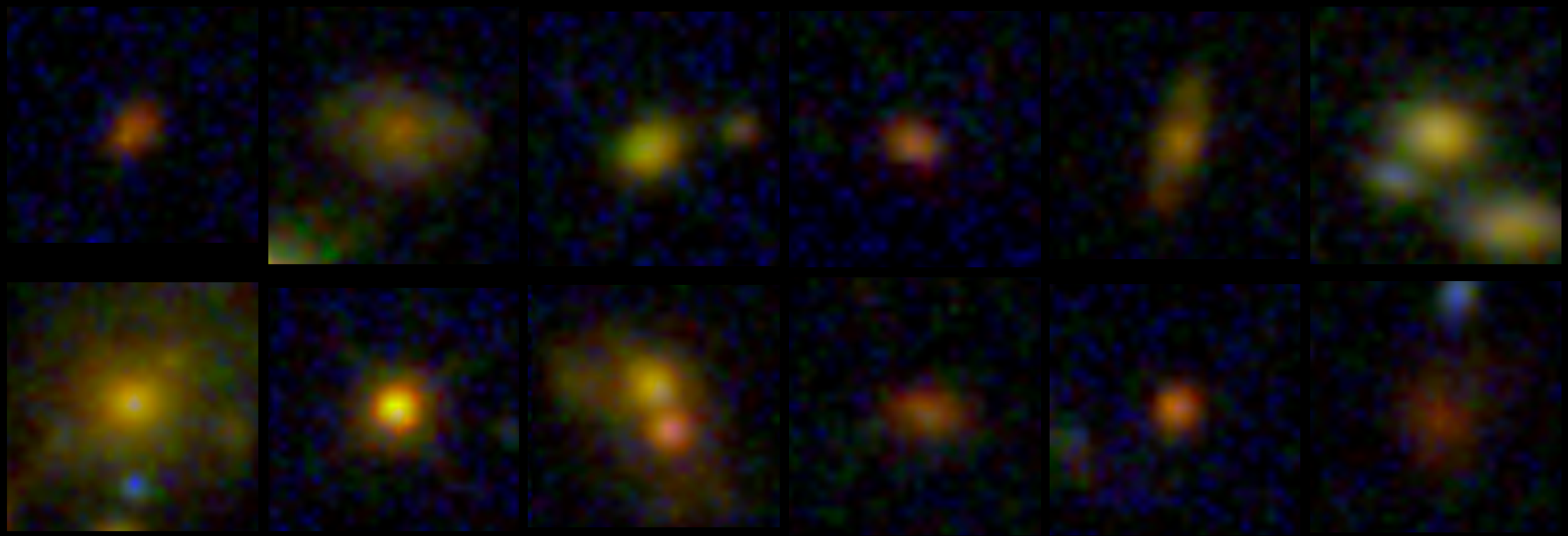
Infrared Selection of Obscured AGNs in the COSMOS Field

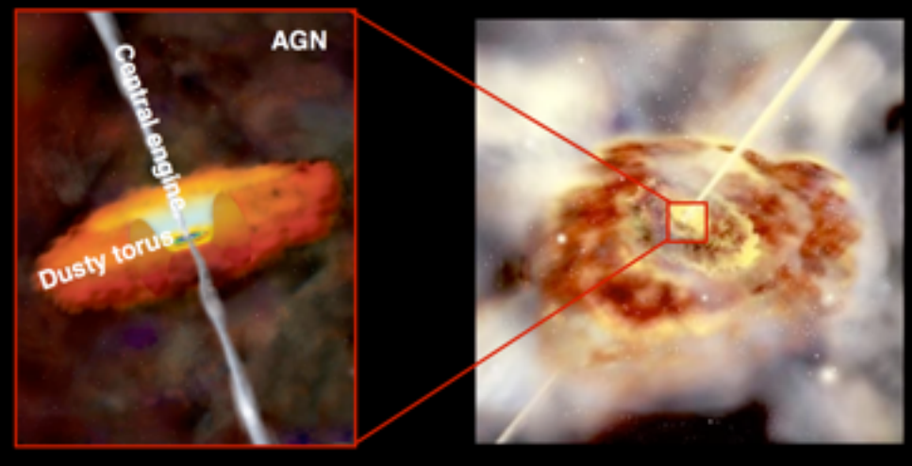


Yu-Yen Chang
張雨晏

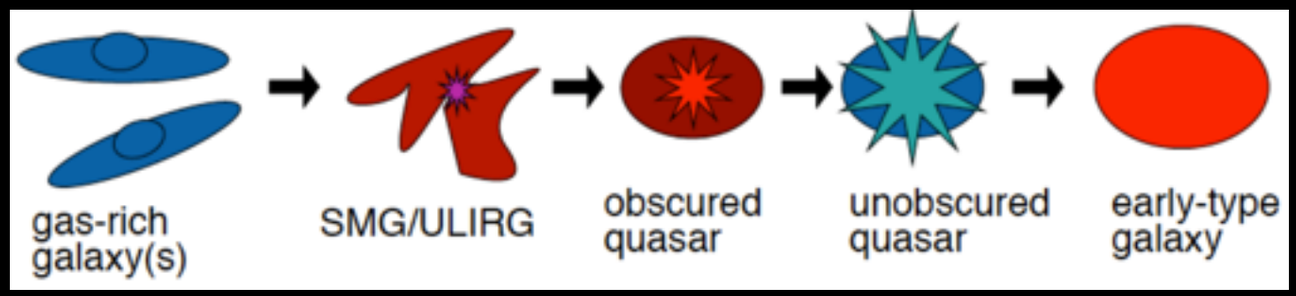
with Emeric Le Floc'h (CEA), Stephanie Juneau (CEA), Elisabete da Cunha (ANU), Mara Salvato (MPE), Francesca Civano (CfA), Stefano Marchesi (UClemson), Olivier Ilbert (LAM), **Yoshiki Toba** (ASIAA), Chen-Fatt Lim (ASIAA/NTU), **Ji-Jia Tang** (ASIAA/NTU), **Wei-Hao Wang** (ASIAA), Nicholas Ferraro (ASIAA/UVa), Megan C. Urry (Yale), Richard E. Griffiths (UHawaii), Jeyhan S. Kartaltepe (URochester), and the COSMOS team

5 Dec 2017
EAAGN

AGN vs. star formation vs. morphology?



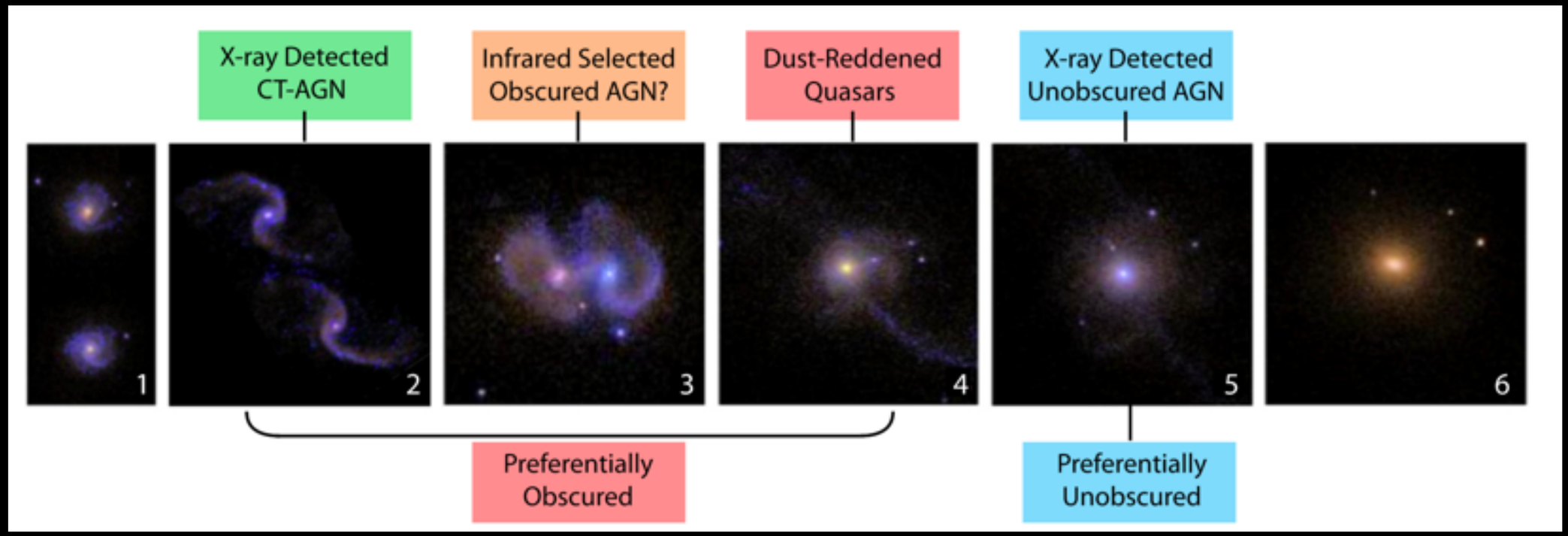
Credit: NASA, ESA, the Hubble Heritage Team (STScI/AURA)-ESA/ Hubble Collaboration and A. Evans (University of Virginia, Charlottesville/NRAO/Stony Brook University), K. Noll (STScI), and J. Westphal (Caltech)



Alexander & Hickox 2012

Compton-thick (obscured) AGNs

- Tend to show a high fraction of disturbed morphologies
  (Hickox+2014, Kocevski+2015, Lanzuisi+2015b)



