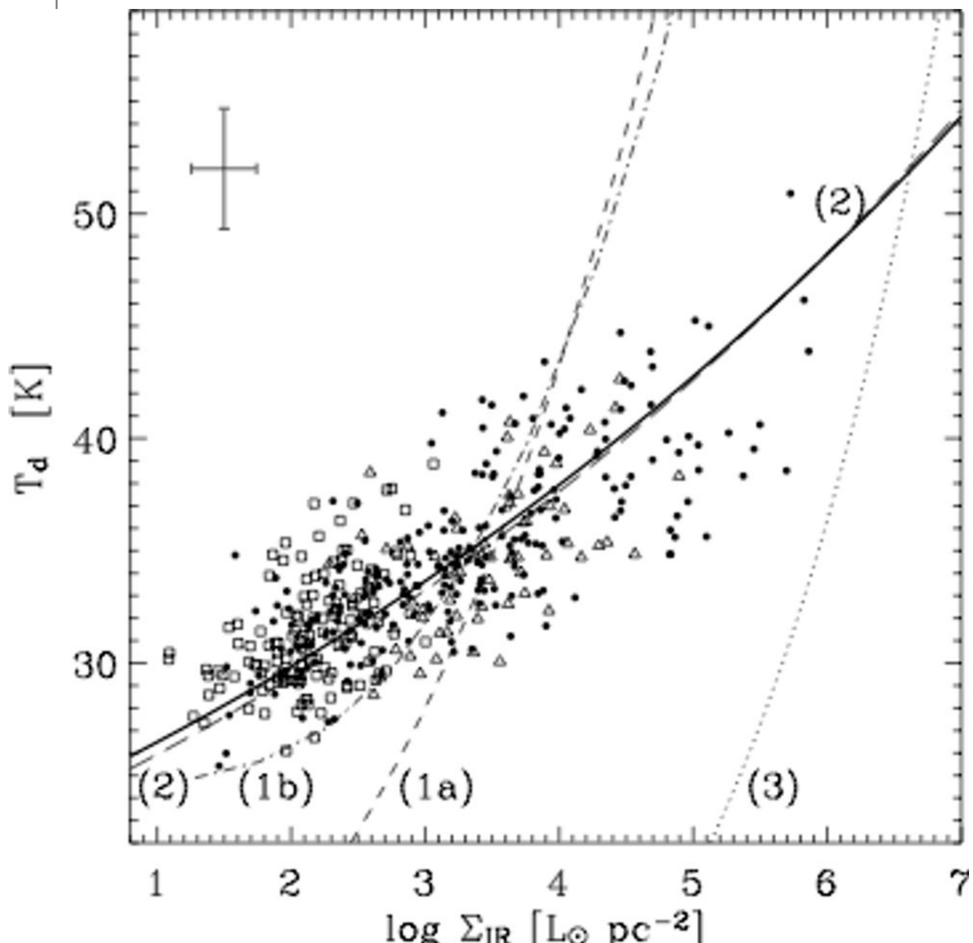
Thank you for coming!

MODULO - The "big picture"

- Metallicity cannot be the only parameter behind star-formation properties of galaxies. "Active/passive" (compact/dense vs. tenuous, diffuse) modes of star formation play a role in shaping the SED and driving SFR and molecular content.

