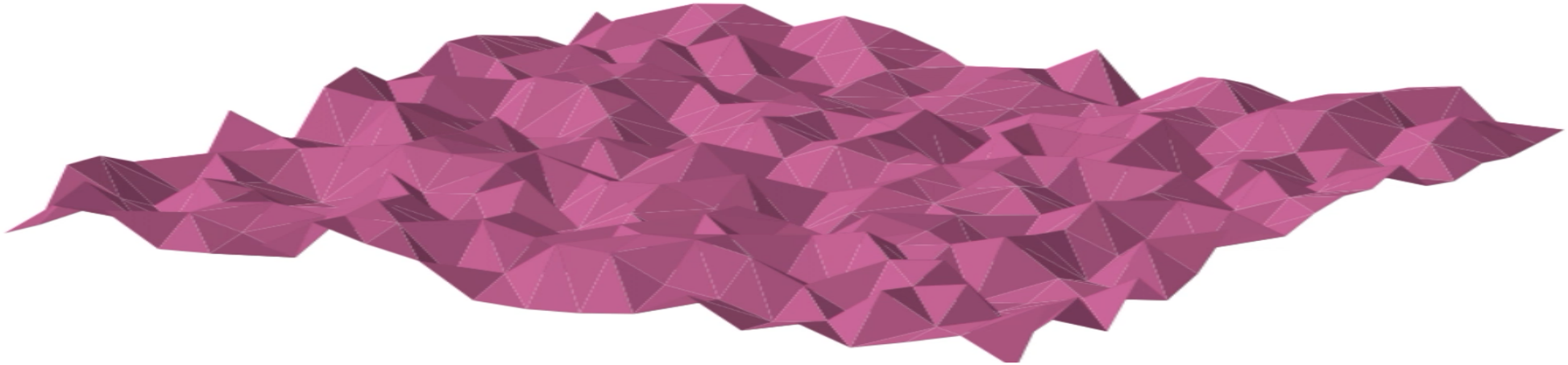
Jet Propulsion Laboratory
California Institute of Technology

# Bringing Manifold Learning and Dimensionality Reduction to SEDfitters

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Government sponsorship acknowledged.

# Self Organizing Maps

Class of Unsupervised neural networks to reduce dimensionality while preserving topology