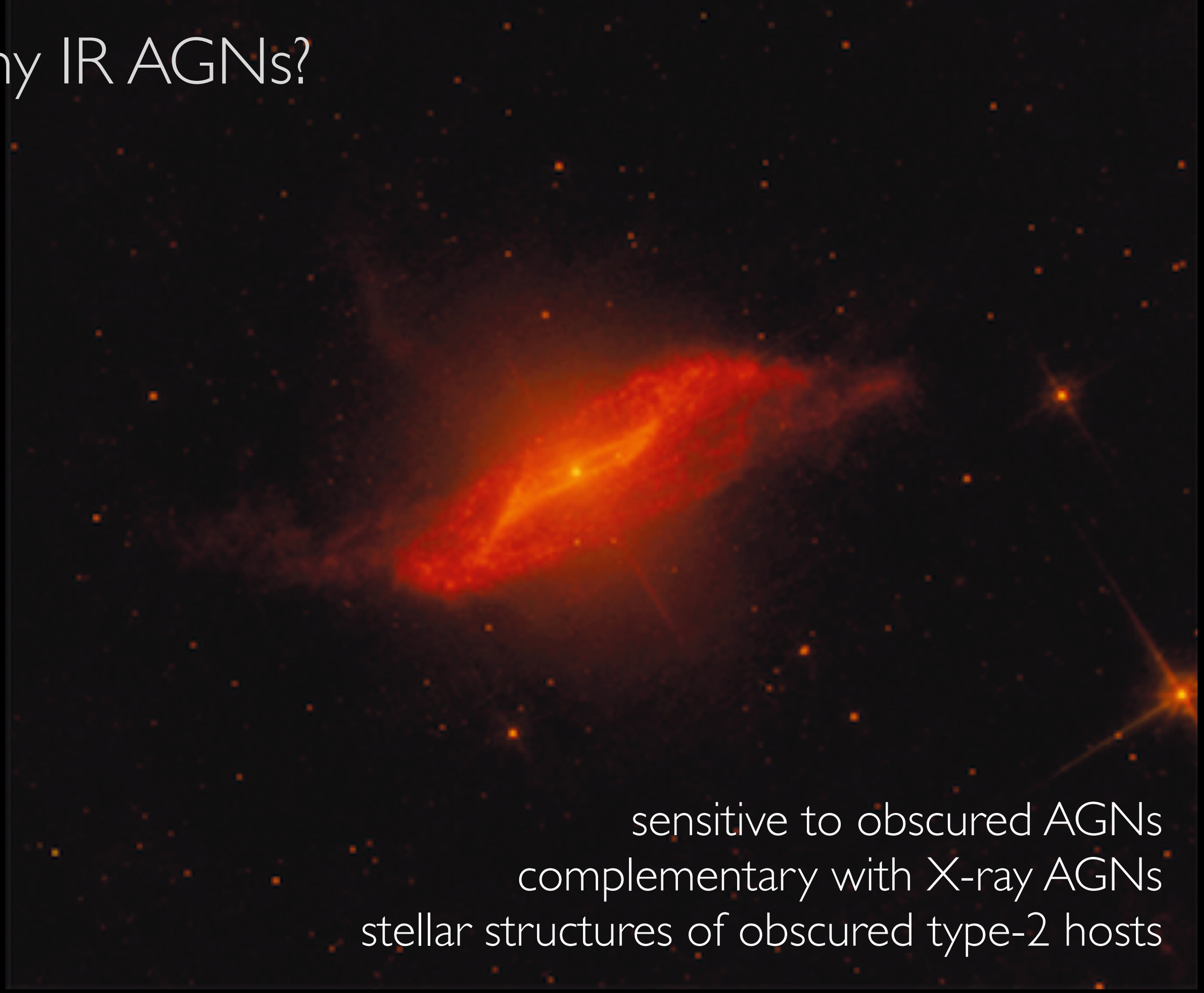
Are AGNs triggered by major merger or internal mechanisms
(secular process, disk instabilities, compaction…) ?

Morphology of X-ray selected AGN hosts

@z~1
bulgier: Grogin+2005. Pierce+2007. Georgakakis+2008
in between: Gabor+2009
similar: Böhm+2013. Villforth+2014
slightly diskier: Rosarios+2015
@z~2
bulgier: Bruce+2015. Rosarios+2015
similar: Fans+2014
diskier: Schwaninski+2011. Simmons+2012

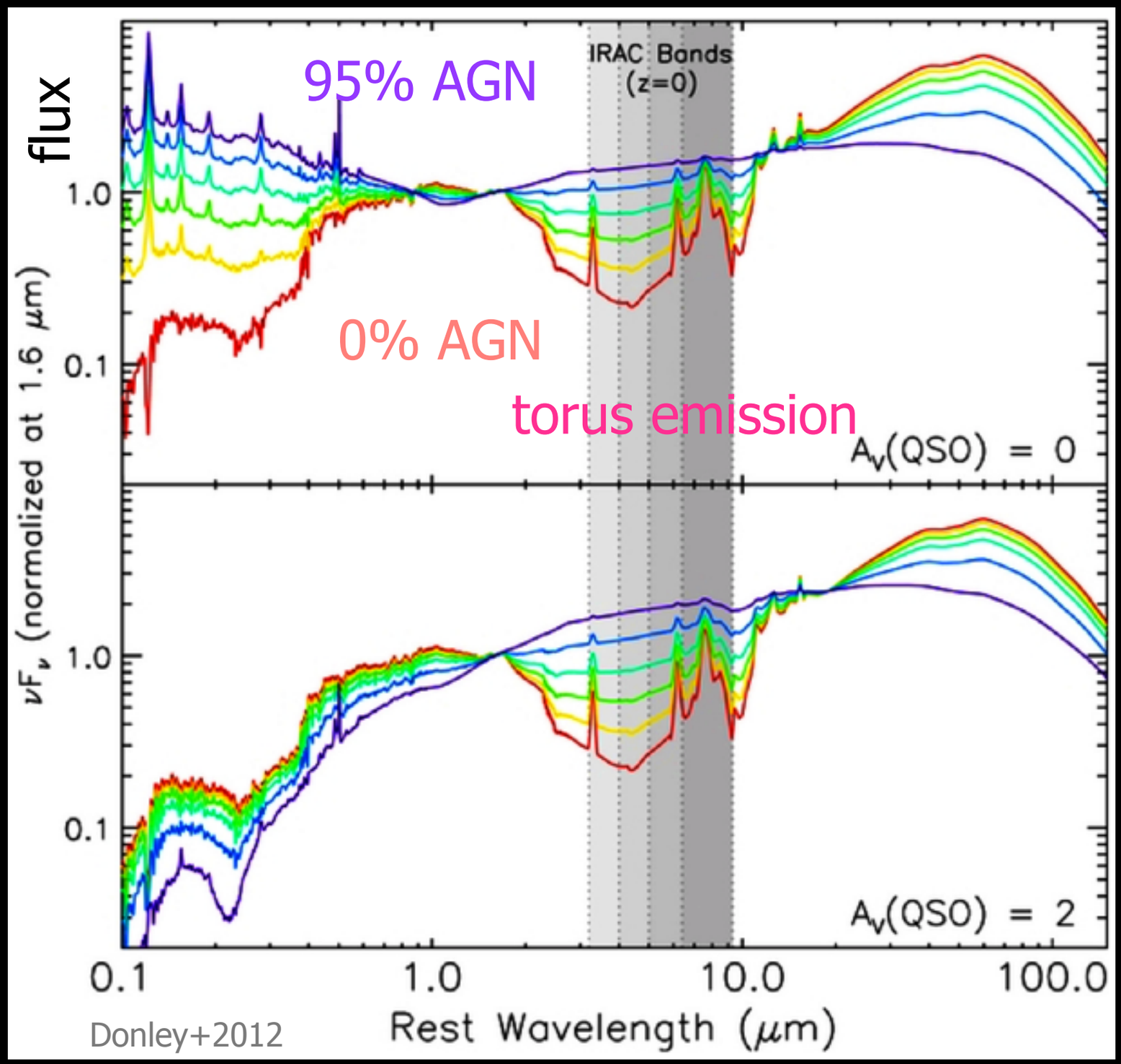
Are AGNs triggered by major merger or internal mechanisms
(secular process, disk instabilities, compaction…) ?

Why IR AGNs?