Dust temperature correlates with IR brightness



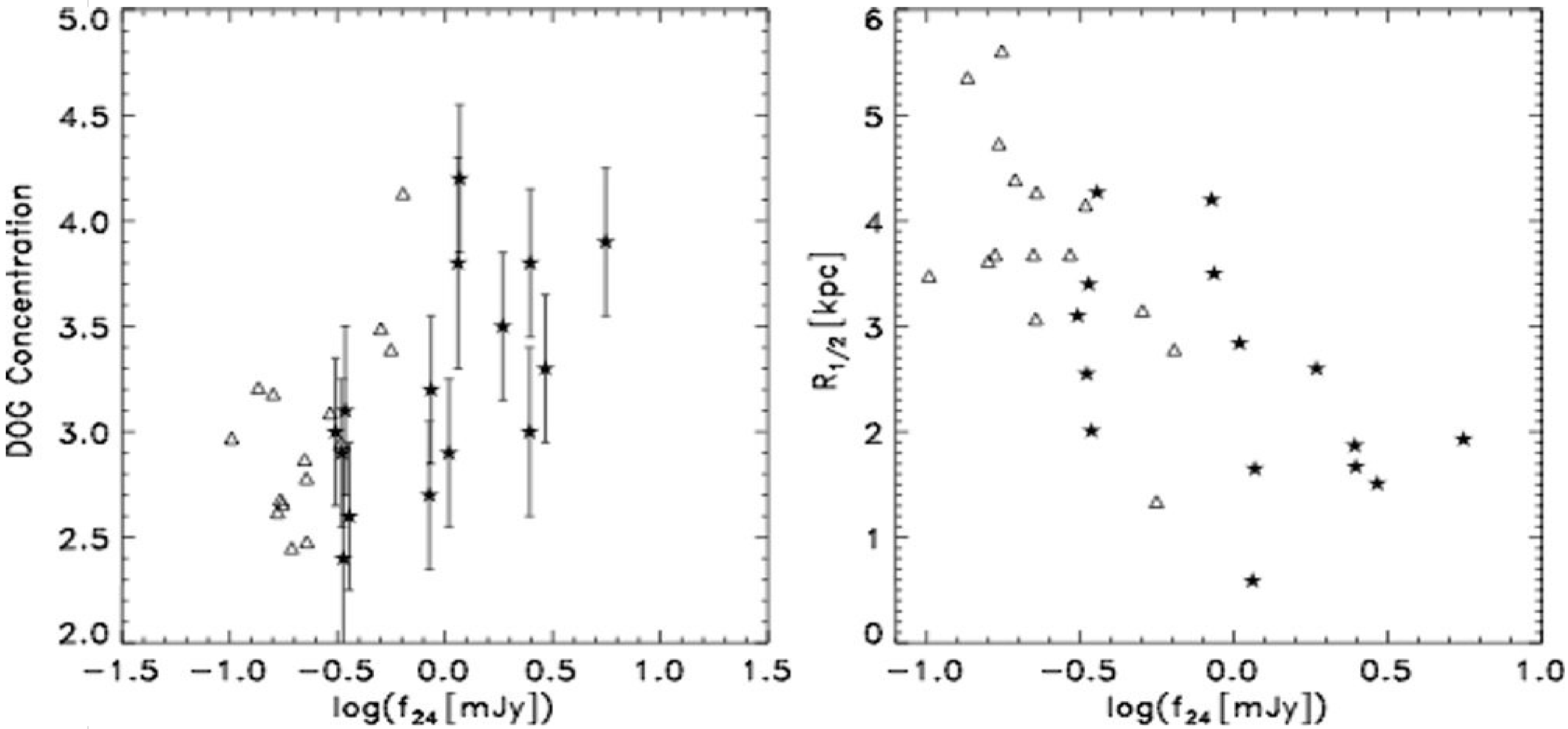
In a sample of metal-enriched LIRGs with radio sizes, T_{dust} (from IRAS 60, 100 m f uxes) correlates with IR surface brightness

IR

Models are optically thick dust cocoons (1a, 1b), and optically thin isothermal dust clouds (2).

Chanial et al. (2007)

Dust Obscured Galaxies (DOGs) at redshift ~2



L_{24} increases with concentration and with decreasing size (Melbourne et al. 2009: 24μm selected, z~2, so $F_{24} \sim L_{24}$)

MODULO - The "big picture"

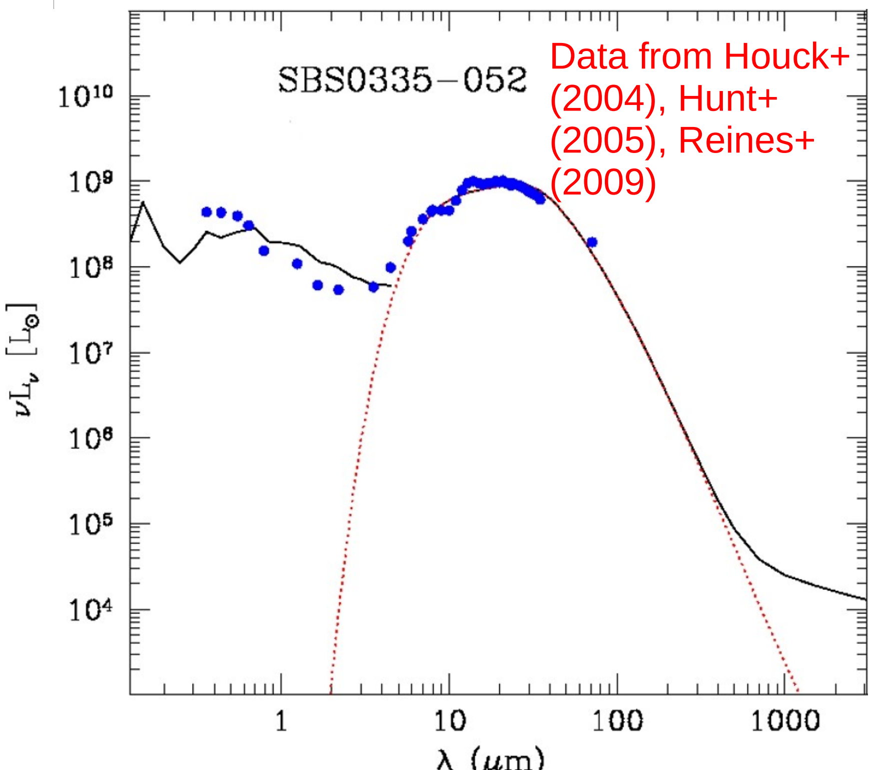
- Metallicity cannot be the only parameter behind star-formation properties of galaxies. "Active/passive" (compact/dense vs. tenuous, diffuse) modes of star formation play a role in shaping the SED and driving SFR and molecular content.

