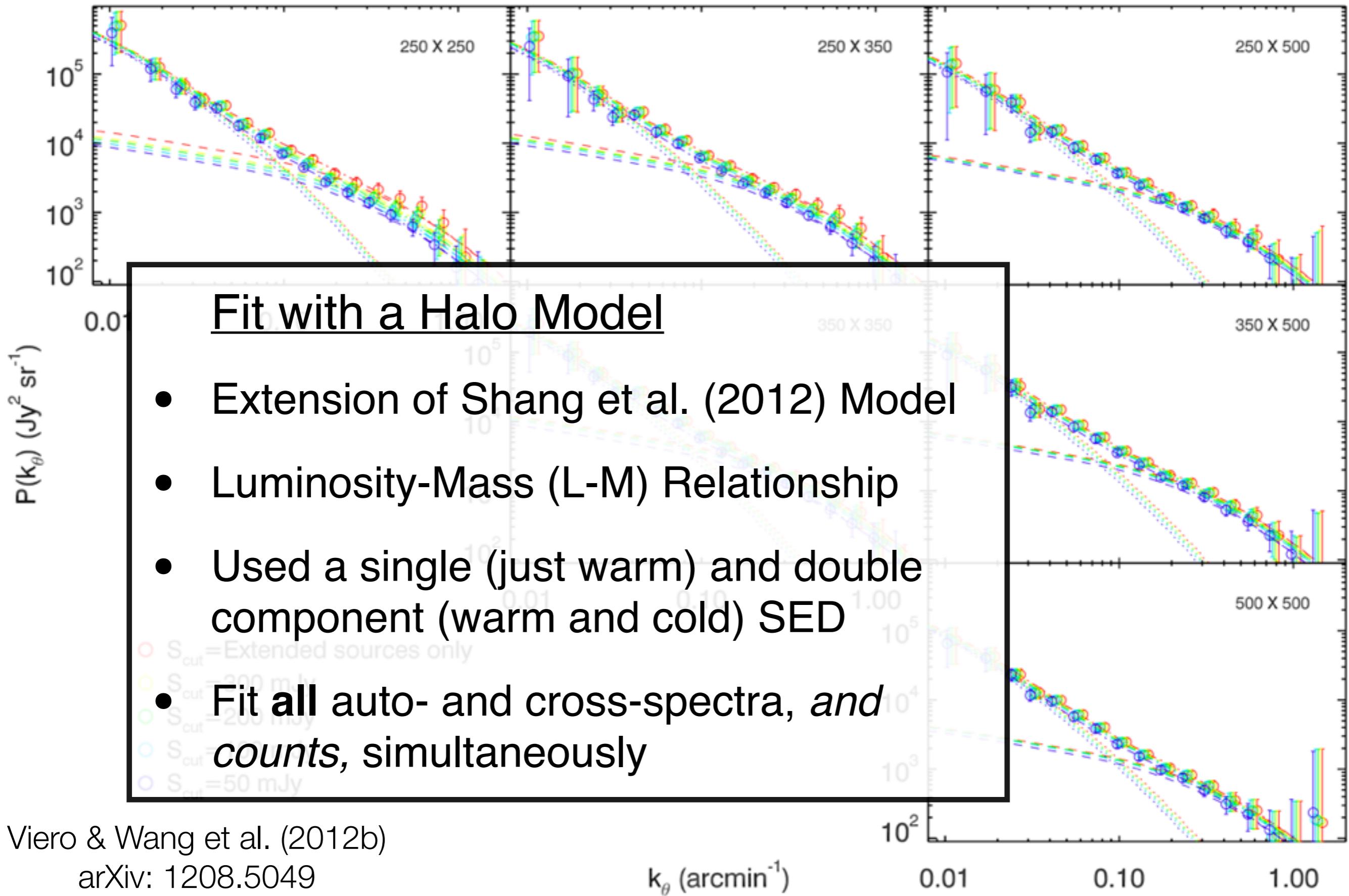


CIBA w. other data

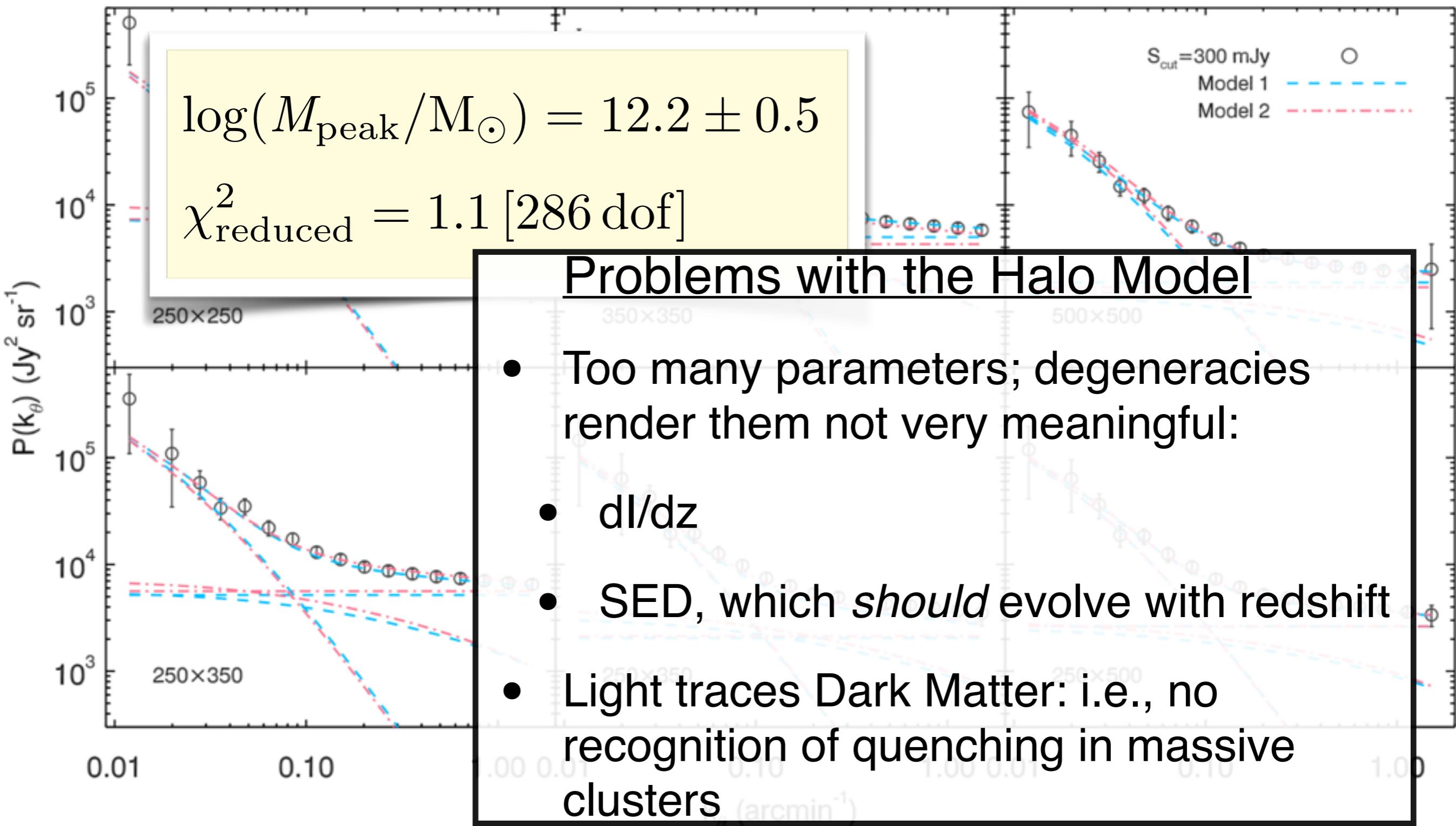


Viero & Wang et al. (2012b)
arXiv: 1208.5049

Poisson-Removed CIBA

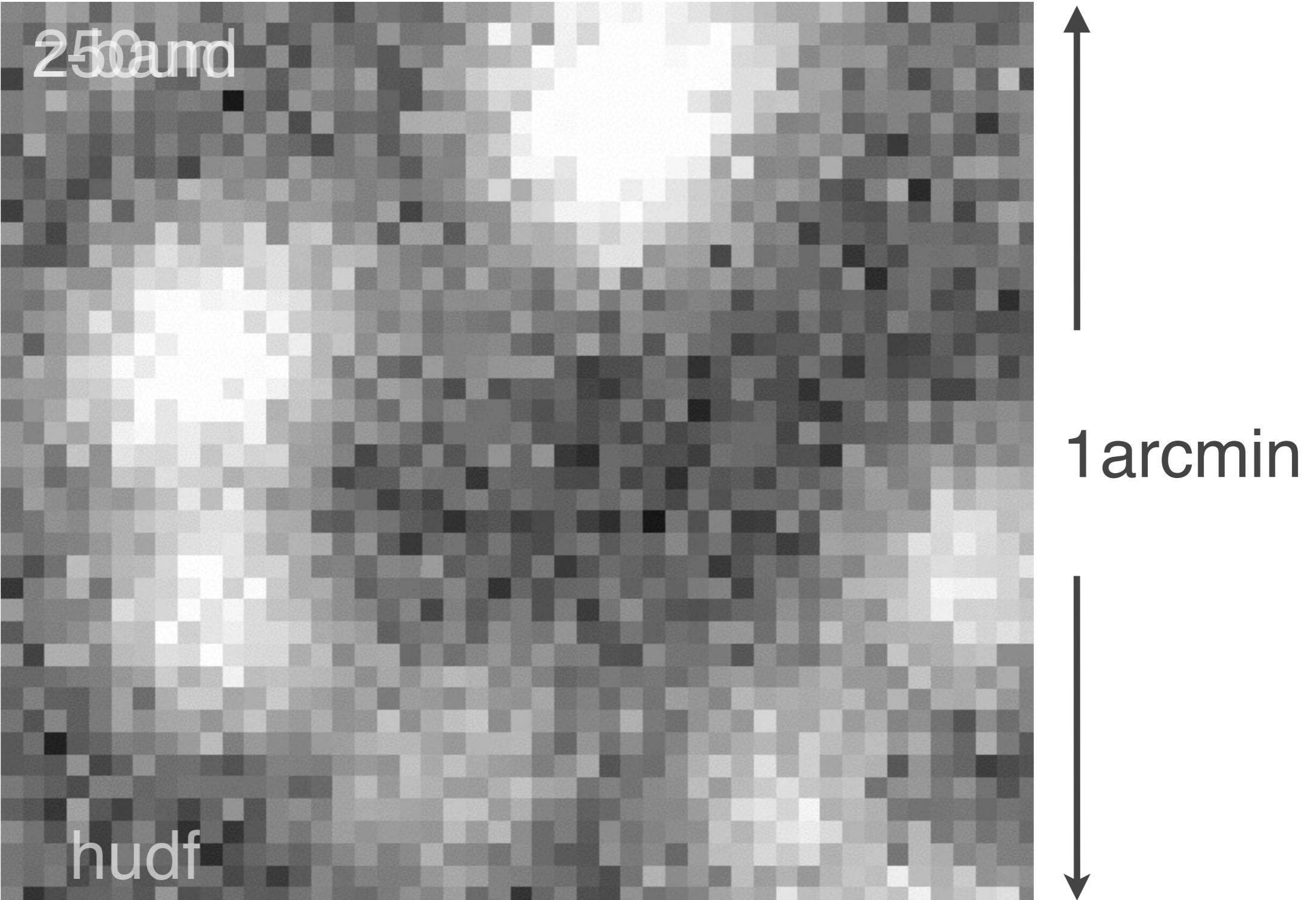


Best-Fit Halo Model

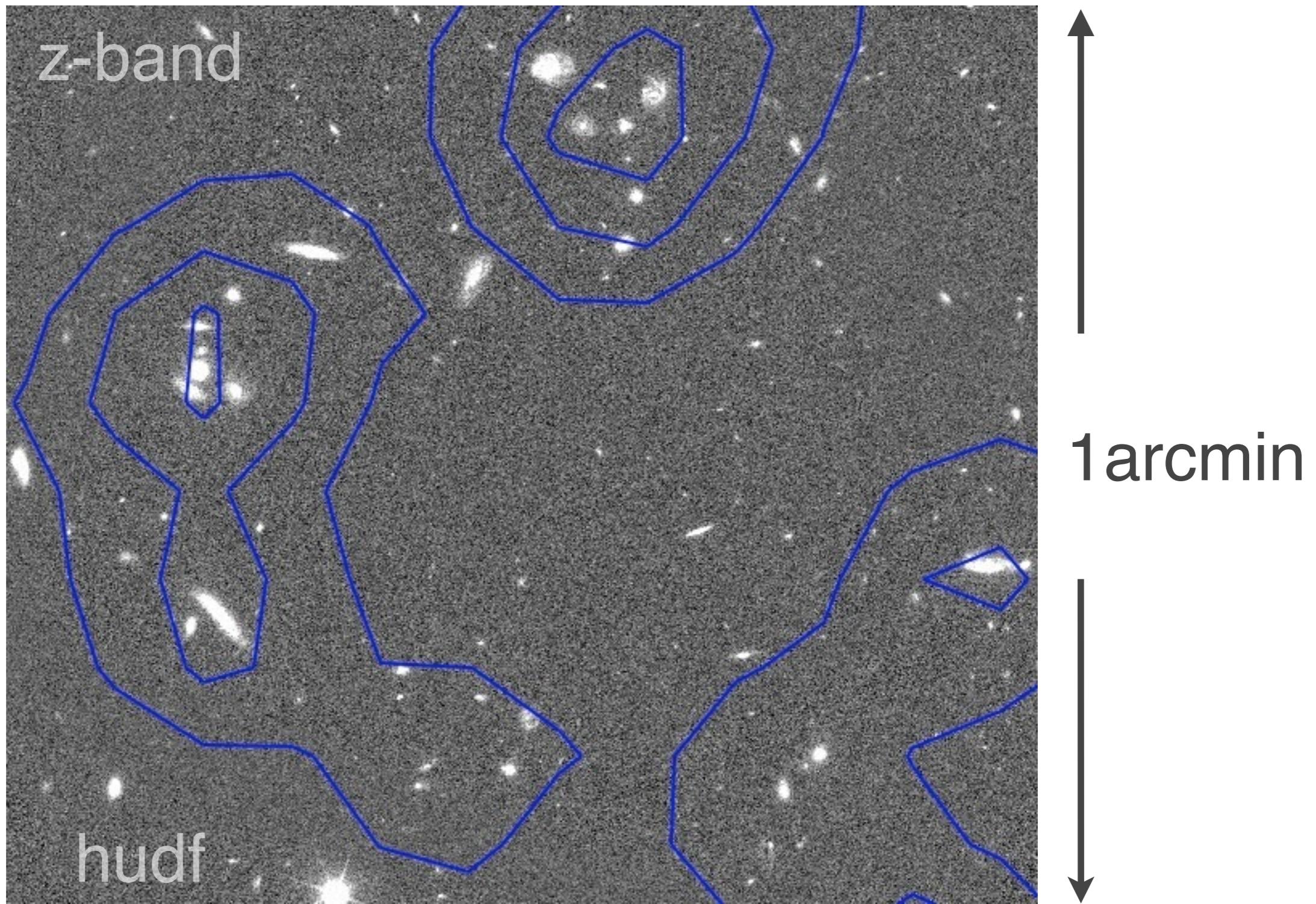


outline

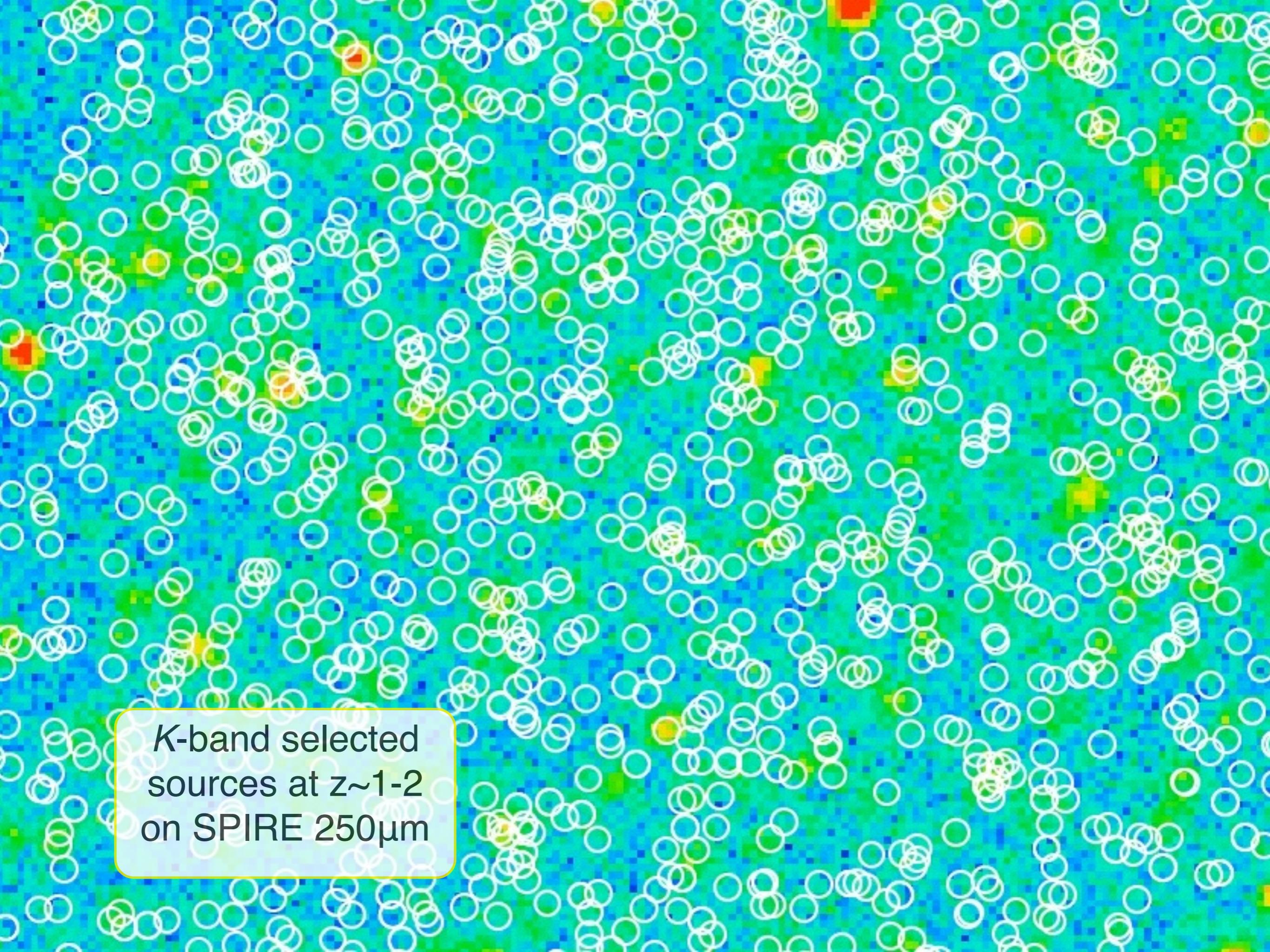
- measuring and modeling CIB Anisotropies (CIBA)
- properties of galaxies that make up the CIB w. stacking



