HALO+EMPIRICAL MODELING

Marco Viero, KIPAC/Stanford
COMAP Collaboration Meeting
OVRO, January 10-11, 2017

OUTLINE

- Mixing theory (Tony Li's model) and observation (my SIMSTACK measurements) in new round of sims.
- Modeling meetings Friday and Tuesday.

TONY LI ET AL. 2016

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et al. 2016; Rovilos-

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Luminosity

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aforementioned studies, where a scatter has been quoted.

Note that the conversion from $L'_{\rm CO}$ (units of K km s^{-1} pc^2) to $L_{\rm CO}$ (units of $L_\odot$) is

$$L_{\rm CO} = 4.9 \times 10^{-5} L_\odot \left(\frac{\nu_{\rm CO,rest}}{115.27\ {\rm GHz}}\right)^3 \left(\frac{L'_{\rm CO}}{{\rm K\ km\ s^{-1}\ pc^2}}\right) \quad (4)$$

where $\nu_{\rm CO,rest} = 115.27$ GHz is the rest-frame frequency of the CO transition.

To resummarize the model:

1. Halos $\rightarrow$ SFR: Get $\overline{\rm SFR}(M, z)$ from the results of Behroozi et al. (2013a)
2. Add log-scatter, $\sigma_{\rm SFR}$
3. SFR $\rightarrow L_{\rm IR}$: Get $L_{\rm IR}$ from ${\rm SFR} = \delta_{\rm MF} \times 10^{-10} L_{\rm IR}$
4. $L_{\rm IR} \rightarrow L'_{\rm CO}$: Get $L'_{\rm CO}$ from $\log L_{\rm IR} = \alpha \log L'_{\rm CO} + \beta$
5. Add log-scatter, $\sigma_{L_{\rm CO}}$

with fiducial parameter values:

$$\sigma_{\rm SFR} = 0.3,\ \sigma_{L_{\rm CO}} = 0.3,$$
$$\delta_{\rm MF} = 1.0,\ \alpha = 1.37,\ \beta = -1.74.$$

Figure 2 shows the combined result of these steps, plotting the mean $L_{\rm CO}(M_h)$ relation from our fiducial model, as well as the equivalent relation from previous studies. Notably, $L_{\rm CO}$ in this model is not linear in M, a simplifying assumption that has

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To resummarize the model:

Stellar Mass – M_*

1. Halos $\rightarrow$ ~~SFR:~~ Get ~~$\overline{\rm SFR}(M, z)$~~ from the results of Behroozi et al. (2013a)
2. ~~Add log-scatter, $\sigma_{\rm SFR}$~~
3. ~~SFR $\rightarrow L_{\rm IR}$: Get $L_{\rm IR}$ from SFR $= \delta_{\rm MF} \times 10^{-10} L_{\rm IR}$~~