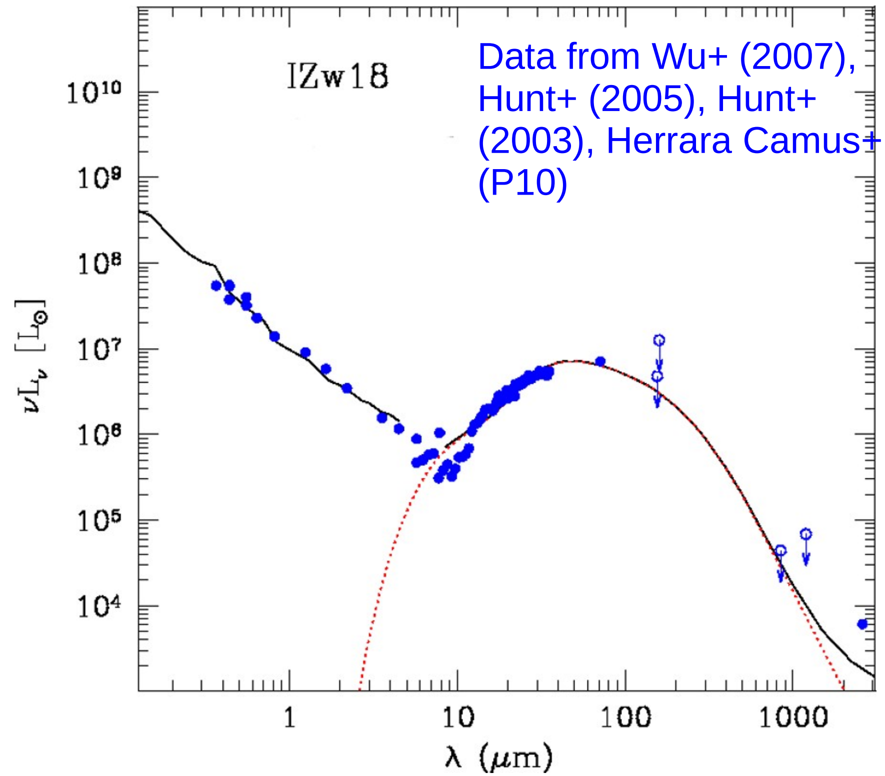
- Thus, just as there are metal-enriched starbursts, there can be low-metallicity starbursts with warm dust and high SFR.

