

Origin of the $12\mu\text{m}$ Emission Across Galaxy Populations from WISE and SDSS

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Combining WISE and SDSS

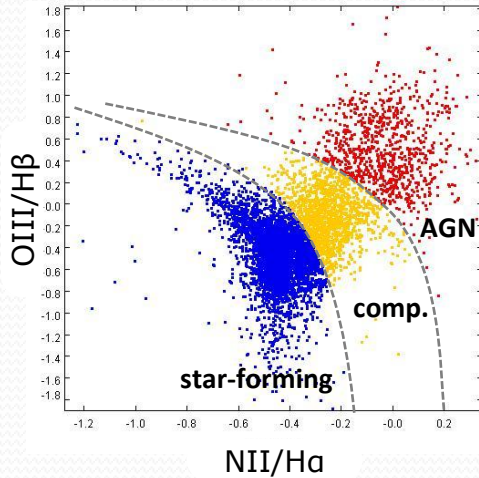
WISE PR1 Catalog

- 12 μ m flux > 1 mJy
- clean photometry

SDSS MPA –JHU Catalog

Brinchman et al. (2004)

- $r^* < 17.7$ $< z > = 0.1$
- improved emission line fluxes
→ SFR, metall., dust, mass
- No QSOs!



(3" radius)

Single Match

96.217 (40%)

Double Matches

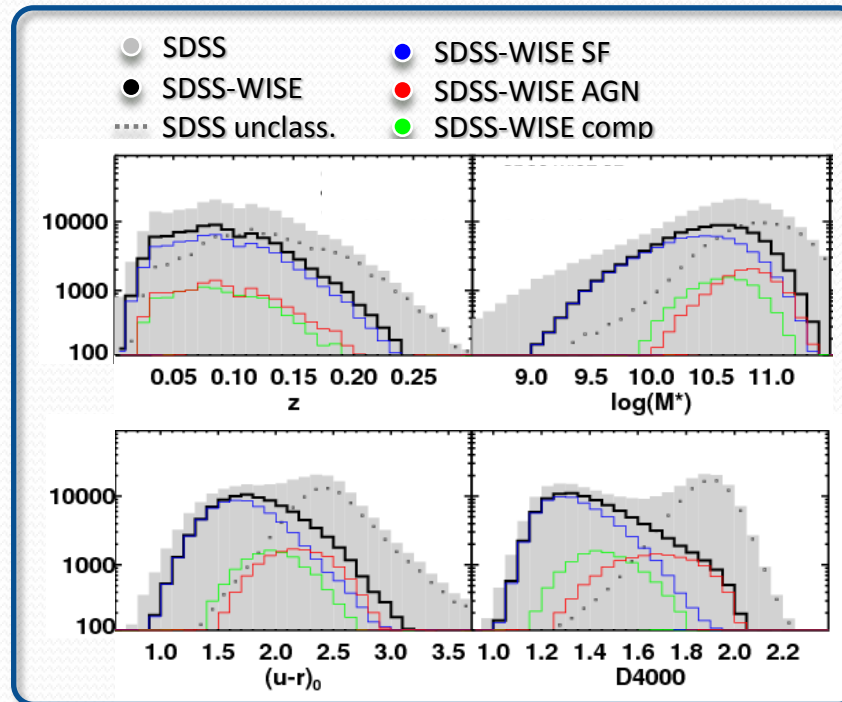
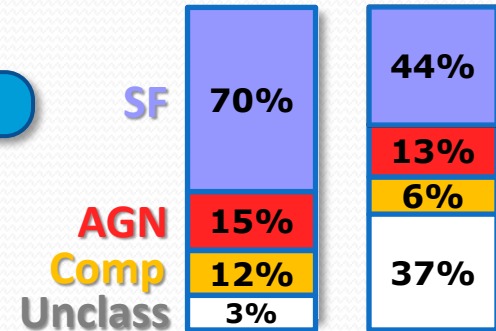
73 (0.03%)

No Match

150.100 (60%)

SDSS+12 μ m

SDSS



Low Lum. (31%)

$$L_{IR} < 10^{10} L_{\odot}$$

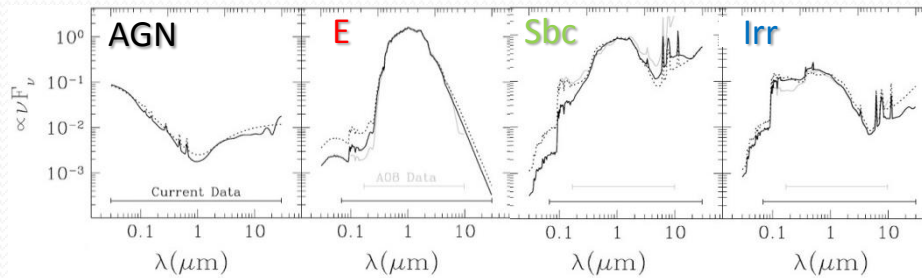
Normal (60%)

$$L_{IR} \sim 10^{10-11} L_{\odot}$$

LIRGs (9%)