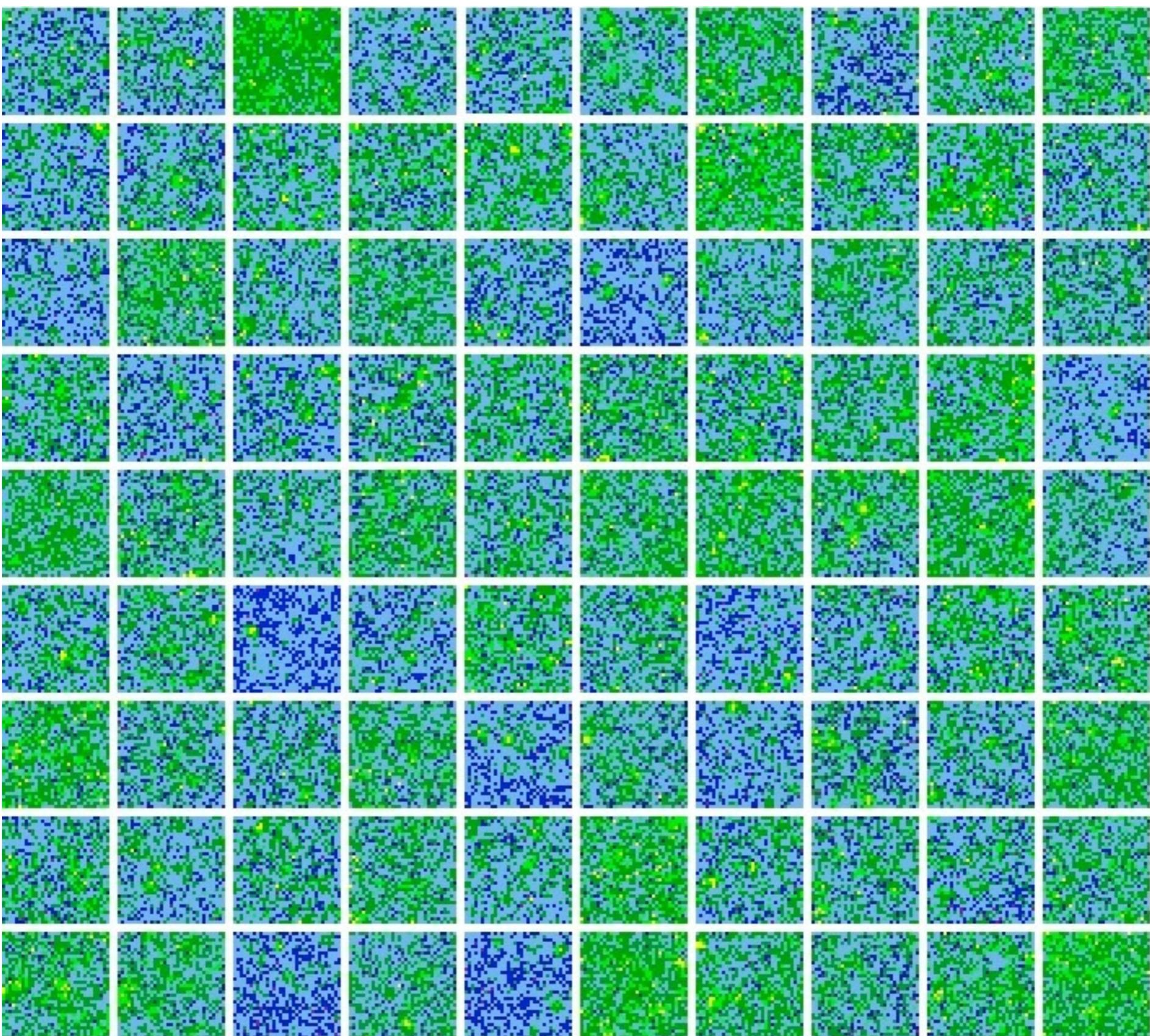
source confusion



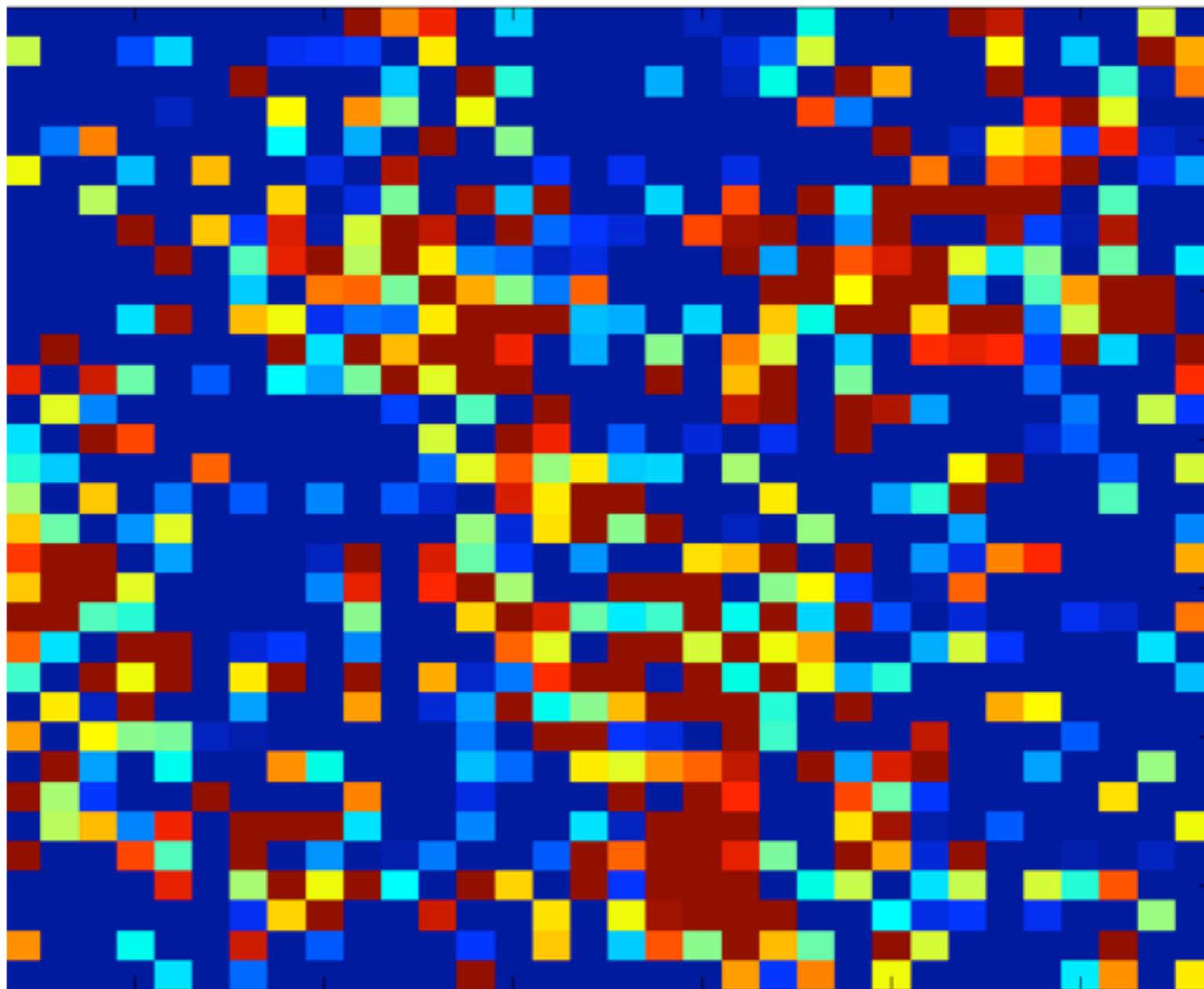
source confusion



**K-band selected
sources at $z \sim 1-2$
on SPIRE 250 μ m**

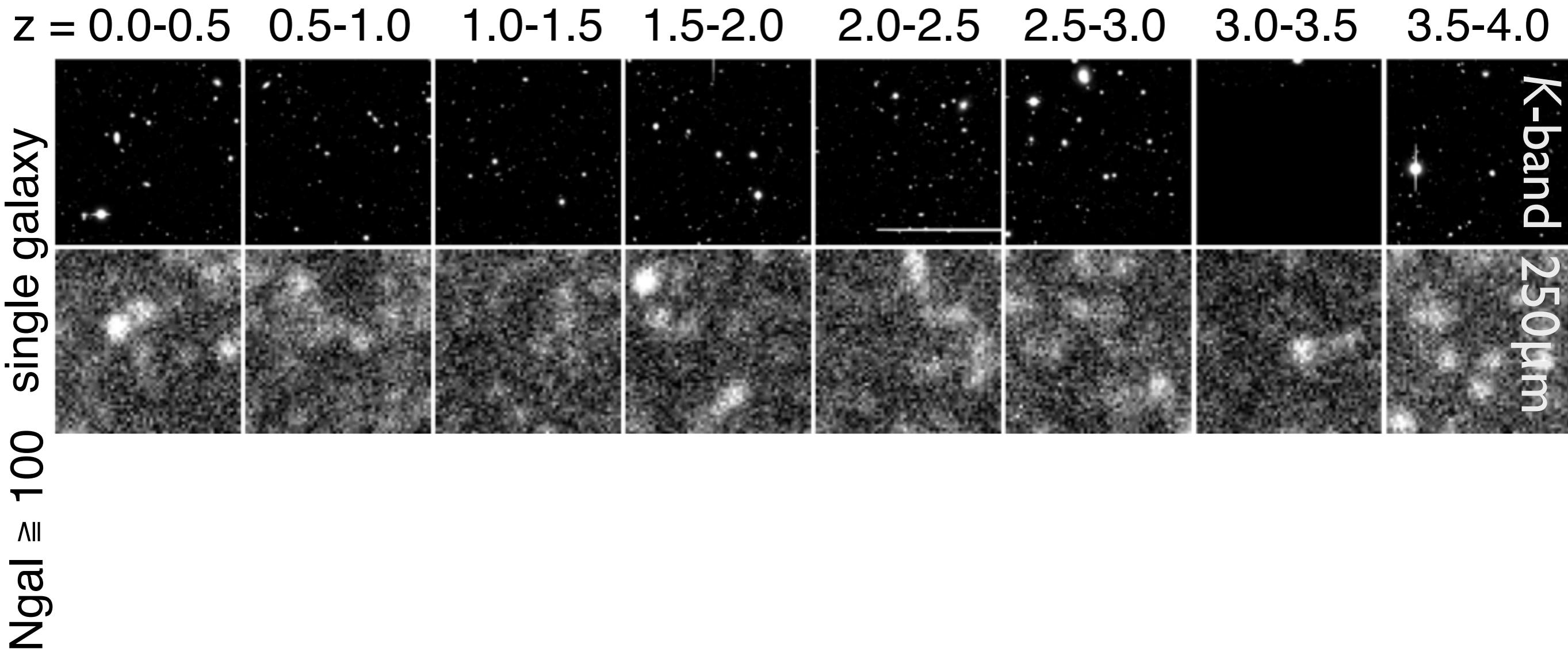


thumbnail stacking

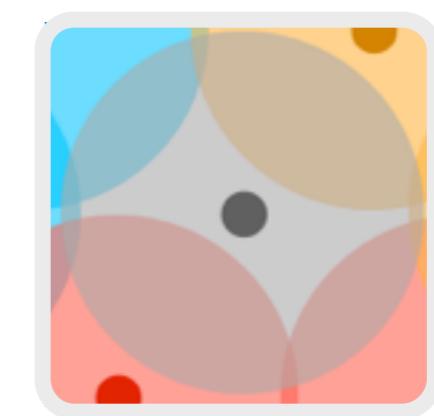
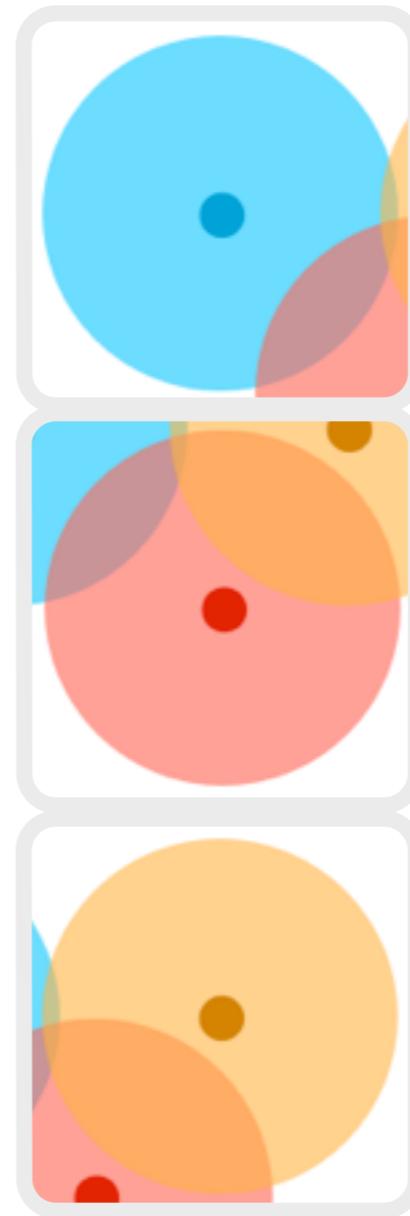
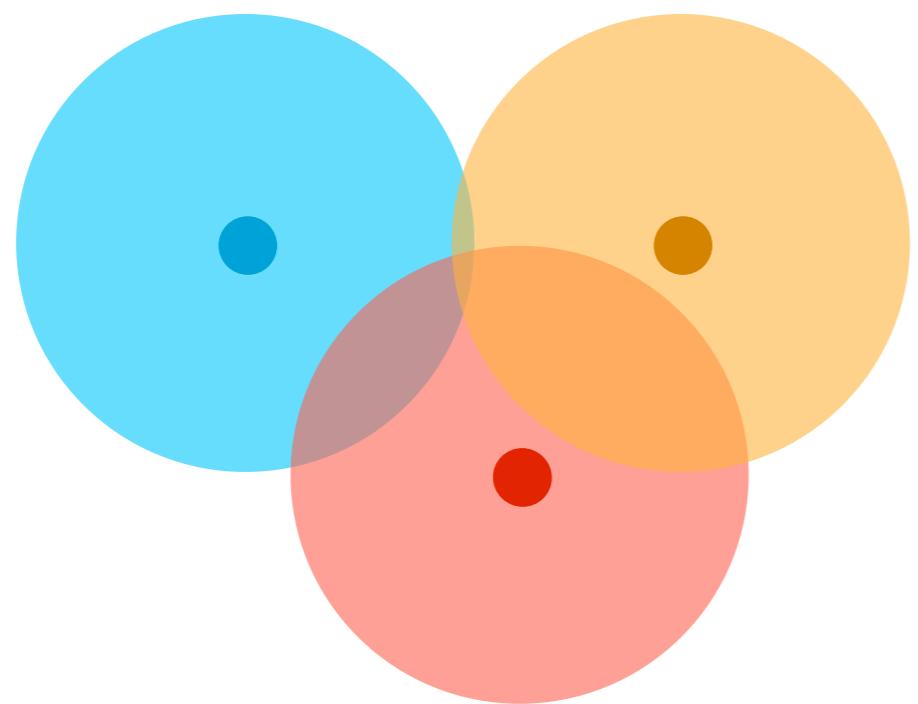


Phil Korngut (Caltech)

thumbnail stacking



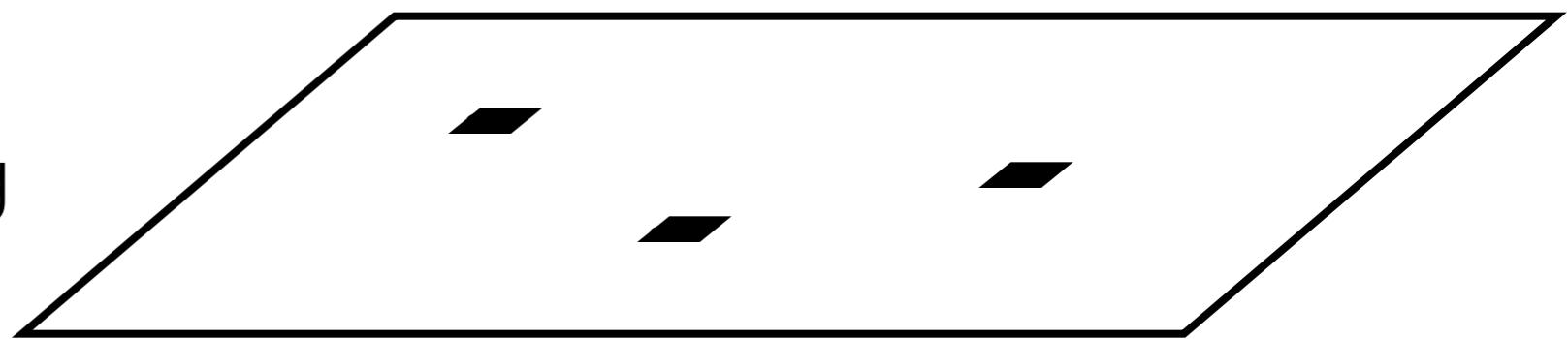
stacking is magic



