

SS2013 Poster Award Talk@Zao
Aug 01, 2013

Buried AGN activity in infrared galaxies studied by AKARI 2.5-5 um spectroscopy

Ichikawa et al. 2013, to be submitted

Your understanding
Infrared (IR)
Galaxies
AGNs
PAH



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市川幸平
(Kyoto University)

Before my talk...

For the anonymous 9 guys who voted me

- ✓ Thank you for voting!!
- ✓ My talk was realized by your great passion!

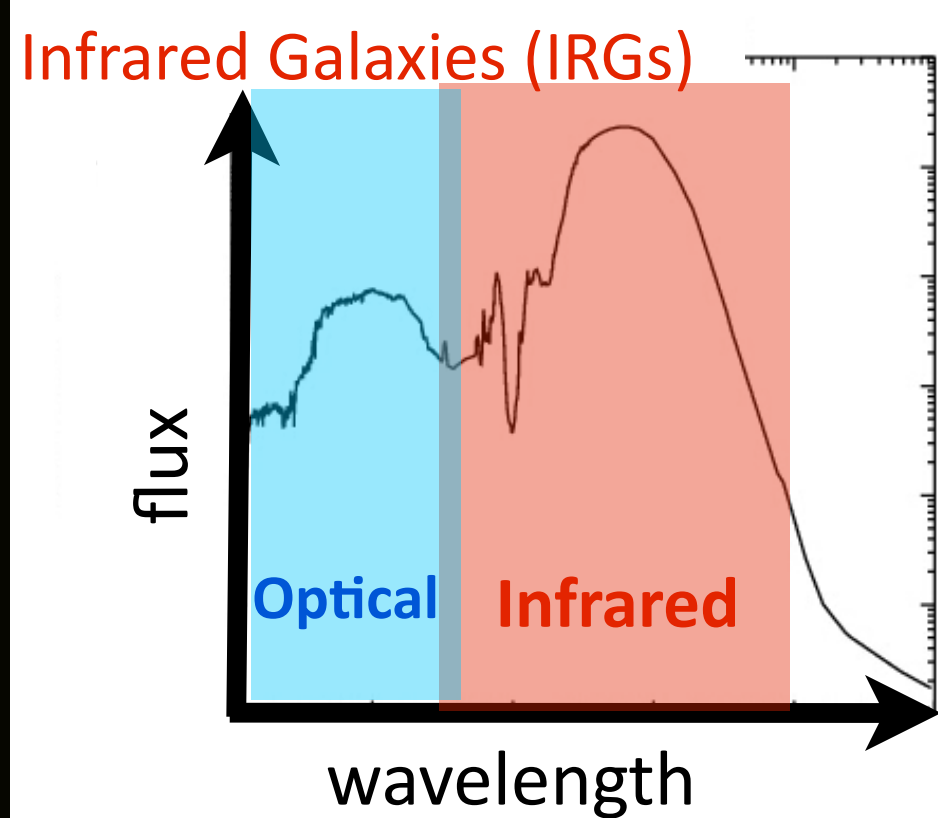
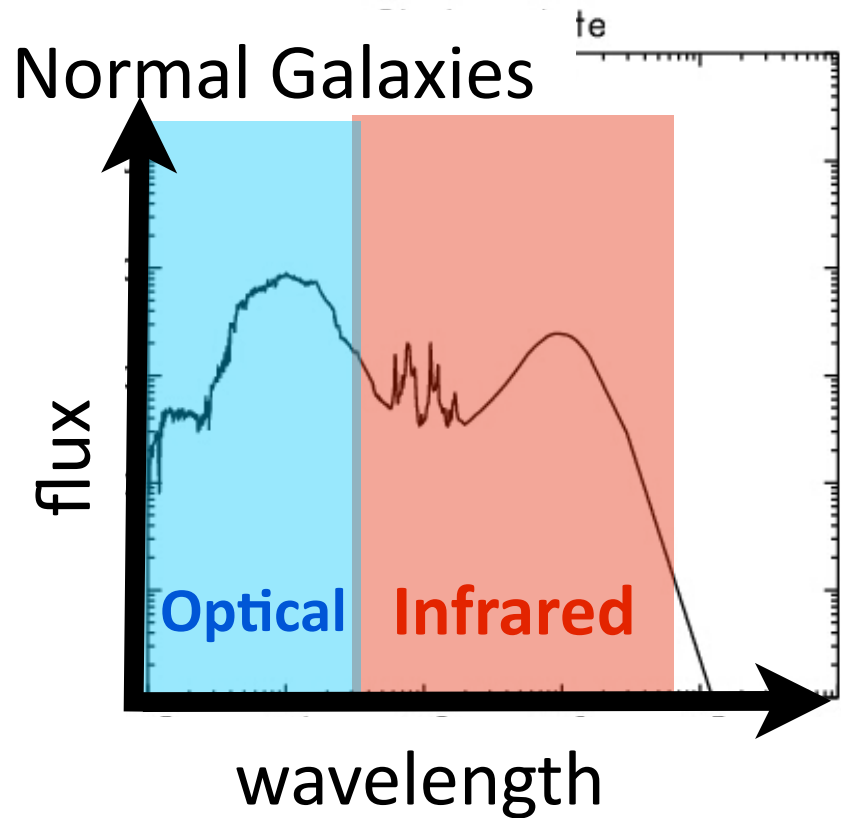
For the audience

- ✓ Thank you for coming/sharing the time with us!!
- ✓ My talk will be completed by adding your fruitful questions!!