DUSTY fits to global SEDs of active/passive prototypes

12+logO/H=7.23 (1/26 Zsun)
$L_{IR} = 1.4\ 10^{9}\ L_{sun}$

12+logO/H=7.19 (1/29 Zsun)
$L_{IR} = 3.6\ 10^{7}\ L_{sun}$





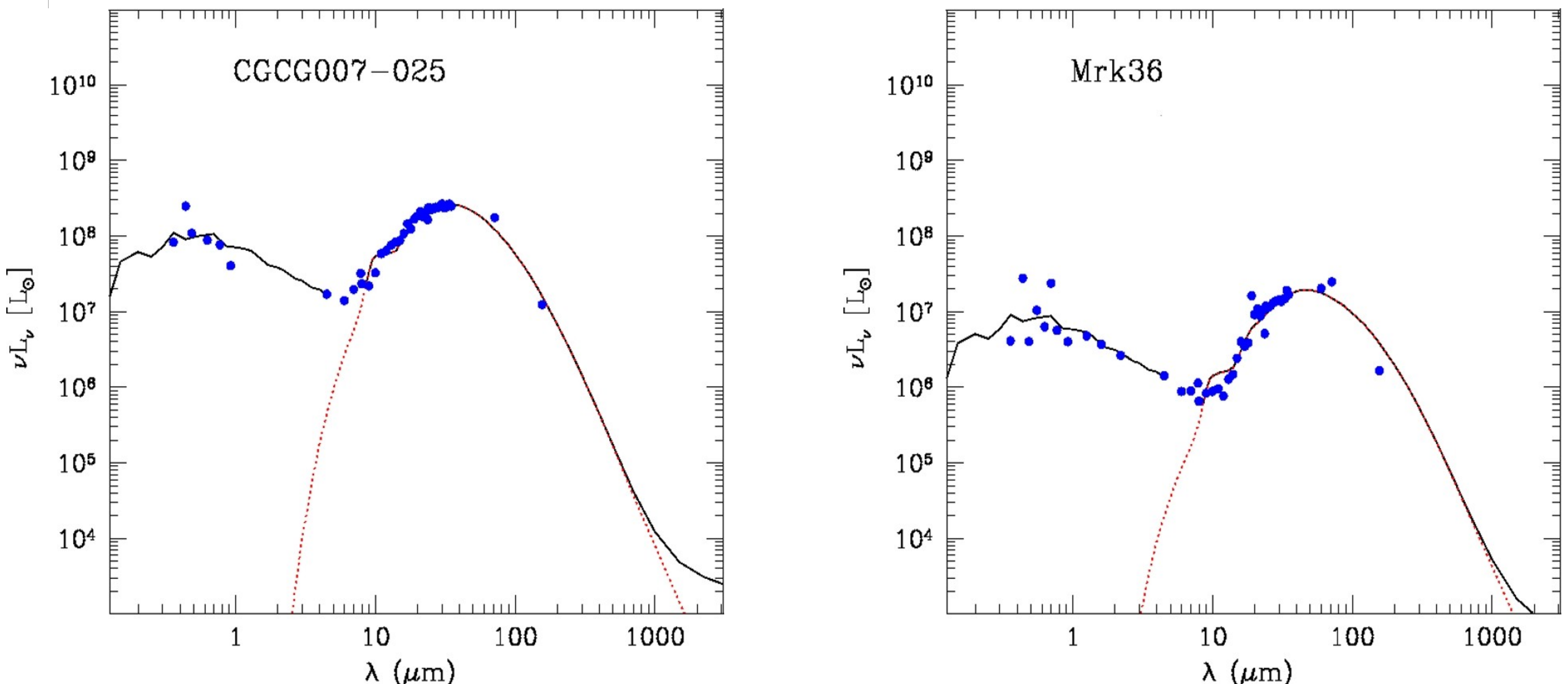
Stars more luminous than IR in IZw18, but not in SBS0335-052

SED peaks at longer wavelengths (cooler dust) in IZw18 than in SBS0335-052; factor of 40 in IR luminosity at same O/H

SEDs (with DUSTY fits) of active/passive BCDs

12+logO/H=7.76 (~3.5 times SBS0335-052)
SFR = 0.2 M_{sun}/yr
L_{IR} = 4.1 10^8 L_{sun}

12+logO/H=7.81
SFR = 0.04 M_{sun}/yr
L_{IR} = 3.1 10^7 L_{sun}



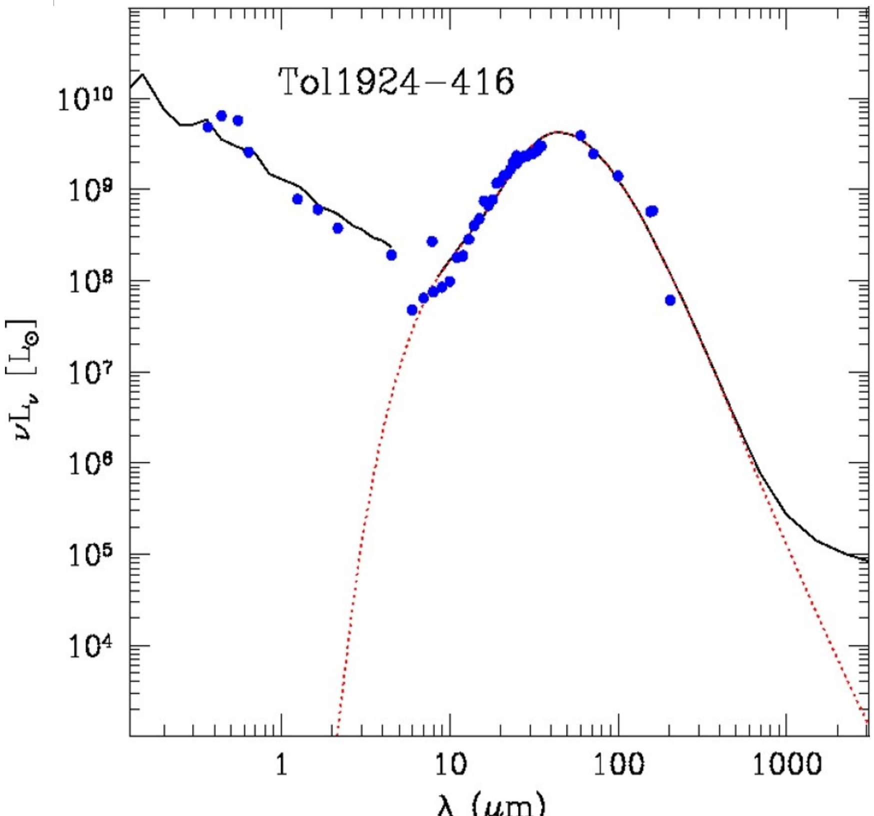
BCDs paired according to similarity of nebular oxygen abundance, but also the largest difference in Σ_{SFR}...