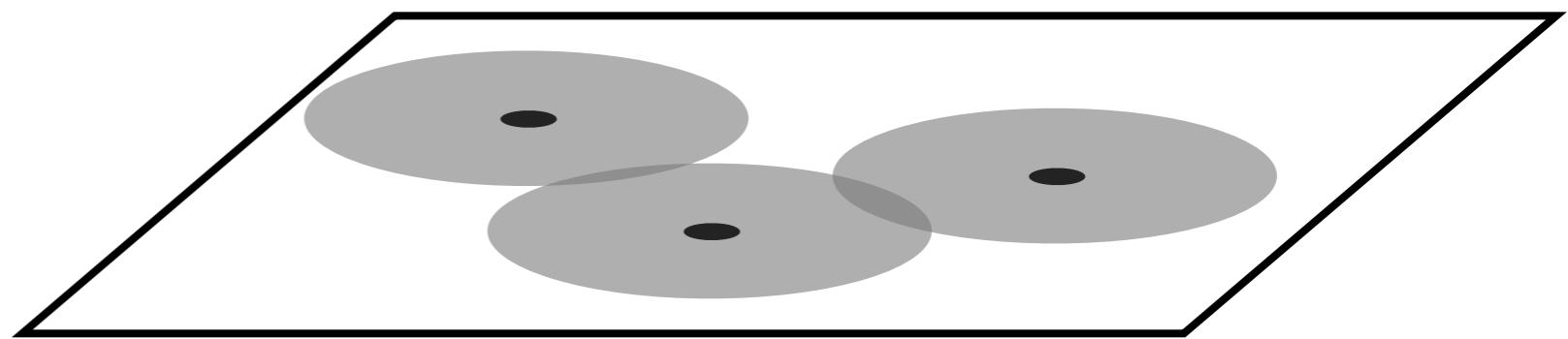
clustering induced bias

simultaneous stacking (SIMSTACK)

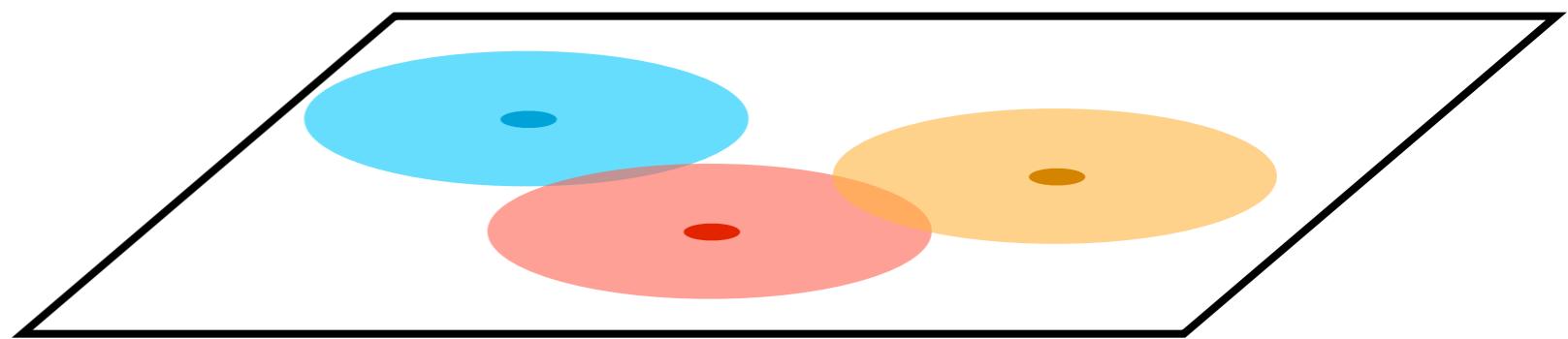
make hits map from catalog



convolve with map p.s.f.

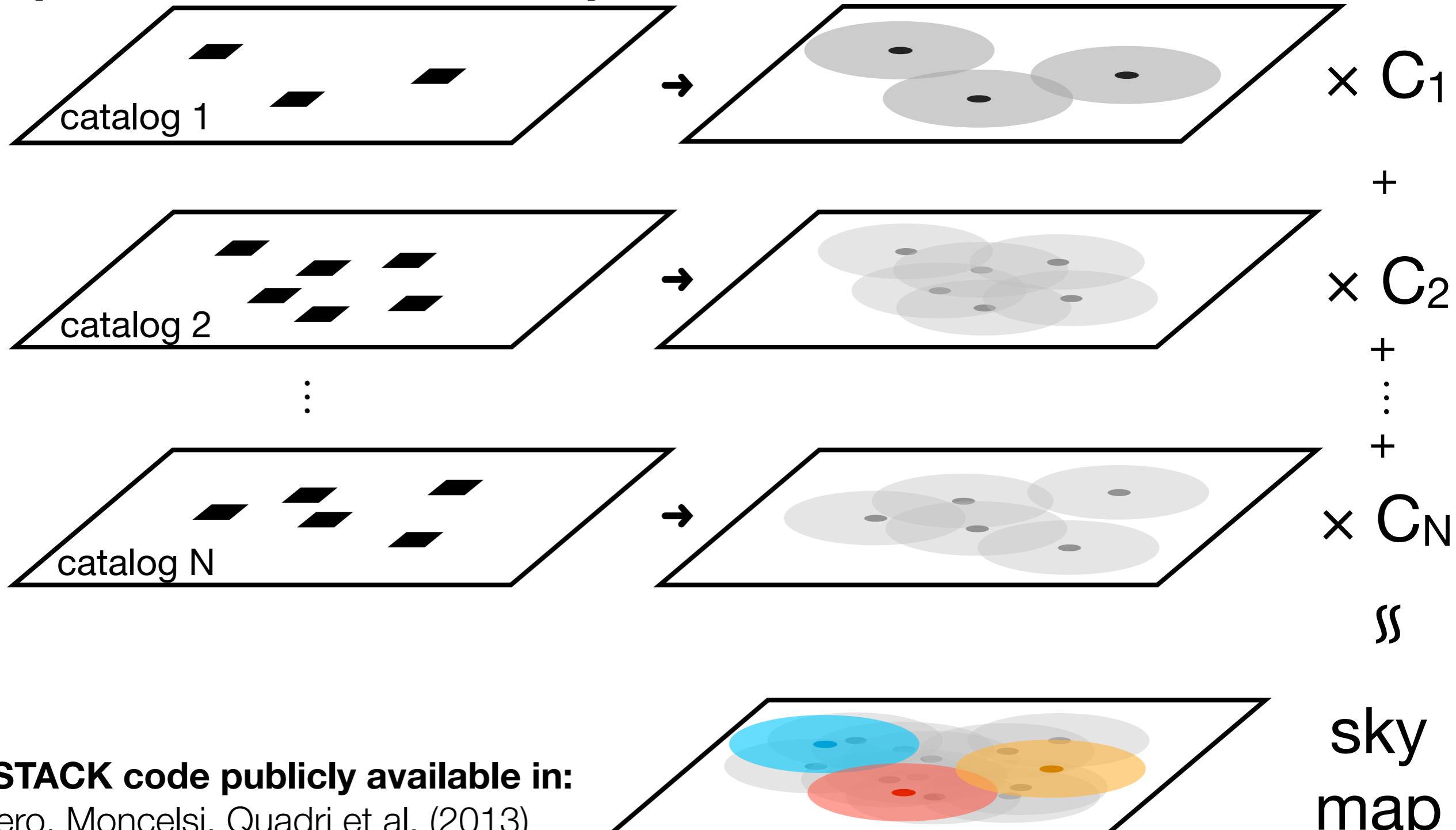


regress to find stacked flux



Formalism developed w/ Lorenzo Moncelsi (Caltech);
also see Kurczynski & Gawiser (2010), Roseboom et al. (2010)
SIMSTACK code publicly available in arXiv:1304.0446

simultaneous stacking (SIMSTACK)



SIMSTACK code publicly available in:

Viero, Moncelsi, Quadri et al. (2013)

arXiv:1304.0446

UDS data

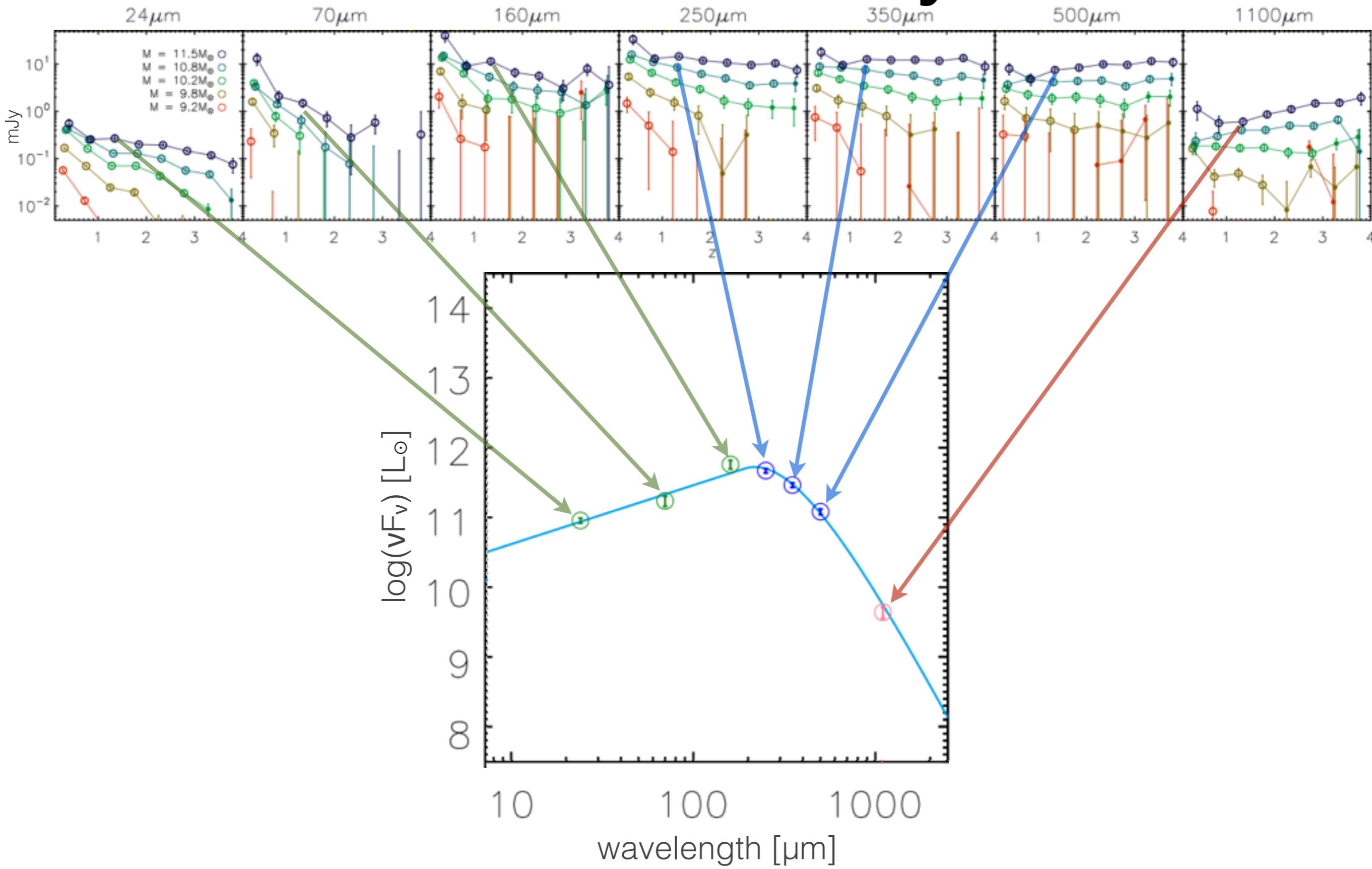
catalogs (Williams & Quadri, in prep.)

- UKIDSS/UDS [2/3 deg²]
 - uBVRizJHK + IRAC ch1234
 - K-band magnitude cut 24 AB
 - 54,000 sources in ~0.63 deg²
- redshifts - EAZY (Brammer 2008)
- masses - FAST (Kriek 2009)

maps (HerMES; Oliver et al. 2012)

- *Spitzer*/MIPS
 - 24, 70, 160um
- *Herschel*/SPIRE
 - 250, 350, 500um
- ASTE/AzTEC
 - 1100um

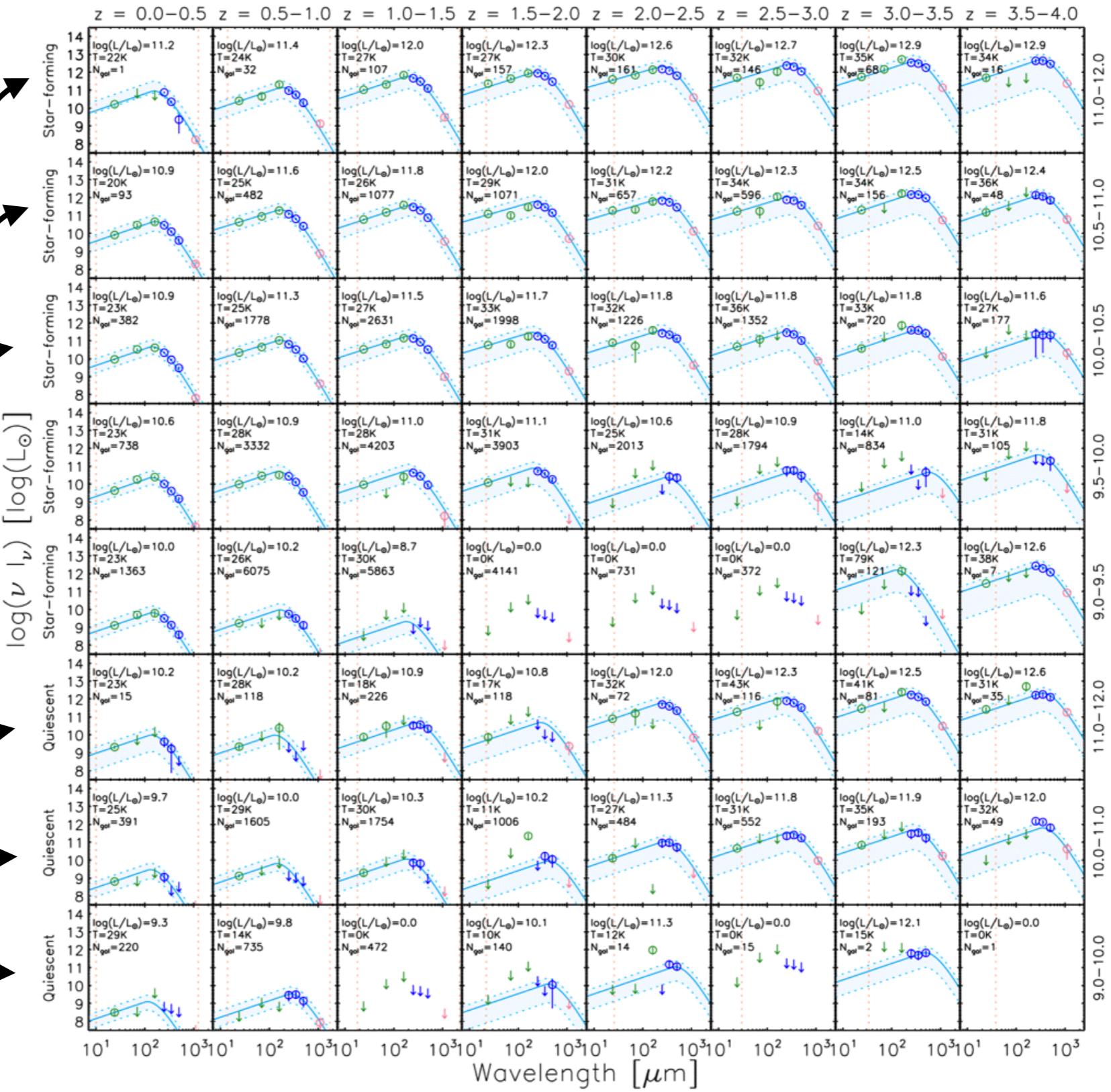
stacked flux density

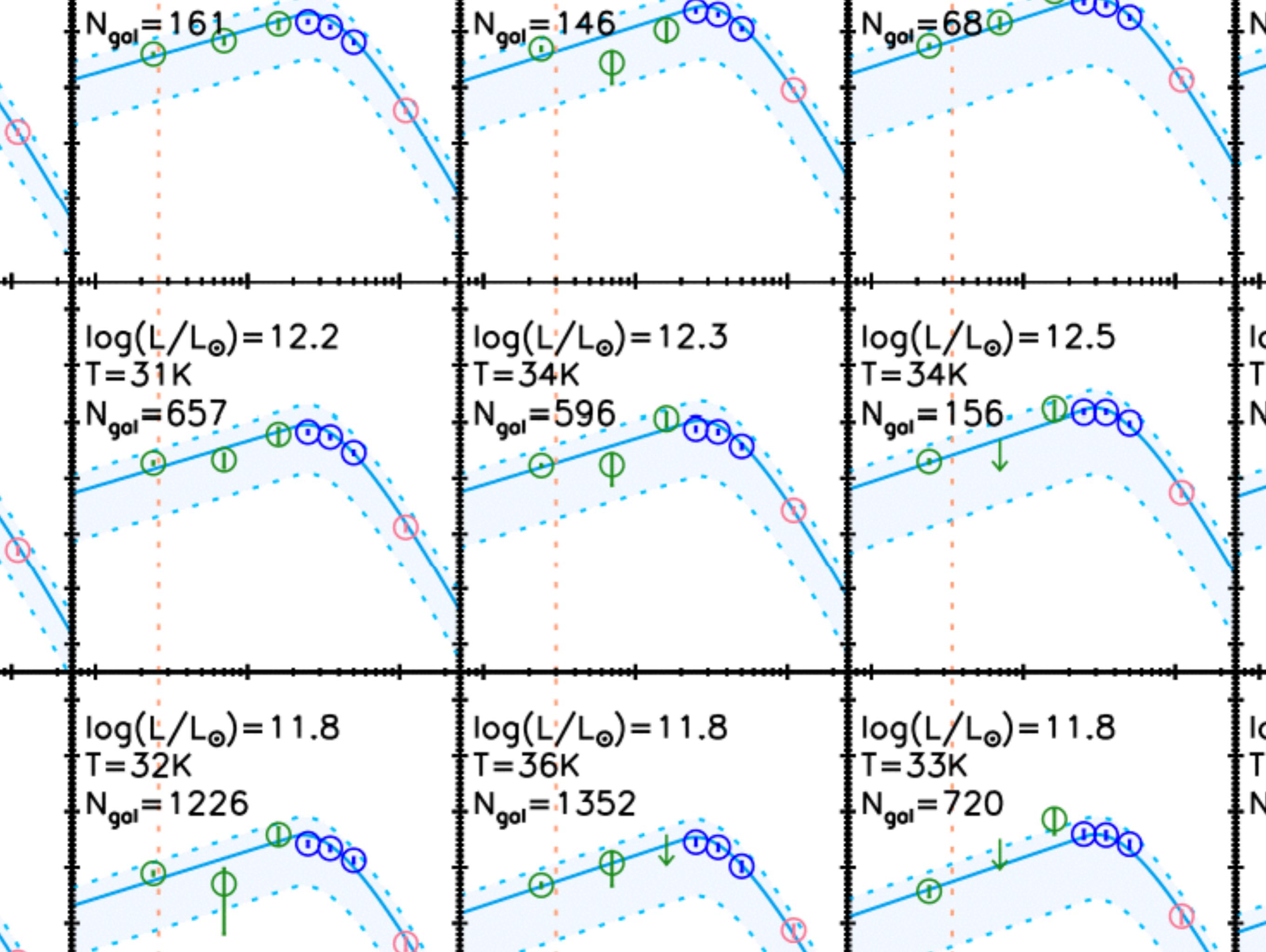


SEDS

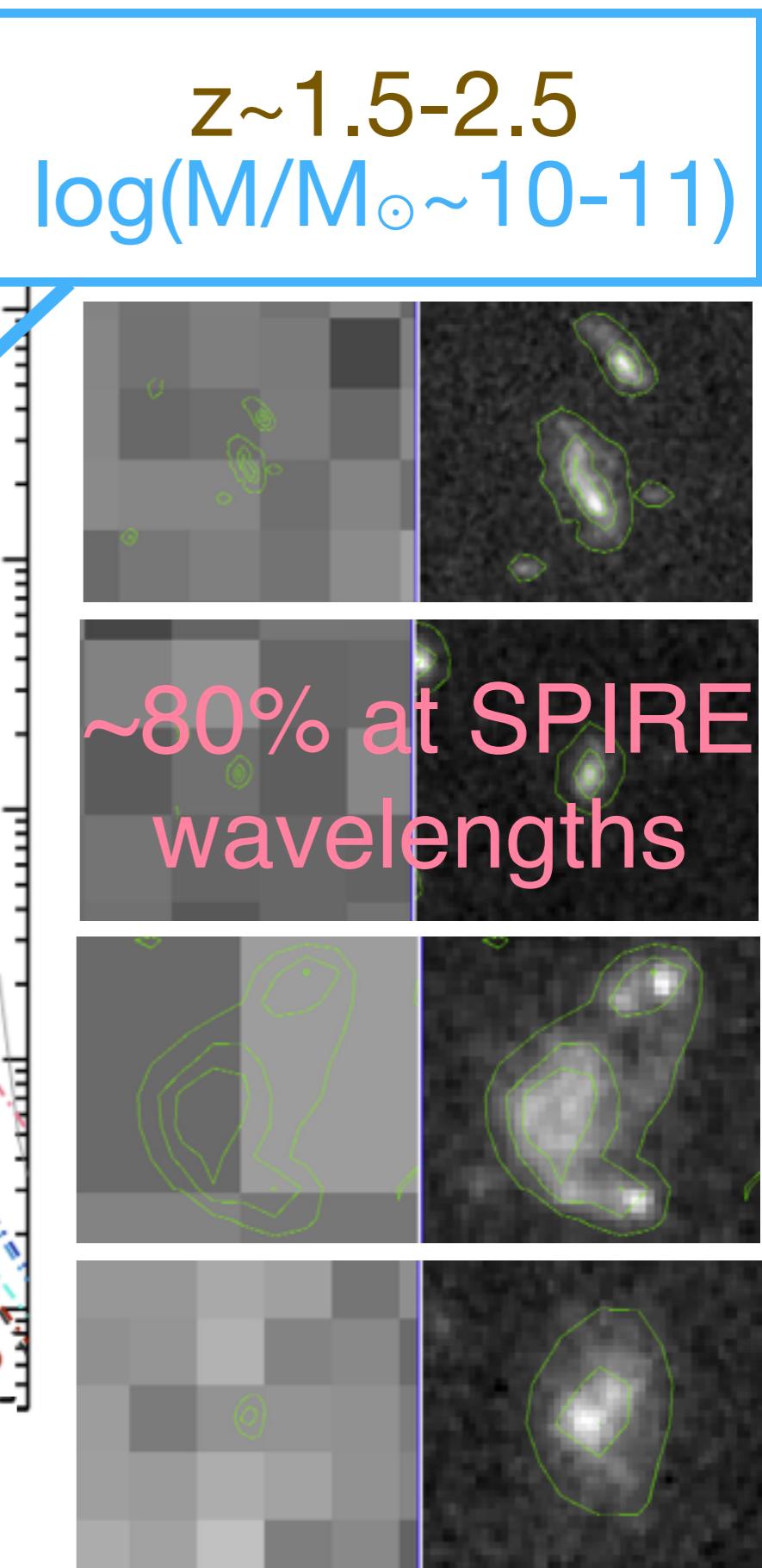
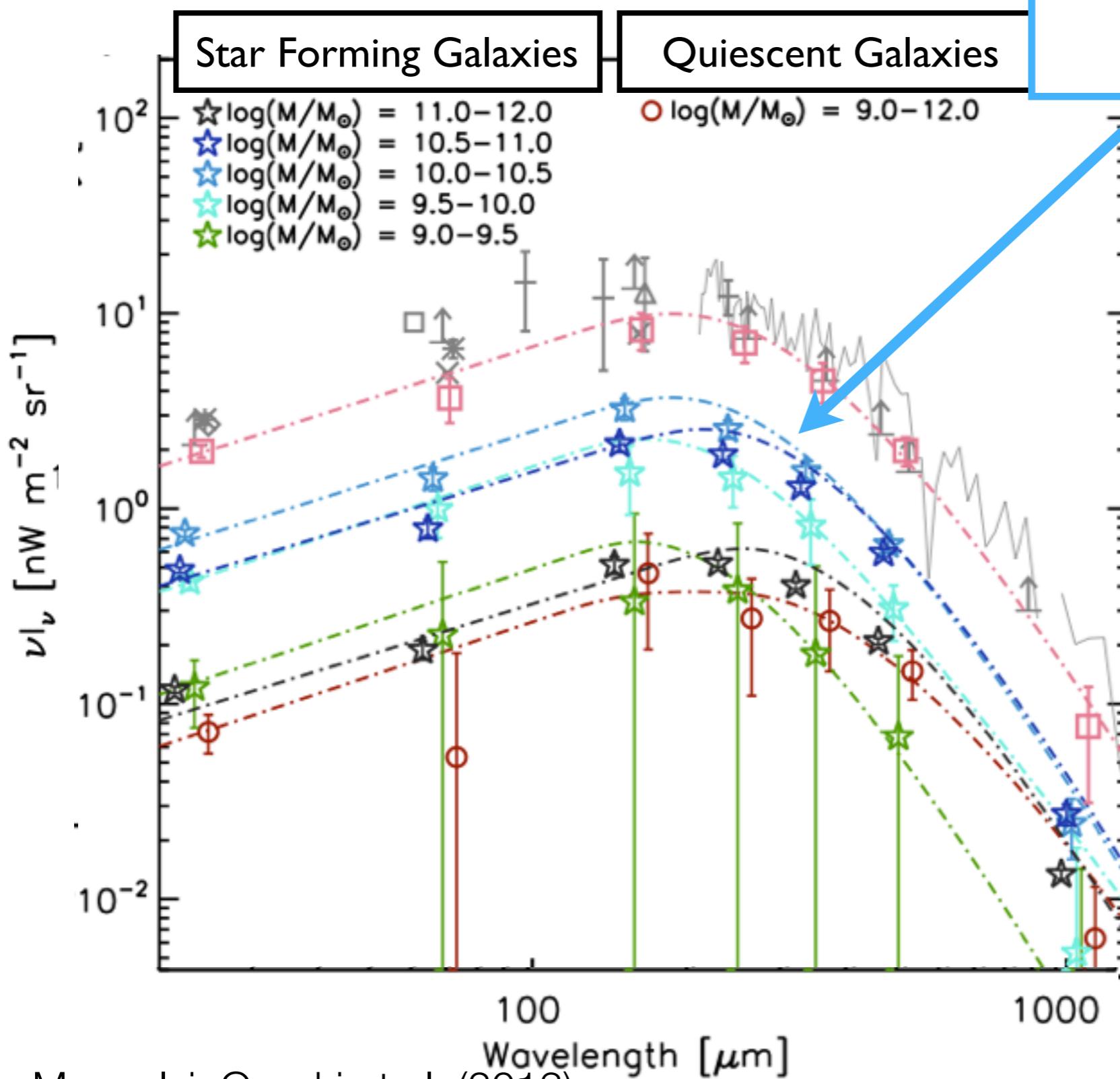
mass slices