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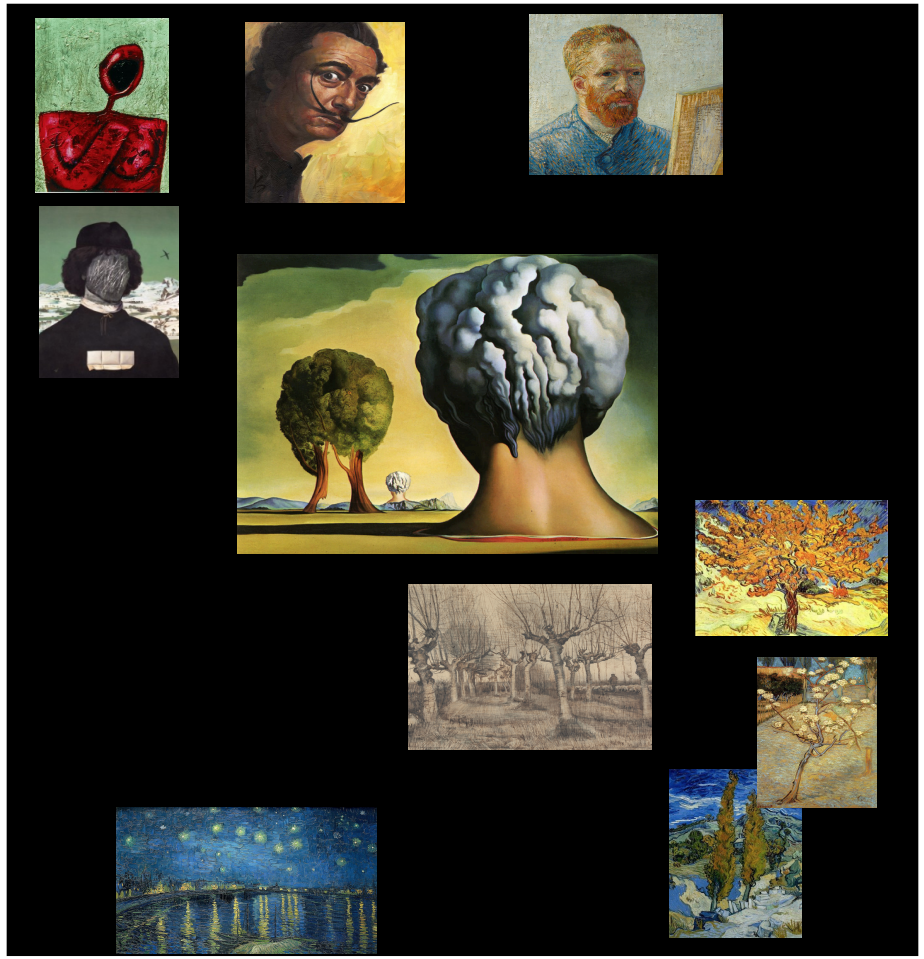
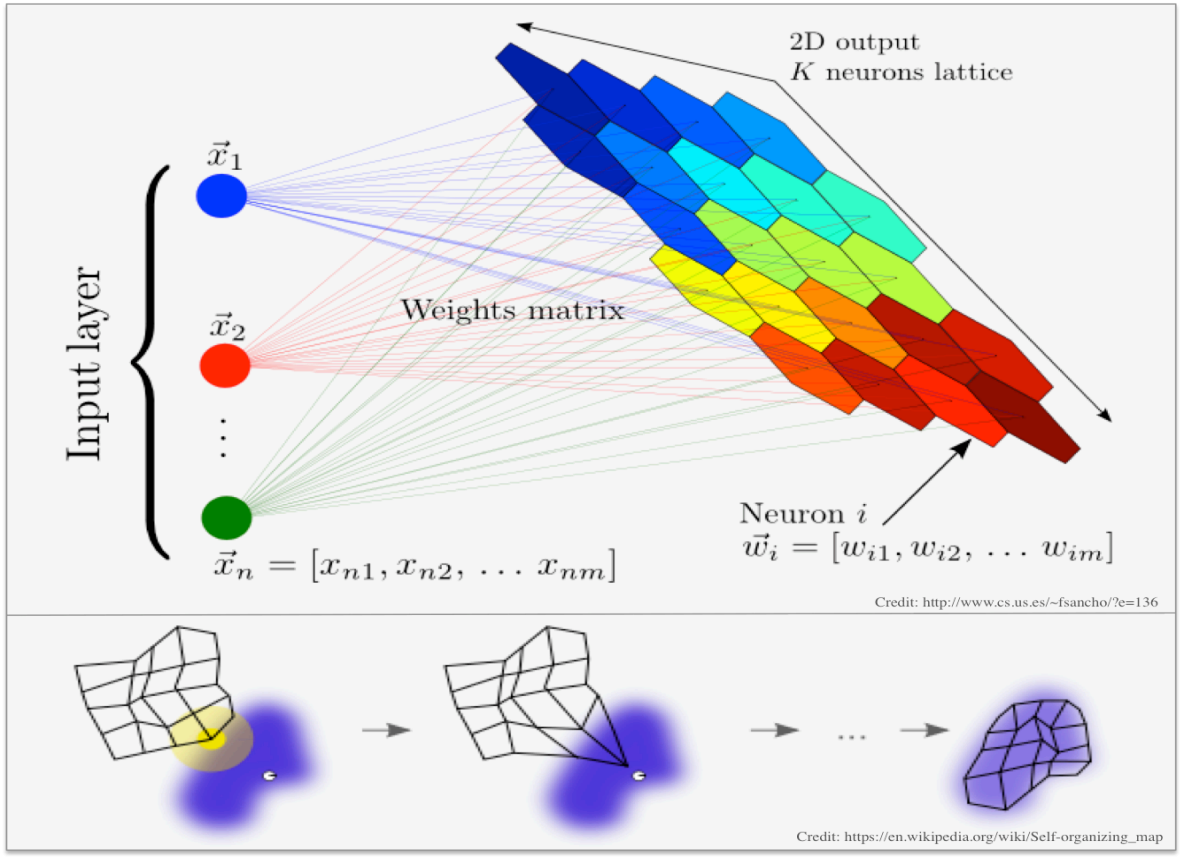
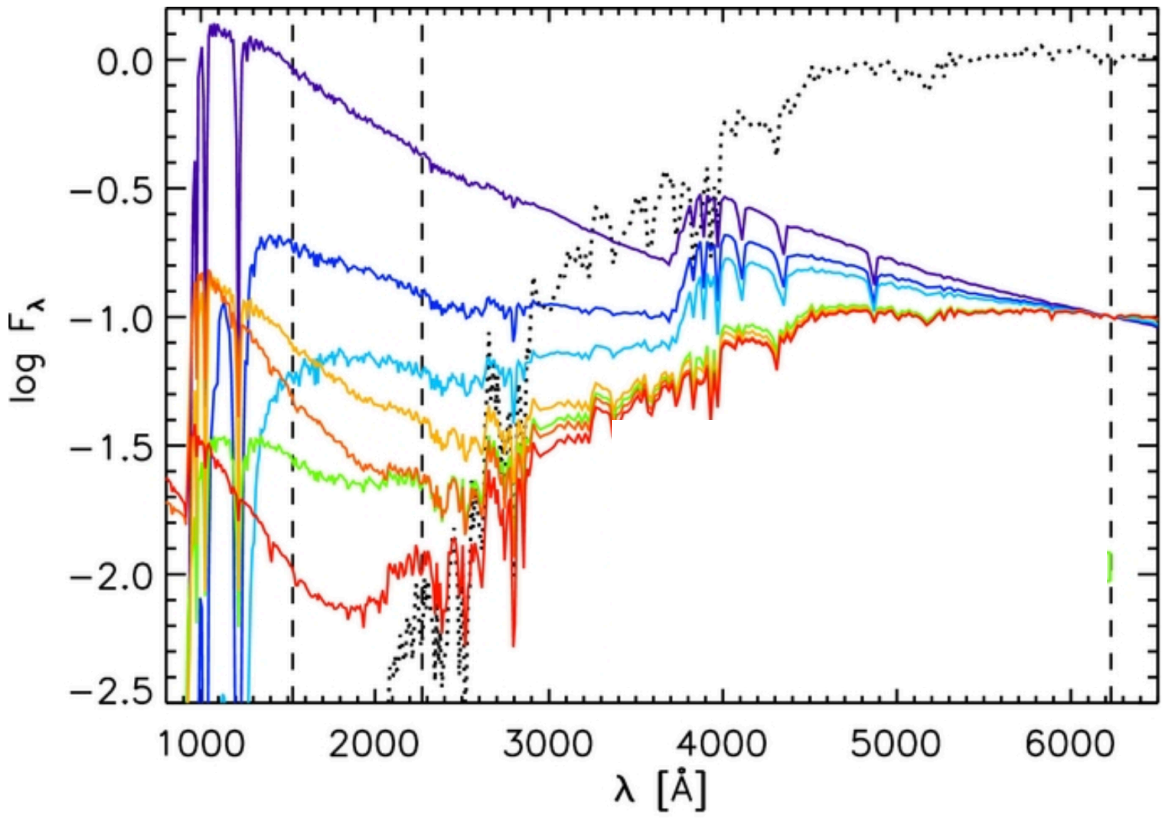
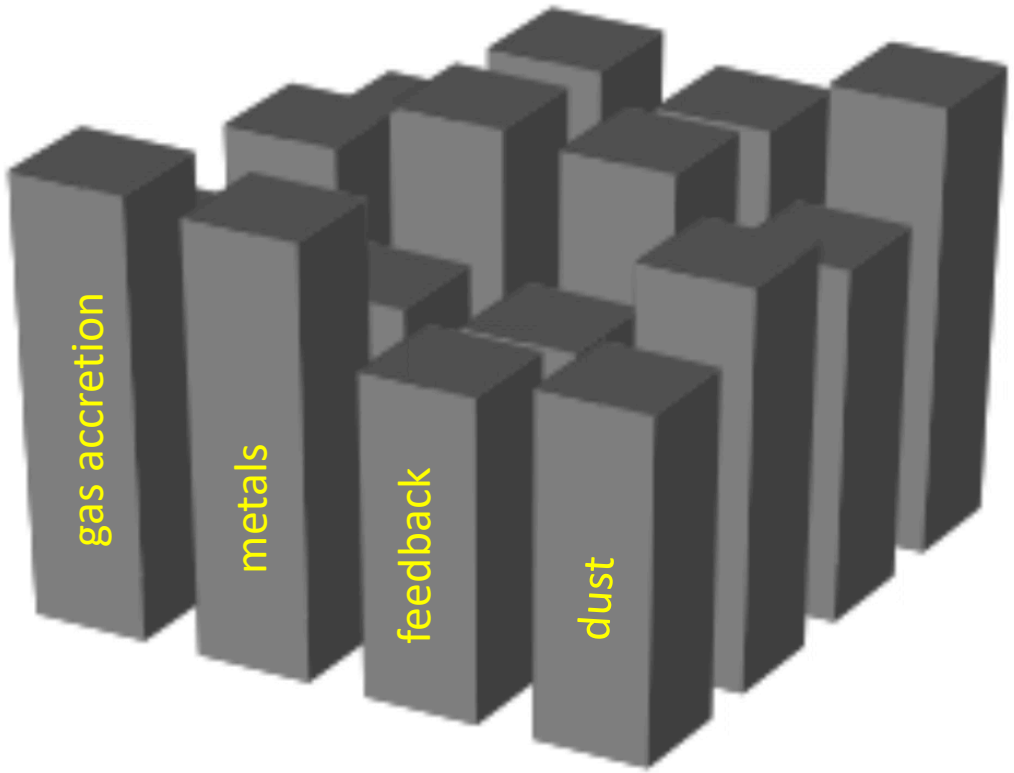