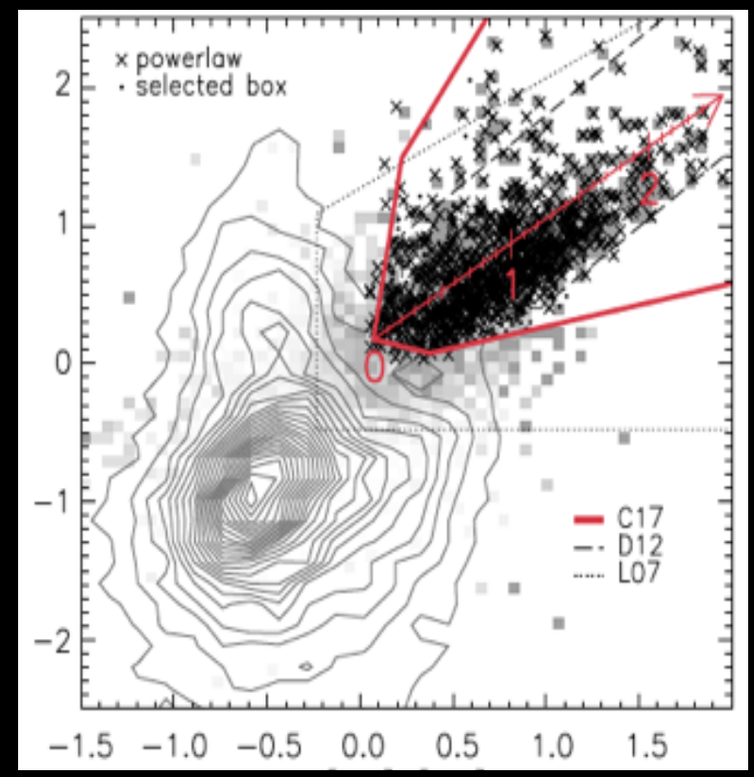


sensitive to obscured AGNs
complementary with X-ray AGNs
stellar structures of obscured type-2 hosts

Infrared Selected AGNs: power-law SEDs



Donley+2012



Chang+2017b

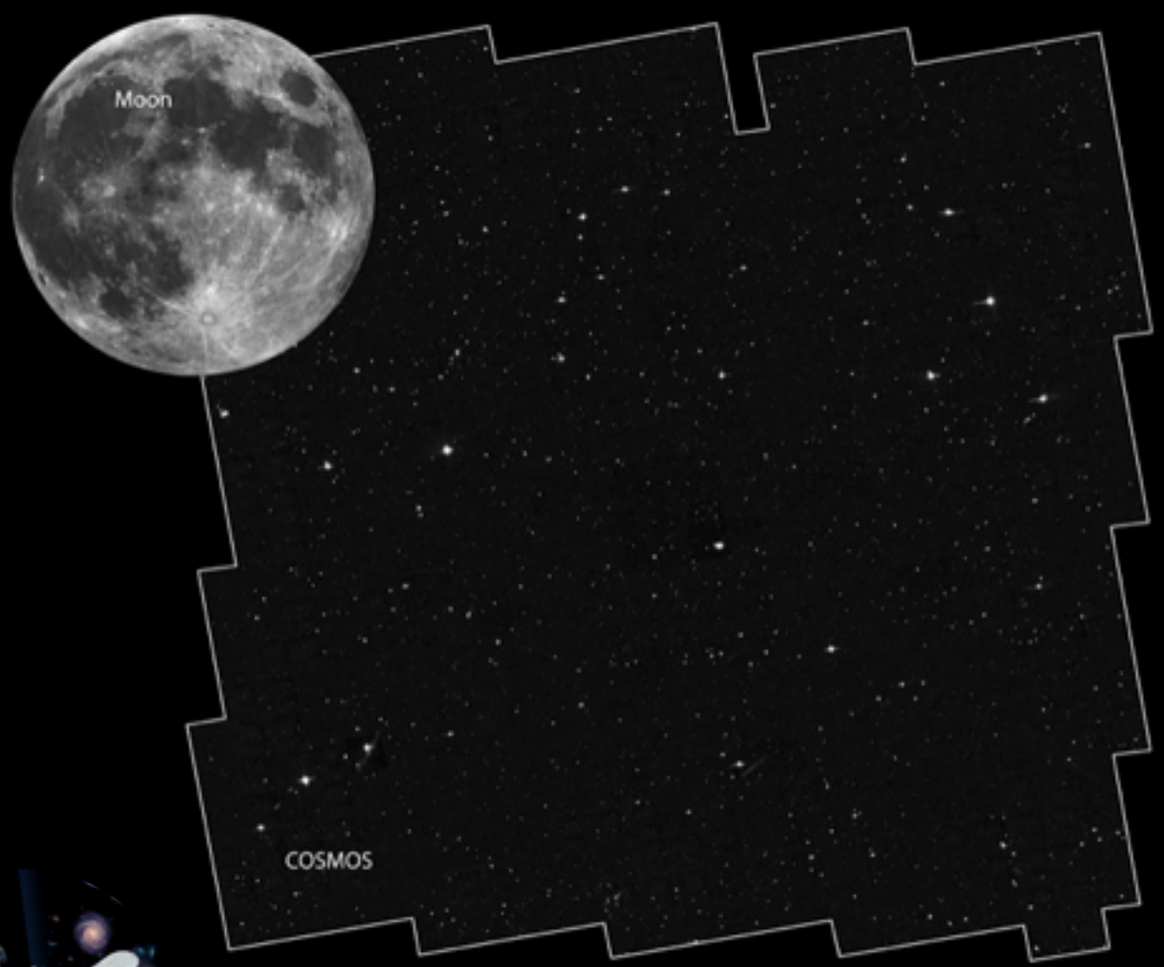
between Lacy+2007 and Donley+2012

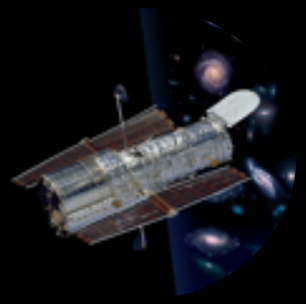
→z~2.5

Sample selection: 24um

~36,670 MIR galaxies & ~1,000 IR-AGNs in COSMOS

photometry from optical to FIR:
- COSMOS2015 Laigle+2016





Credit: NASA, ESA, and Z. Levay

redshift:
- AGN+photo-z Salvato+2009.2011.2016 Civano+2016, Marchesi+2016
- spec-z
- new photo-z Ilbert+2013, Laigle+2016

images:
- HST/ACS (I-band) Koekemoer+2007
- HST/WFC3 (J/H-band) CANDELS Grogin+2011, Koekemoer+2011

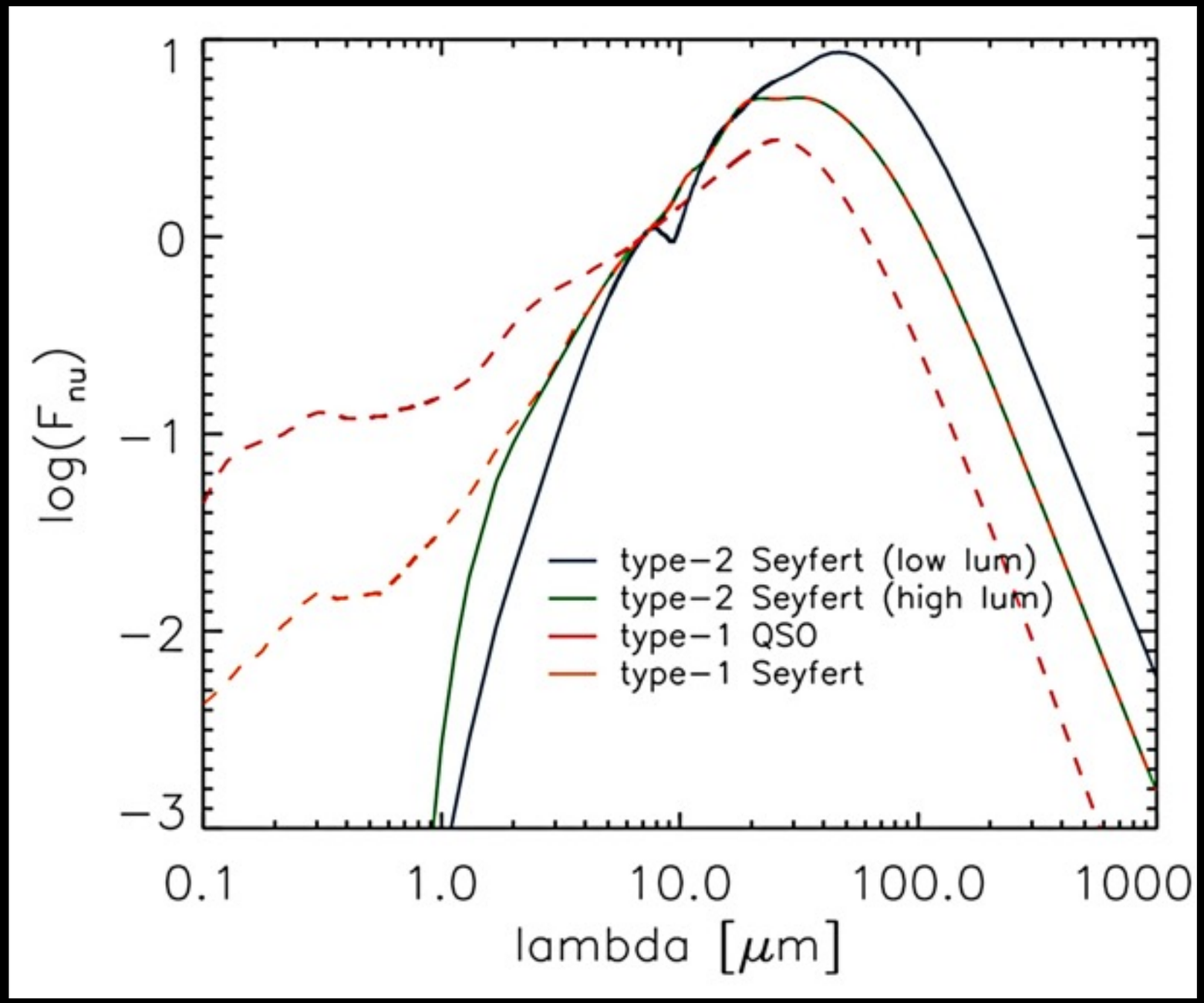
COSMOS=Cosmic Evolution Survey

SED fitting

(=Spectral Energy Distribution)

MAGPHYS
da Cunha+2008

+high-z star formation history
da Cunha+2015



MAGPHYS+AGN

da Cunha+, in prep.
Juneau+, in prep.