redshift slices

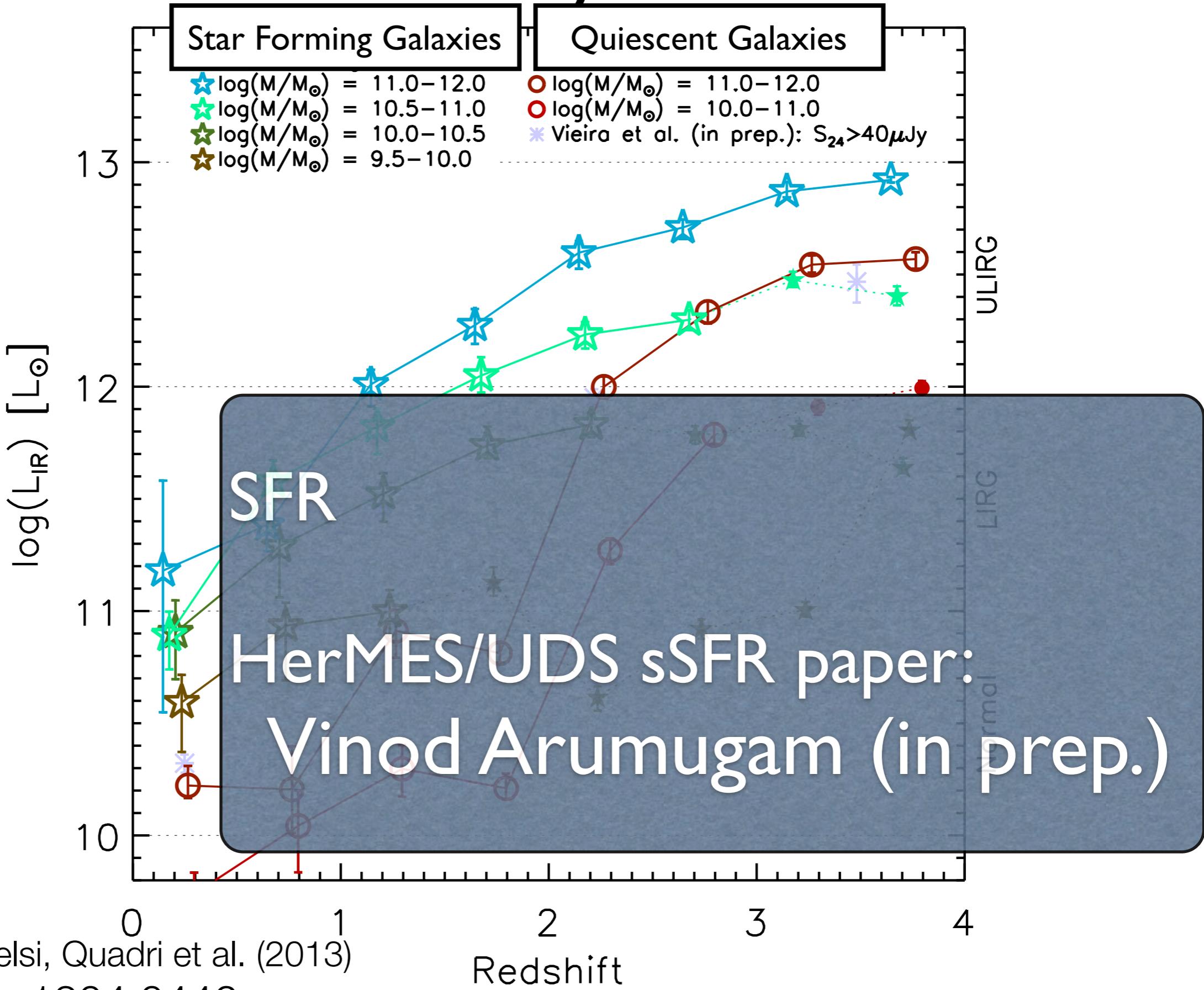




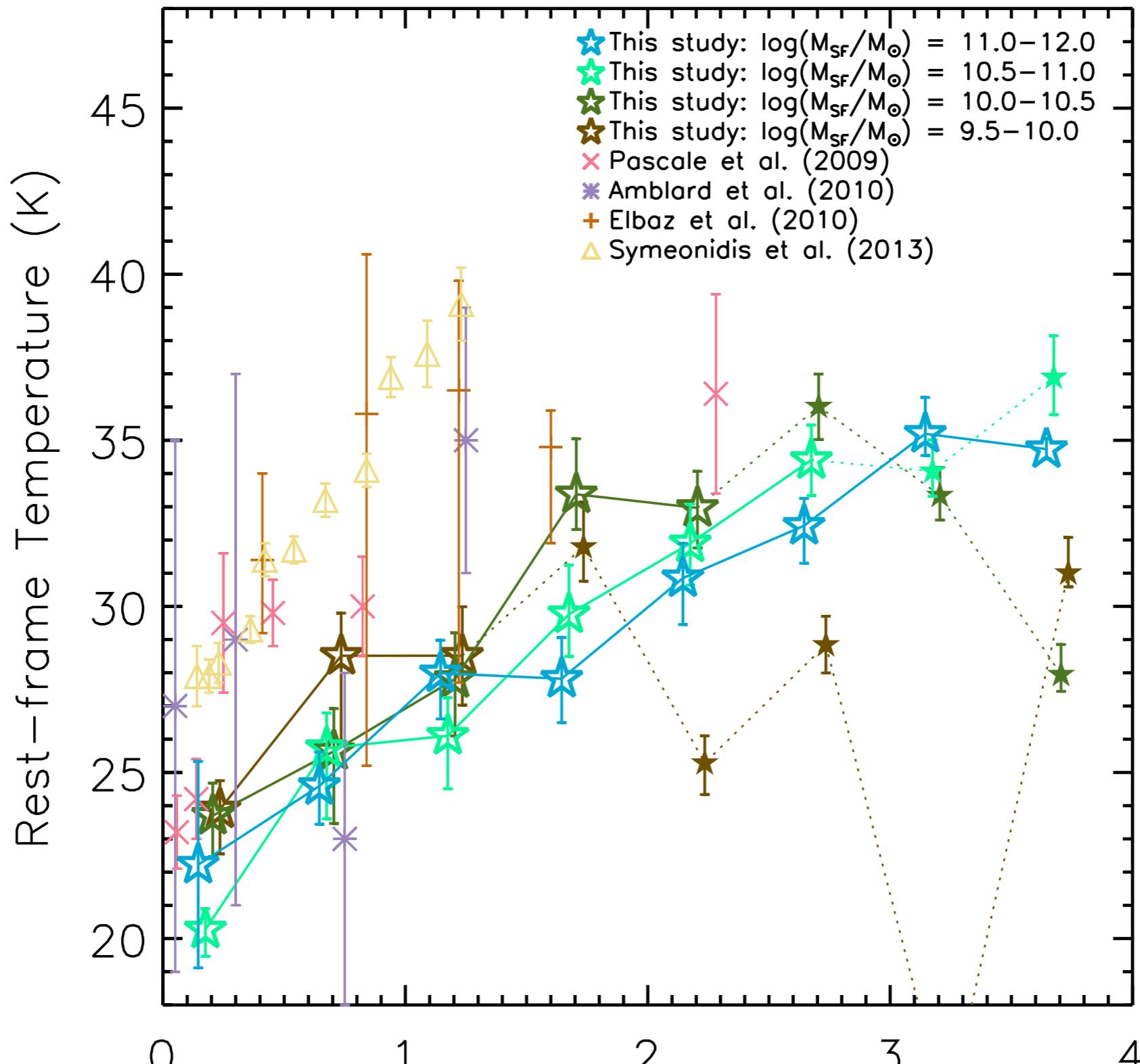
stacked CIB



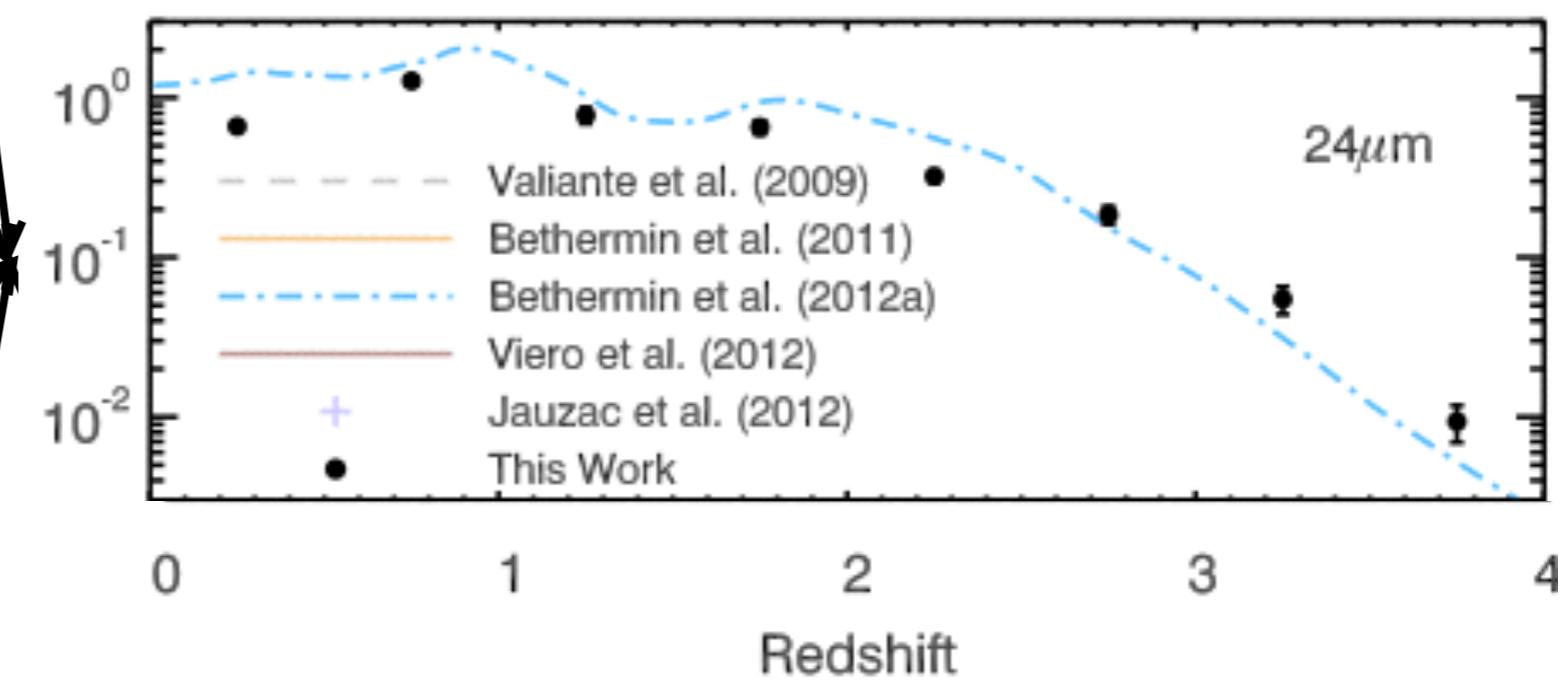
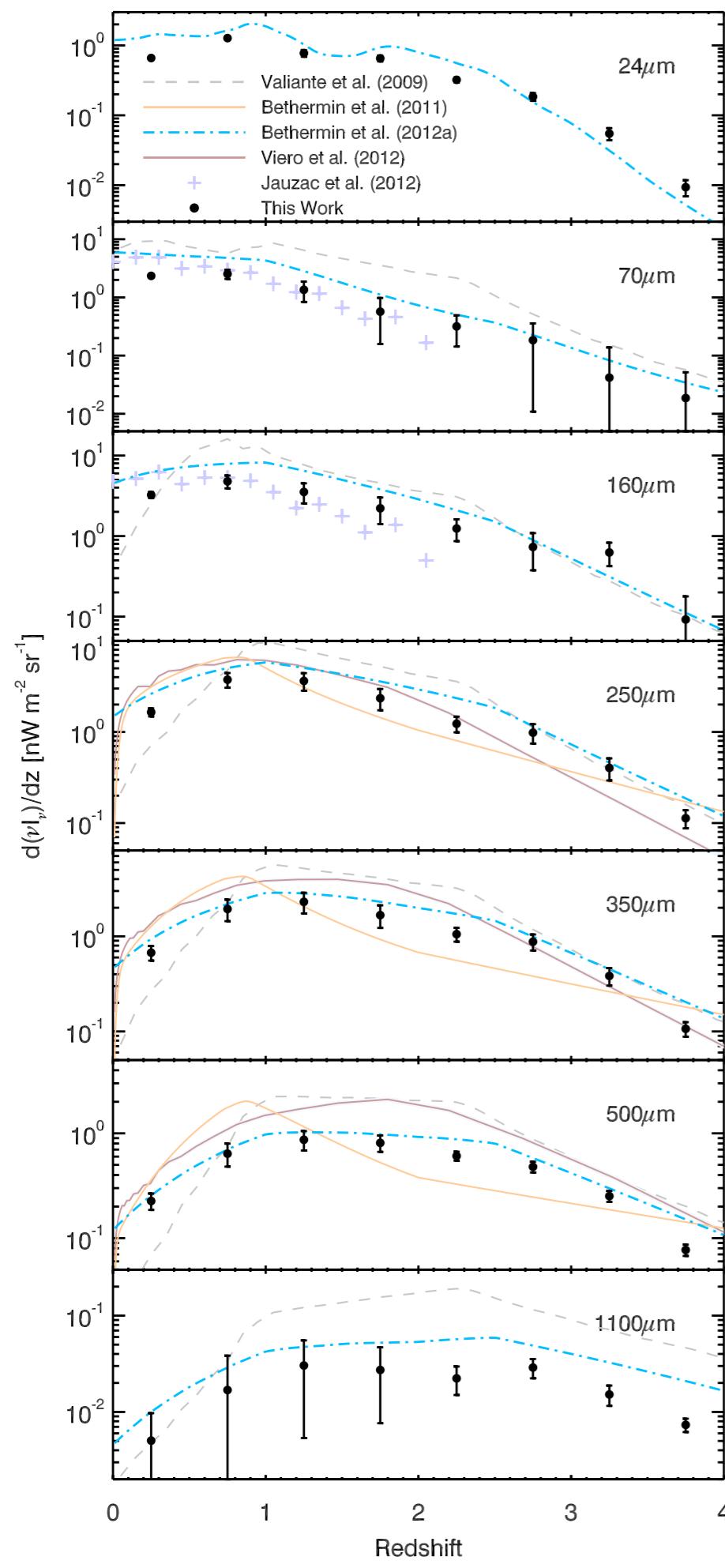
Infrared Luminosity