For the LOC members

- ✓ Thank you for the great organization!
- ✓ This summer school cannot be realized without your help!!

Motivation: Hidden Energy Source

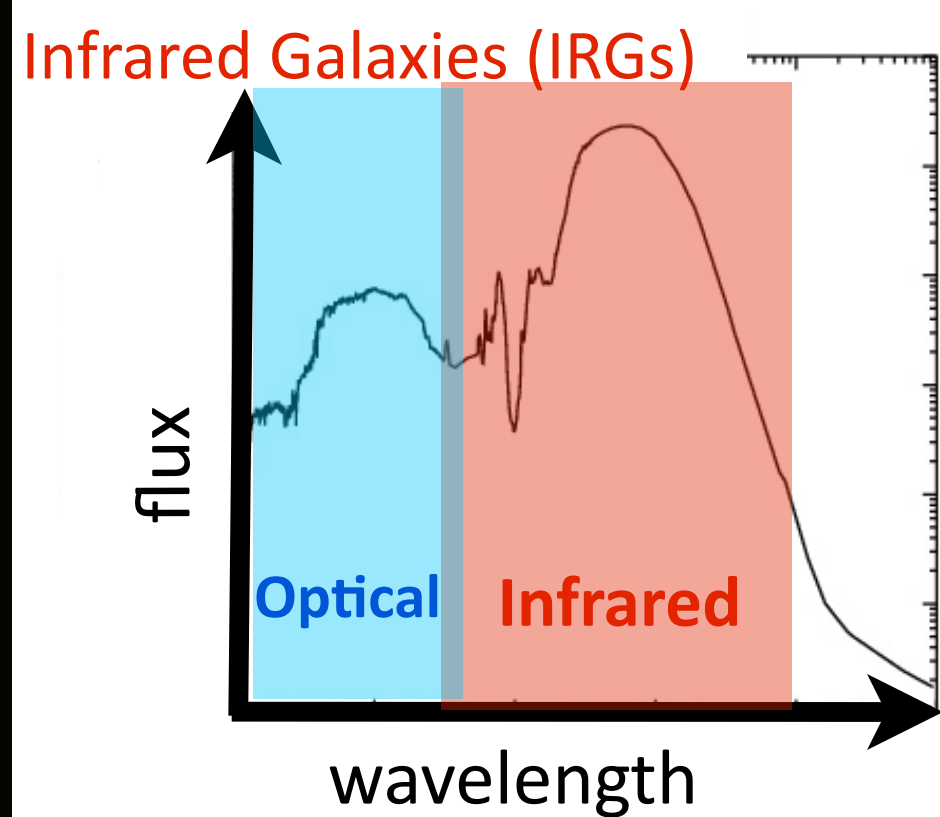
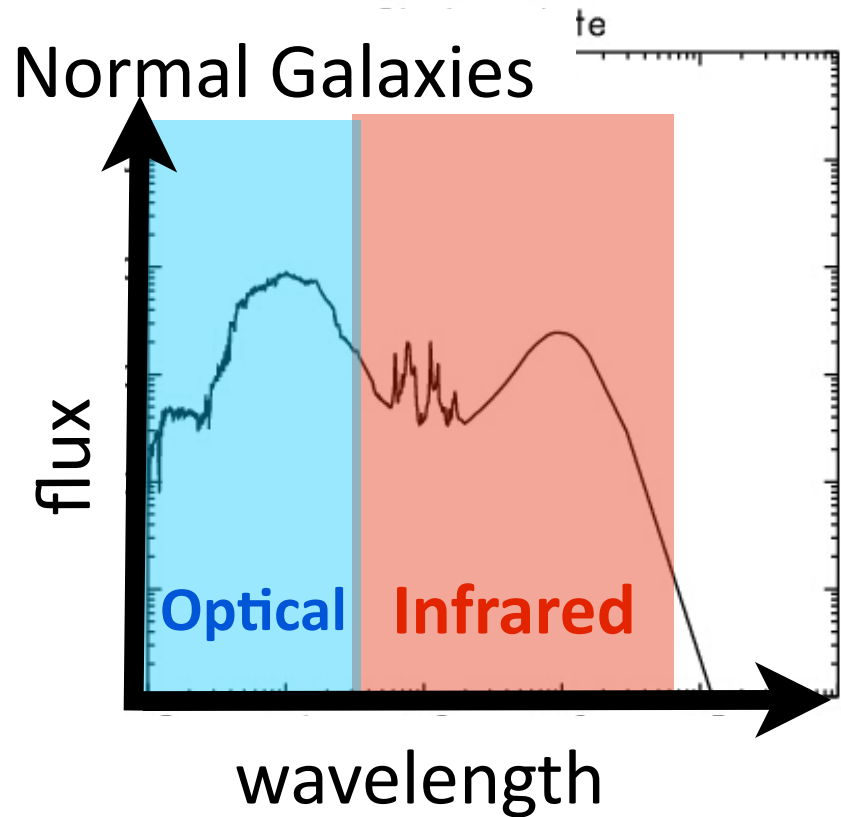