Use empirically derived $L_{IR}(z,M_*)$

4. $L_{\rm IR} \rightarrow L'_{\rm CO}$: Get $L'_{\rm CO}$ from $\log L_{\rm IR} = \alpha \log L'_{\rm CO} + \beta$
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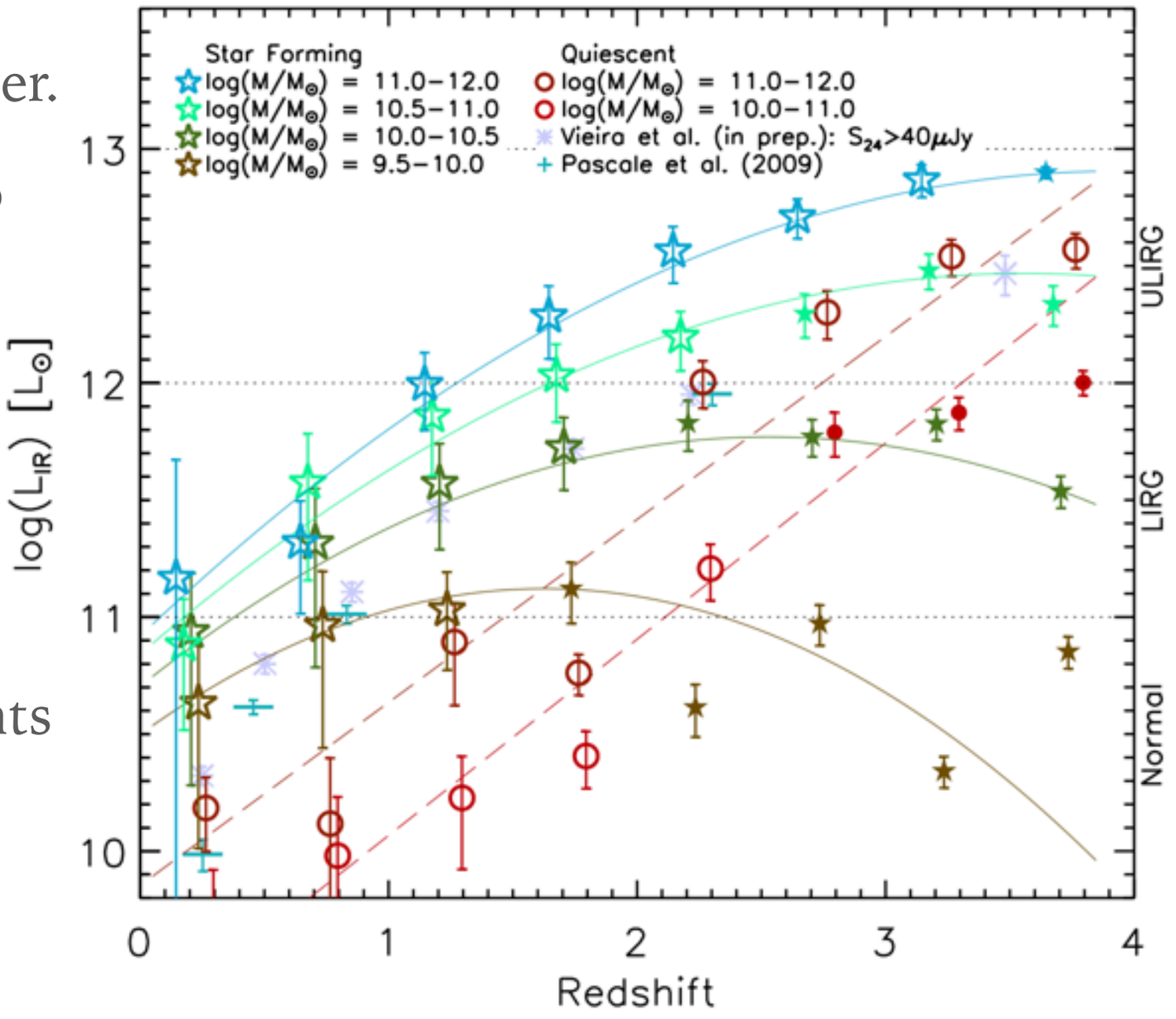
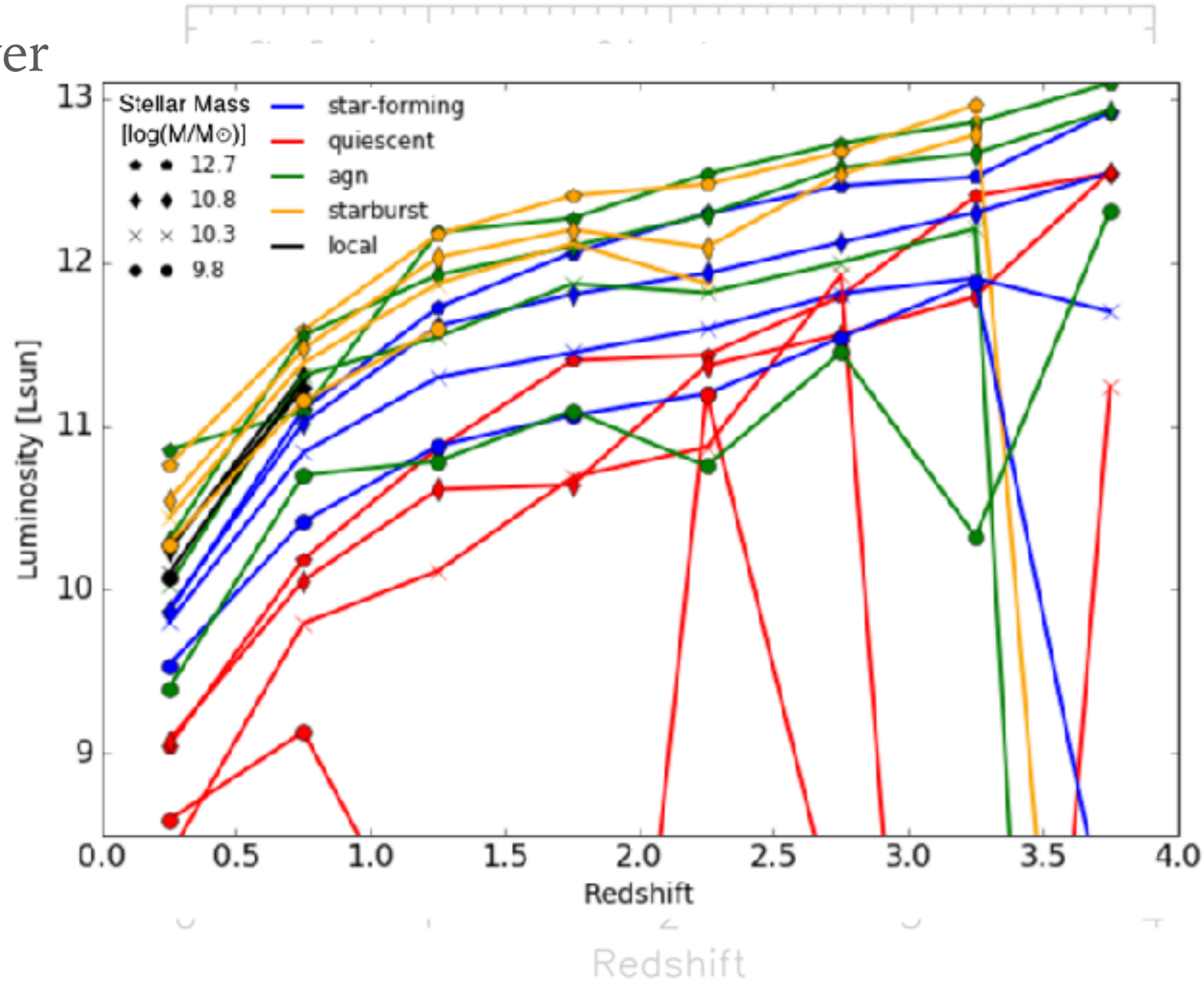
SIMSTACK — VIERO ET AL. 2013