SED Temperature



Redshift Distribution of CIB



Viero, Moncelsi, Quadri et al. (2013)
arXiv:1304.0446

summary

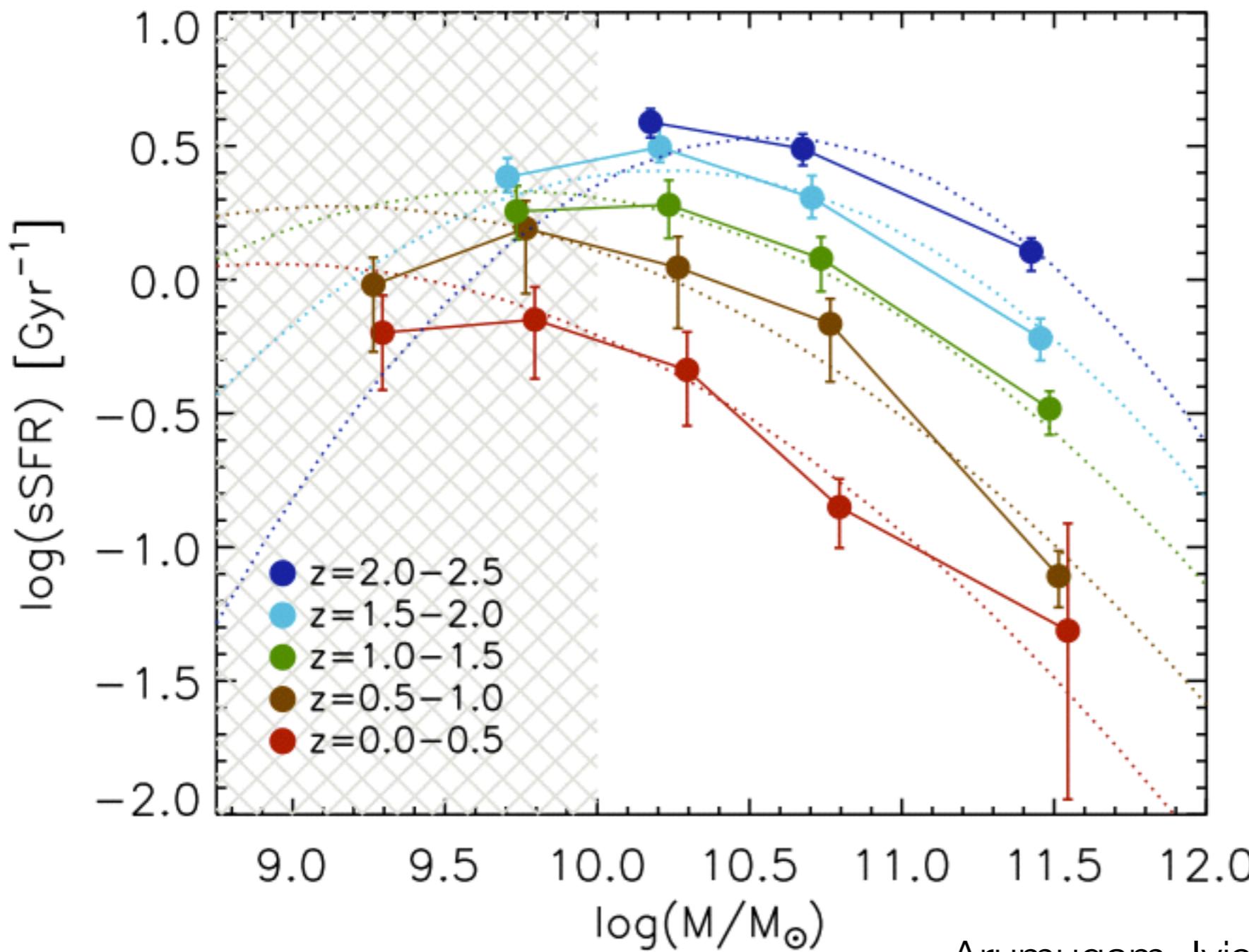
- ~99% of sources lie beneath the confusion noise floor
- Peak **Halo** Mass of efficient SF
 - $\log(M_{\text{halo}}/\text{M}_{\odot}) = 12.2 \pm 0.5$
- Peak **Stellar** Mass of CIB sources
 - $\log(M_{\text{star}}/\text{M}_{\odot}) = 10-11$

SIMSTACK code publicly available in:

Viero, Moncelsi, Quadri et al. (2013)

arXiv:1304.0446

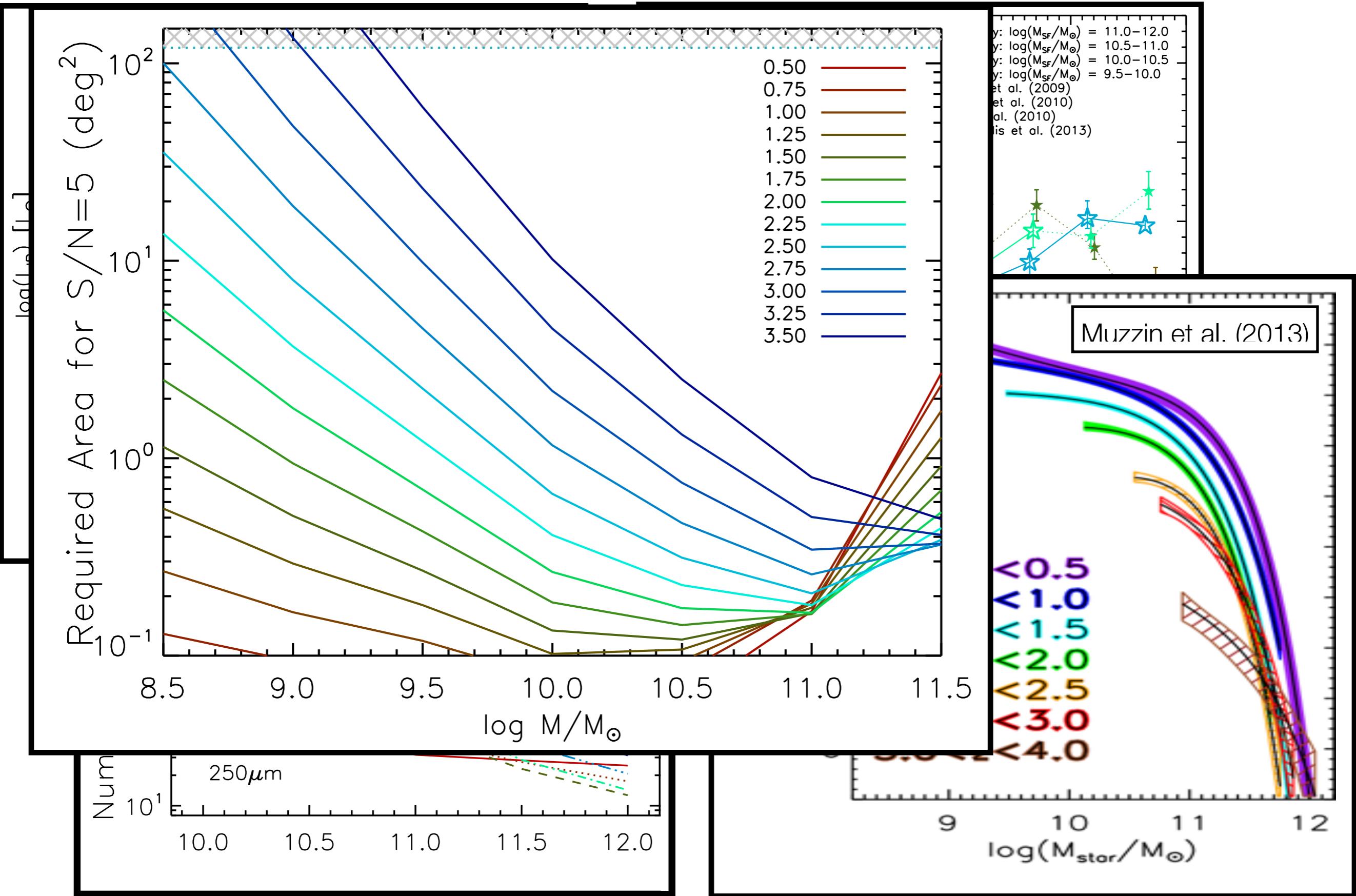
Reaching our Limits

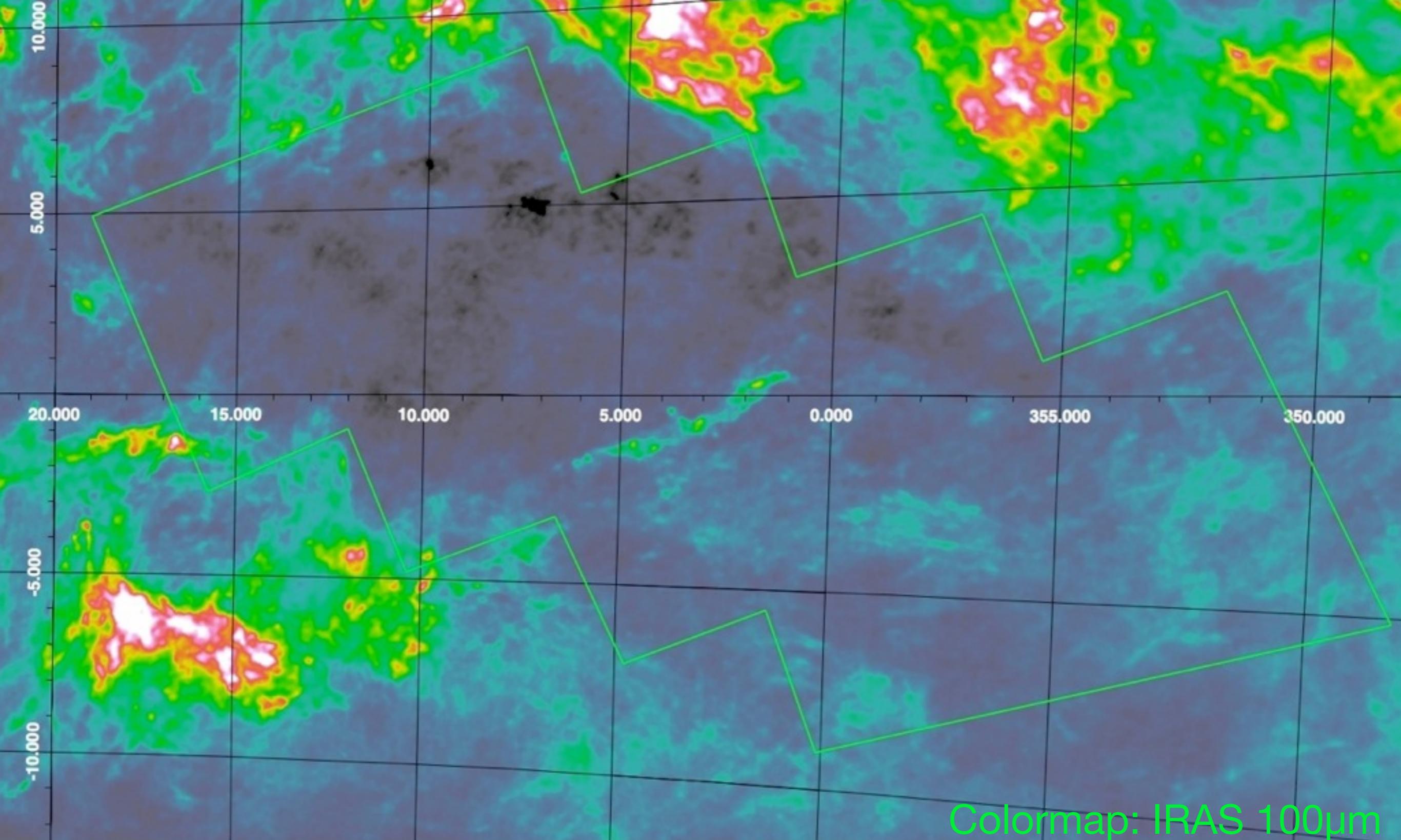


- Can Measure sSFRs well to:
 - $0 < z < 2.5$
 - $\log(M/M_\odot \gtrsim 10)$
- **How can we reach higher-z and lower mass?**

