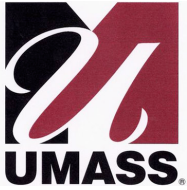


CONTINUOUS MID-INFRARED STAR FORMATION RATE INDICATORS



Andrew Battisti¹, D. Calzetti¹, B. Johnson², D. Elbaz³

1)U. Massachusetts 2)Institut d'Astrophysique de Paris 3)Laboratoire AIM-Paris-Saclay



M31



Spitzer, NASA/JPL-Caltech

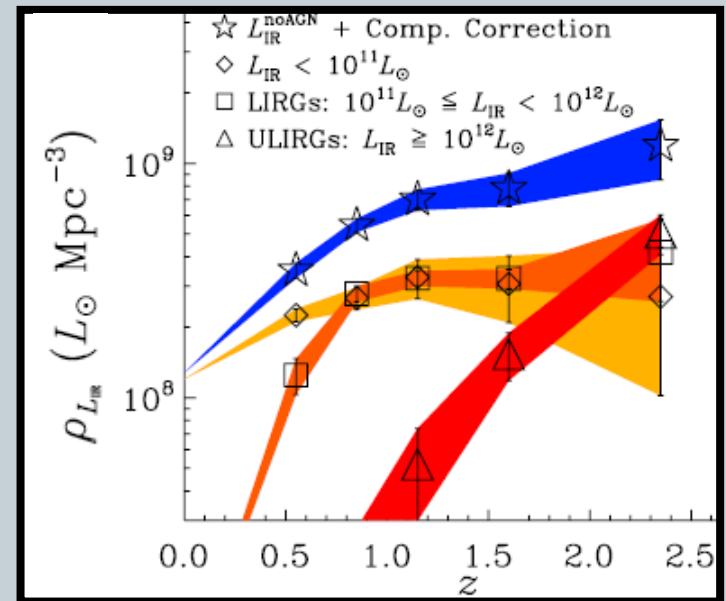
Galaxies in 3D: U. Vienna, July, 2014

Introduction – Importance of Infrared

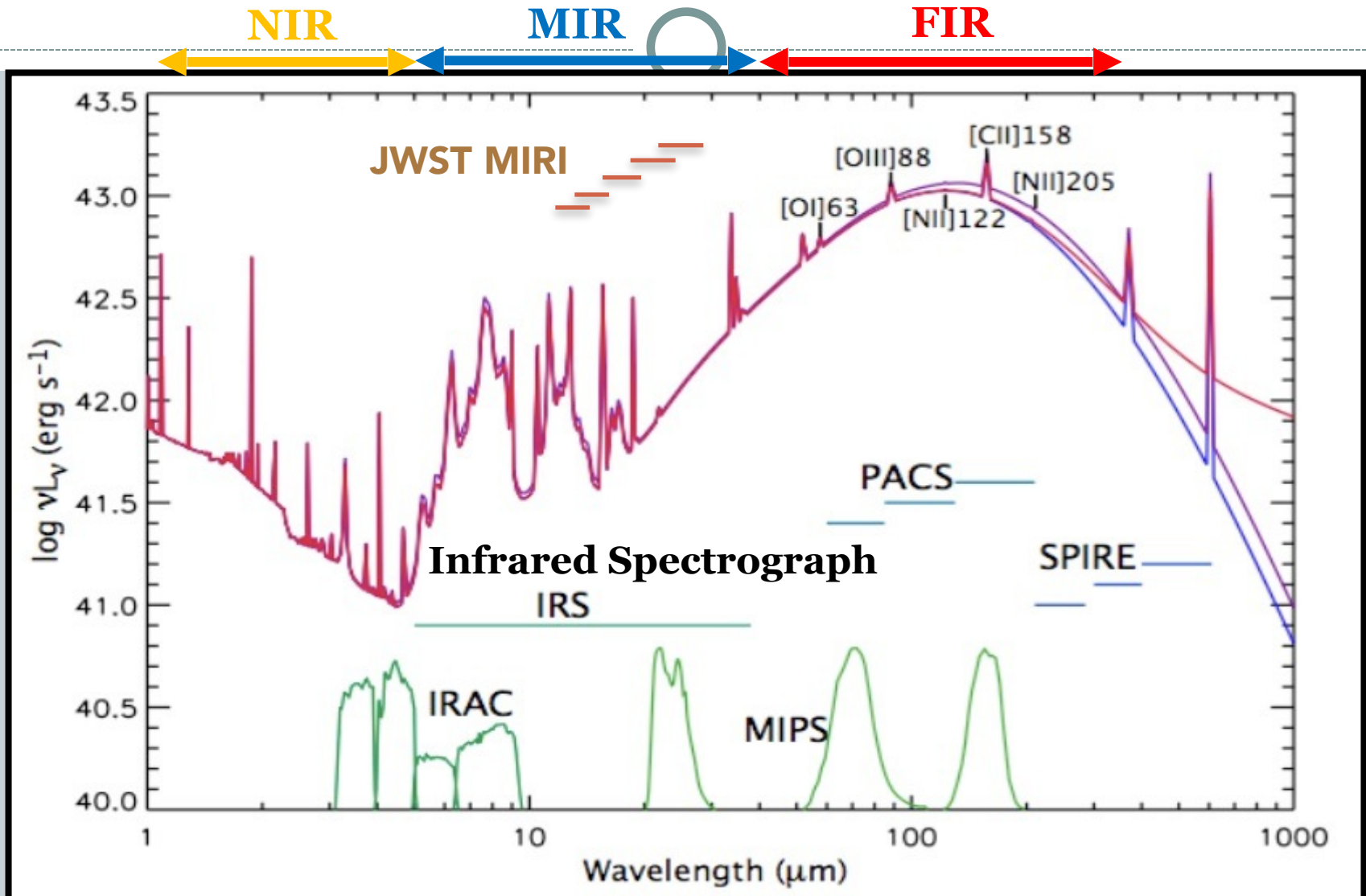


- IR energy budget is significant
 - 50% or more UV is reprocessed
 - Fraction increases with redshift
 - IR-bright galaxies more prevalent
- Well calibrated SFR
 - $z \sim 0$ – *Spitzer* and WISE bands
 - $z > 0$ – SED fit (model-dependent)
- JWST will expand IR window
 - “Normal” SFG out to $z \sim 3$

Murphy+(2011)



Introduction – Galaxy IR spectrum



Spitzer-SDSS-GALEX Spectroscopic Survey



- SSGSS – O’Dowd+(2011)
 - 101 galaxies (58 SFG)
 - $z \sim 0.1$, majority covered by IRS slits
- Suite of multi-wavelength data
 - UV to FIR photometry; add WISE
 - SDSS, *Spitzer* spectroscopy

