

# Millimeter interferometric follow-up of IR-selected buried AGNs candidates

## Abstract

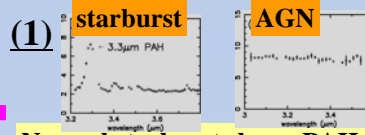
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We performed millimeter interferometric follow-up observations of ULIRGs possessing luminous buried AGNs suggested from IR spectroscopy. We confirmed that these IR-selected buried AGNs show millimeter line emission properties expected from XDRs, supporting the buried AGN scenario.

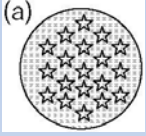
## 1. Introduction

We performed IR spectroscopy of ULIRGs to distinguish between **buried AGNs** and **normal starbursts**, using (1) PAH emission and (2) geometry between energy sources and dust.



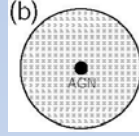
Normal starburst shows PAH emission, but AGN does not.

(2)



Starburst: energy-sources/dust are spatially well mixed

Dust absorption features at 3-4 micron: **weak**



Buried AGN: energy source is more centrally-concentrated than surrounding dust

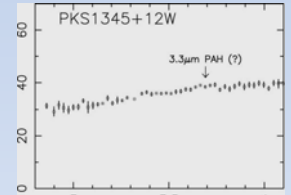
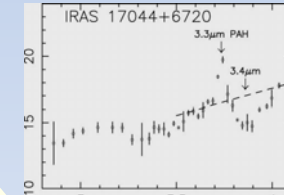
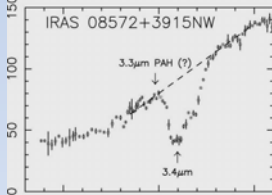
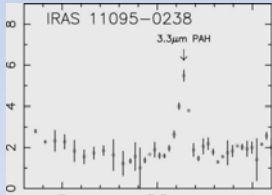
Dust absorption features: **strong**

Starburst-like

Pure buried AGN

Starburst/buried-AGN composite

Weakly obscured AGN



Large equivalent width (EW) PAH

No detectable PAH

Low EW PAH

Low EW PAH

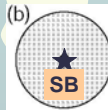
Weak dust absorption features

Strong dust absorption features

Strong dust absorption features

Weak dust absorption features

We can distinguish buried AGNs and **normal** starbursts from our IR energy diagnostics. However, **extreme** starbursts remains a possibility.



Exceptionally centrally-concentrated, very high surface-brightness starbursts?

Imanishi et al. 2006 ApJ 637 114

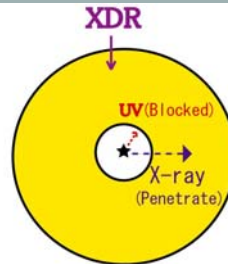
## 2. Method: how to distinguish buried AGNs and extreme starbursts

E>2 keV X-ray emission: AGNs much stronger than any starbursts

but

Compton thick ( $NH > 10^{24} \text{ cm}^{-2}$ ) buried AGNs in ULIRGs are not detectable with current X-ray satellites ( $E < 10 \text{ keV}$ )

We instead search for the chemical effects of the strong X-ray emitting buried AGNs to the surrounding interstellar medium

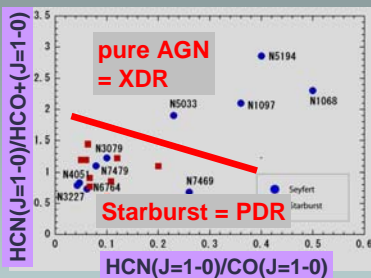


UV is blocked at the innermost dust, but X-rays can penetrate more outside because of low dust extinction

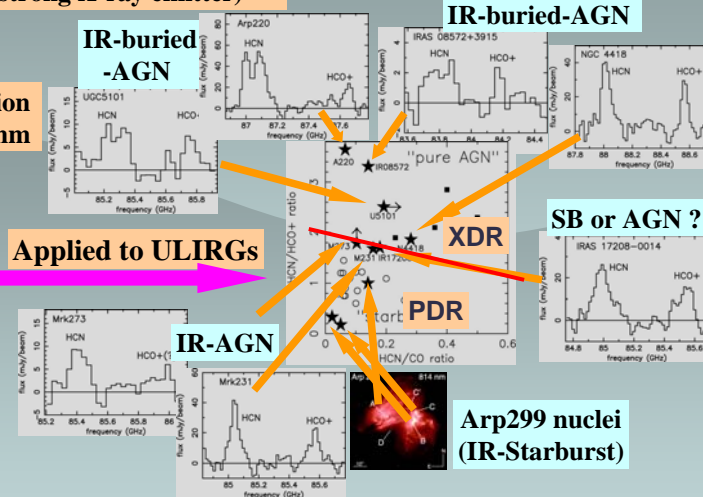
In a starburst, PDRs (Photo dissociation regions) develop, while XDRs (X-ray dissociation regions) do around a buried AGN (= a strong X-ray emitter)

X-rays dominate the chemistry and physics of the interstellar medium = XDR (Maloney et al. 1996 ApJ 466 561)

XDRs and PDRs may show emission lines with different flux ratio in mm



Kohno astro-ph/0508420



Applied to ULIRGs

Please see Imanishi et al. 2004 AJ 128 2037 Imanishi et al. 2006 AJ 131 2888

**"ULIRGs with IR-selected buried AGN candidates distribute in the AGN range"**

suggesting that our IR energy diagnostic is reliable