1. type-2 Seyfert [low luminosity] (Mullaney+2011)

2.type-2 Seyfert [high luminosity] (Mullaney+2011)

3. type-1 QSO (Richard+2006+Prieto+2010)

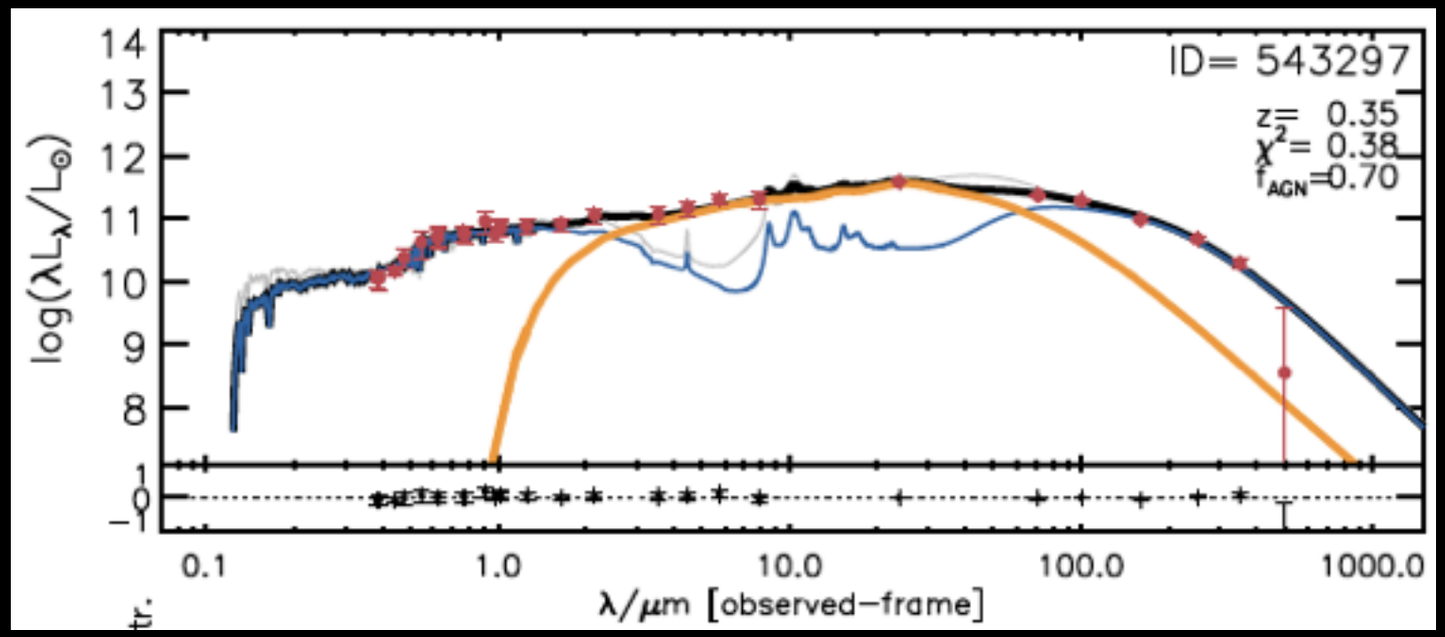
4. type-1 Seyfert (Polletta+2007)

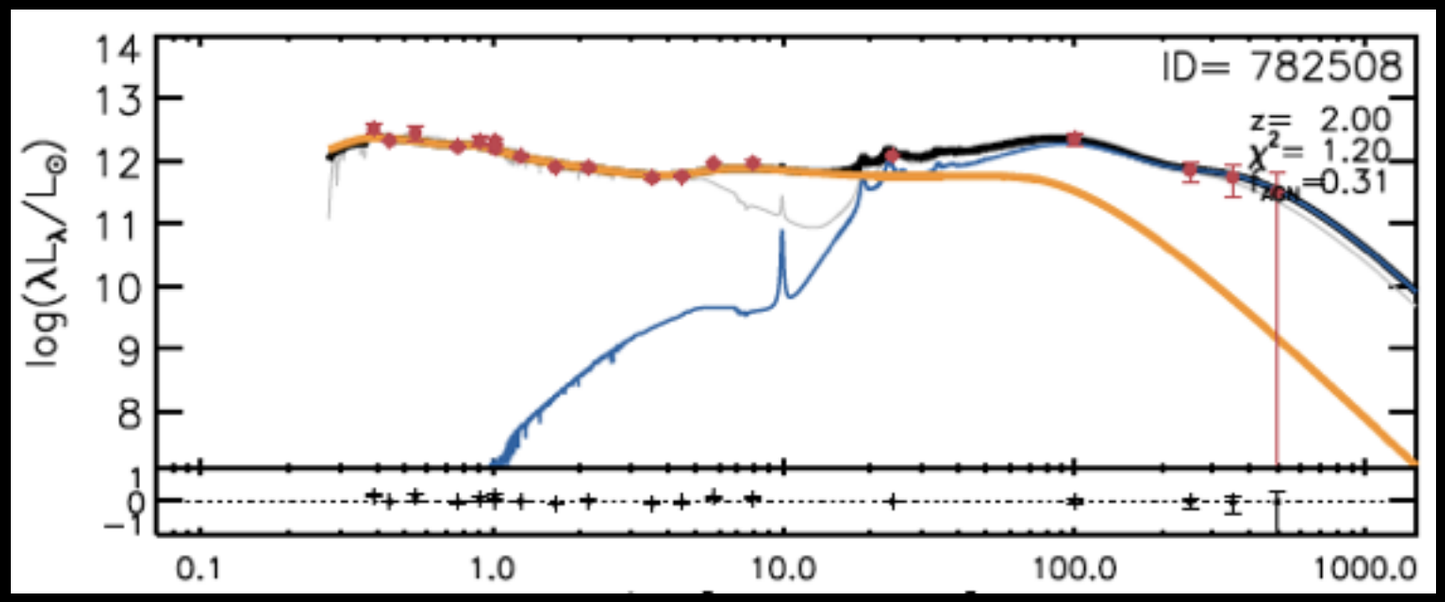
SED fitting

(=Spectral Energy Distribution)

MAGPHYS
da Cunha+2008

+high-z star formation history
da Cunha+2015





MAGPHYS+AGN

da Cunha+, in prep.
Juneau+, in prep.

1. type-2 Seyfert [low luminosity] (Mullaney+2011)

2.type-2 Seyfert [high luminosity] (Mullaney+2011)

3. type-1 QSO (Richard+2006+Prieto+2010)

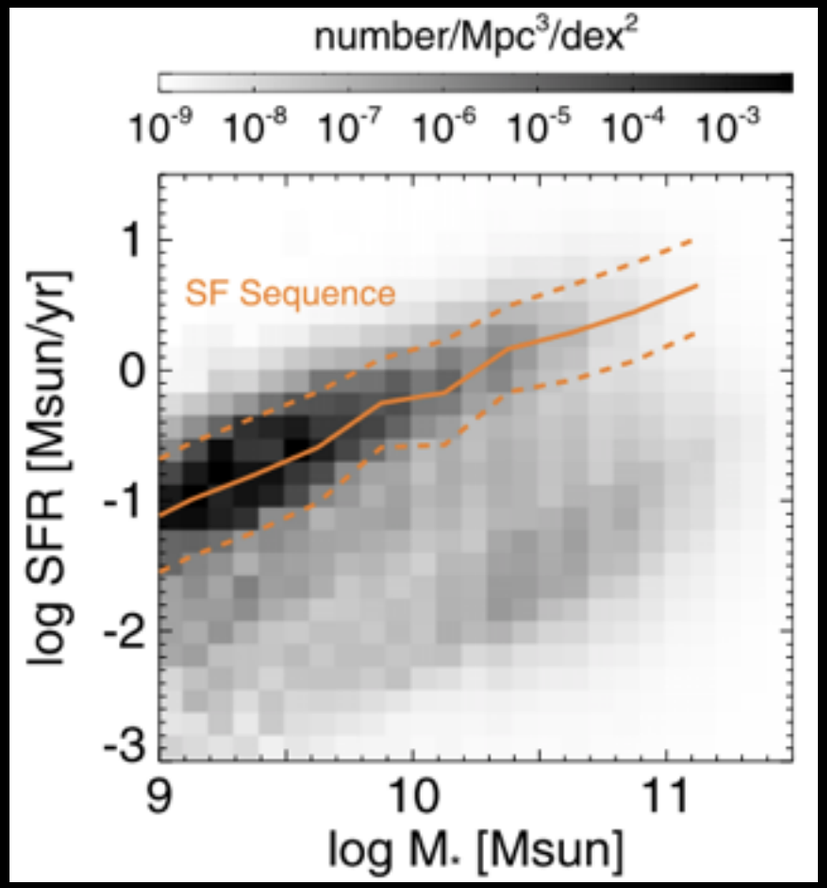
4. type-1 Seyfert (Polletta+2007)

Chang+17b

catalogs are available for the whole COSMOS2015 sample:
http://www.asiaa.sinica.edu.tw/~yychang/ca.html

Star-forming Relation (Main Sequence)

Where obscured IR-AGN hosts lie in the main sequence?

