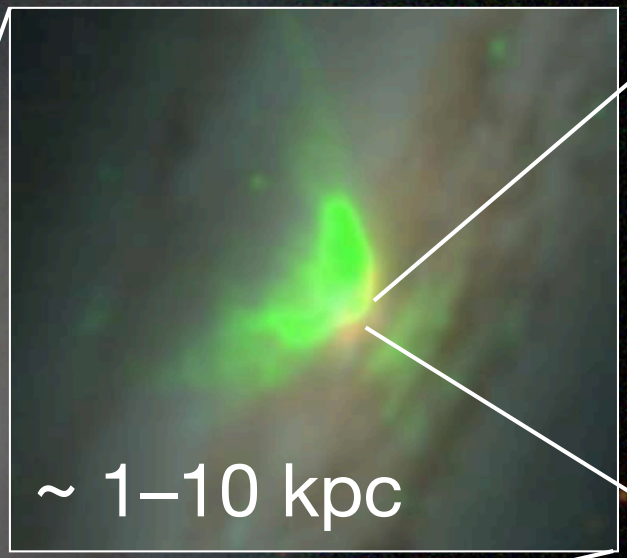

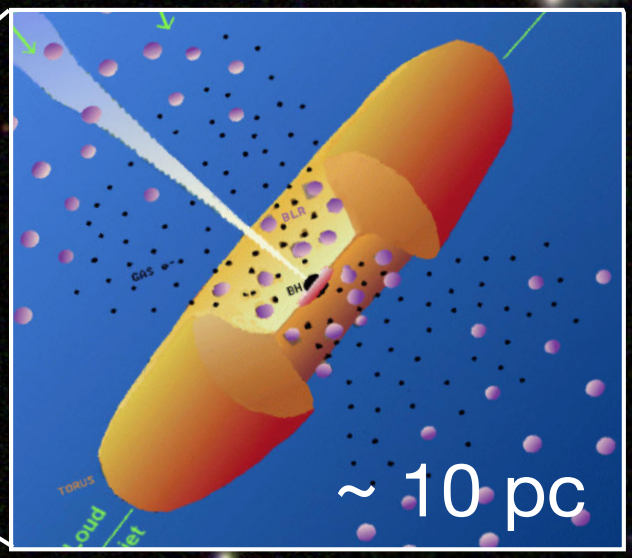

Nuclear structure studied by X-rays, and the relevance to the surrounding ionized gas

2017/11/6 @ EAYAM 2017

Taiki Kawamuro (NAOJ)

Collaborators: Y. Ueda (Kyoto Univ.), F. Tazaki (NAOJ), Claudio Ricci (PUC), Y. Terashima (Ehime Univ.), Richard Mushotzky (UMD), M. Shirmer (MPA), J. H. Turner (Gemini obs.), R. Davies (MPA), **K. Ichikawa (Columbia Univ.)**, N. Isobe (JAXA/ISAS), **A. Tanimoto (Kyoto Univ.)**, M. Imanishi, T. Izumi (NAOJ)

AGN and the connection to the host gal.