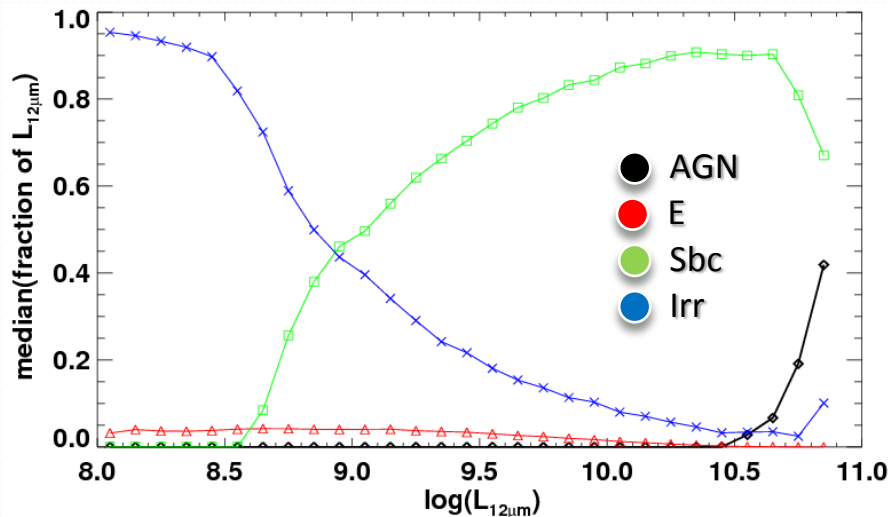
$$L_{IR} \sim 10^{11-12} L_{\odot}$$

Role of AGN in the Energy Budget

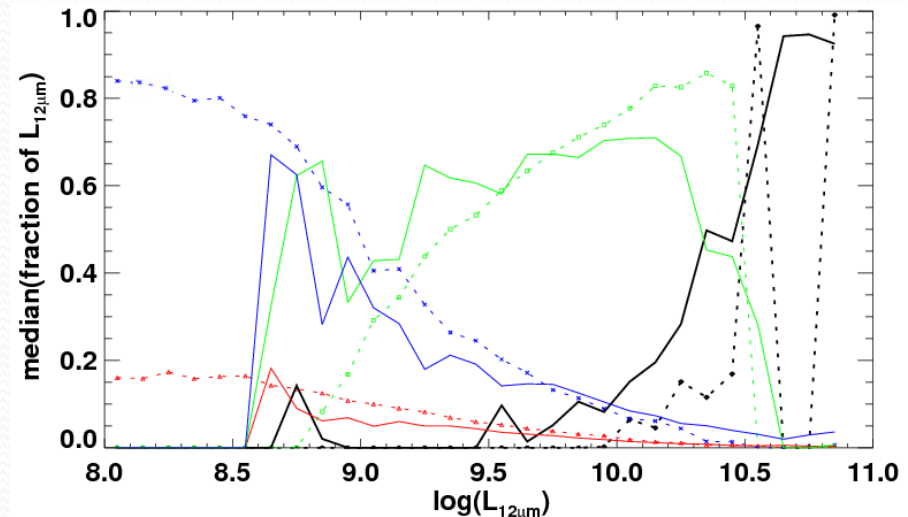


Empirical SEDs of
Assef et al. (2010)