- SIMSTACK is like familiar thumbnail stacking, but better.
- Viero 2013 Split sample into stellar-mass, redshift, and star-forming/quiescent.
- Find 70% of the CIB is accounted for by K-selected optical galaxies.
- Functions fit to measurements (the lines in figure —>) can be used for simulations.



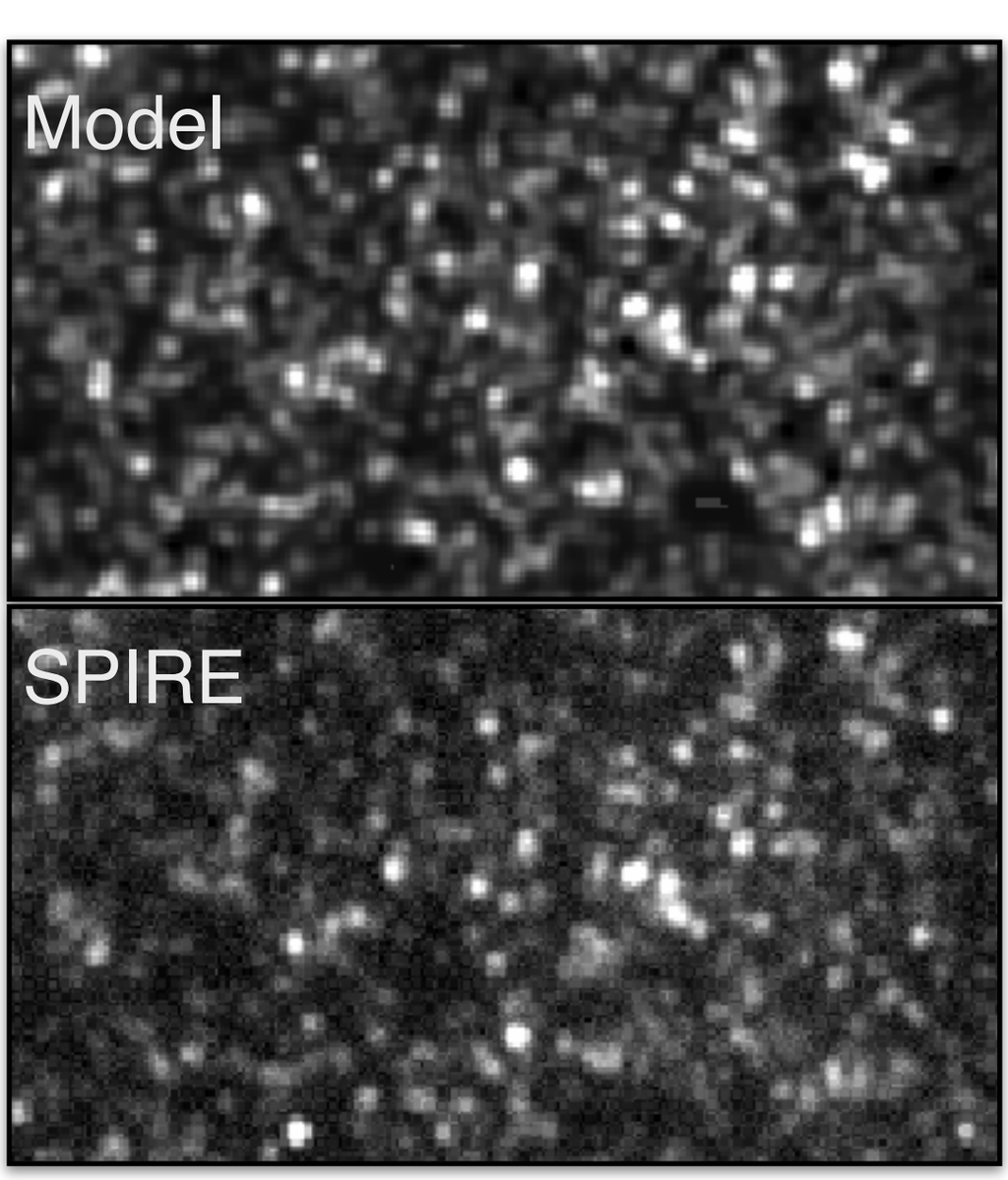
SIMSTACK — VIERO ET AL. 2013

- Viero 2017 in prep. update includes larger catalog over more area, and…
- Split further into galaxy types.



SIMSTACK — VIERO ET AL. 2013

- Works very well for “typical” galaxies that make up background fluctuations, but
- Fails to find outliers, which may or may not be in the original source catalog.



SCHEDULE OF UPCOMING MODELING MEETINGS (AT CALTECH)

- Currently planning to meet Friday 13th and Tuesday 17th. Open-ended, with *brief* talks to update each other on models, and brain-storming sessions to facilitate collaboration and integration.
- Friday
  - Meeting with Phil Hopkins and Norm Murray
    - Working around Phil's teaching, will probably consist of morning and afternoon sessions.
- Tuesday
  - Marcelo Alvarez will be here.
- Hamsa Padmanabhan is giving the Tea Talk on Tuesday at 4pm