- Tight correlation between
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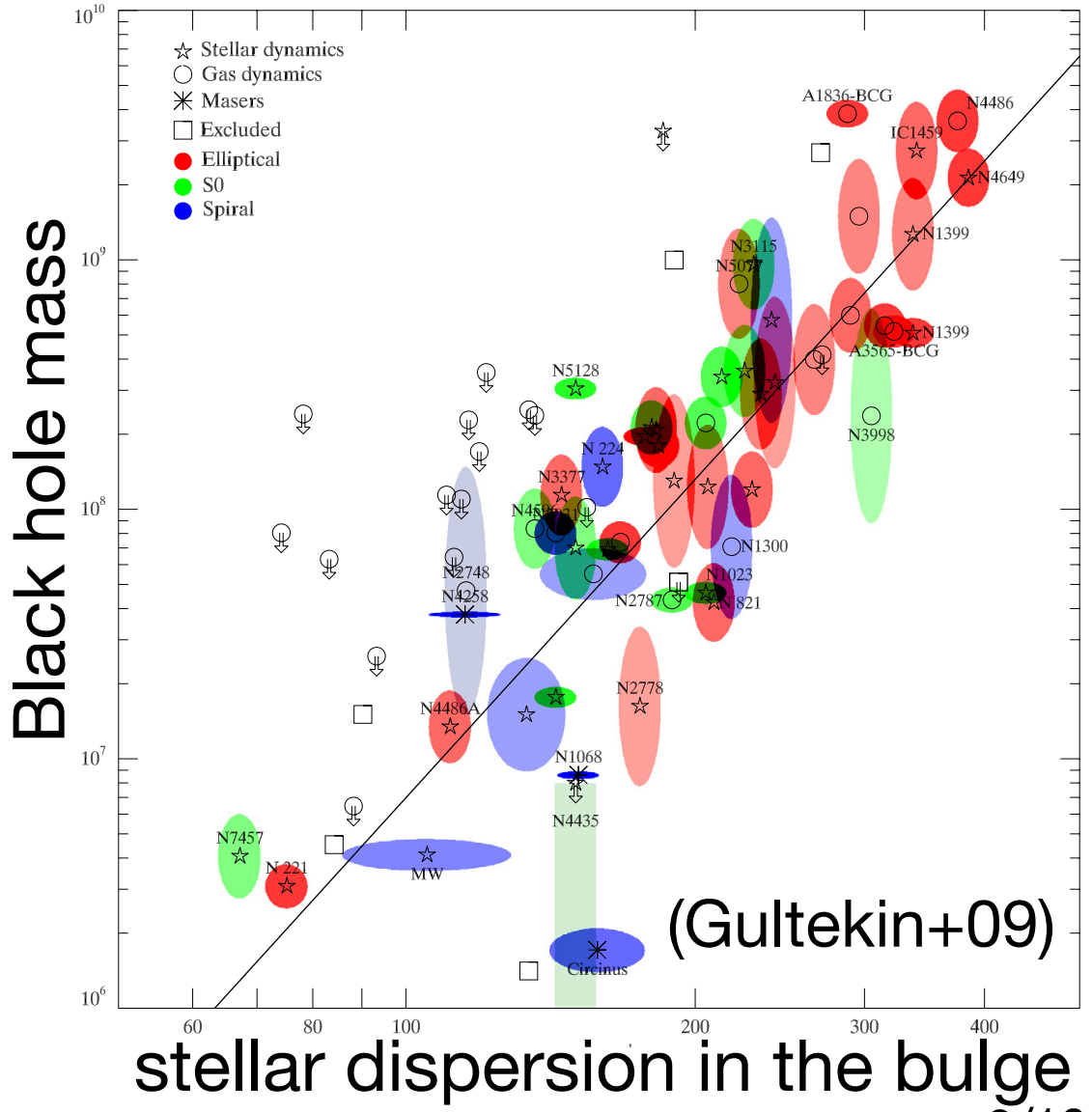
  → ***the co-evolution***



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- AGN may be a key object.
  ✓ SMBH growth
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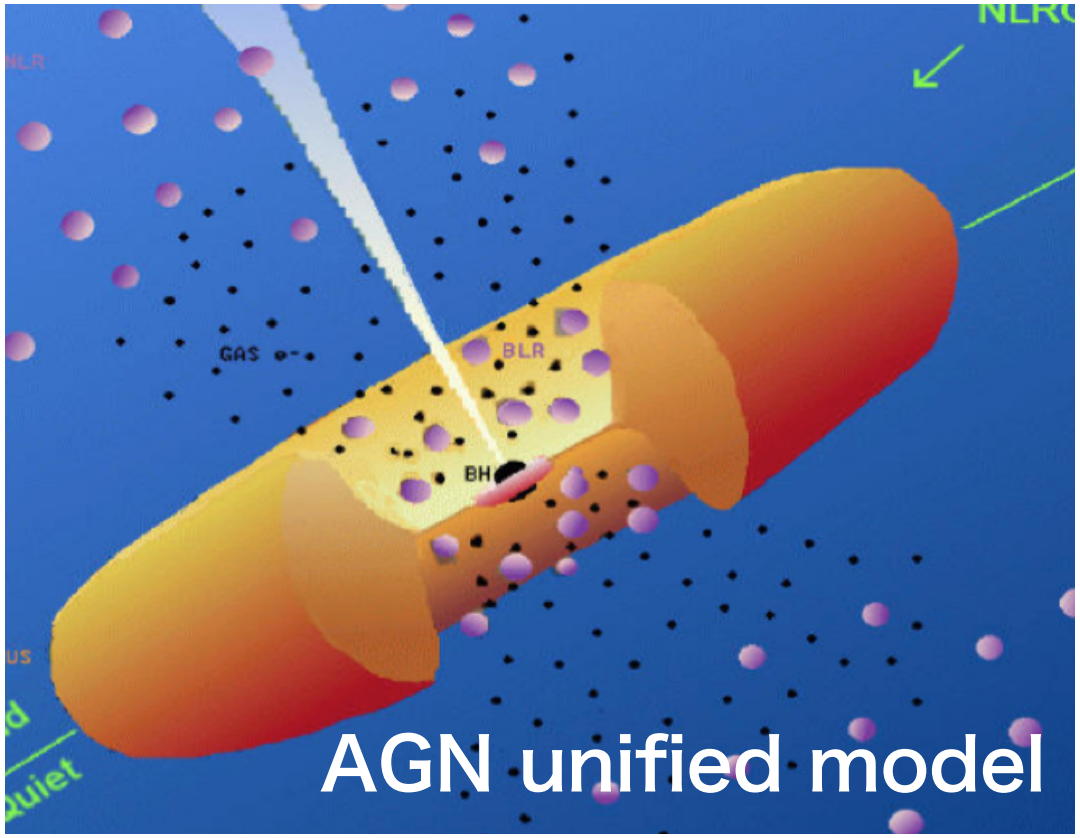