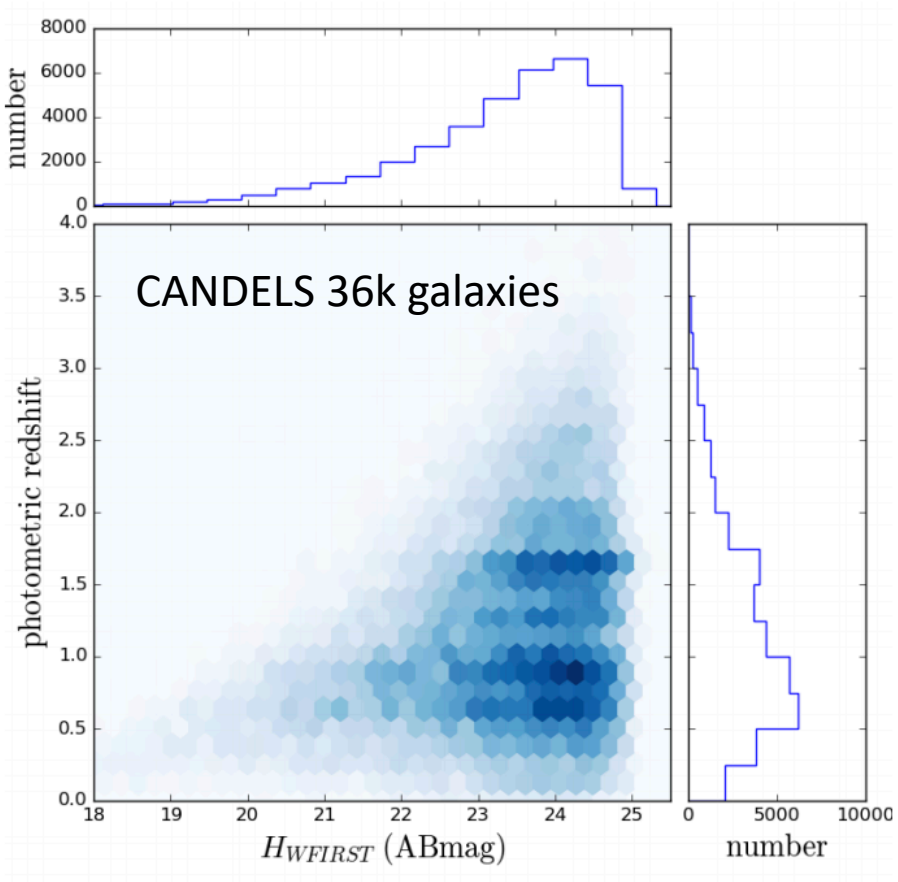
# Galaxy Evolution and problem of dimensions