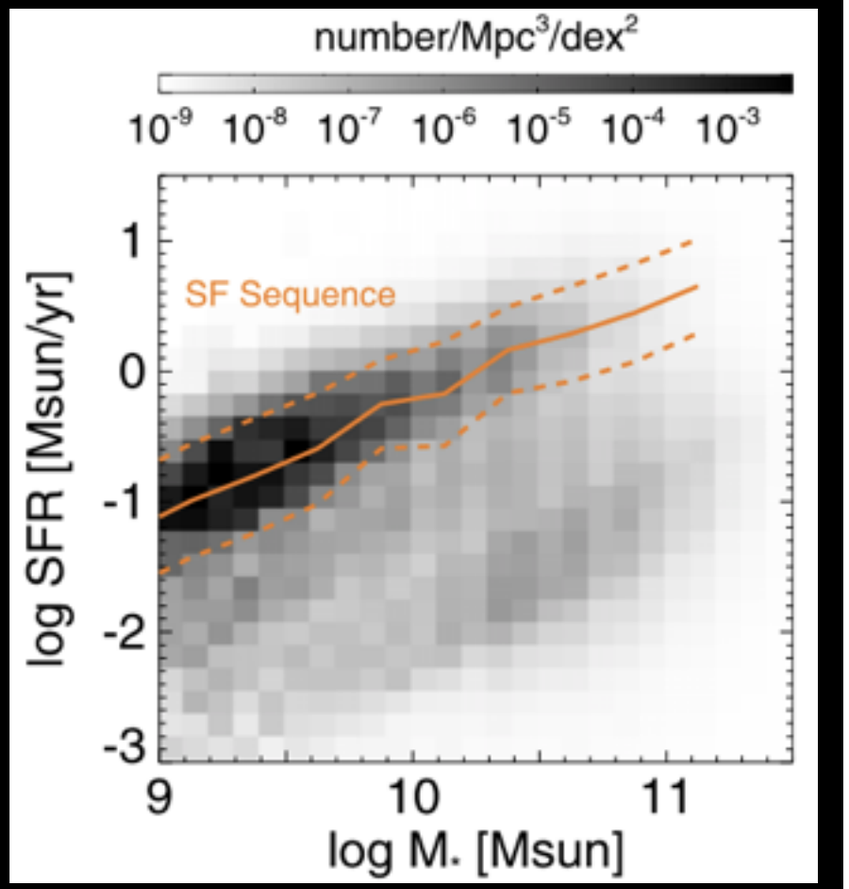


Chang+15

z~0

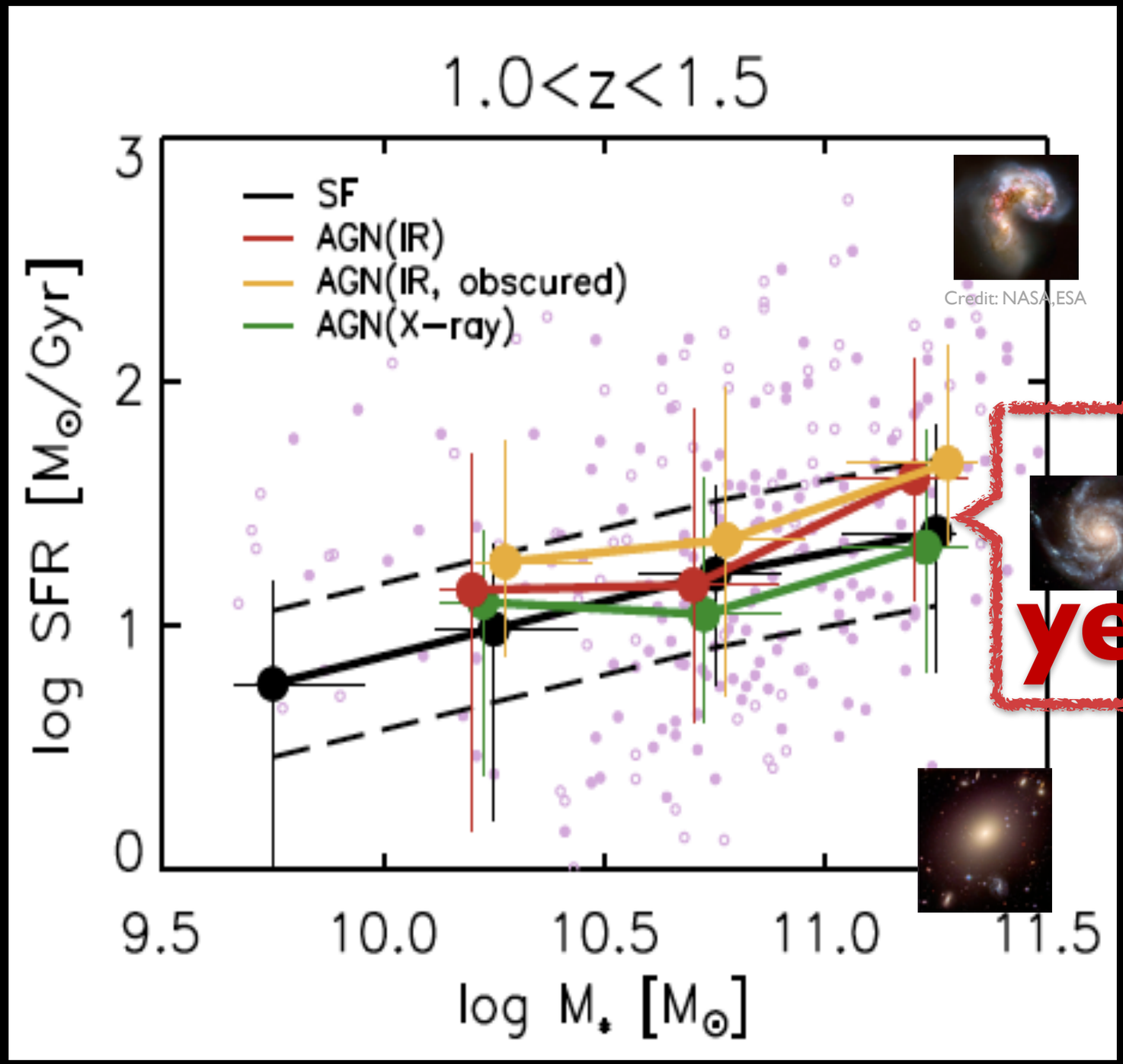
Star-forming Relation (Main Sequence)

Where obscured IR-AGN hosts lie in the main sequence?



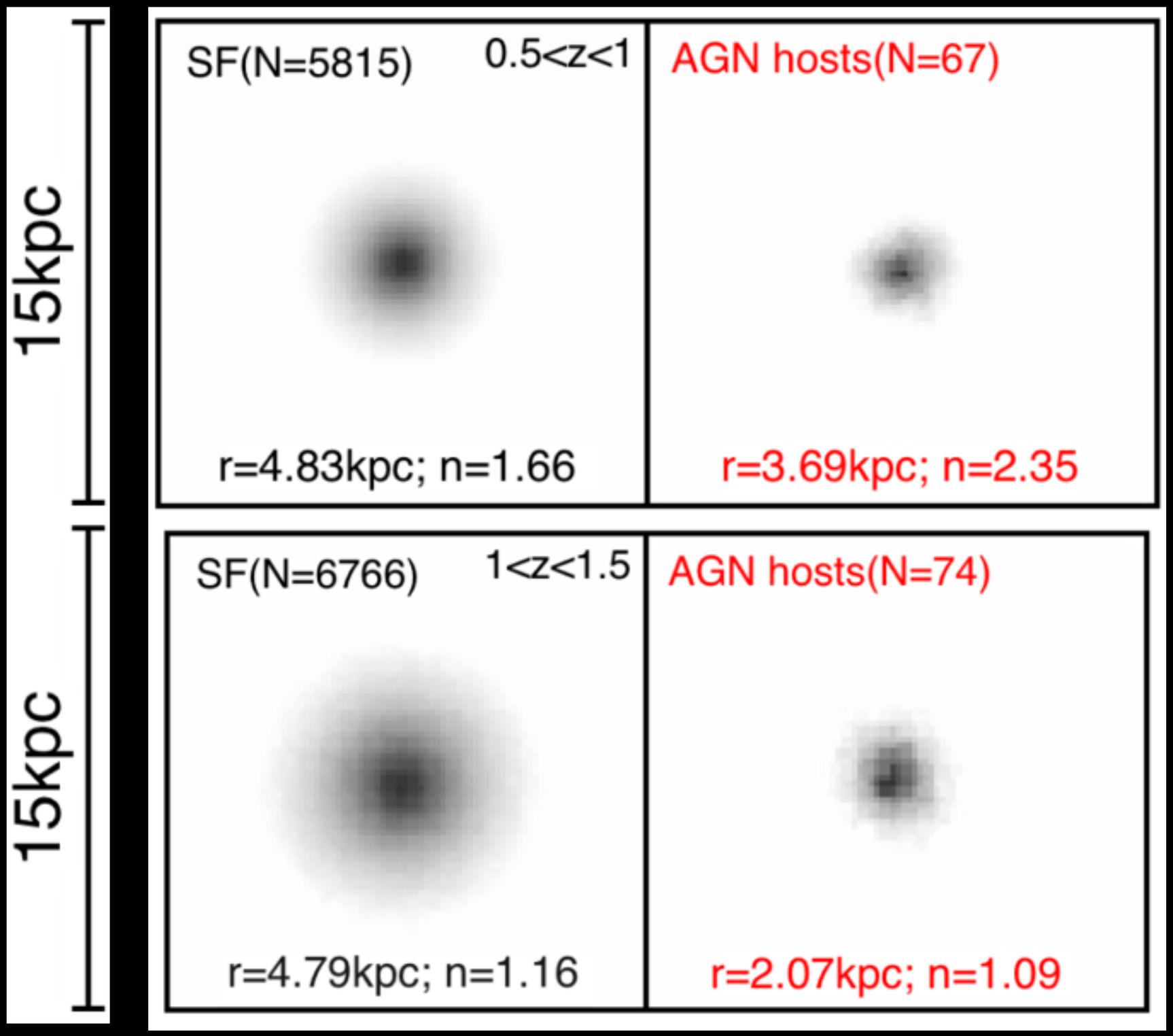
Chang+15

z~0



Chang+17b

Stacked HST/ACS I-band Image



Obscured type-2
$\log M_{star} > 10.5$
(mass matched)