Infrared Galaxies: very bright in IR than optical

- ✓ Hidden energy source should exist behind the dust
- ✓ Possible energy sources: Starburst (SB) and/or AGNs

→ **Disentangling two energy sources are crucial** to understand the starformation and AGN activity³

Motivation: Hidden Energy Source

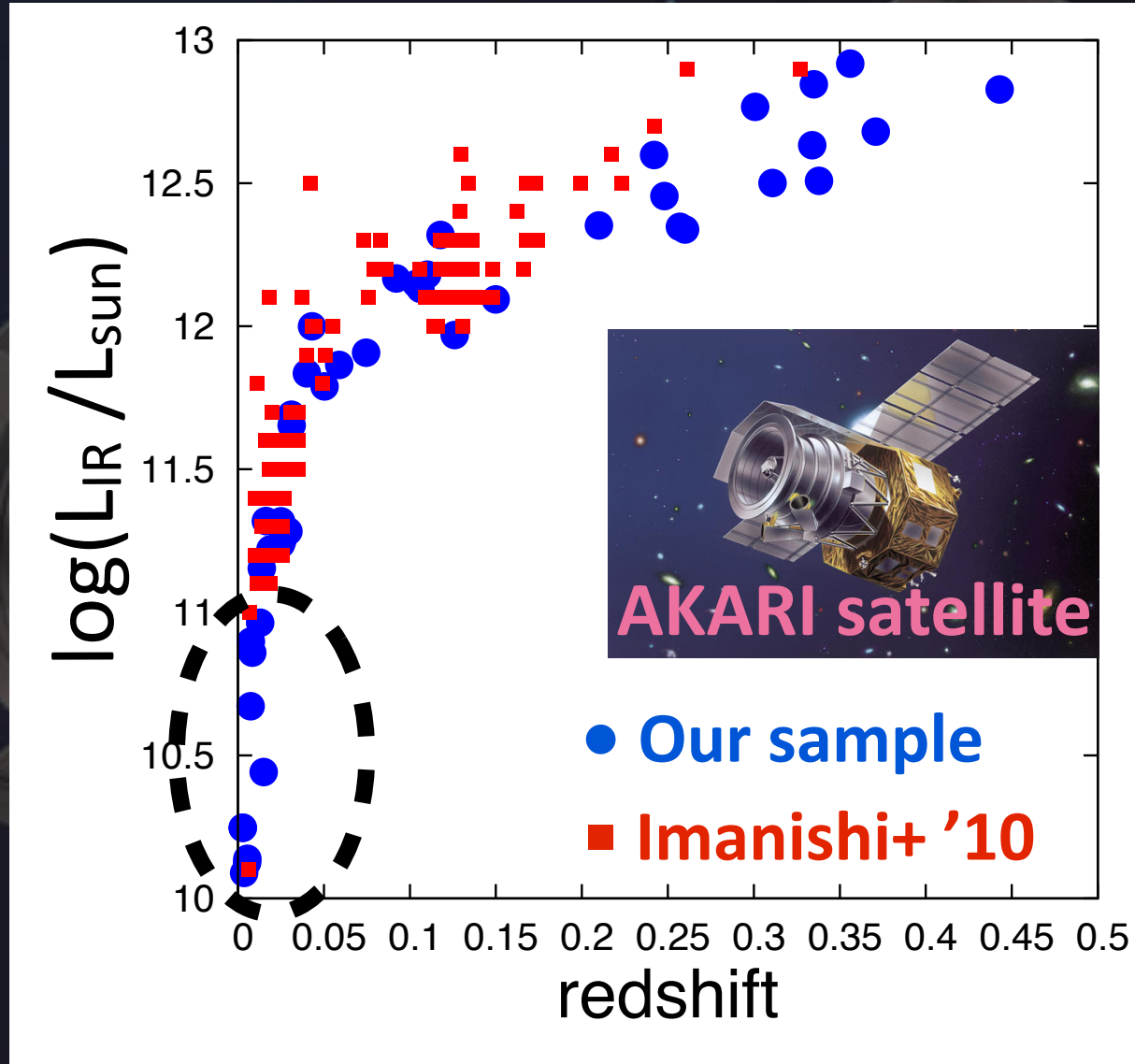