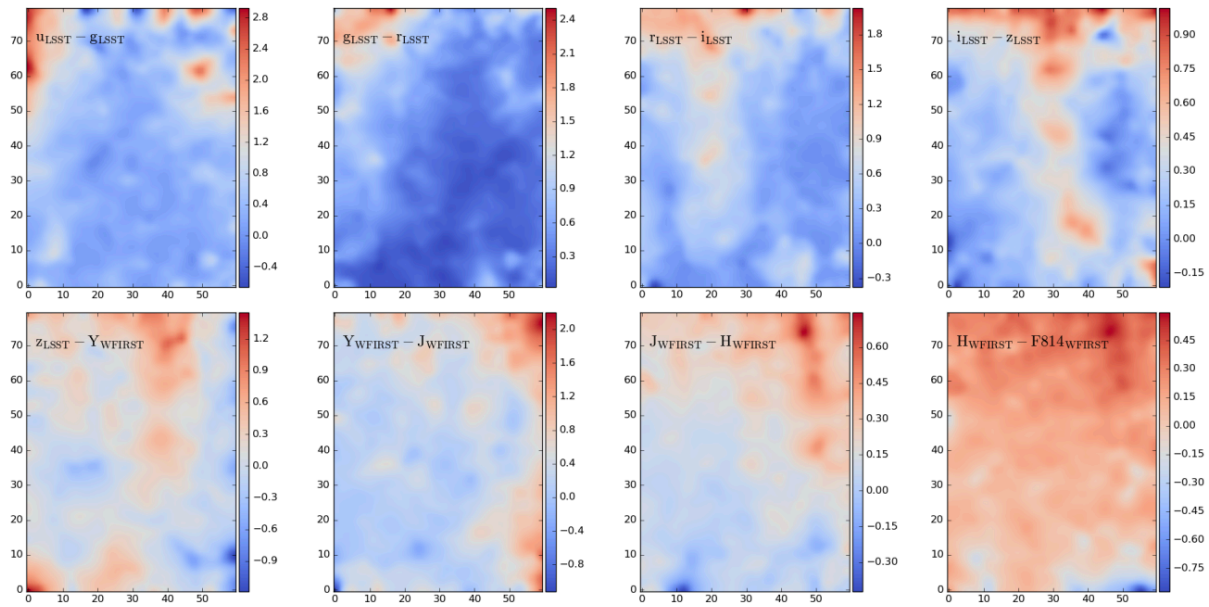


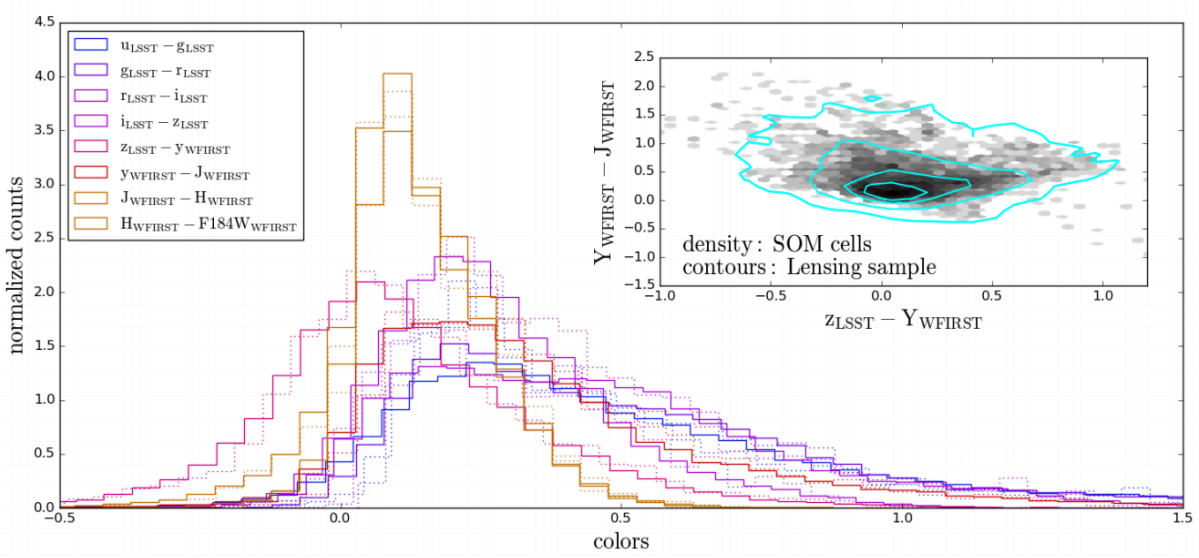



# Redshifts

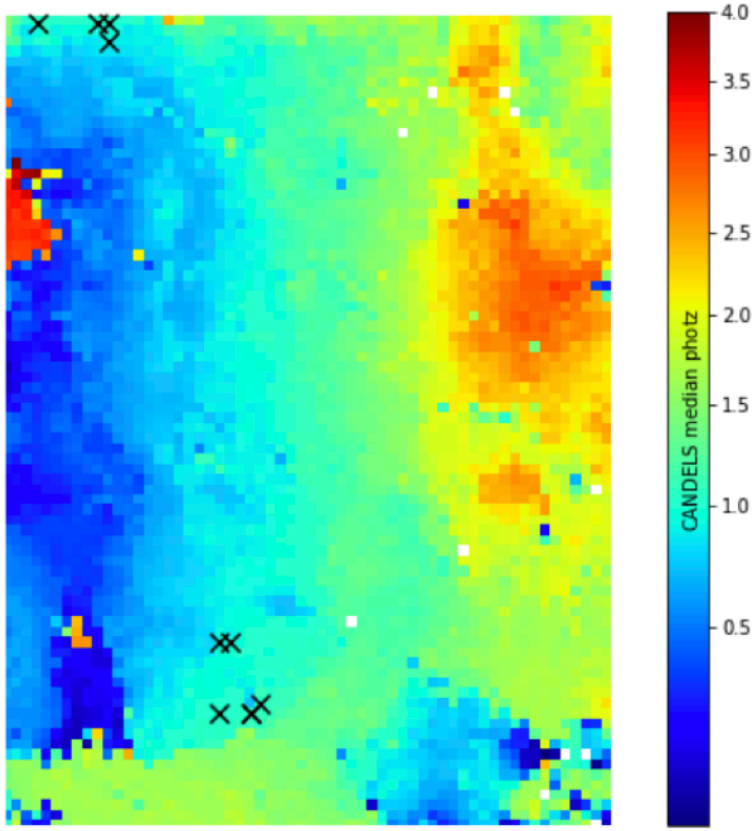
In Hemmati et al. 2019, to calibrate WFIRST weak lensing redshifts similar to Masters et al.  2015 for Euclid