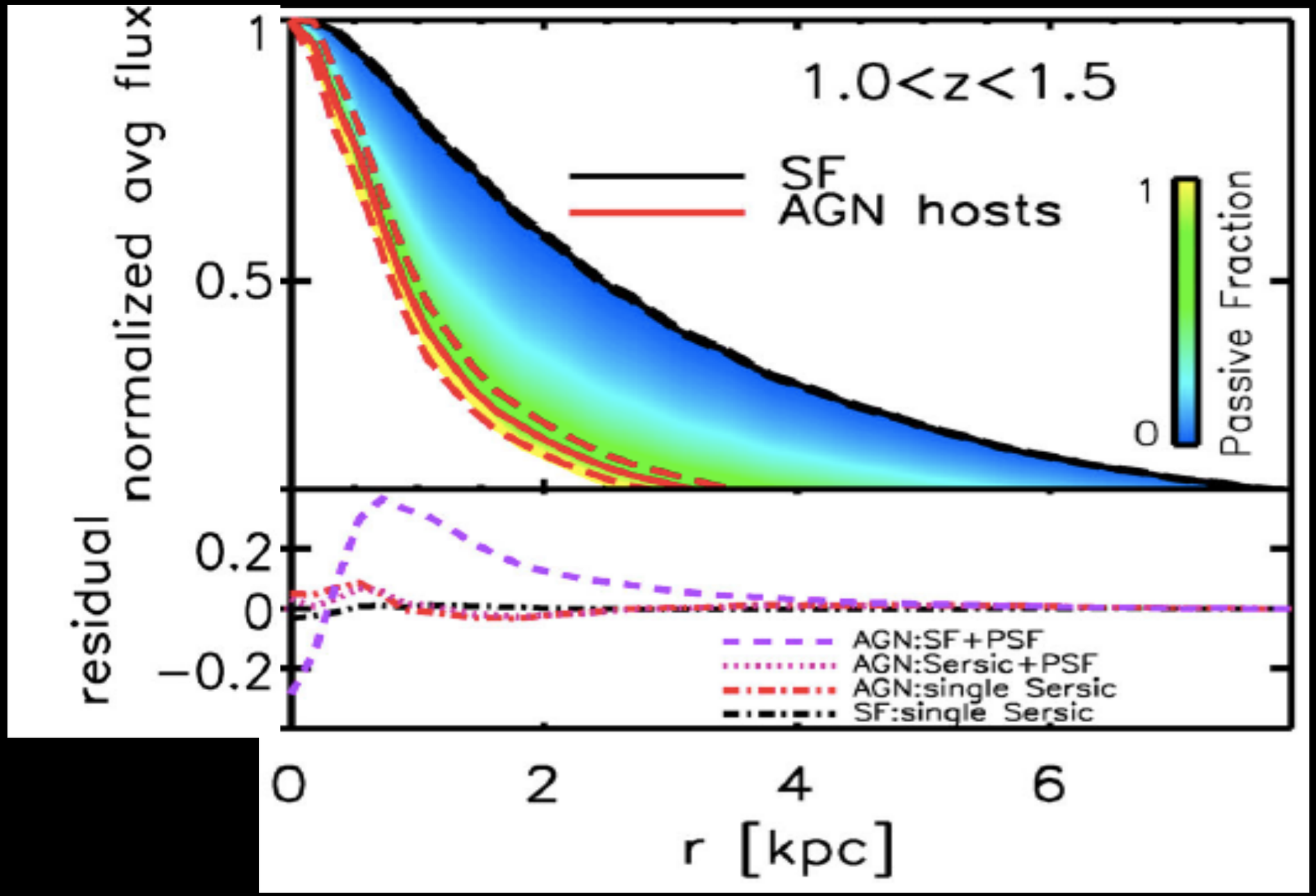
AGN hosts are rounder and smaller

Chang+17a

Average Profiles

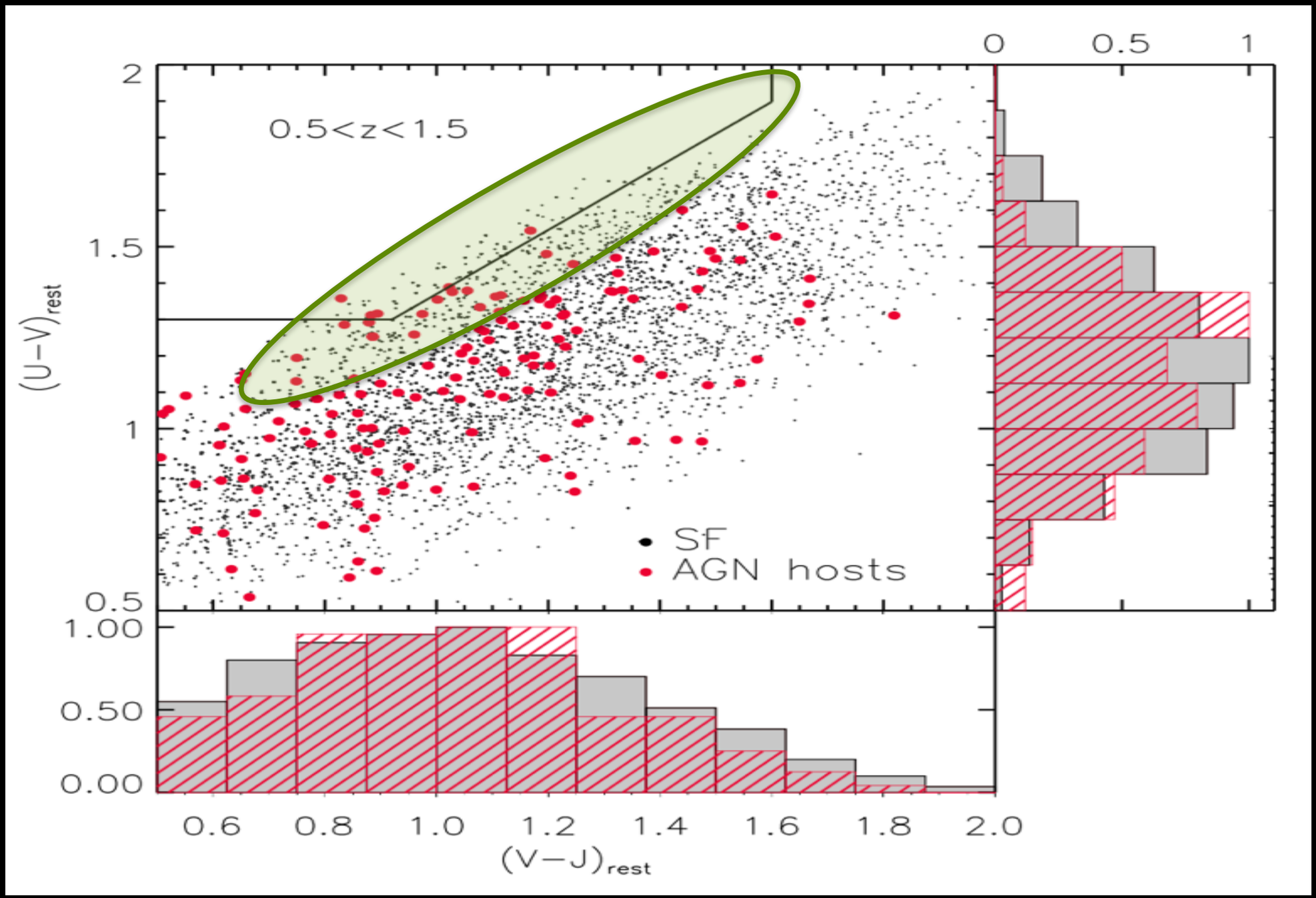
Obscured IR-AGNs
MIR (SF) galaxies

—— images
- - - uncertainty



Chang+17a

Decomposed UVJ plot: passive or star-forming?