Infrared Galaxies: very bright in IR than optical

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見えないものを、見てみたい

Sample: Infrared Galaxies

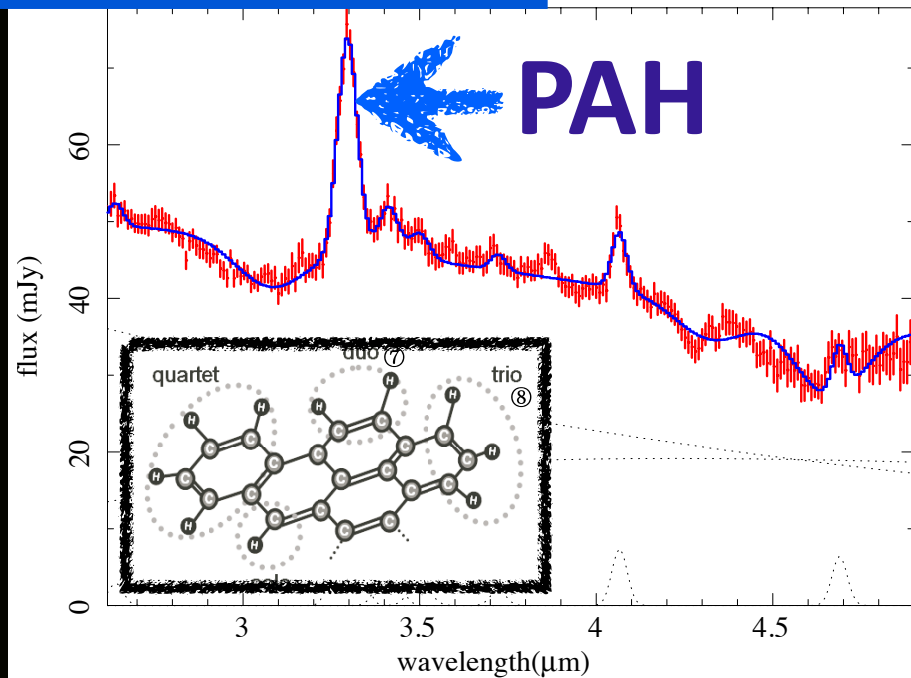


Infrared Galaxies in the local Universe

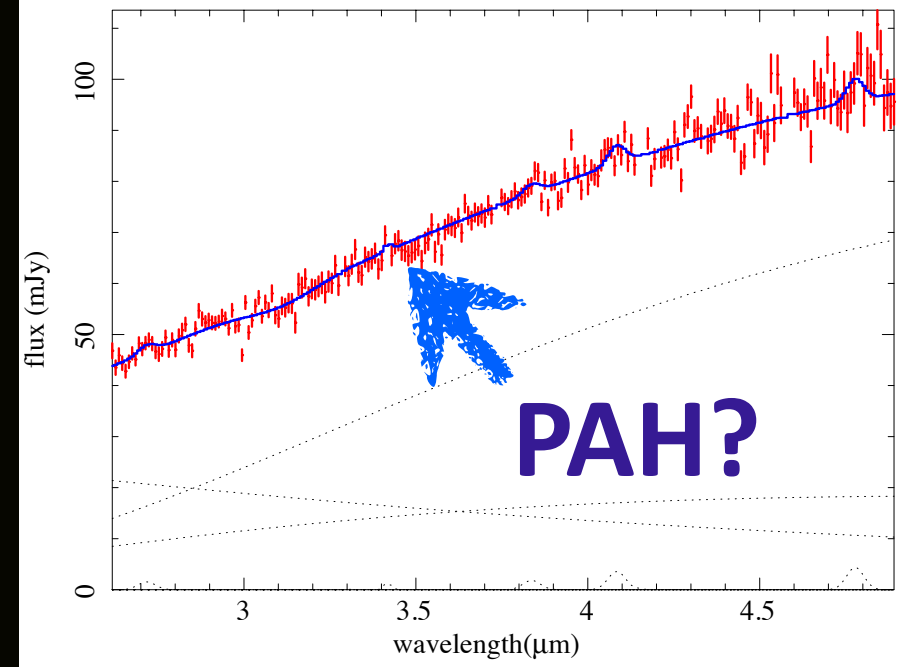
LIRG: $L_{\text{IR}} > 10^{11} L_{\text{sun}}$, ULIRG: $L_{\text{IR}} > 10^{12} L_{\text{sun}}$