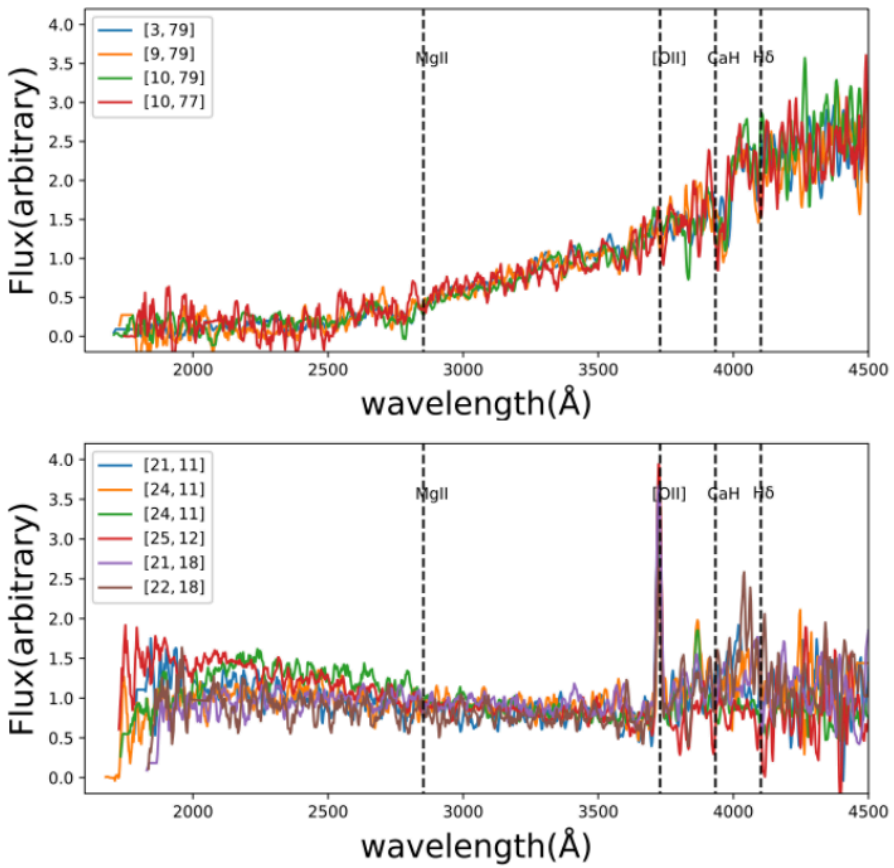


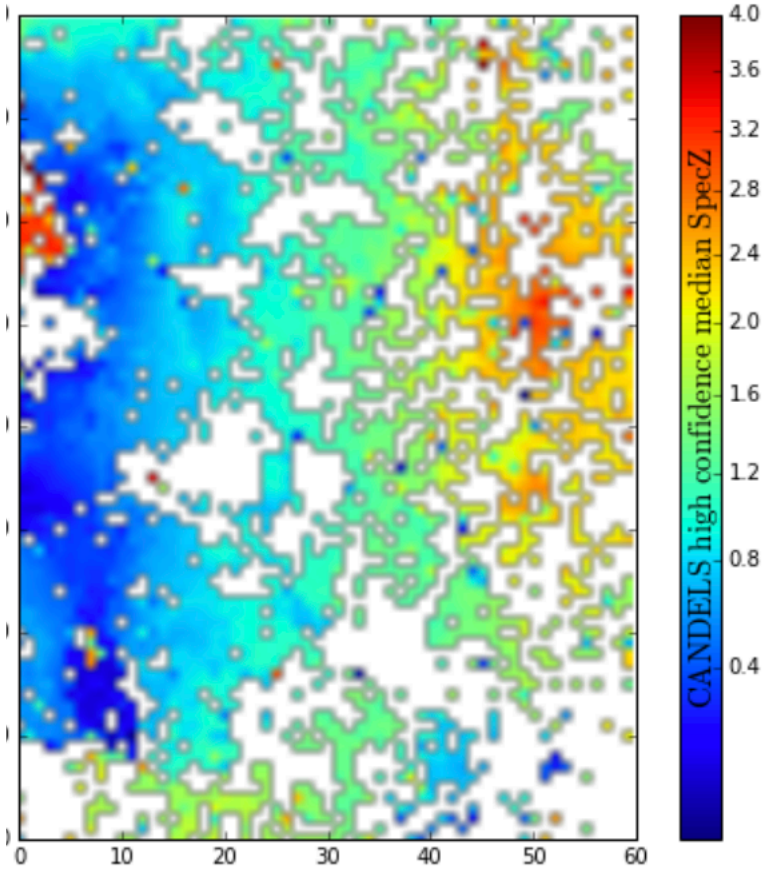



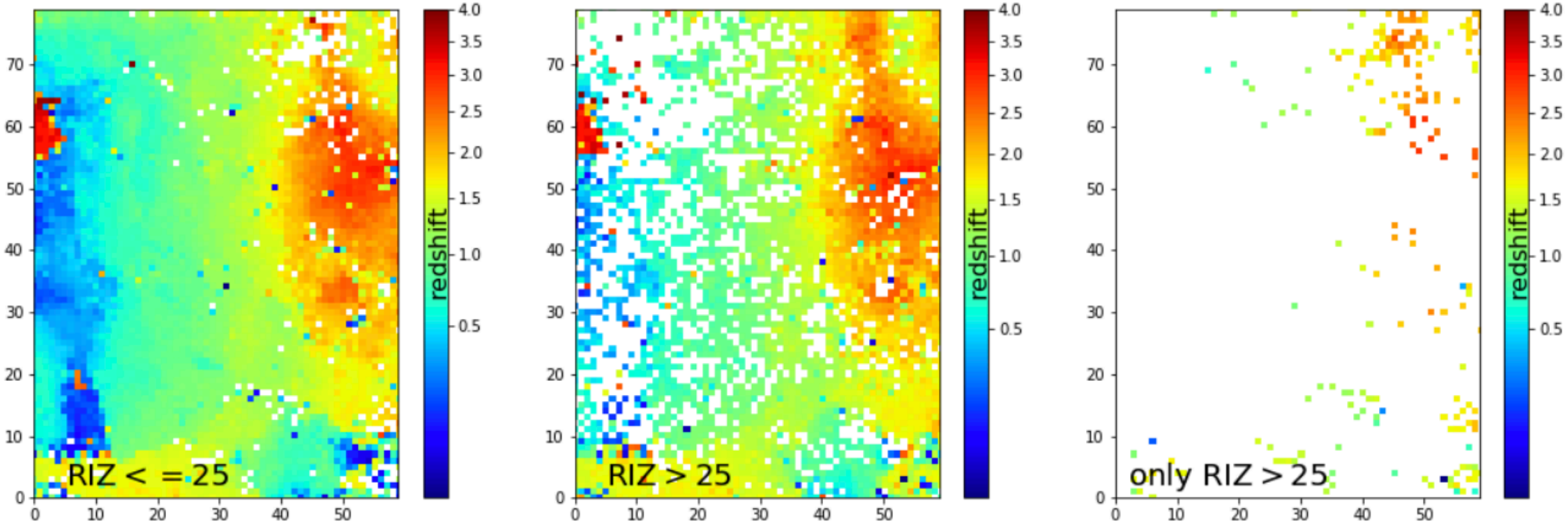
# Redshifts


CANDELS median photz
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5


[3, 79]
[9, 79]
[10, 79]
[10, 77]
MgII
[OII]
CaH
Hδ
Flux(arbitrary)
wavelength(Å)
[21, 11]
[24, 11]
[24, 11]
[25, 12]
[21, 18]
[22, 18]
MgII
[OII]
CaH
Hδ
Flux(arbitrary)
wavelength(Å)


CANDELS high confidence median SpecZ
4.0
3.6
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0
10
20
30
40
50
60