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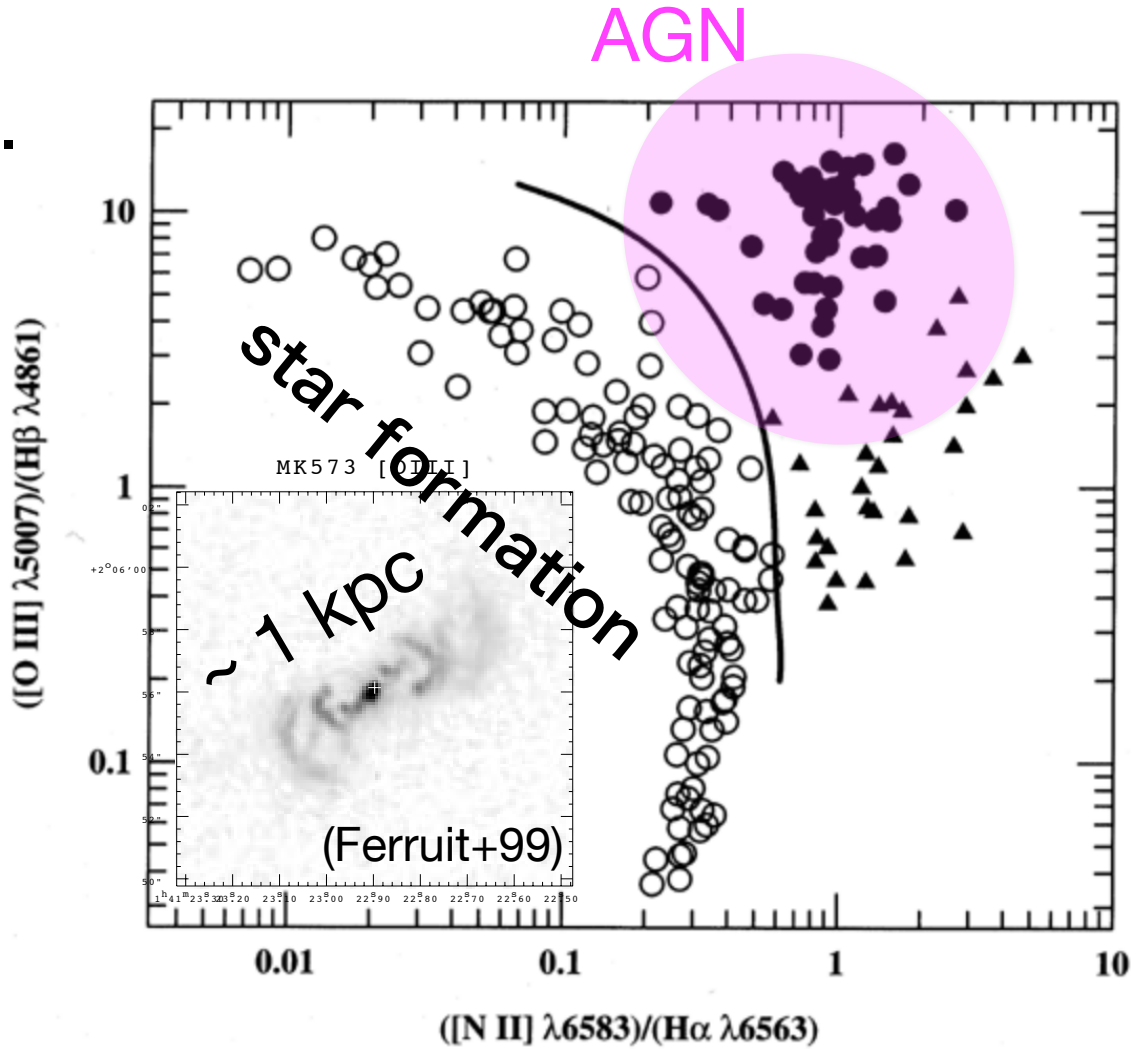