Buried AGN diagnostics: PAH

SB: $EW > 40\text{nm}$



AGN: $EW < 40\text{nm}$



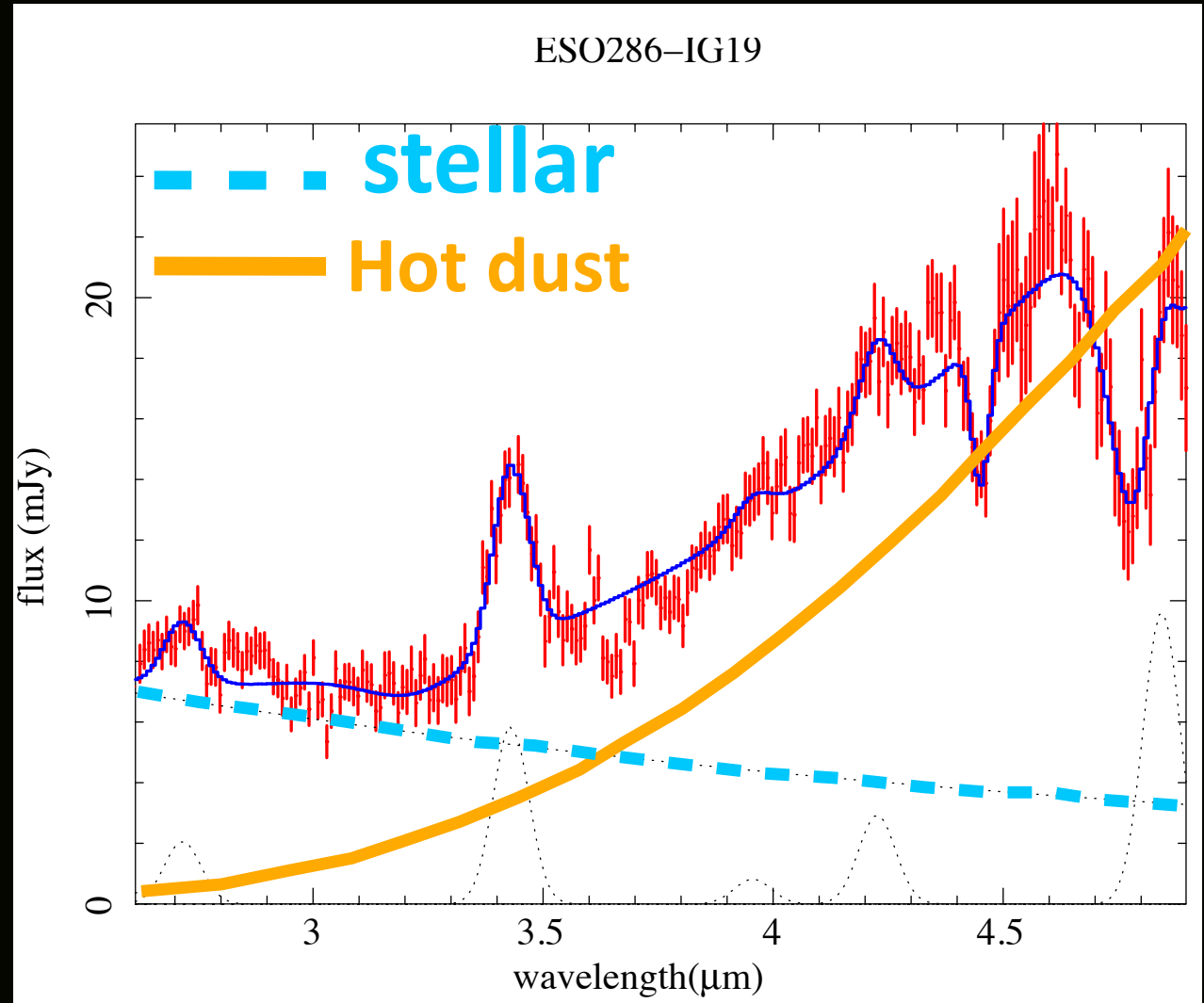
PAH emission

- ✓ PAH emission is excited by UV radiation (from SB)
- ✓ PAH emission is destroyed by X-ray (from AGN)

PAH Diagnostics

- ✓ **Weak PAH emission ($EW < 40\text{nm}$):** a sign of buried AGN

Buried AGN diagnostics: continuum



Hot dust component

- ✓ starburst can heat only up to $\sim 100\text{K}$
- ✓ Hot dust ($T > 200\text{K}$) continuum: a sign of buried AGN