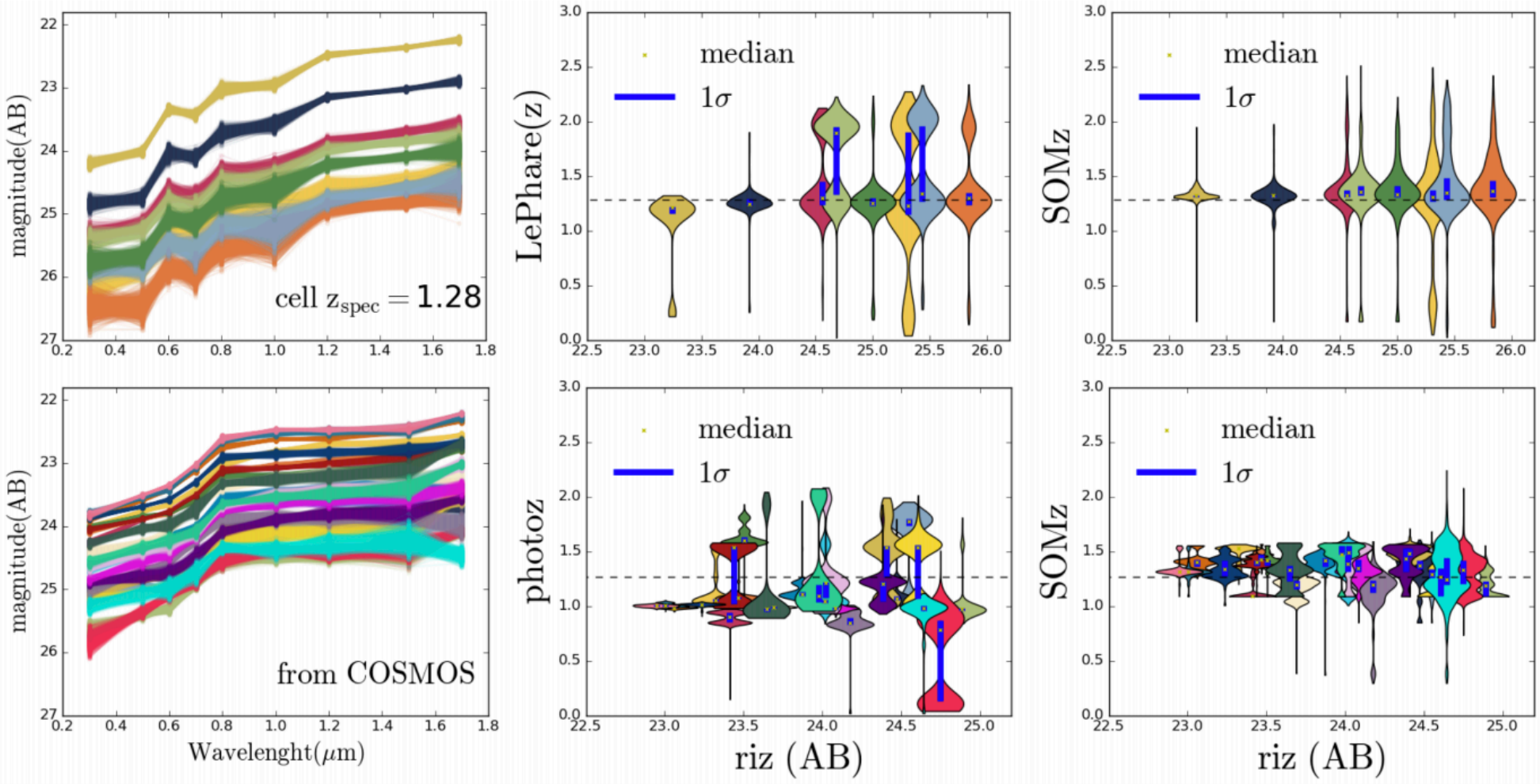
# Redshifts and brightness




For spectroscopic calibrations:

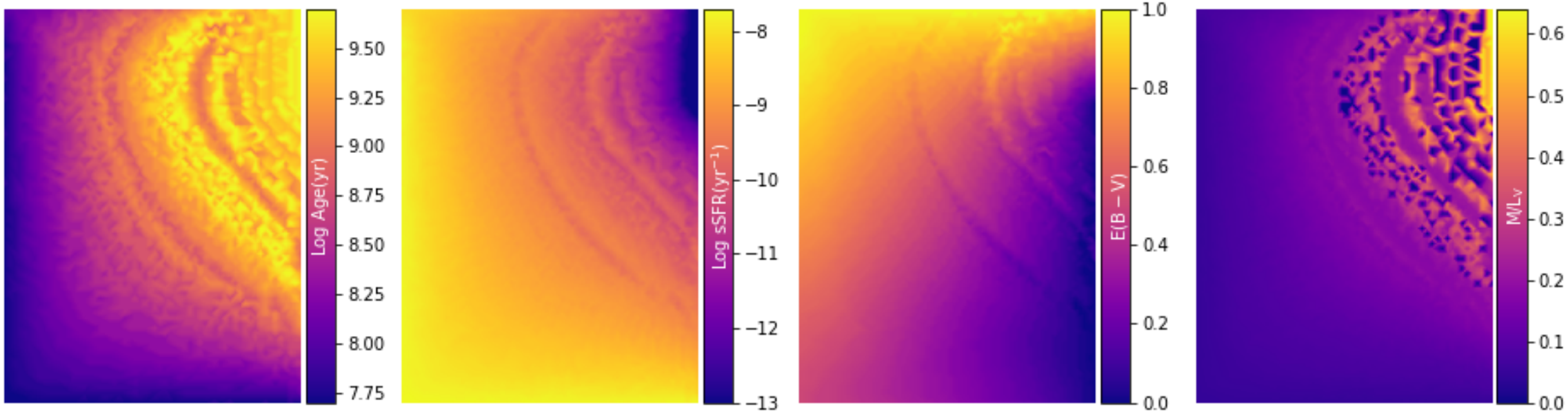
- 91% of color-space is filled with bright galaxies. → brighter galaxies can be used to calibrate fainter counterparts?!
- Only 4% of cells have no bright counterparts.