SSGSS SFG Properties

$$3.8e9 \leq L(\text{TIR}) / L_{\text{sun}} \leq 2.6e11$$

$$1.6e9 \leq M^* / M_{\text{sun}} \leq 1.7e11$$

$$8.7 \leq 12 + \log(\text{O}/\text{H}) \leq 9.2$$

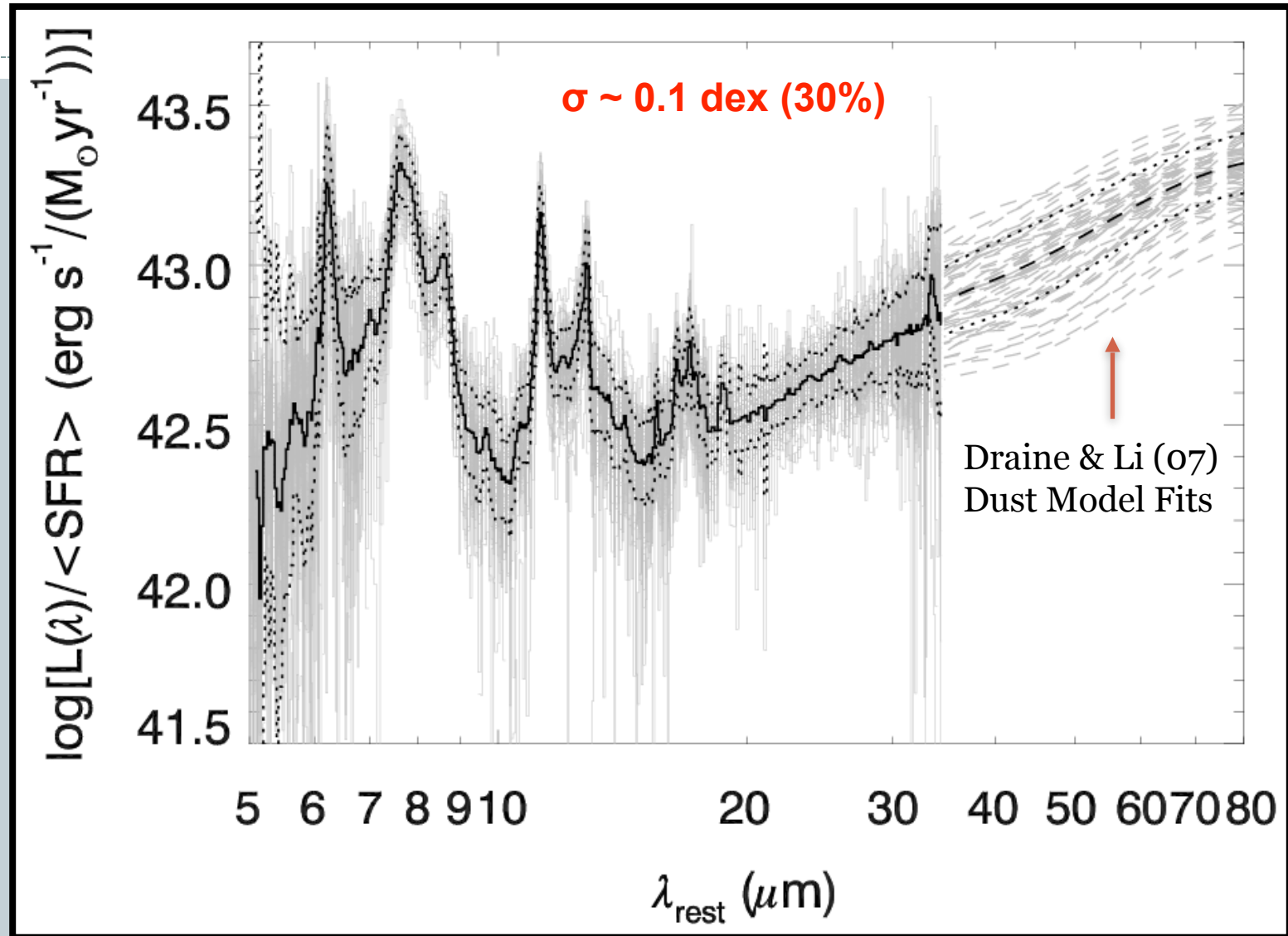


IRS Slits

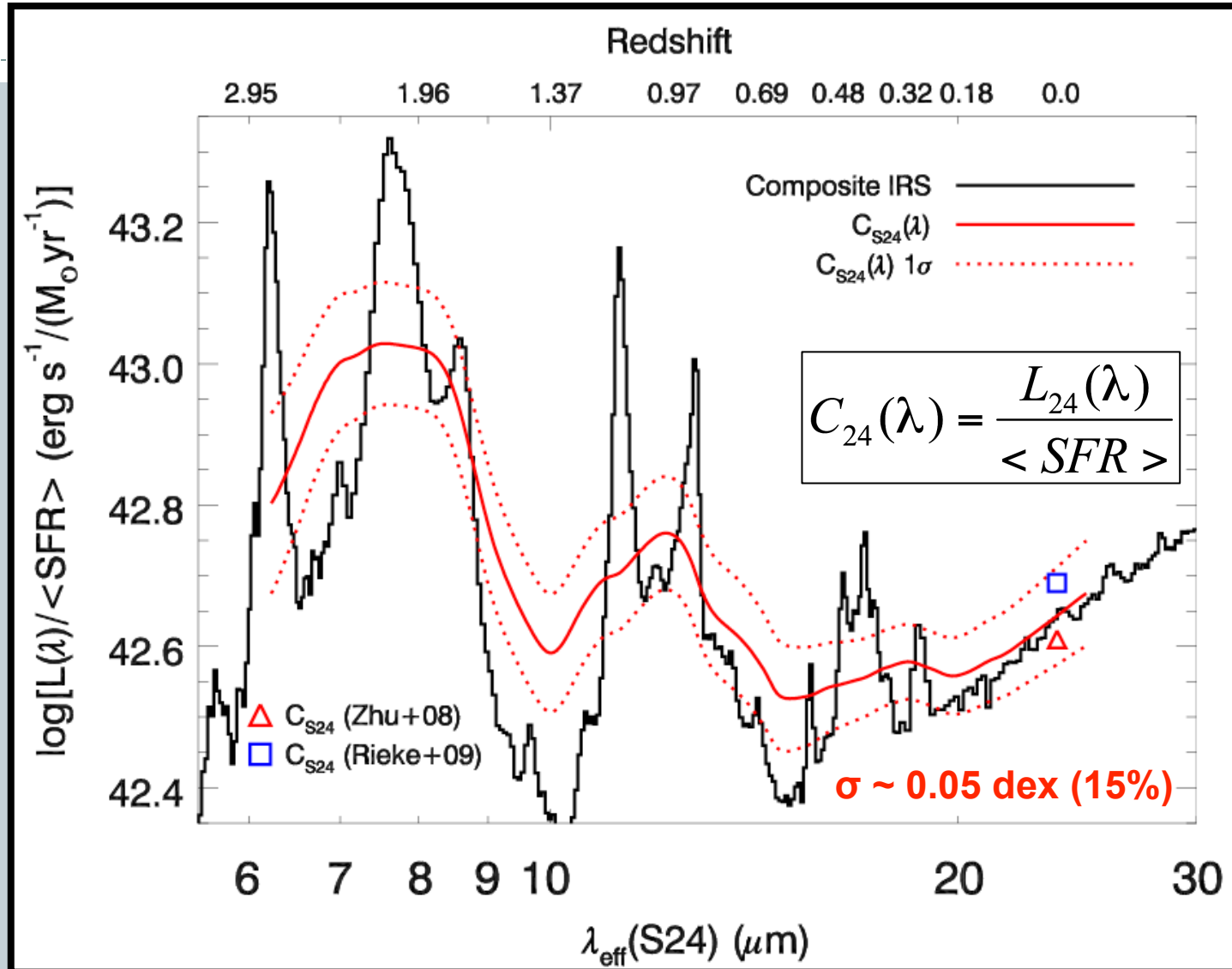
SL: 5.2-14 μm (3.6'')

LL: 14-38 μm (10.6'')

