

Galaxy Science Breakout

3 Key Projects to get Started

- SPHEREx can answer in a statistical way how things like the large scale environment will affect observables such as metallicity, star formation rate, stellar mass
- How well does this translate into constraining models of galaxy formation? Star formation histories, the assembly of stellar mass across all galaxy types

Construct detailed few square-degree lightcones based on multi-scale hydrodynamic simulations

- **Construct high-resolution SED and catalog of positions (ra/dec)**
- **Simplest task –generate 1D SPHEREx spectra (accurate band centers and noise levels)**
- **Run existing SED codes, how accurately can these capture inputs?
Estimate of systematic errors and need for development in SED fitting code**
- **Future development run through SPHEREx image generation pipeline (generate series of images in LVF space); photometer to capture survey effects**

3 Key Projects to get Started

- Multi-wavelength Cross Correlation Science
- How do SPHEREx observables correlate with other tracers of astrophysical processes in galaxies (particularly as well be measured by intensity mapping experiments?)

Construct detailed few square-degree lightcones based on multi-scale hydrodynamic simulations

- **Build off of development from previous work**
- **Diffuse components from Hydrosims (OII, H-alpha, H-beta, CO, C+, Ly-a (in progress))**
- **Low-z IHL (capture in the hydrosim from all the tidal interactions)**

3 Key Projects to get Started

What can we learn from low-redshift galaxies for which SPHEREx will have many pixels/source?

- Produce Spectral Data cubes for low-redshift galaxies based on high-resolution FIRE simulations
- Also make predictions based on the data that exists already (don't use a hydrosim of a fake galaxy, data driven model based on extensive observations of real galaxies); no truth table, but use existing information on Andromeda, LMC, SMC
- How do SPHEREx observables trace signs of e.g., feedback and other processes?
- Explore questions such as how many PAH's are in the outflows? There is molecular Hydrogen in the outflows. Would be interesting to look.
- Development of custom photometry algorithms to analyze low-z galaxies