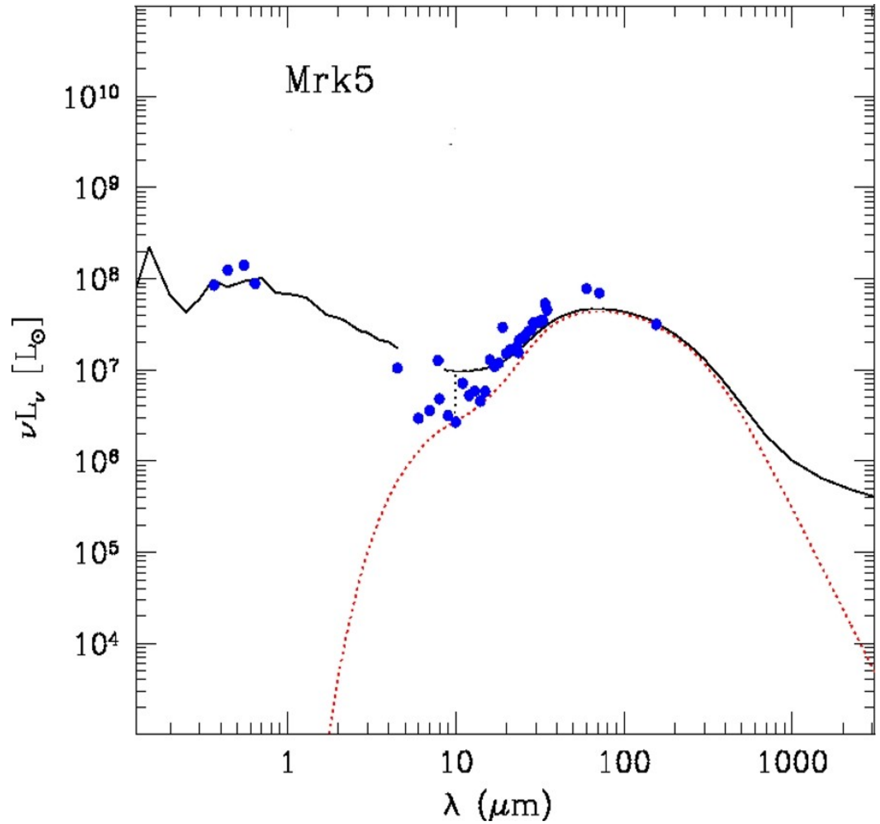
L_{IR} can vary widely even at a given metallicity!

More SEDs of active/passive BCDs

12+logO/H=7.94 (~6 times SBS0335-052)
SFR = 6.2 M_{sun}/yr
L_{IR} =5.6 10^9 L_{sun}