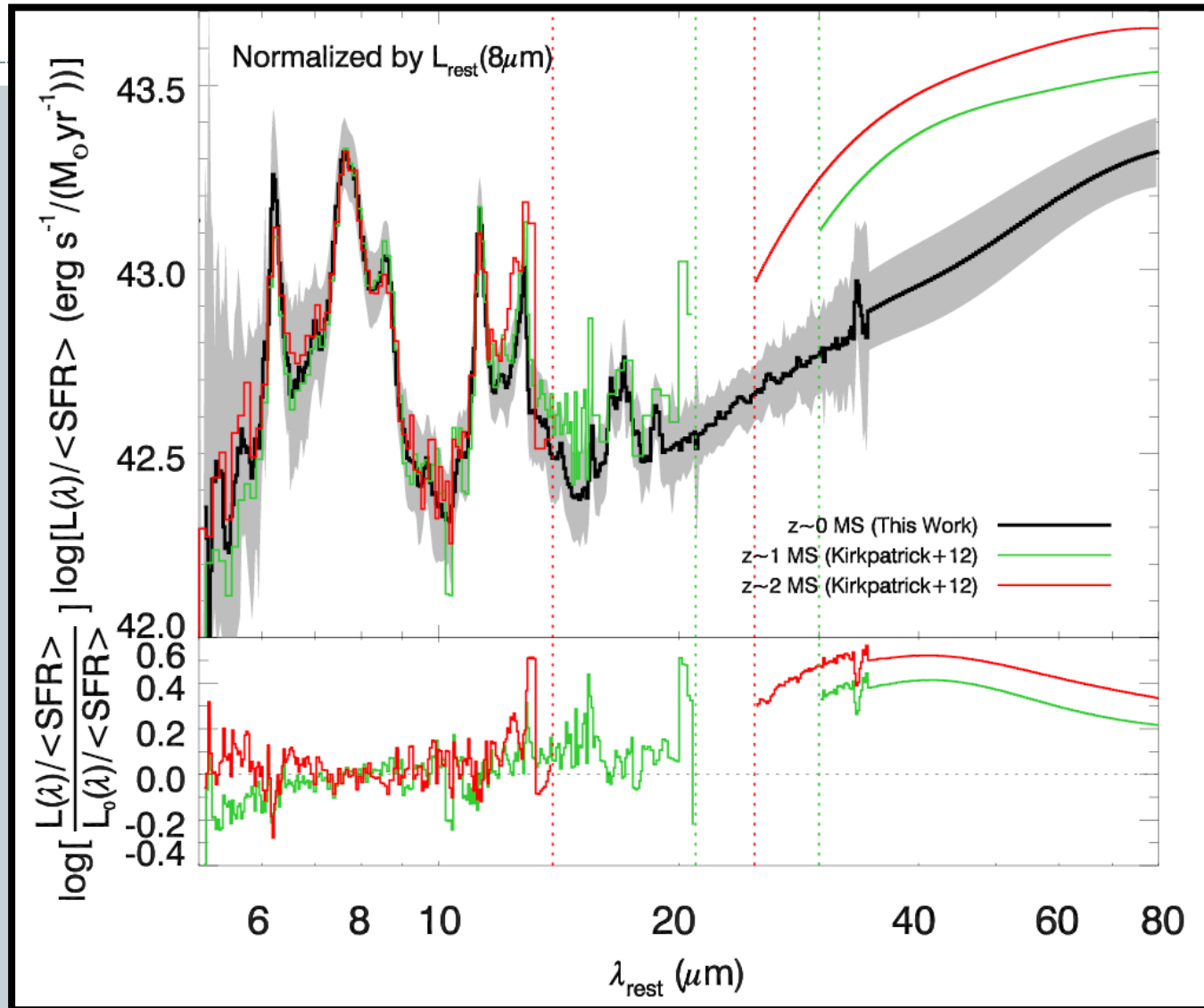
SFR Normalized Template



Filter Convolved Template



Evolution of SFG SED



Conclusions



- Calibrate continuous MIR SFR indicators (6-25 μm)
 - Can be applied up to $z \sim 3$
 - Achieve similar accuracy of monochromatic indicators ($\sim 30\%$)
 - No reliance on k-correction, SED models
- Caveats
 - Only for SFGs (need to classify)
 - Properties of sample vs. higher z
- Future Work
 - Apply the calibration to MIR surveys (*Spitzer*, WISE, JWST)