SF CLASS

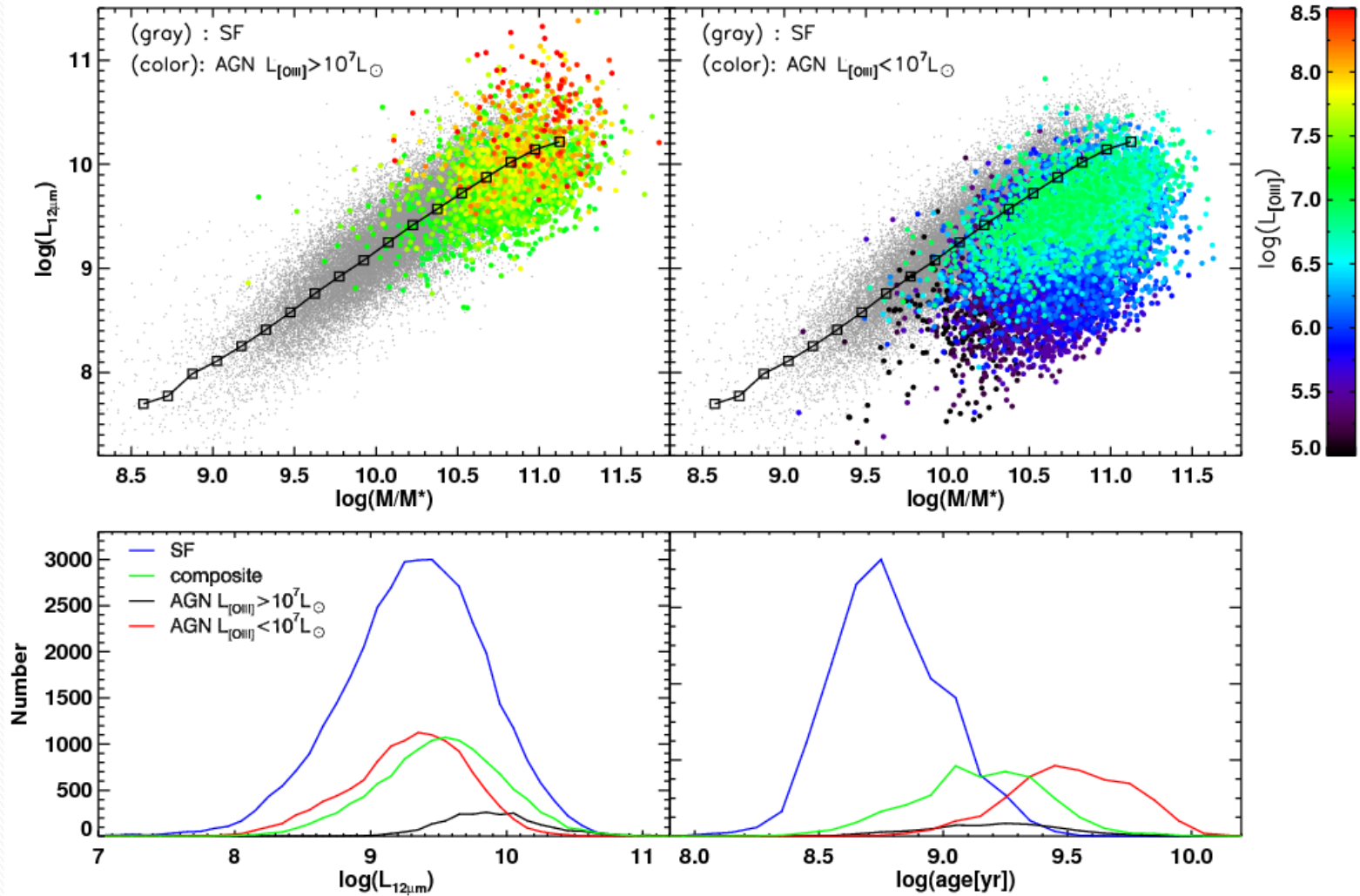


AGN CLASS

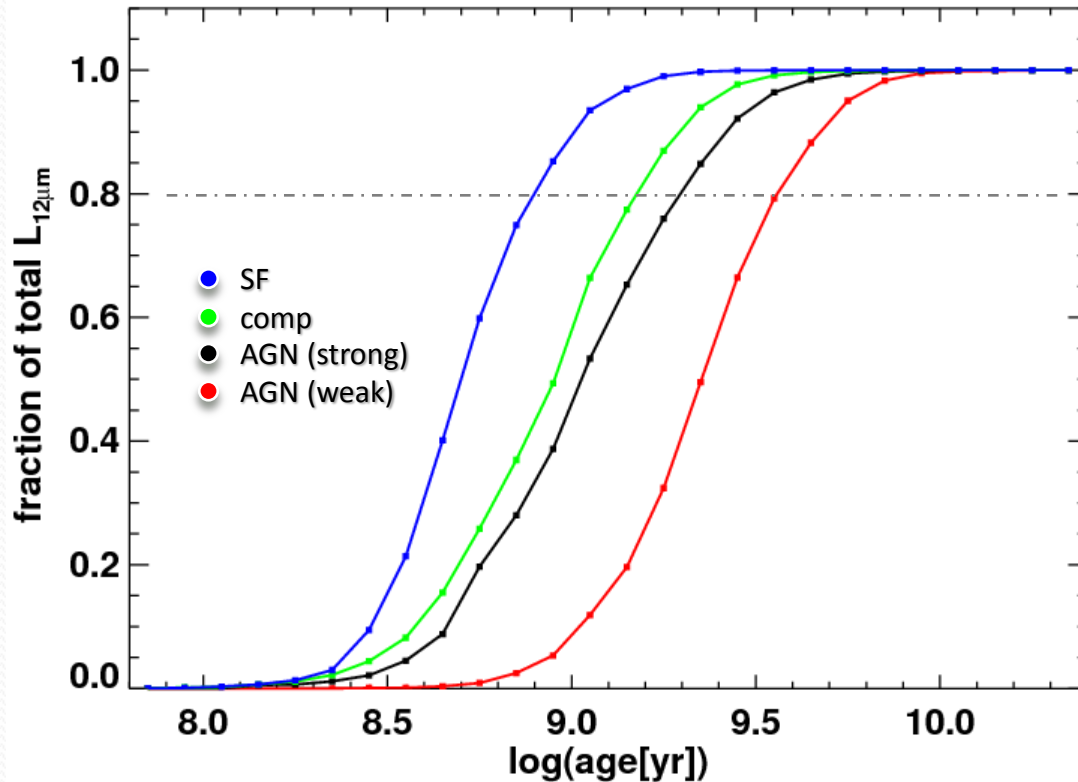


- 96% of sources have AGN contributing <10% of L_{bol}
- For AGN class \rightarrow 86% have AGN contributing <40% of L_{12}
- AGN play small part in the total energy budget (no type 1 AGN in the sample !)

Mass - IR Luminosity Relation



IR Luminosity budget of stellar age



80% of total IR luminosity produced in galaxies :

- < 0.6 Gyr (SF)
- < 1.5 Gyr (comp)
- < 2 Gyr (strong AGN)
- 1-3 Gyr (weak AGN)