# Redshifts and brightness



# Visualizing model SED Libraries

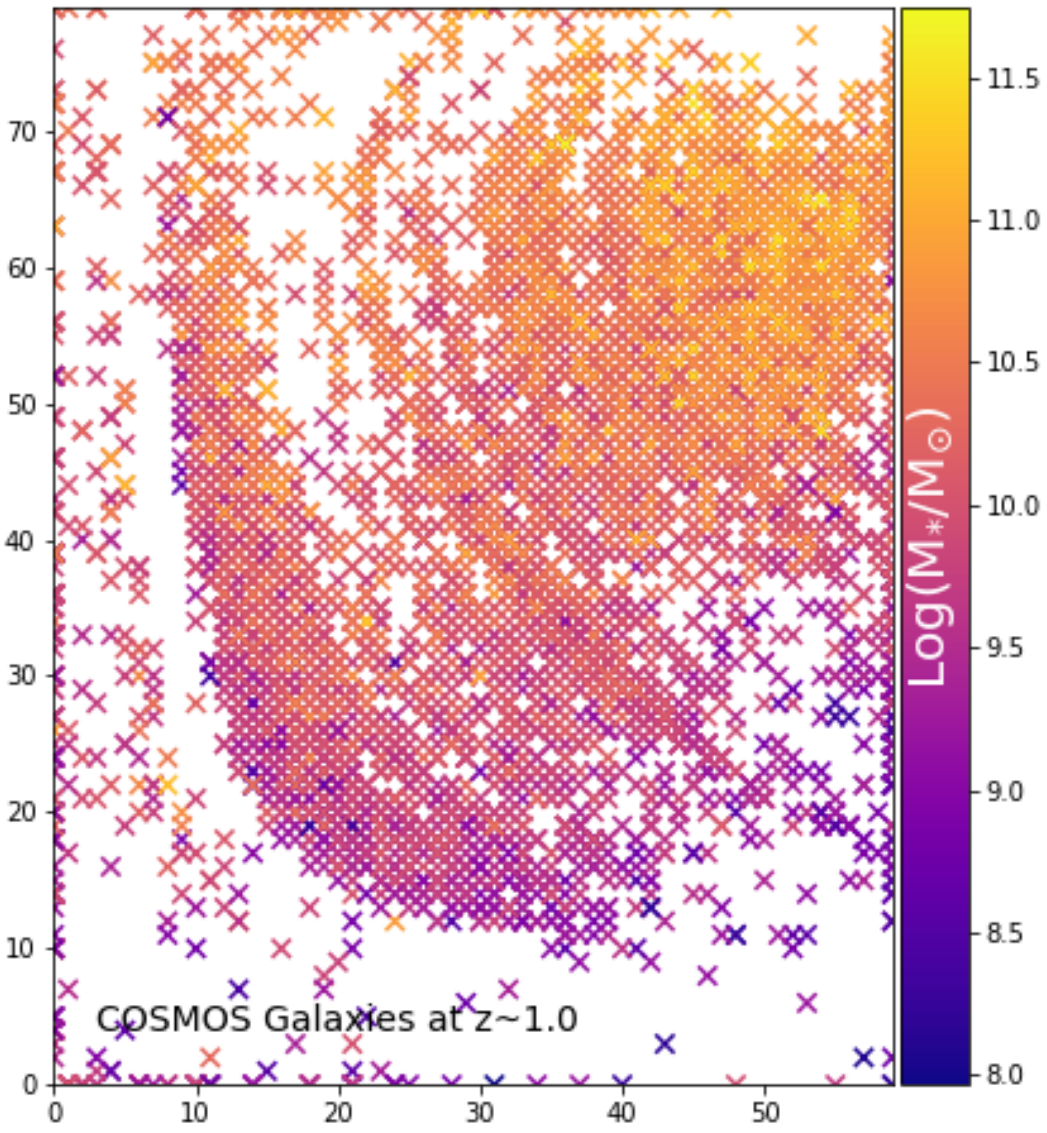
| stellar templates | IMF | SFH | $log(\tau/yr)$ | metallicity$[Z_\odot]$ | $log(age/yr)$ | extinction law | E(B-V) | redshift |
|---|---|---|---|---|---|---|---|---|
| BC03 | Chabrier | $e^{-t/\tau}$ | 8.5-10 (0.1) | 0.4 | 7.7-10.0 (0.1) | Calzetti | 0.0-1.0 (0.025) | 1.0 |



# Optimizing Libraries given Observations

14000 COSMOS galaxies at z~1 mapped to the SOM trained by Colors of models

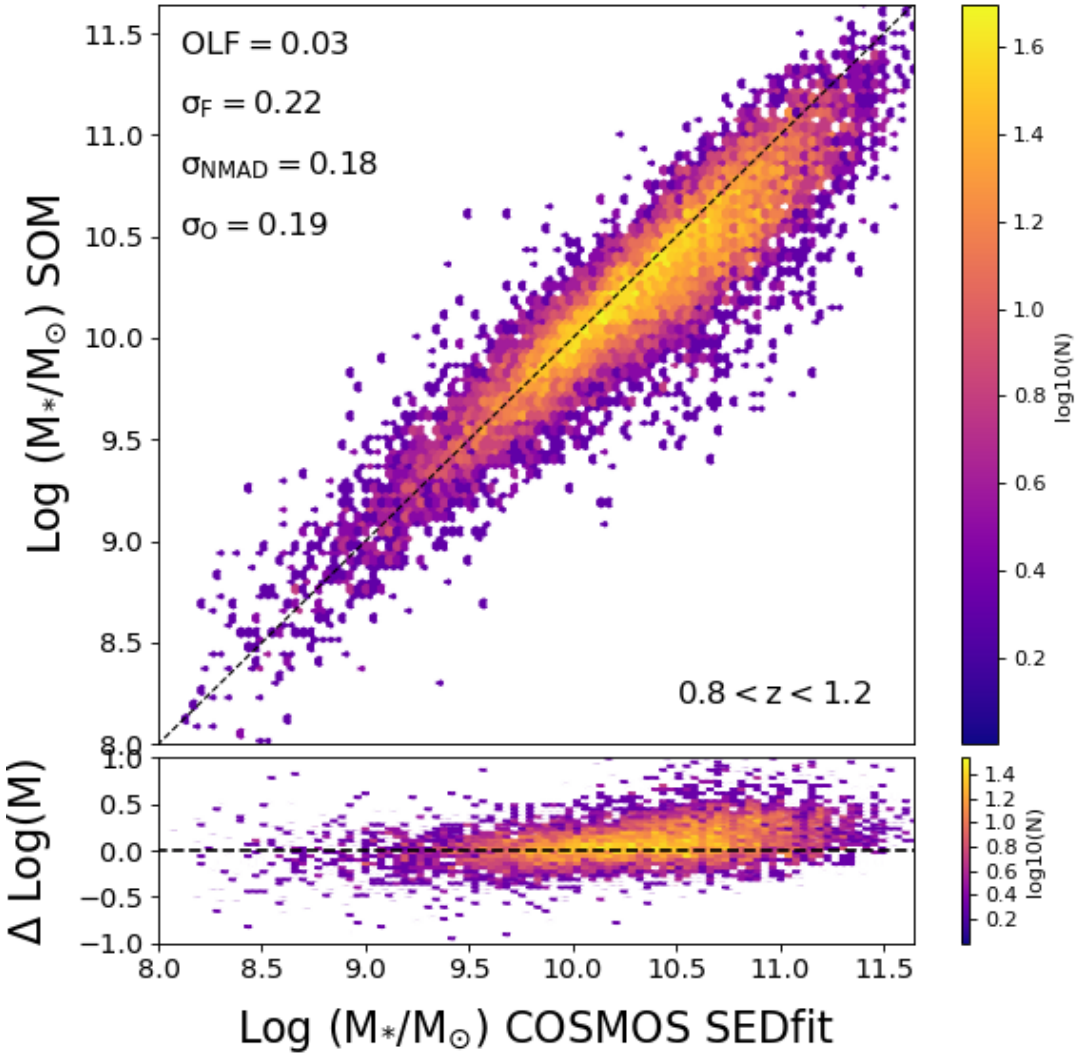
- Remove parameter space not occupied with data
- Add more features (e.g., emission lines, dif SFH) or ranges
- repeat