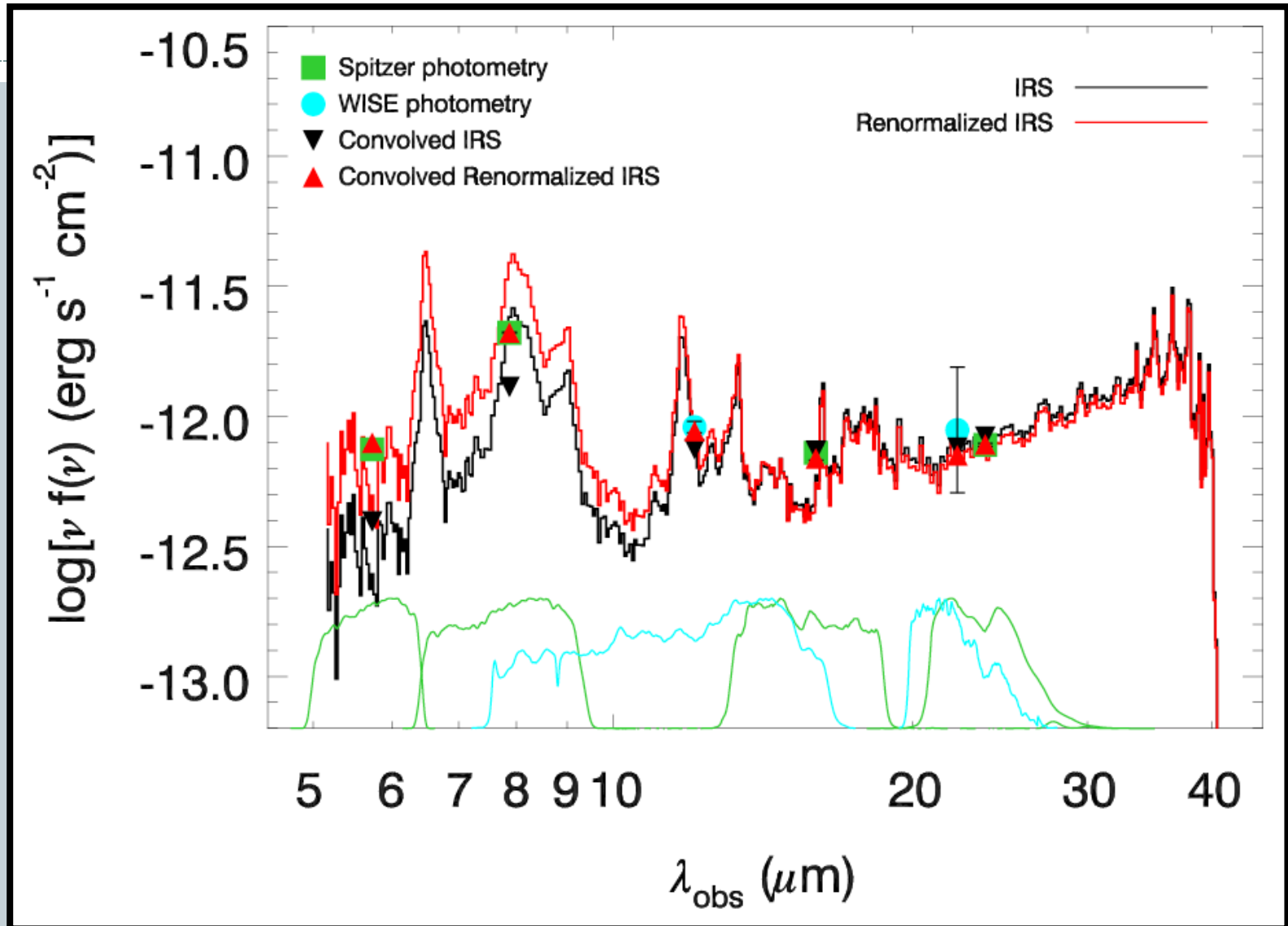
SSGSS SFG Properties

$$3.8e9 \leq L(\text{TIR}) / L_{\text{sun}} \leq 2.6e11$$

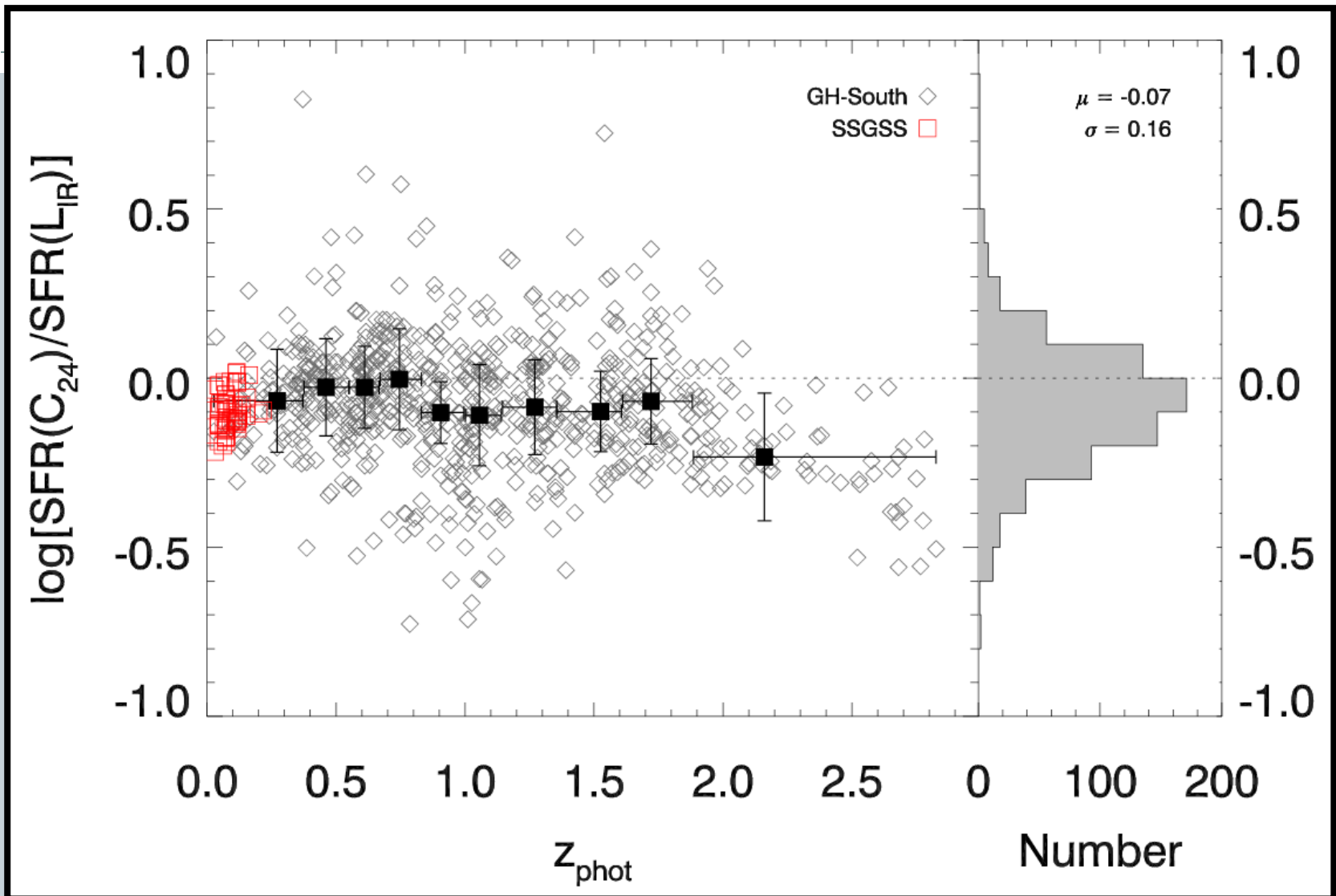
$$1.6e9 \leq M^* / M_{\text{sun}} \leq 1.7e11$$

$$8.7 \leq 12 + \log(\text{O}/\text{H}) \leq 9.2$$

Anchoring the Spectrum



Application to High Redshift



Filter Convolved Template