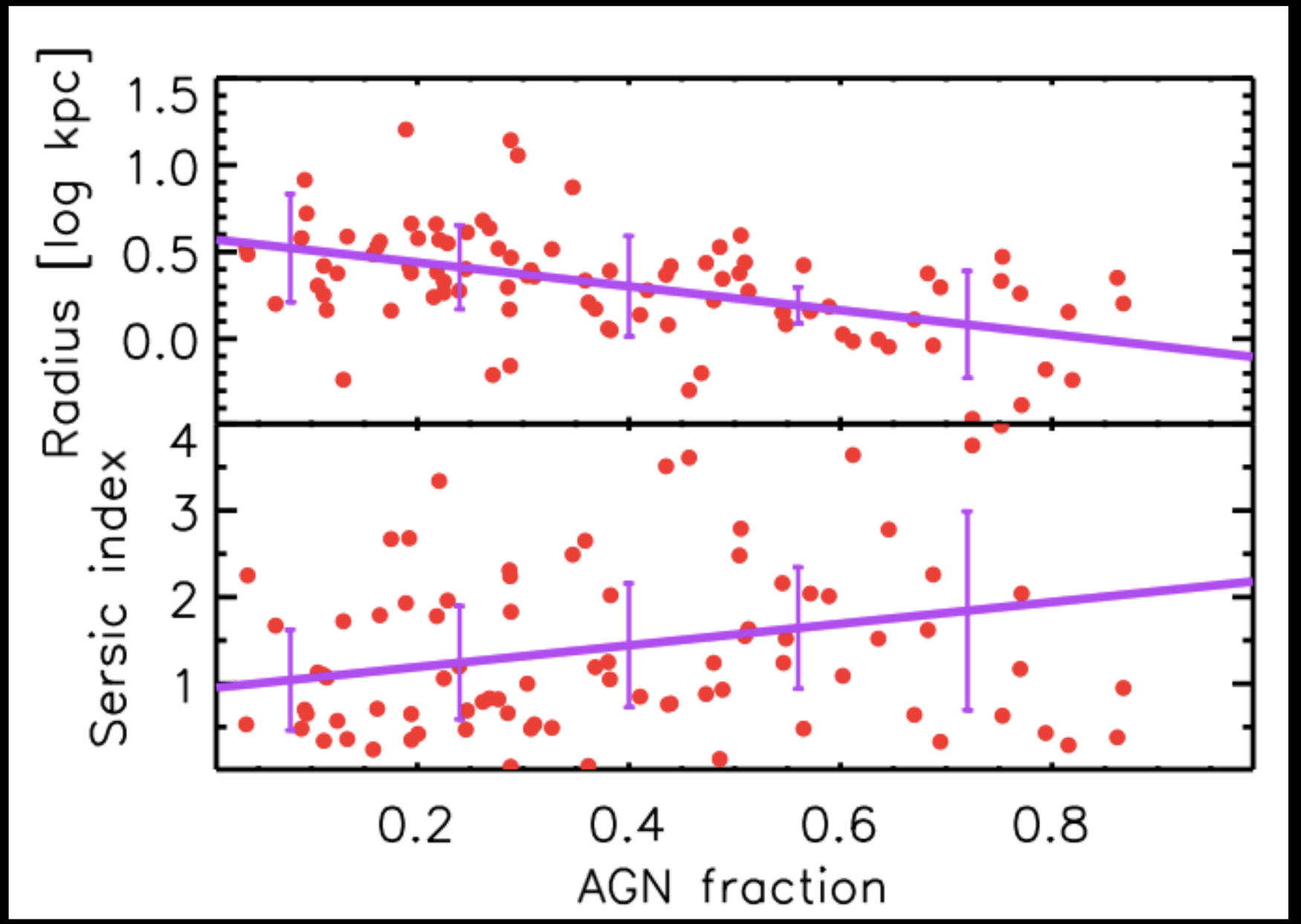


IR obscured AGN hosts: <0.1 mag difference
50% passive+50% SF SEDs: ~0.5 mag difference