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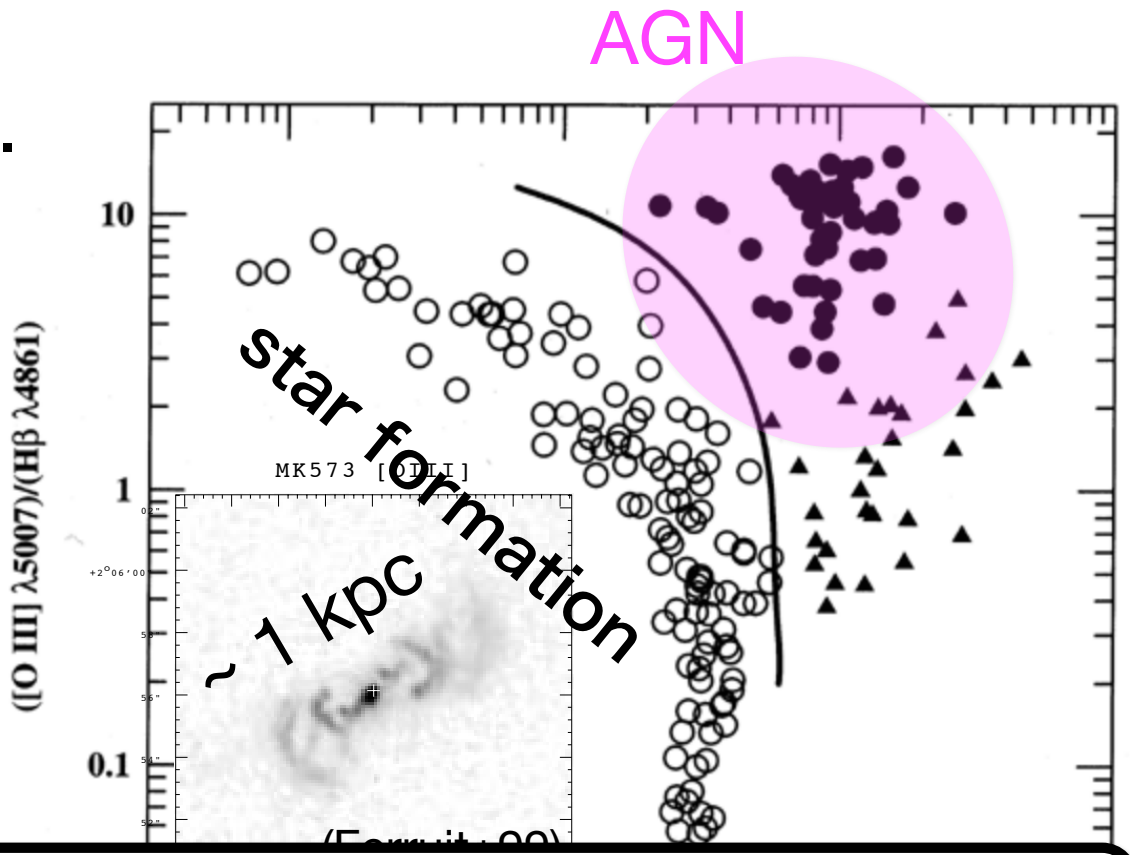
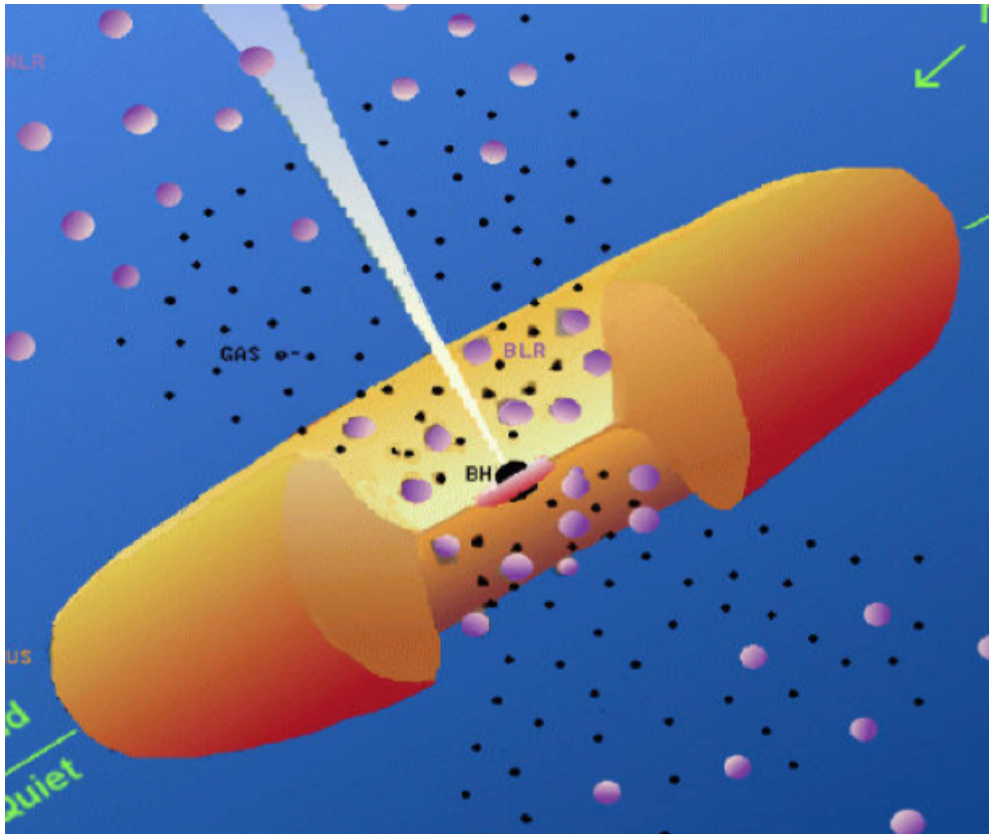