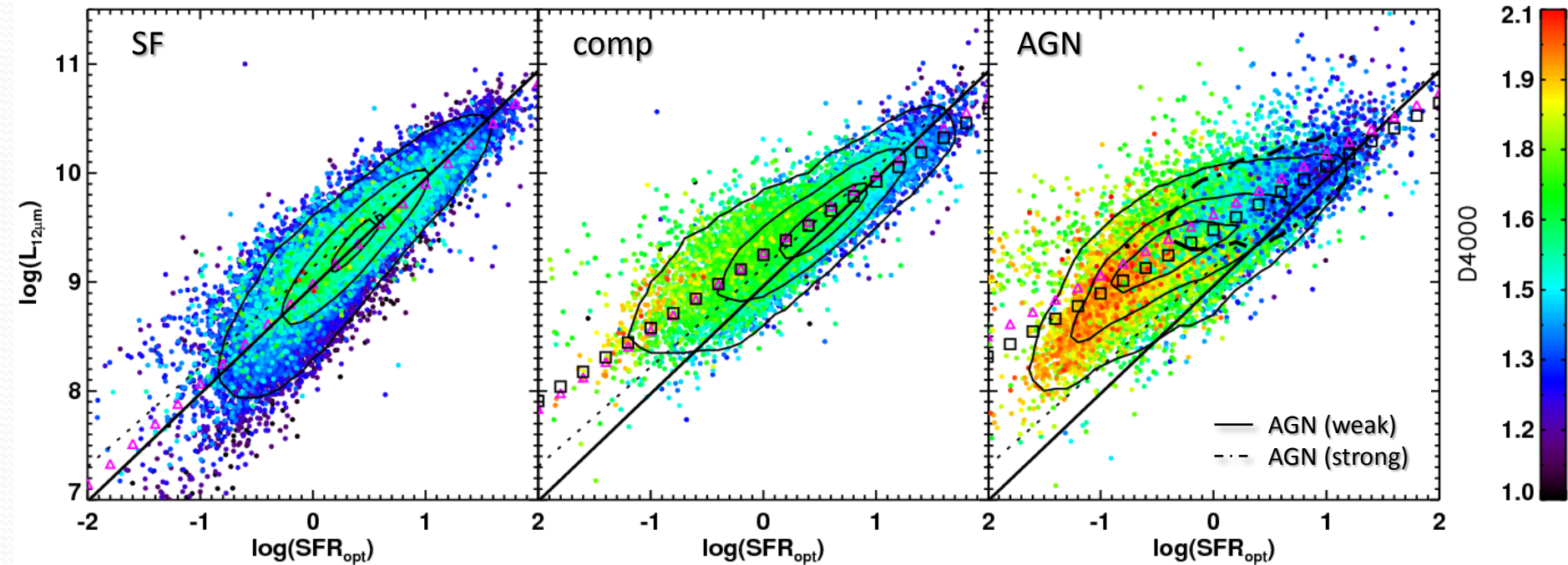


Important role of young/old stars in powering $12\mu\text{m}$ emission

Smooth seq. between

High SF  quiescent

SFR-IR Luminosity Relation



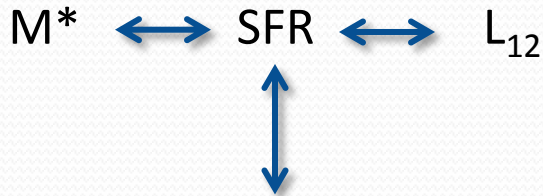
SF $\log(L_{12}) = 0.98 \log(\text{SFR}_{\text{opt}}) + 8.96$

com $\log(L_{12}) = 0.67 \log(\text{SFR}_{\text{opt}}) + 9.25$

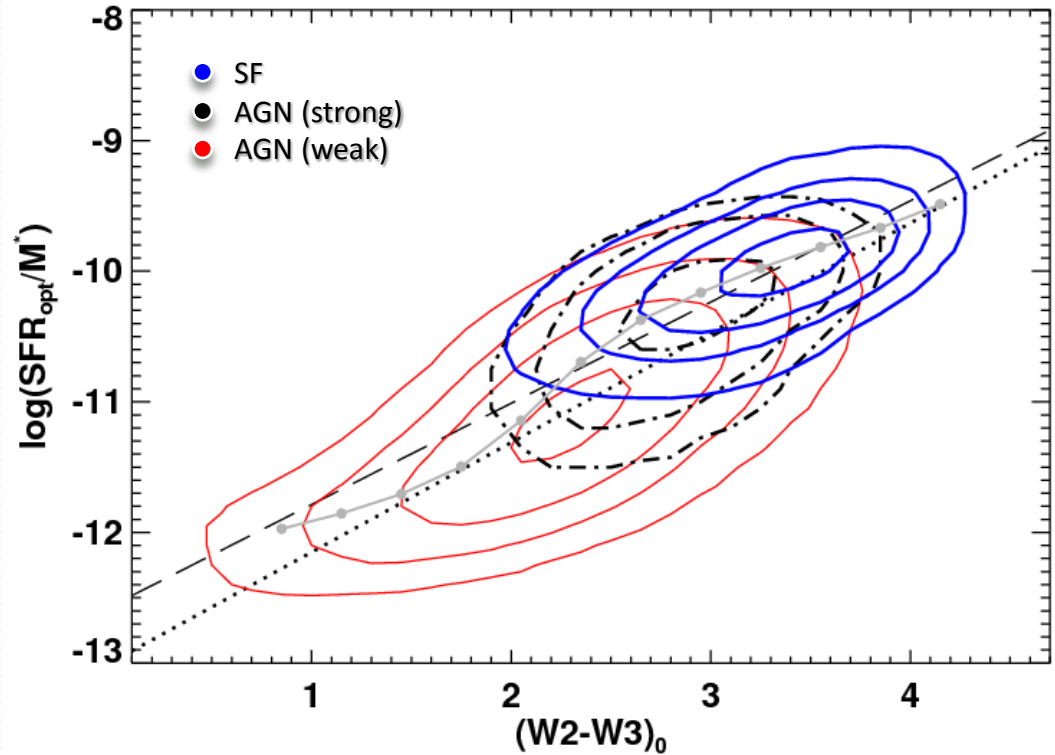
AGN $\log(L_{12}) = 0.58 \log(\text{SFR}_{\text{opt}}) + 9.48$

The Color of Star Formation

So far, there is a tight link between



What about
IR color?



ALL $\log(\text{SSFR}) = 0.77(W_2 - W_3)_0 - 12.56$

AGN $\log(\text{SSFR}) = 0.84(W_2 - W_3)_0 - 12.99$

Conclusions

- SDSS+WISE 12 μ m sources trace typical, blue sequence star-forming galaxies, but also AGN. Avoids the bulk of “red and dead” galaxies. Low/normal IR luminosities.
- Redder systems are dominated by older stellar pop., which contribute more to the 12 μ m emission \rightarrow relevance of old/interm. age stars in heating the dust
- Strong AGN \rightarrow smooth continuation at massive-end of normal SF sequence, where the AGN gradually quenches SF (possibly after a SB episode)
- The AGN, if present, does not dominate the energy budget
- The (4.6 μ m–12 μ m) color can be used as a first-order indicator of the overall SF activity