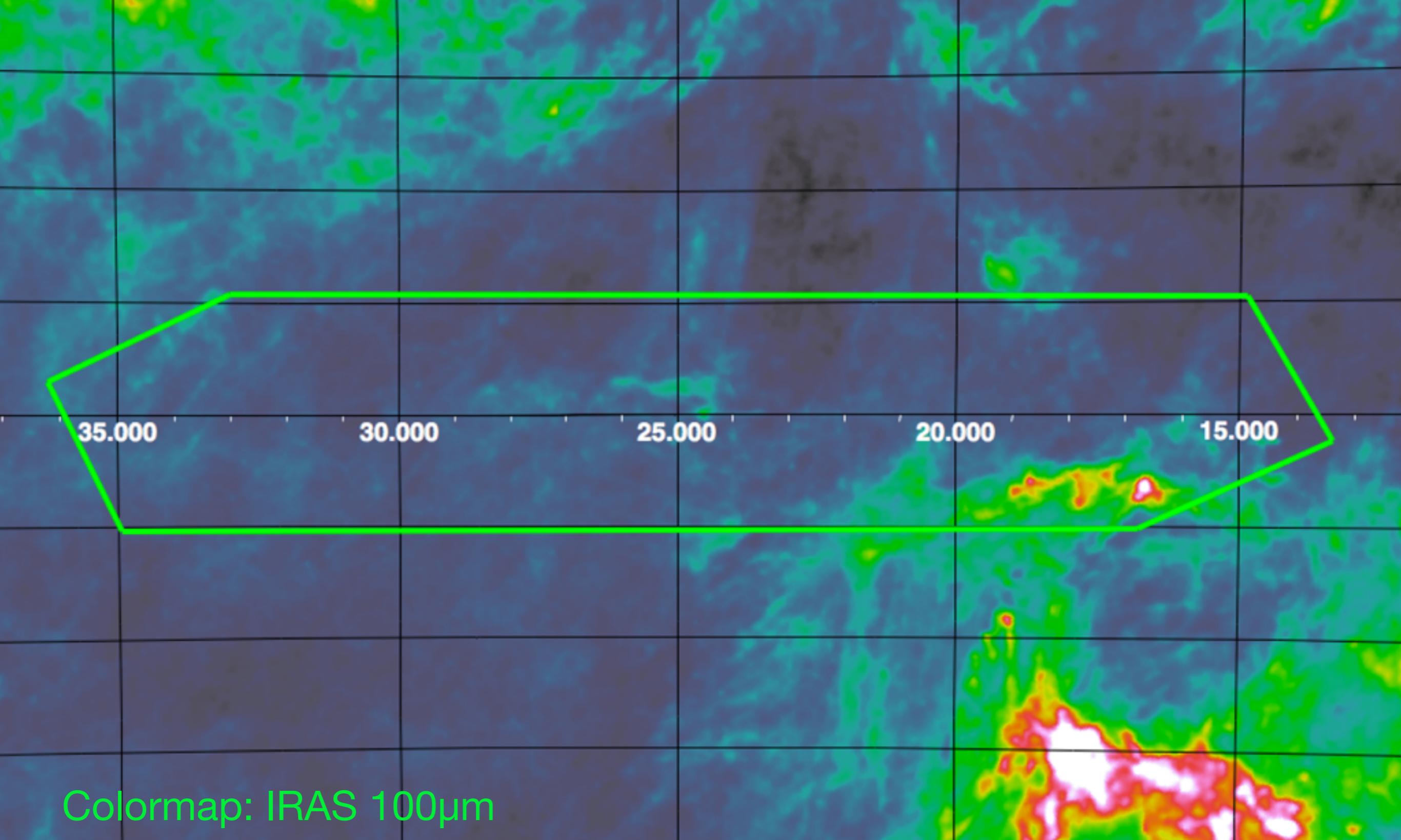
Arumugam, Ivison, Viero et al. (in prep.)

By going big!



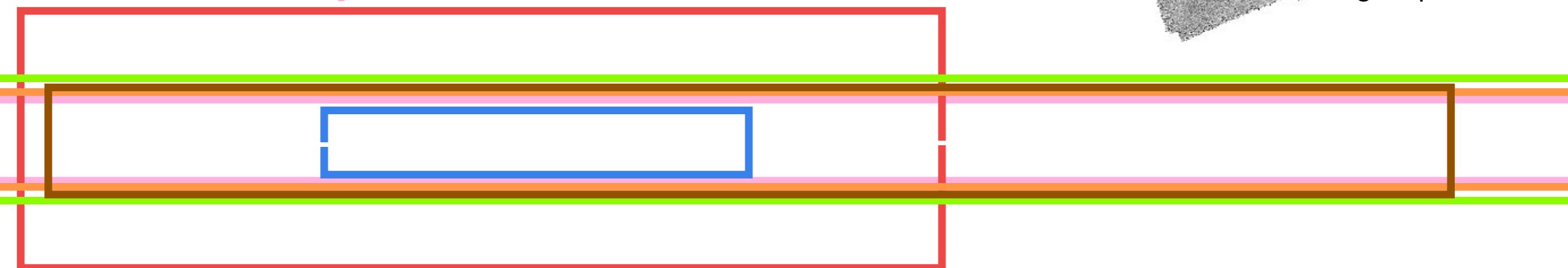
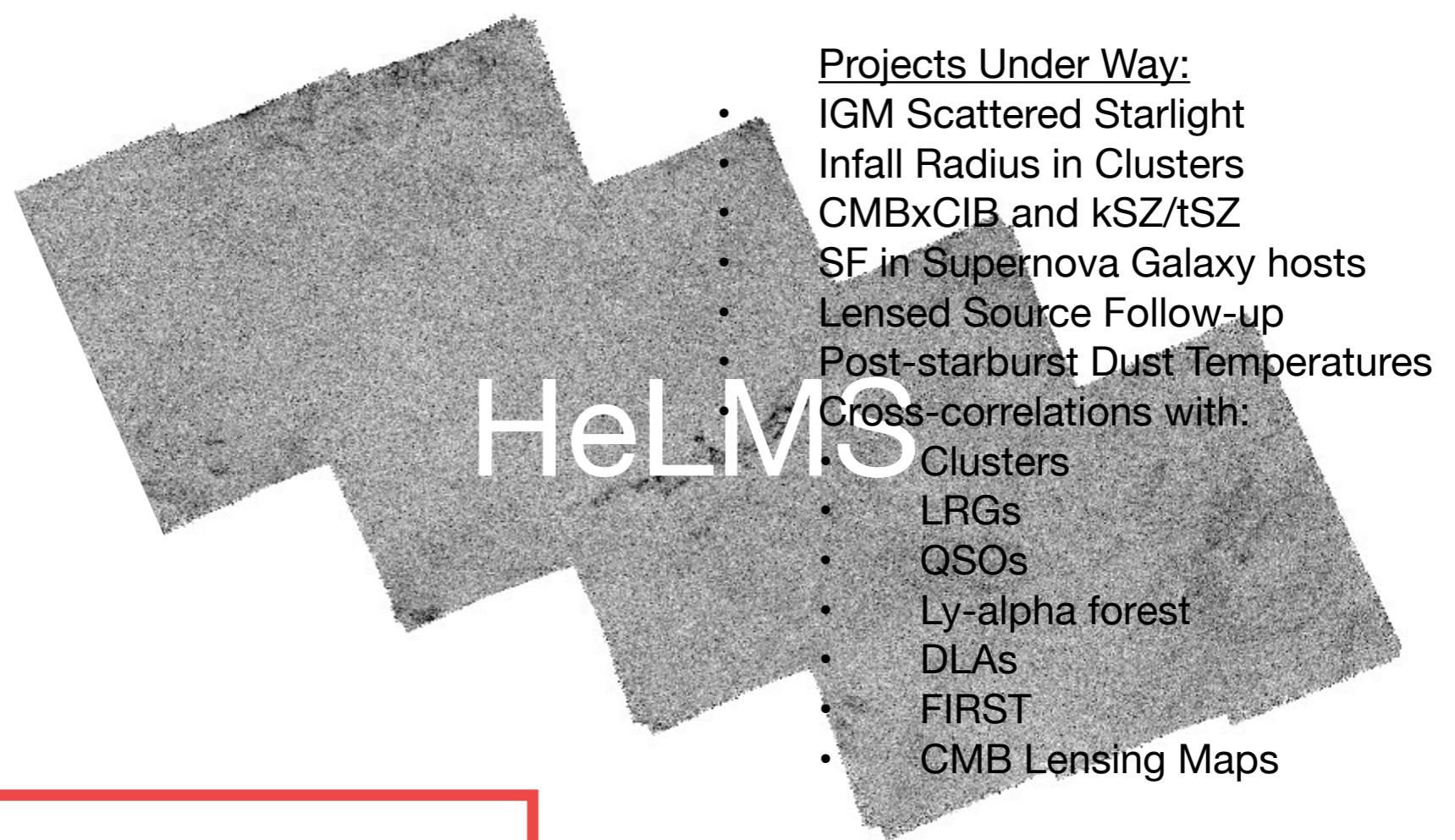


HerMES Large-Mode Survey (HeLMS)



Herschel Redshift Survey (HeRS)

ACT
SHELA
SpIES
HETDEX
SDSS Stripe 82



Also:

- DES (DHS?)
- VHS/VICS82
- VLA
- Wiggle-z
- LSST

Includes:

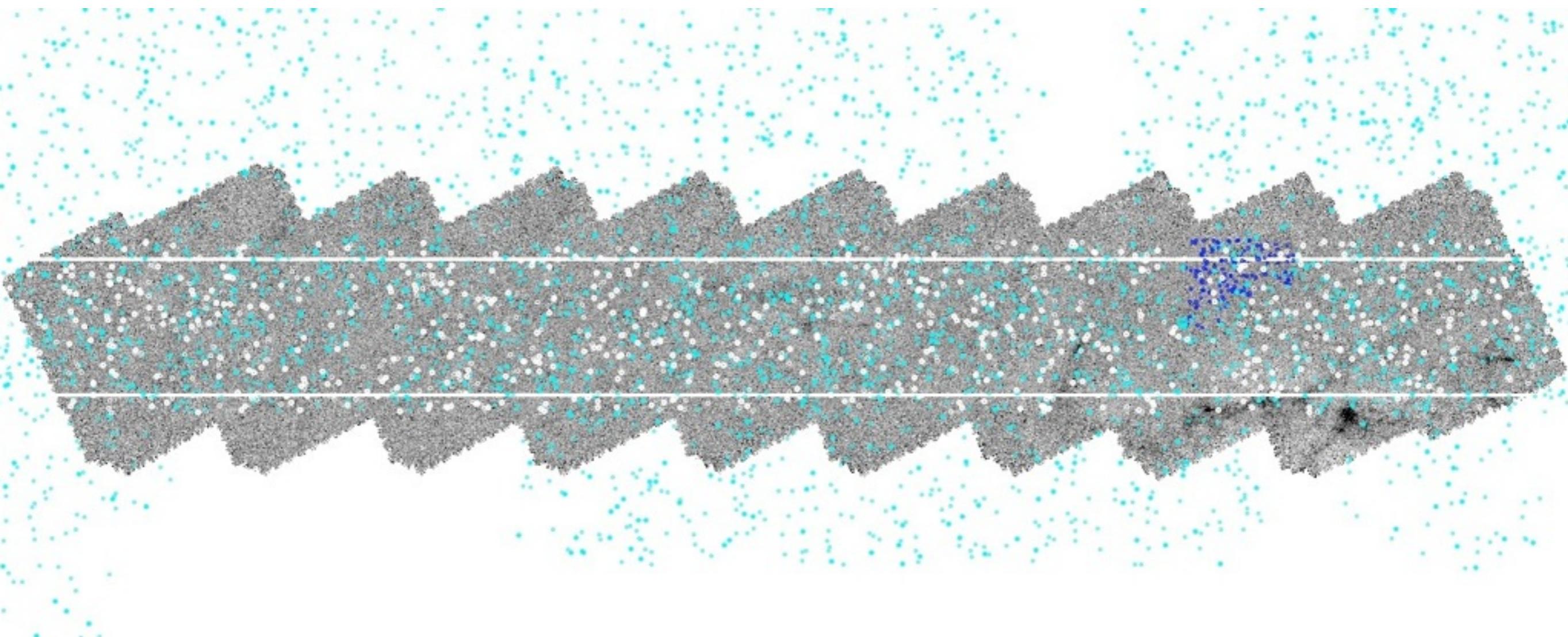
- Clusters
- QSOs
- LRGs
- maxBCGs
- HI

Optical Spectra:

- Lyman Alpha Forest
- DLAs/Mg2/CIV

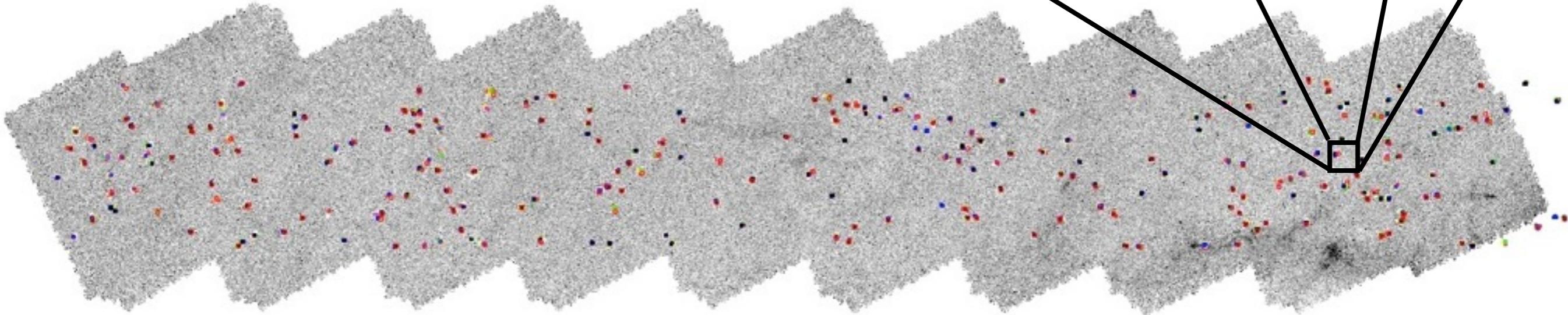
END!