12+logO/H=8.04
SFR =0.1 M_{sun}/yr
L_{IR} = 9.3 10^7 L_{sun}



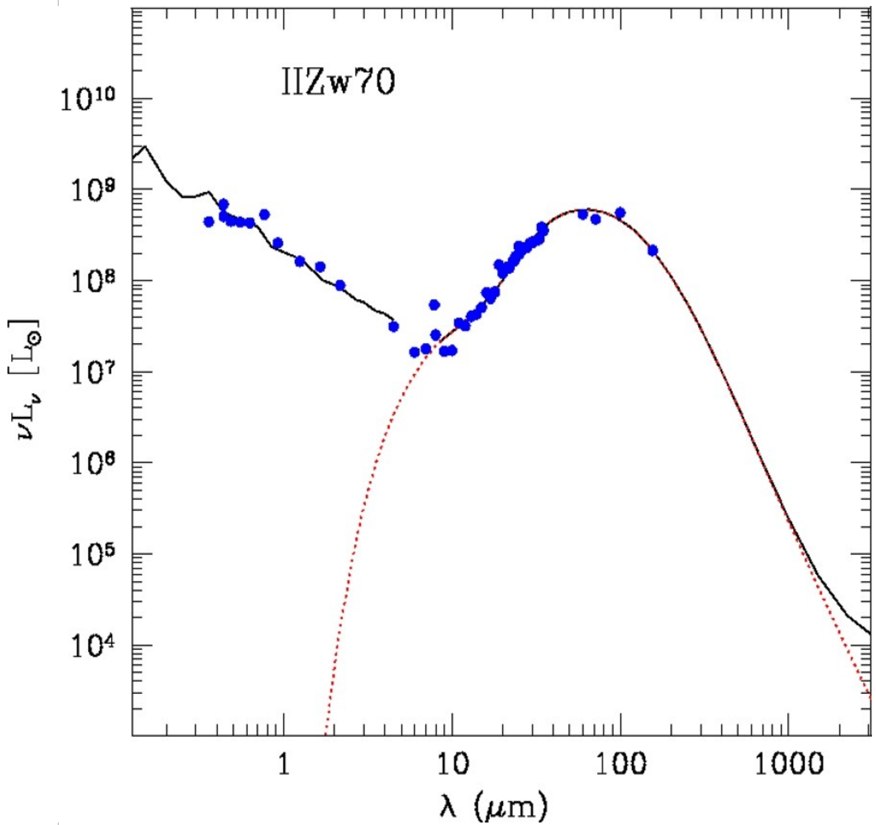


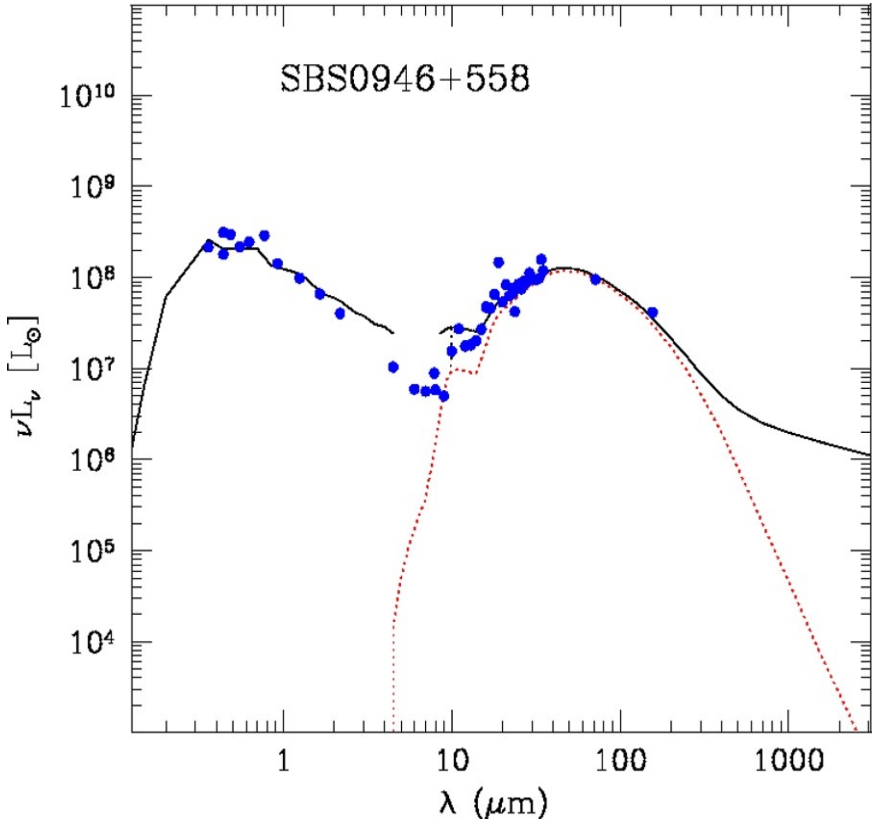
L_{IR} differs by a factor of ~50

Yet more SEDs of active/passive BCDs

12+logO/H=8.04 (~7 times SBS0335-052)
SFR = 0.5 M_{sun}/yr
L_{IR} =1.0 10^9 L_{sun}