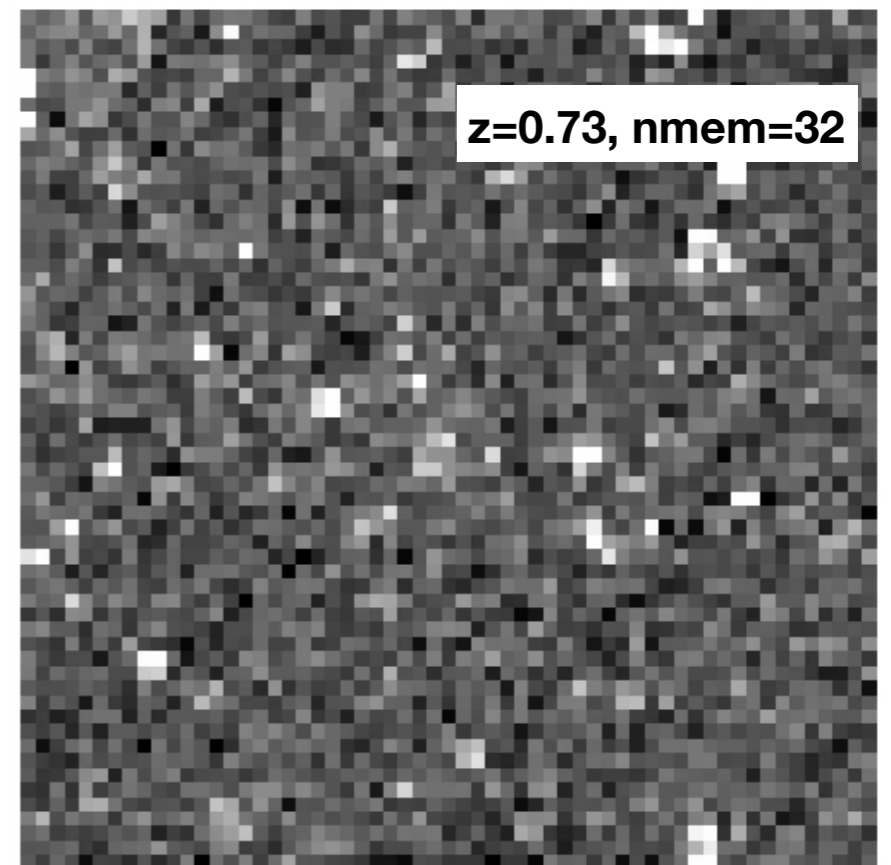
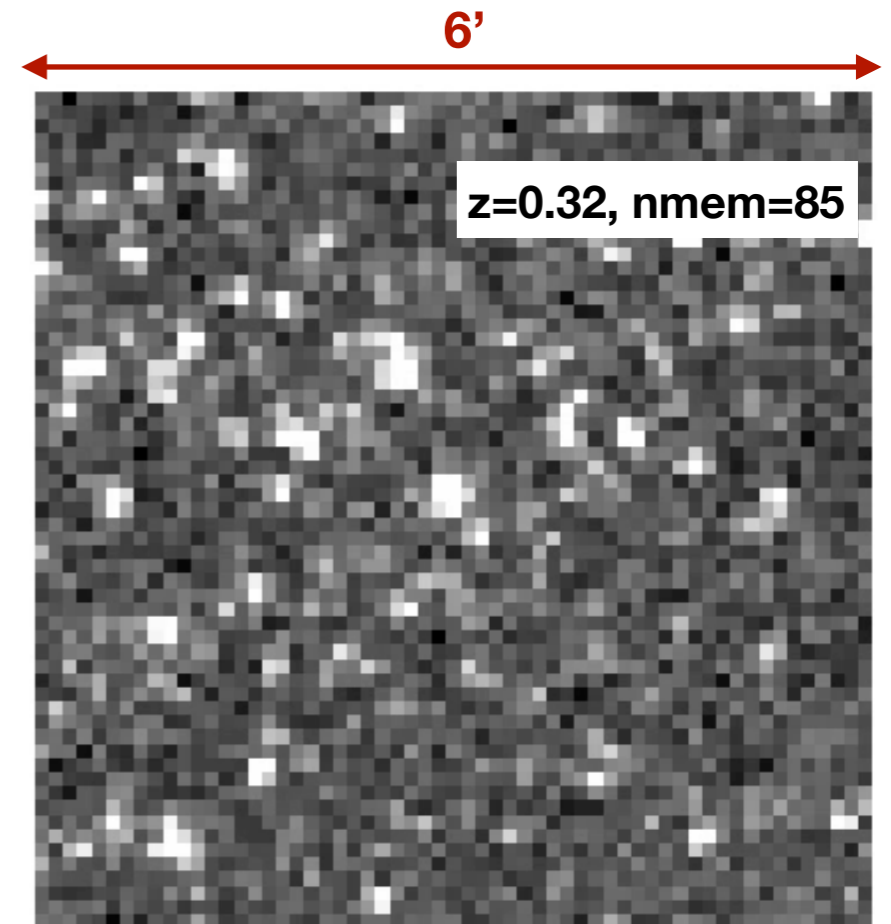


Andromeda as seen by WISE

Clusters of Galaxies

As an all sky spectrometer, SPHEREx will give us the ability to identify rare extraordinary systems for followup with *HST*, *JWST* as well as to constrain quantities such as average SFR in clusters across cosmic time via various diagnostic indicators (H-alpha, OII, etc) as they redshift into the SPHEREx wavelengths.

- Detailed study of *individual* low-z systems
- Stacked studies of the *average* properties of high-z clusters
- Splash back measurements?
- V high-z cluster confirmation (e.g., MadCOWS)
- Products:
 - SPHEREx redshift measurements for X-ray (eRosita) and SZ catalogs
 - IR Spectra for LRGs
 - Stellar mass estimates and SFRs for low-z cluster members



What we need to get started

To get to 1d spectra:

- Band centers
- Noise levels (deep and wide survey)

To get to images:

- Resolution as a function of λ
- pixel scale
- Noise/per pixel/ λ (μJy)

Emission lines in the SPHEREx wavelengths (1-3 μm)