Results

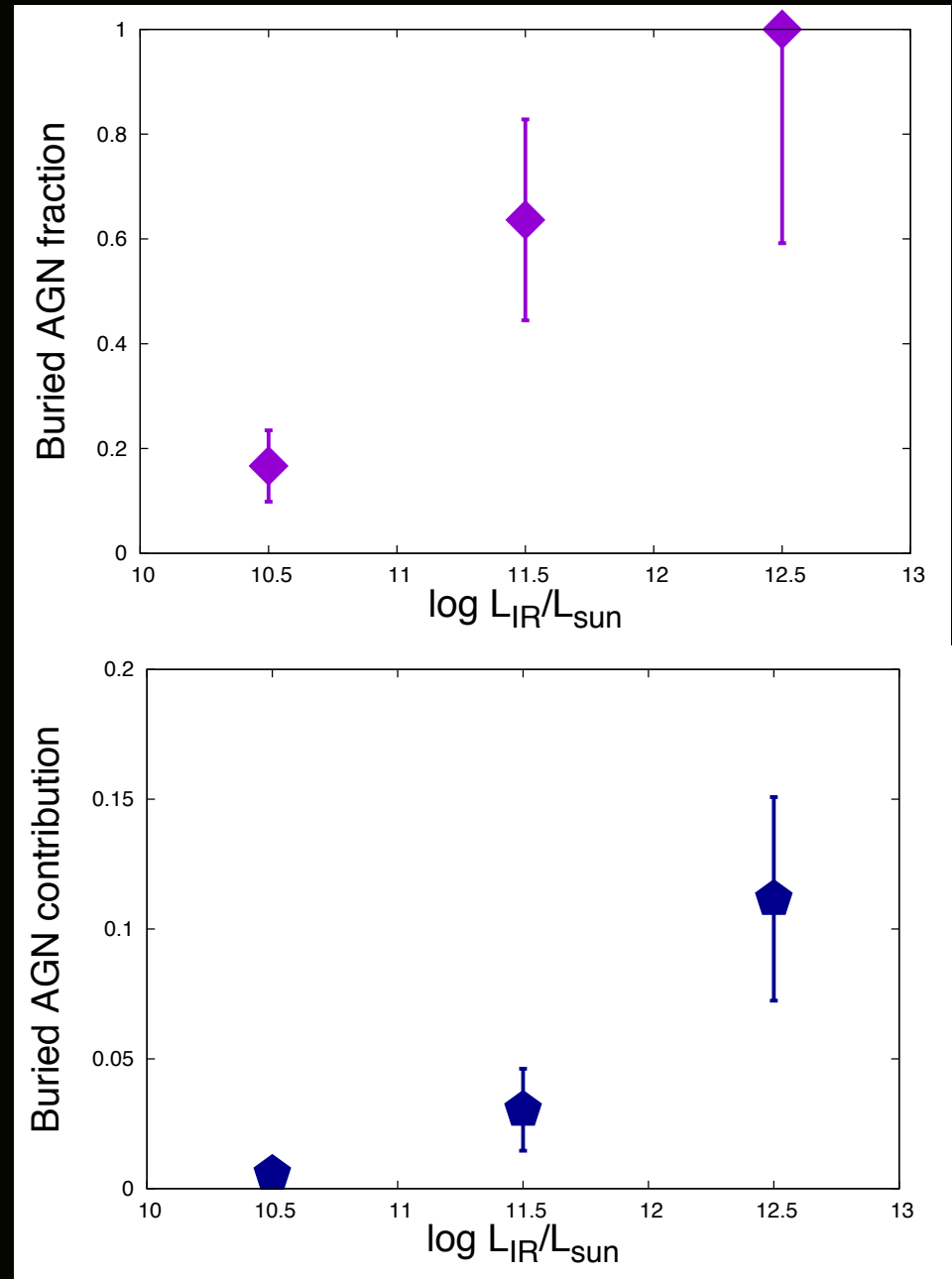
Buried AGN fraction

- ✓ increase with infrared Luminosity
- ✓ AGN activity is almost ubiquitous in U/LIRG range

Buried AGN

energy contribution

- ✓ increase with infrared Luminosity
- ✓ only up to ~10% (very small!)



Bulk of infrared emission originates from SB, *NOT* AGN!!

Summary

見えないものを、見てみたい

Infrared Galaxies: very bright in IR than optical

- ✓ Hidden energy source should exist behind the dust
 - ✓ Possible energy sources: Starburst (SB) or AGNs
- > **Disentangling two energy sources!!**

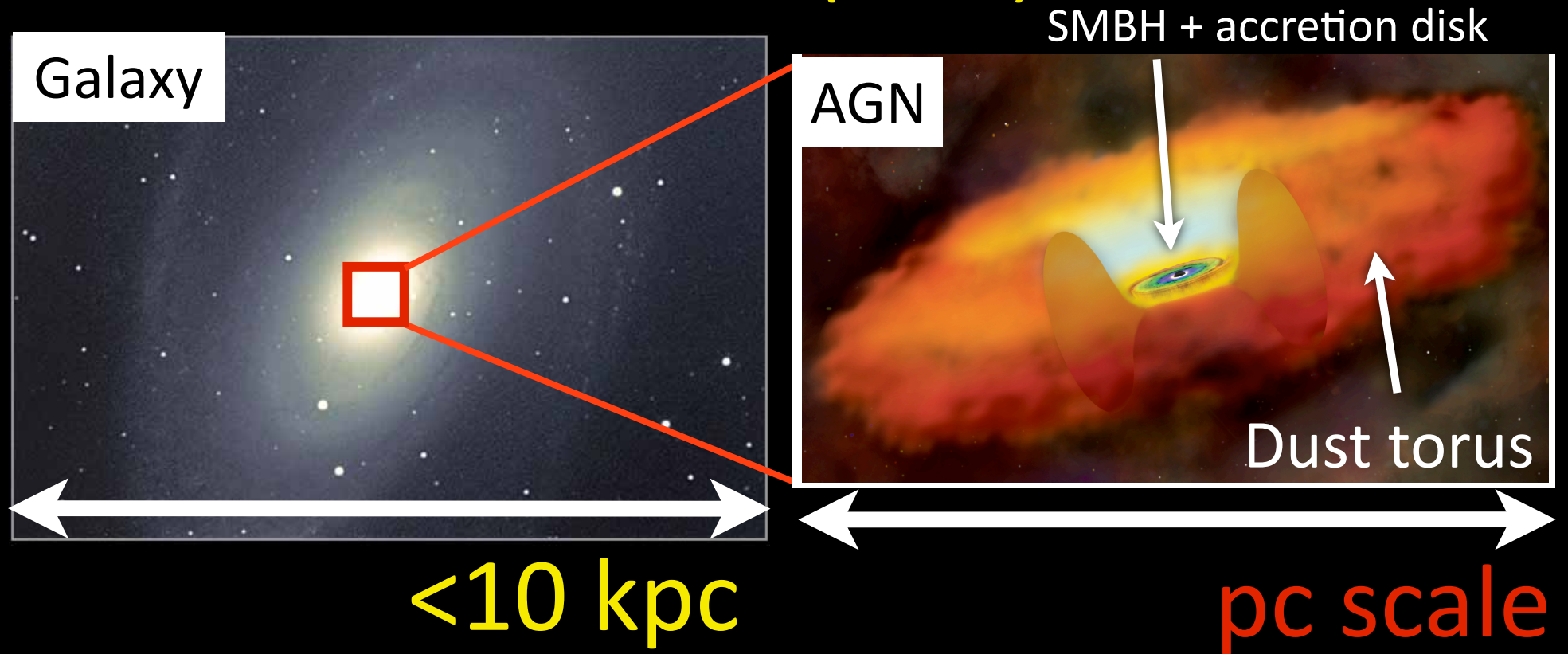
Results

- ✓ Buried AGN is ubiquitous in infrared galaxies
 - ✓ **Buried AGN energy contribution is very small (only up to ~10%)**
- > **Bulk of infrared emission originates from SB, not AGN in the local Universe!!**

Thank you!!