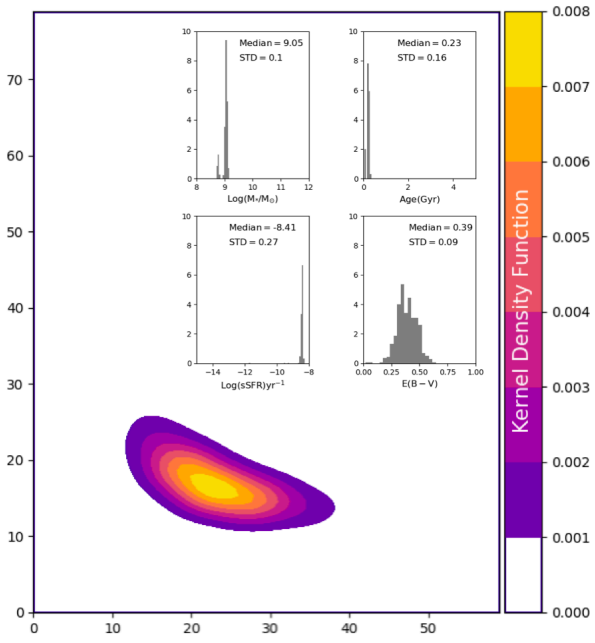
# SOM fit vs. SED fit

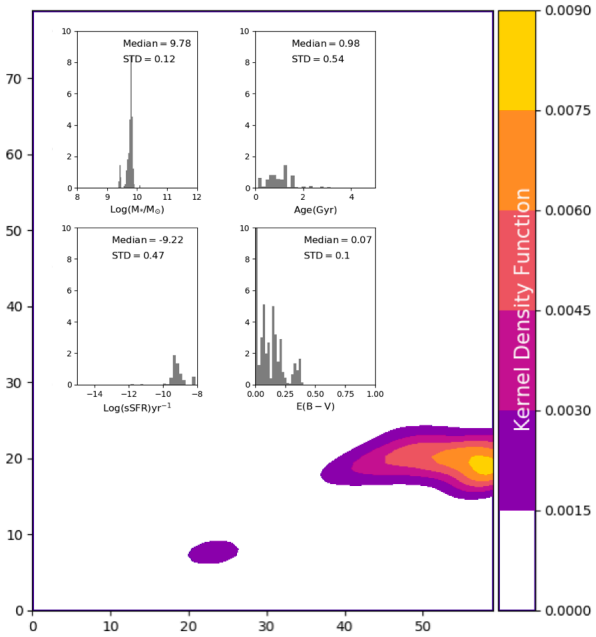
Agreement similar to comparisons of different SEDfitting codes.

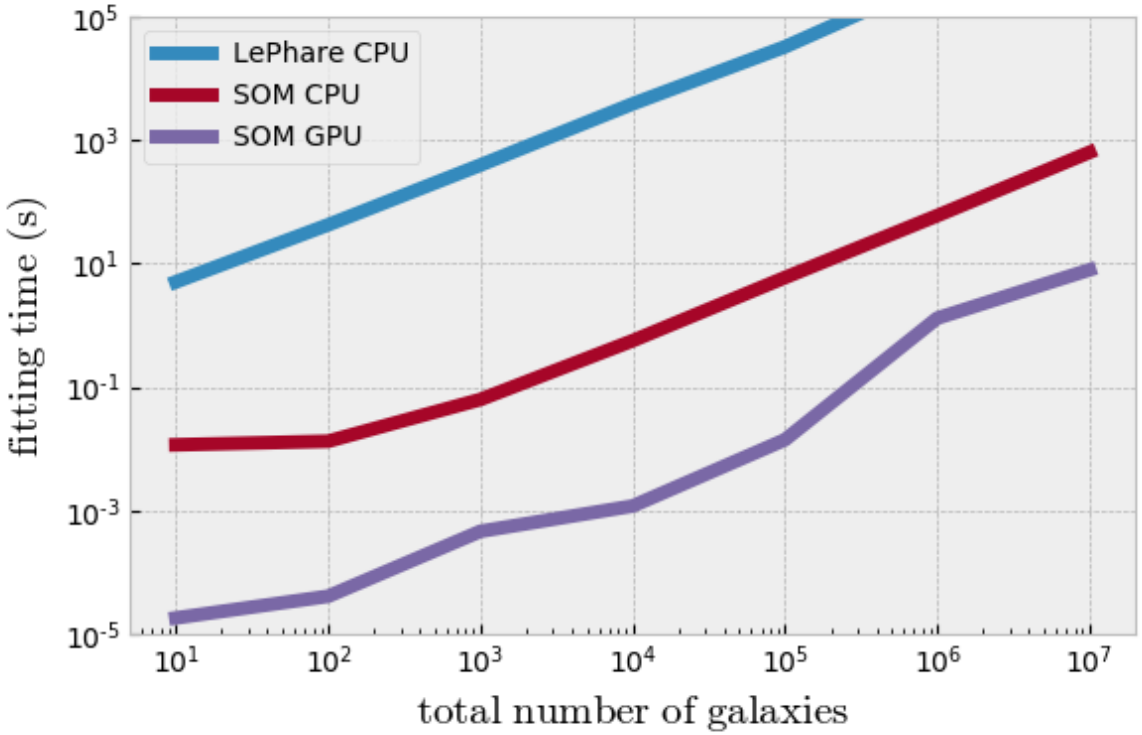
COSMOS Laigle et al. 2016 used emission lines, Delayed SFH and two dust attenuation curves. Might explain small systematic at high mass end



# Build Confidence and Accelerate



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