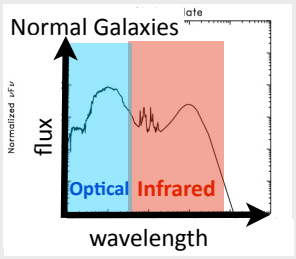
Buried AGN activity in infrared galaxies studied by AKARI 2.5-5.0 um spectroscopy

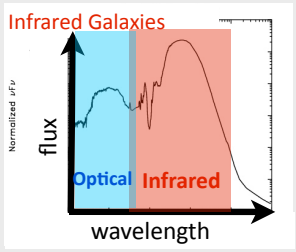
◯**Kohei Ichikawa** (Kyoto Univ.), M. Imanishi (NAOJ), M. Shirahata,
T. Nakagawa (ISAS/JAXA), H. Kaneda, S. Oyabu (Nagoya Univ.) Y. Ueda (Kyoto Univ.)

Abstract

We present the result of systematic infrared 2.5-5 μm spectroscopy of 23 nearby infrared galaxies **over a wide infrared luminosity range (10^{10} L_{sun} <L_{IR} < 10^{13} L_{sun})** obtained from AKARI Infrared Camera (IRC). The unique band of AKARI IRC spectroscopy enable us to access both of 3.3 μm polycyclic aromatic hydrocarbon (PAH) emission feature and continuum slope. We modeled the continuum with 3 black body component (stellar/HII hot dust/AGN hot dust) and 14 out of 23 galaxies have small PAH emission (EW<40 nm) and/or AGN hot dust component (T > 200K), which suggests the existence of buried active galactic nuclei (AGNs). We also confirmed that the both buried AGN fraction and energy contribution in infrared galaxies are highly luminosity dependent, while the AGN thermal energy contributes only up to ~10% of the total infrared luminosity. This proves that **the majority of infrared emission originates not from AGN activity but from the starburst activity in the local Universe.**

Background & Motivation





✔ **Infrared galaxies: very bright in infrared than optical**
→ Hidden energy source should exist!!

✔ Possible energy sources:**Starbursts (SB)** or **Active Galactic Nuclei (AGN)?**

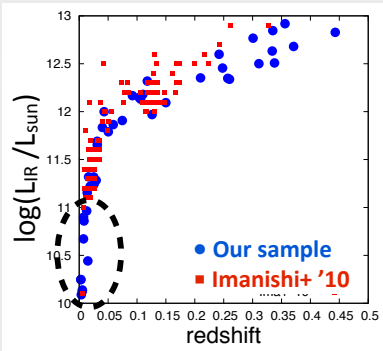
***Disentangling two energy sources are crucial* to understand the starformation and AGN activities behind the dust!!**

Previous Studies

The studies for infrared galaxies are limited only to
✔ Ultra/luminous infrared galaxies (U/LIRGs: 10^{11} L_{sun} < L_{IR} < 10^{13} L_{sun})

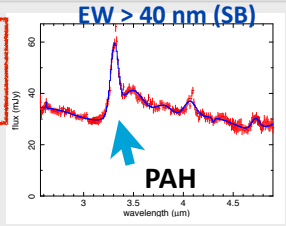
Our Sample

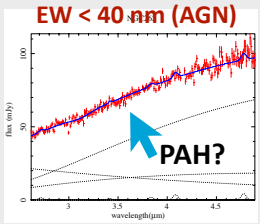
We include..
✔ **moderate infrared galaxies (10^{10} L_{sun} < L_{IR} < 10^{11} L_{sun})**



Buried AGN diagnostics

3.3 μm PAH emission

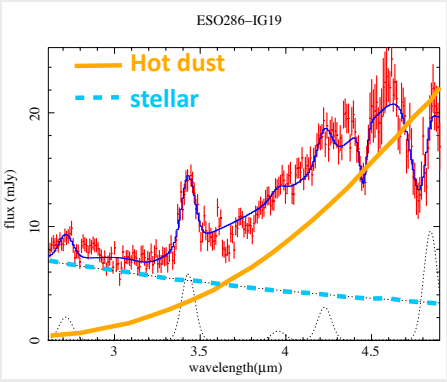




PAH emission is **excited by UV radiation** (originate from **SB**)
PAH emission is **destroyed by X-ray** (originate from **AGN**)

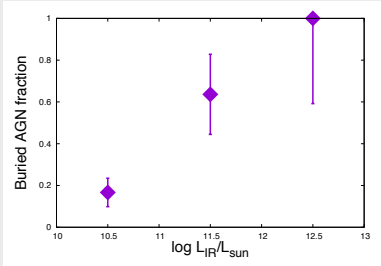
→ ✔ **Strong PAH** emission (EW > 40 nm) is a sign of **pure SB**
✔ **Weak PAH** emission (EW < 40 nm) have a **buried AGN**

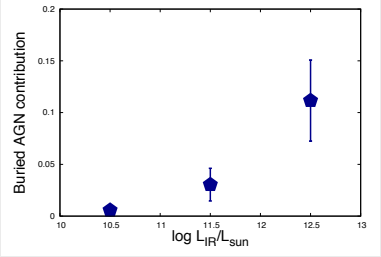
Starburst can heat the dust only up to 100K, while AGN emission can easily heat the dust over 200K. We set that the sources having hot dust component (T>200K) should be a sign of buried AGN.



✔ **Hot dust component (T>200K): a sign of buried AGN**

Results





Buried AGN fraction

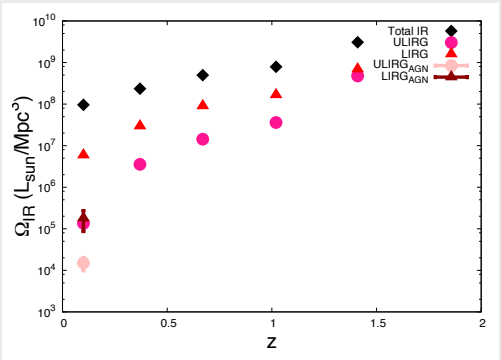
✔ **increase w/ IR luminosity**
AGN activity is almost ubiquitous in U/LIRG range.

Buried AGN energy contribution

✔ **increase w/ IR luminosity**
about
~10% @ULIRGs
~ 5% @LIRGs
~ 1% @IRGs

Discussion

Luminosity density in the local Universe



In the local Universe, luminosity density of infrared galaxies is..

→ ✔ **1.8×10^5 L_{sun} / Mpc^3 @LIRG**
✔ **1.5×10^4 L_{sun} / Mpc^3 @ULIRG**

Bulk of infrared emission originates from starformation, *not* AGN