Appendix

Active Galactic Nuclei (AGN)

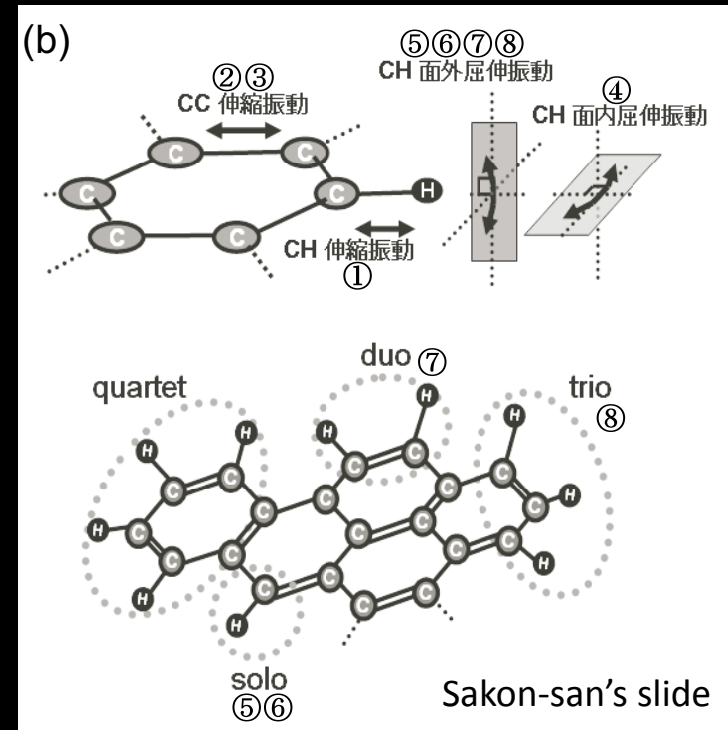
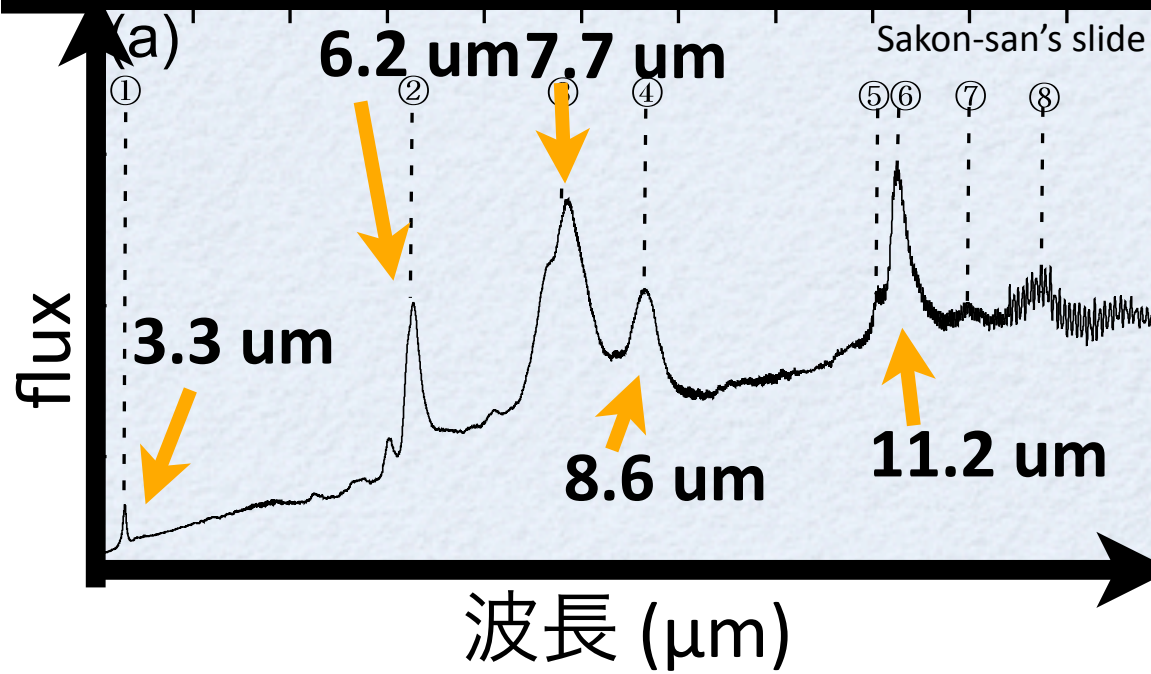