12+logO/H=8.04
SFR = 0.1 M_{sun}/yr
L_{IR} =2.0 10^8 L_{sun}



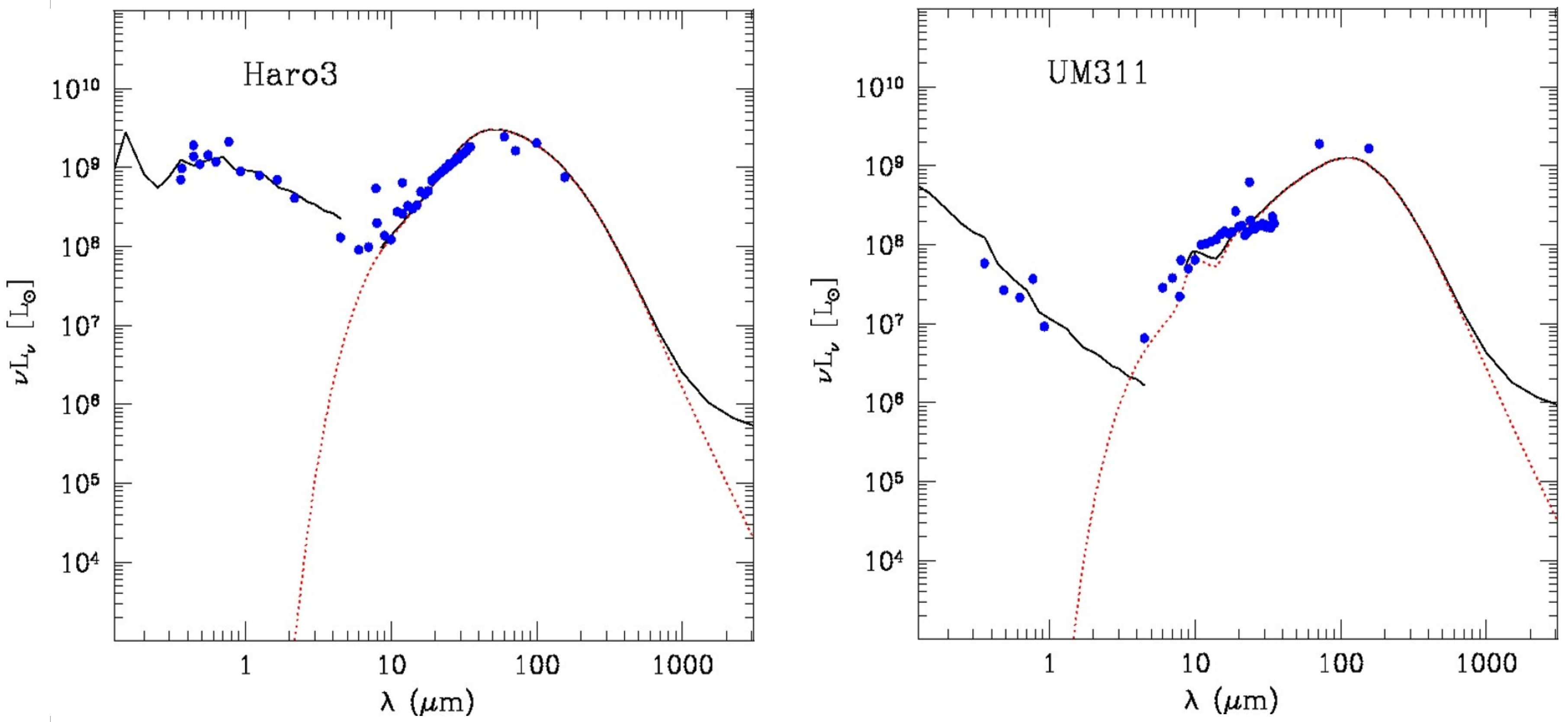


L_{IR} differs in this case only by a factor of ~5

Last of SEDs of active/passive BCDs

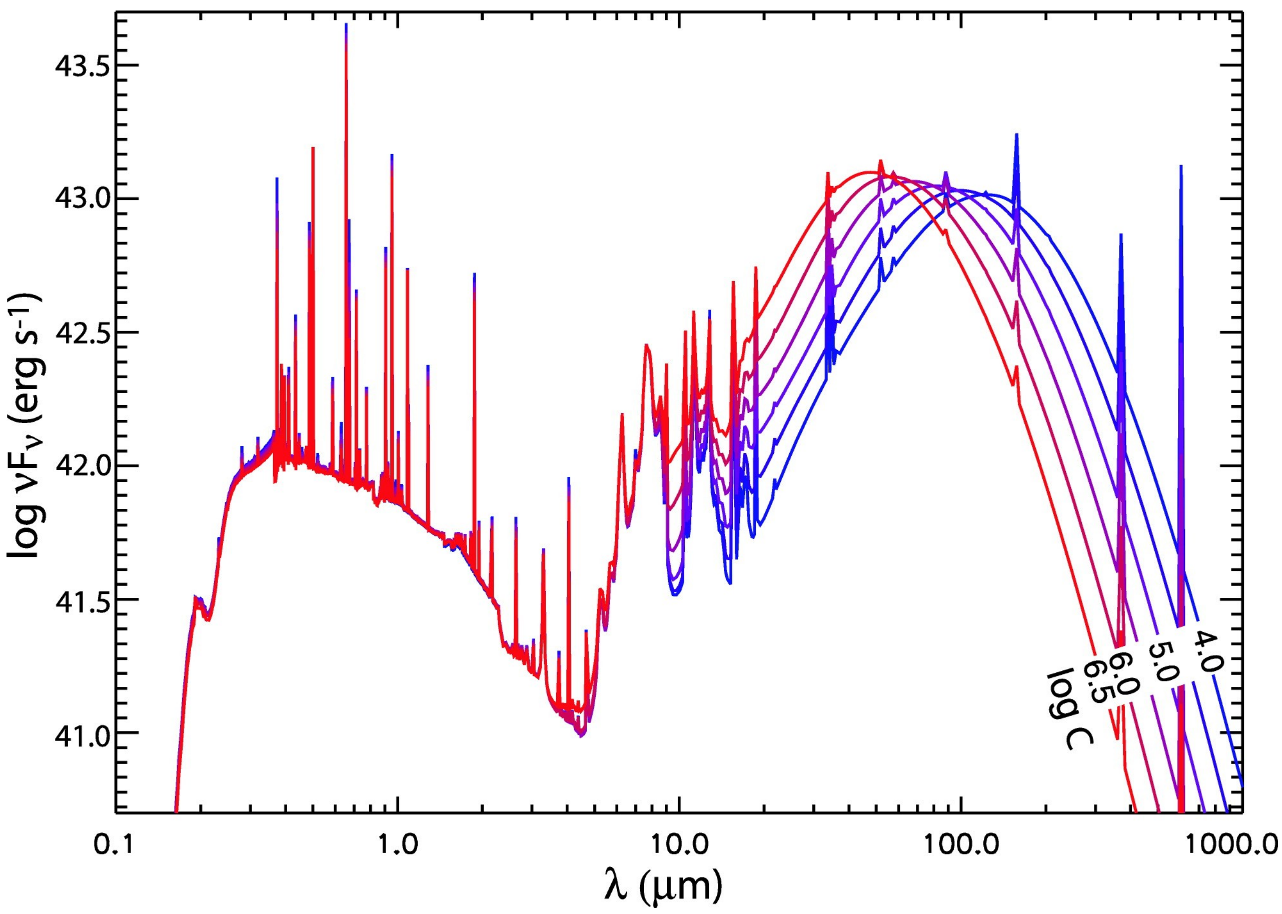
12+logO/H=8.32 (~14 times SBS0335-052)
SFR = 1.2 M_{sun}/yr
L_{IR} =5.0 10^9 L_{sun}