- Not dominant by passive population
- Compact star-forming component

Chang+17a

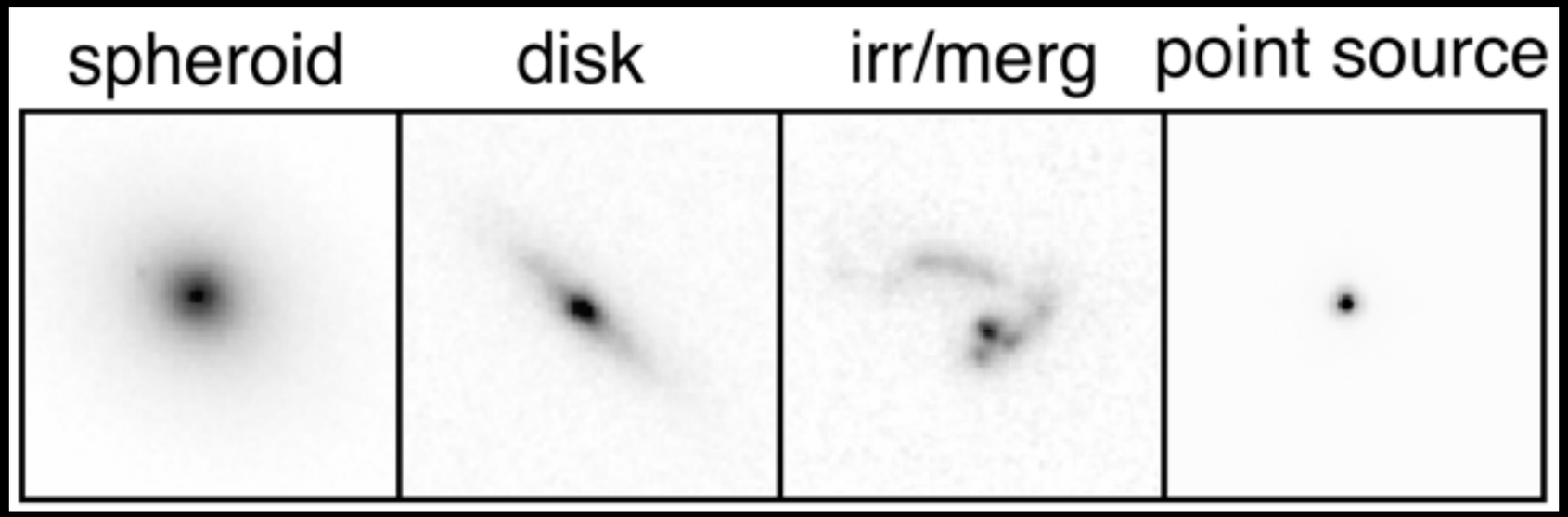
Size v.s. AGN fraction



20-50% AGN → 25-50% size smaller

Chang+17b

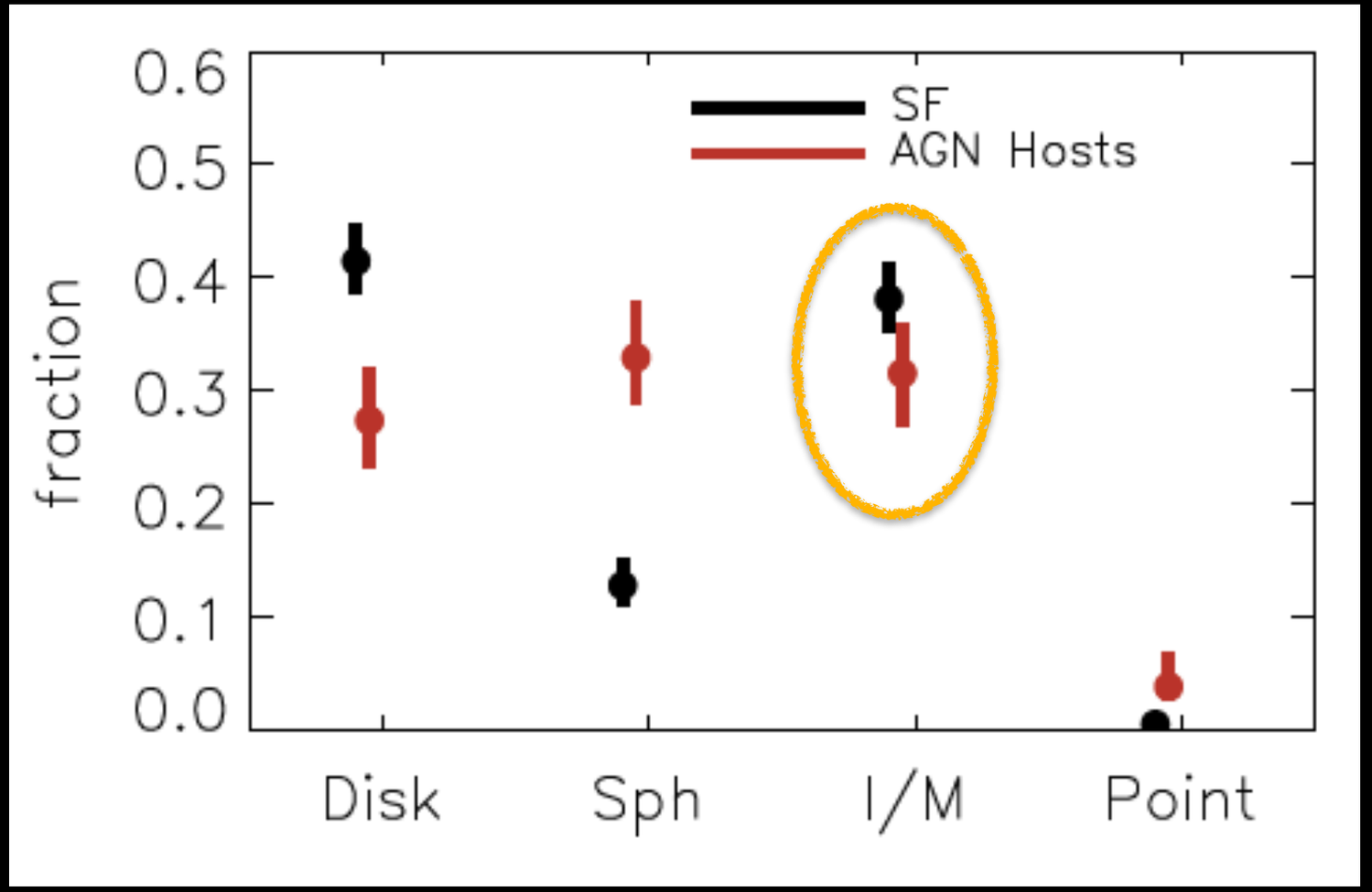
Visual Classification



$\log M_{star} > 10.5$
$0.5 < z < 1.5$

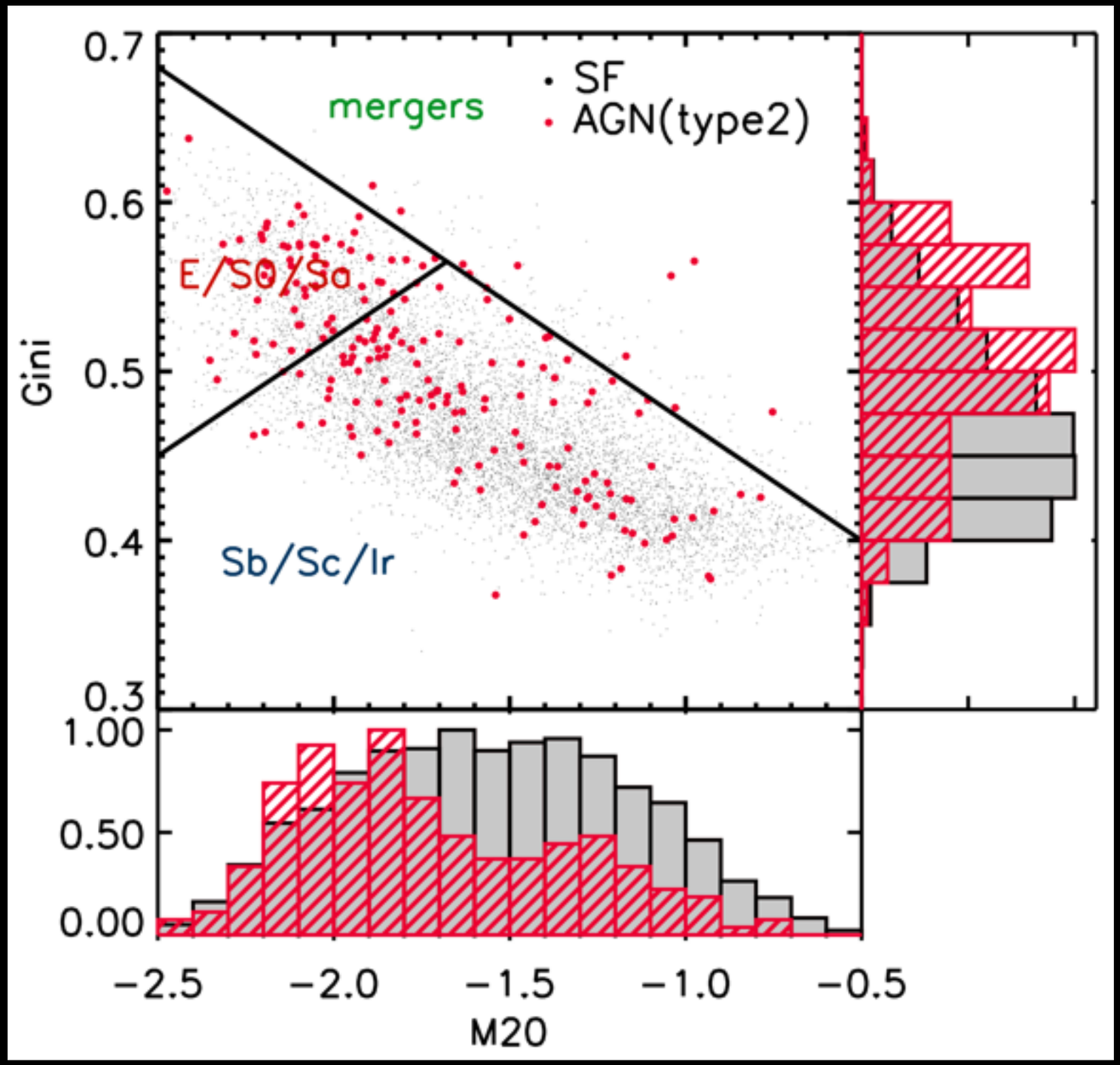
- major merger is not the main driver of obscured IR-AGN activities

Chang+17b



Nonparametric methods

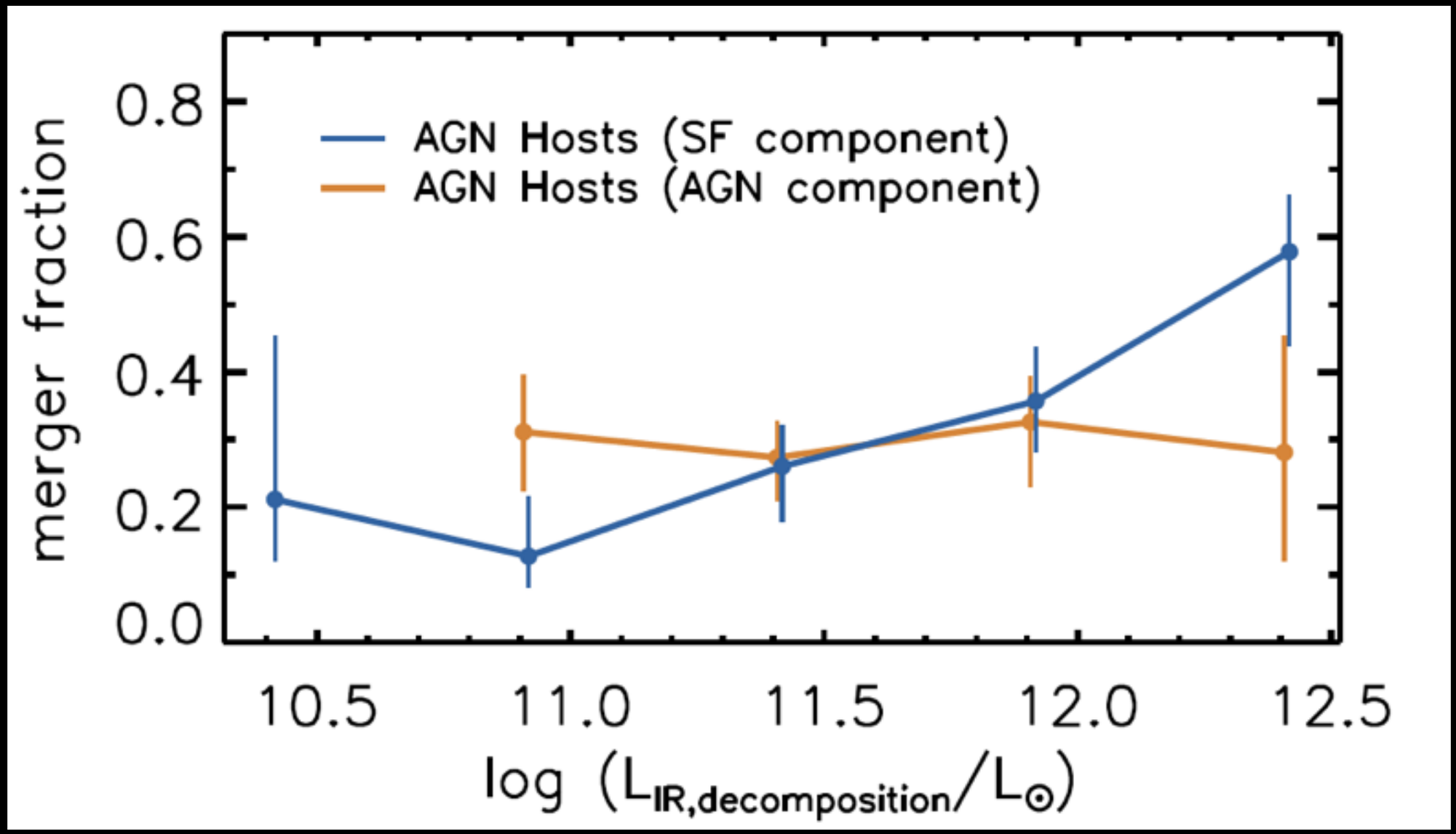
- Gini: the relative distribution of the galaxy pixel flux value
- M20: the second-order moment of the brightest 20% of the galaxy's flux Lotz+2004



- major merger is not the main driver of obscured IR-AGN activities

Chang+17b

Visual Classification: merger fraction



Chang+17b

- Merger fraction@z~1
  - dependence on total or decomposed SF IR luminosity
  - rather than decomposed AGN IR luminosity

Summary: Obscured IR AGN Hosts

- On the star-forming sequence
  - similar to normal galaxies
- Structures of AGN host galaxies@z~1
  - compact star-forming AGN hosts
- Merger fraction@z~1
  - dependence on total or decomposed SF IR luminosity
  - rather than decomposed AGN IR luminosity

Major merger is mainly related to star formation activities; obscured AGN hosts may be trigger by internal mechanisms.
(quenching?secular process?disk instabilities?compaction?)

catalogs are available for the whole COSMOS2015 sample:
http://www.asiaa.sinica.edu.tw/~yychang/ca.html

thank you !