What we see at each energy band

Accretion disk : Optical to X-ray

Dust torus : mid/far Infrared

PAH(Polycyclic Aromatic Hydrocarbon)分子



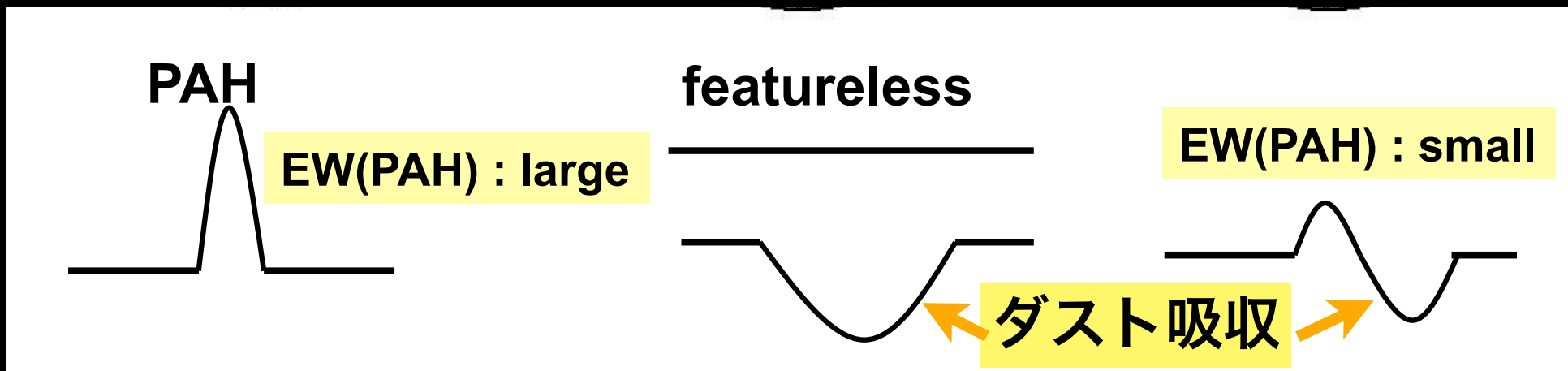
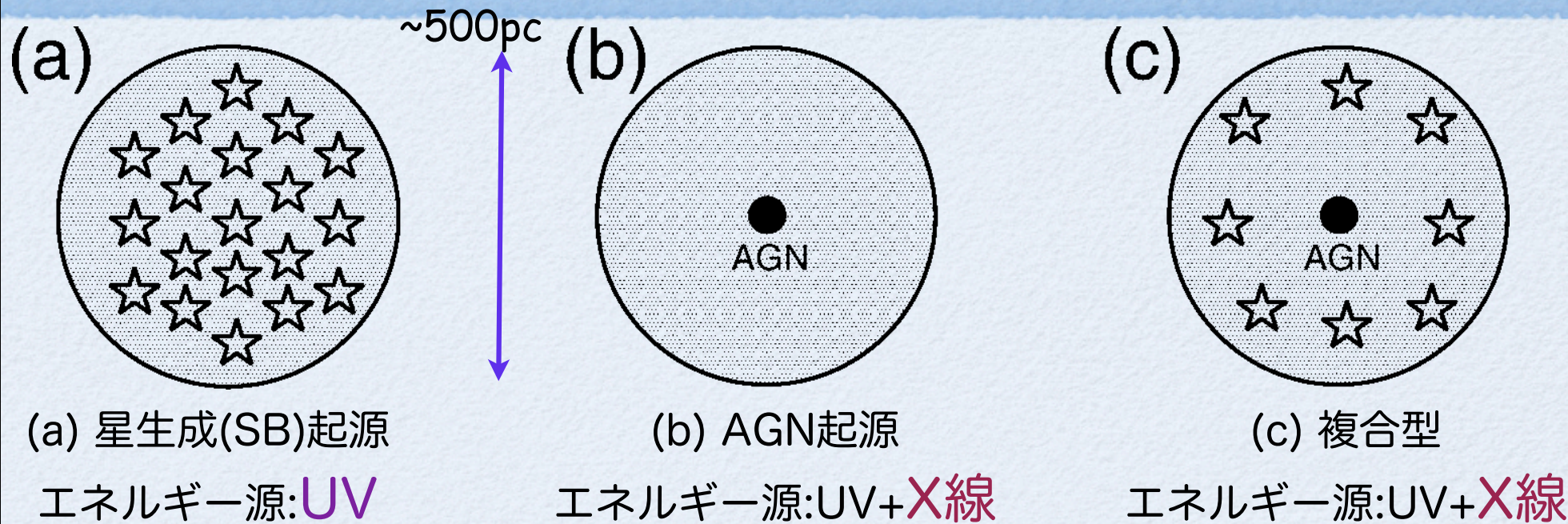
PAH分子の性質

星生成(紫外線) → 励起され、赤外線で再放射
(輝線が見える)

AGN(X線) → 破壊される
(輝線が見えない)

PAH輝線の見え方

EW: 等価幅



$EW(\text{PAH}) > 40 \text{ nm}$

$EW(\text{PAH}) < 40 \text{ nm}$

サンプル

ULIRGに関しては、多数のサンプルがある (Imanishi+ '06, '10)
より低光度側のIRG, LIRGを中心としたサンプルからランダムに選択
IRG: 6天体, LIRG: 11天体, ULIRG: 6天体をAKARI IRCで観測

連続光
+輝線+吸収線で
フィッティング