12+logO/H=8.31
SFR = 1.3 M_{sun}/yr
L_{IR} = 2.5 10^9 L_{sun}



L_{IR} varies by ~50-100, roughly independently of O/H!

SED models as a function of compactness



Fixed (solar) metallicity (Dopita et al. 2006, Groves et al. 2008)

MODULO - The “big picture”

- However, metallicity affects molecular content: CO (and PAHs) are absent at low abundance (KS law deviations), despite high SFR in metal-poor starbursts.
- Is the reason for this lack of raw material? Or indirect effects of metal poverty (hard radiation fields)?

How can metal-poor starbursts form stars apparently without molecules?

MODULO Goals from the proposal

- Compare different chemical evolution models in terms of elemental abundances and abundance ratios: raw material for dust and molecule formation. INCORPORATE active/passive conditions and test predictions against observed relations (e.g., mass-metallicity, KS law)
- Interface molecule formation algorithms with chemical evolution models to predict molecular abundances
- PDR and LVG models to predict observed molecular emission (possibly considering the raw material and molecular abundance constraints above); SED models of continuum for additional diagnostics (e.g., temperature)
- Continue observations of simple low-metallicity systems (e.g., blue compact dwarf galaxies) with IRAM, APEX, JCMT
- Be ready for *Herschel* (and ALMA)

- *Compare different* ***chemical evolution models*** *in terms of elemental abundances and abundance ratios: raw material for dust and molecule formation. INCORPORATE active/passive constraints and test predictions against observed relations*

What is the galaxy unit we are modelling? (single gas cloud? mass dependence? Are these "galaxies"?)

What is the best way to include active/passive constraints?

Can elemental abundances provide age constraints in closed-box models? What if we include inflow/outflow?

How can we verify model predictions? (observed mass-metallicity relation? Observed gas-to-dust mass ratios? Kennicutt-Schmidt laws?) Need road map for paper(s)!

(Raffaella et al., Laura et al.)

- *Interface molecule formation algorithms with chemical evolution models to predict molecular abundances*

Can constraints from chemical evolution models be incorporated in the models?

How can we use SED fitting to constrain molecule formation? (no unique temperature, what temperature should we use?)

(Stephanie et al., Simona et al.)

- *PDR and LVG models to predict observed molecular emission (considering the raw material and molecular abundance constraints above); SED models of continuum for additional diagnostics (e.g., temperature)*

Have already compared Radex models with observations of NGC 1140; relatively strong constraints because have ^{12}CO(1-0), ^{12}CO(2-1), ^{12}CO(3-2), significant ^{13}CO(1-0) upper limit, ^{13}CO(2-1). But have not included abundance constraints from models.

- *Continue observations of simple low-metallicity systems (e.g., blue compact dwarf galaxies) with IRAM, APEX, JCMT.*

Latest IRAM round miserable failure: two C grades.

(Leslie et al.)