Extra Slides Hereafter:



HeRS

- Clusters (Geach et al. 2012)
- BOSS quasars
- Wigglez

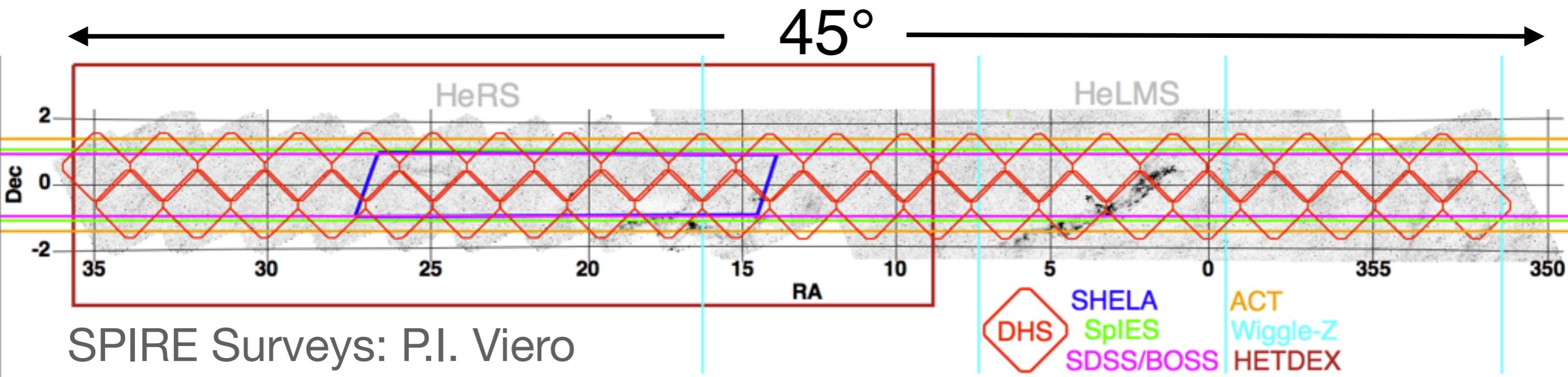


- ClustersMembers (set al. 2012)

HeRS

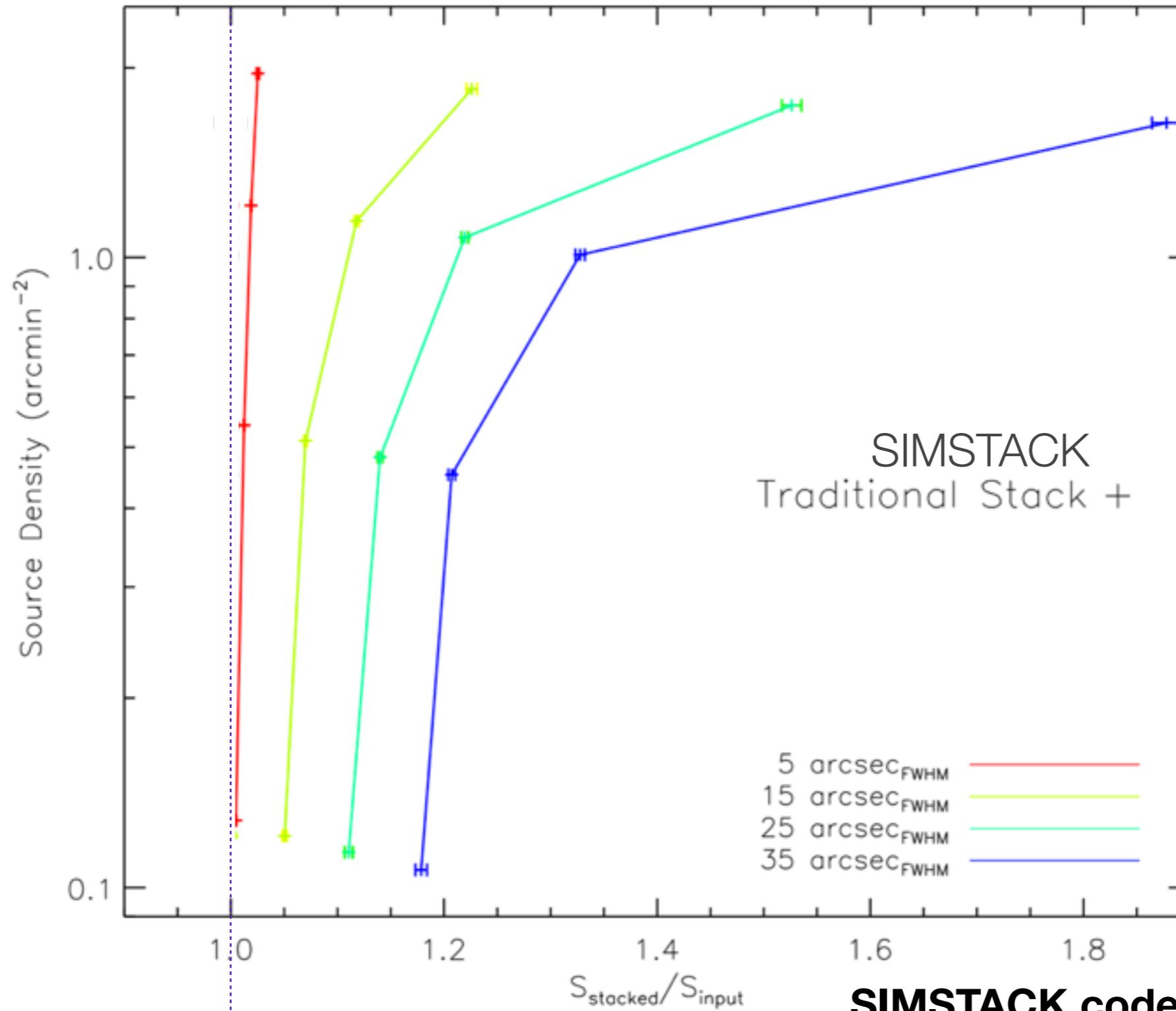
More info at:

[http://www.astro.caltech.edu/~viero/viero homepage/hers.html](http://www.astro.caltech.edu/~viero/viero/homepage/hers.html)



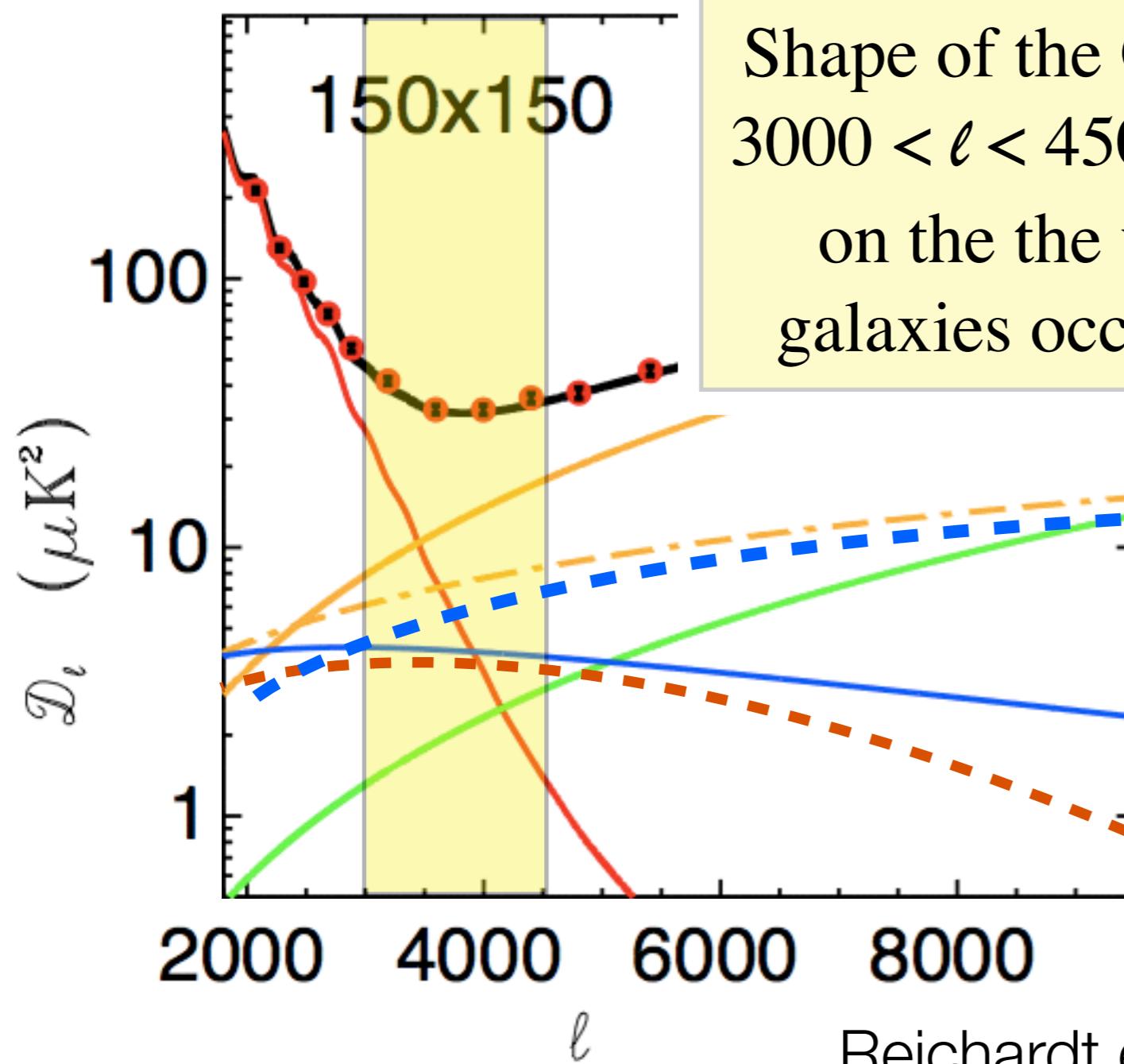
HeLMS/HeRS/DHS

SIMSTACK simulation



unbiased

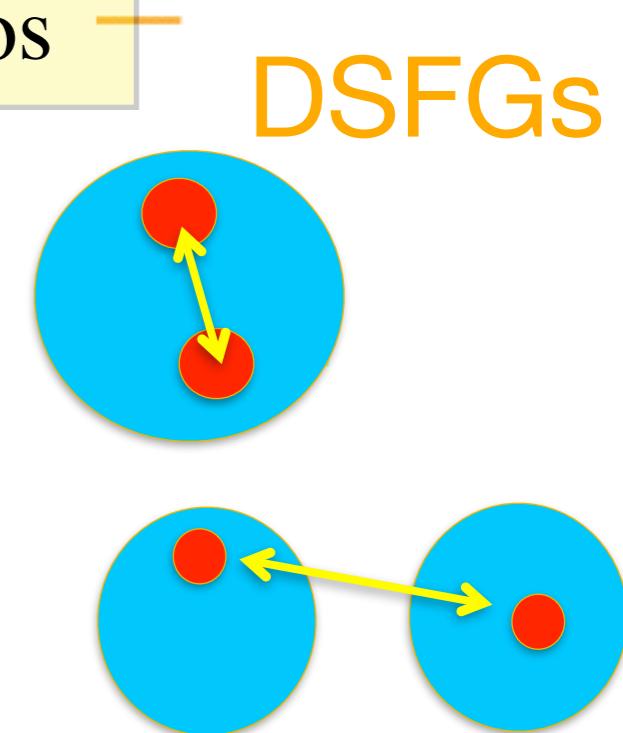
SIMSTACK code publicly available in:
Viero, Moncelsi, Quadri et al. (2013)
arXiv:1304.0446



Shape of the Galaxy Spectrum at
 $3000 < \ell < 4500$ highly dependent
on the way star-forming
galaxies occupy massive halos

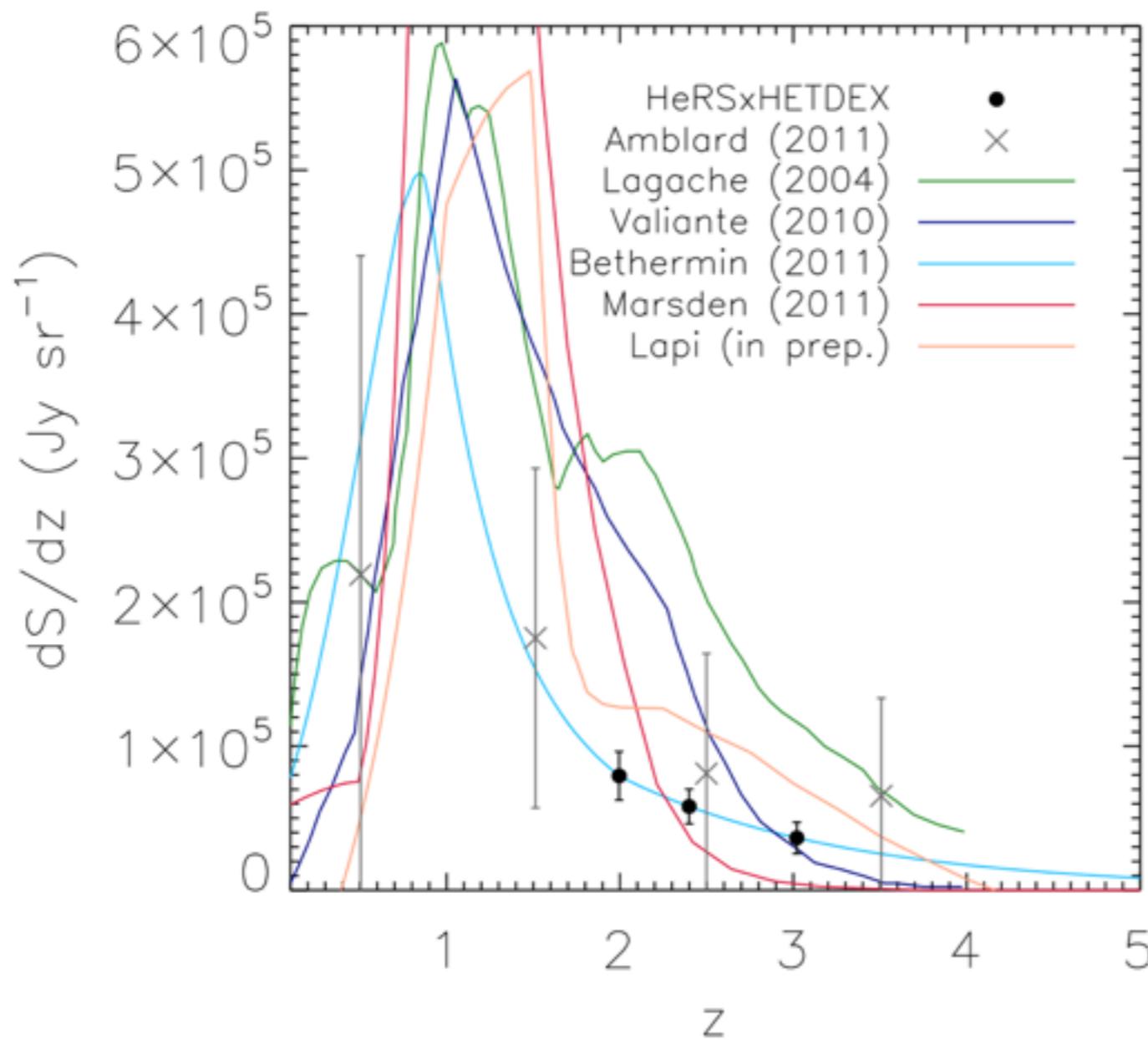
1-halo
(non-linear)

2-halo (linear)



Reichardt et al. (2011)

Power Sources in CMB maps



- dS/dz : redshift distribution of background light
- Models do not agree on dS/dz for $z > 1$
- Aim to constrain dS/dz from $2 > z > 3$ to 5σ

redshift distribution of CIB