Do all AGNs influence the host galaxy in the same efficiency?

Do all the AGN effectively influence the host galaxy?

Likely, ***No***

- Even the simplified torus can obscure the AGN emission.

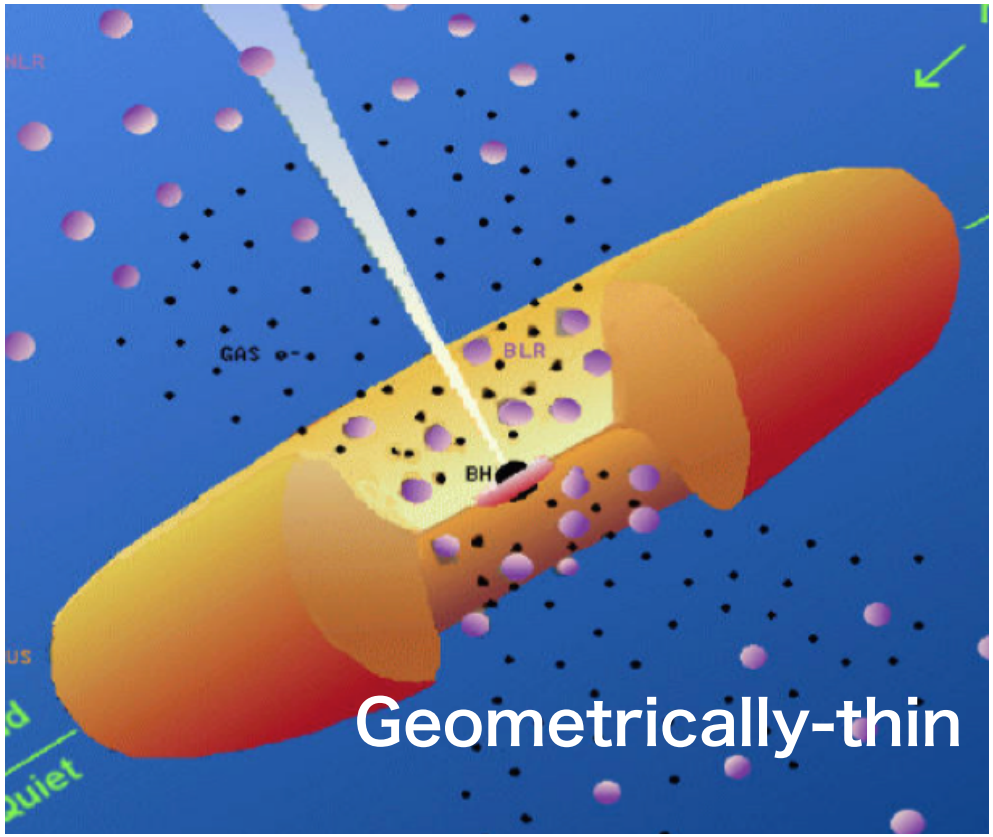


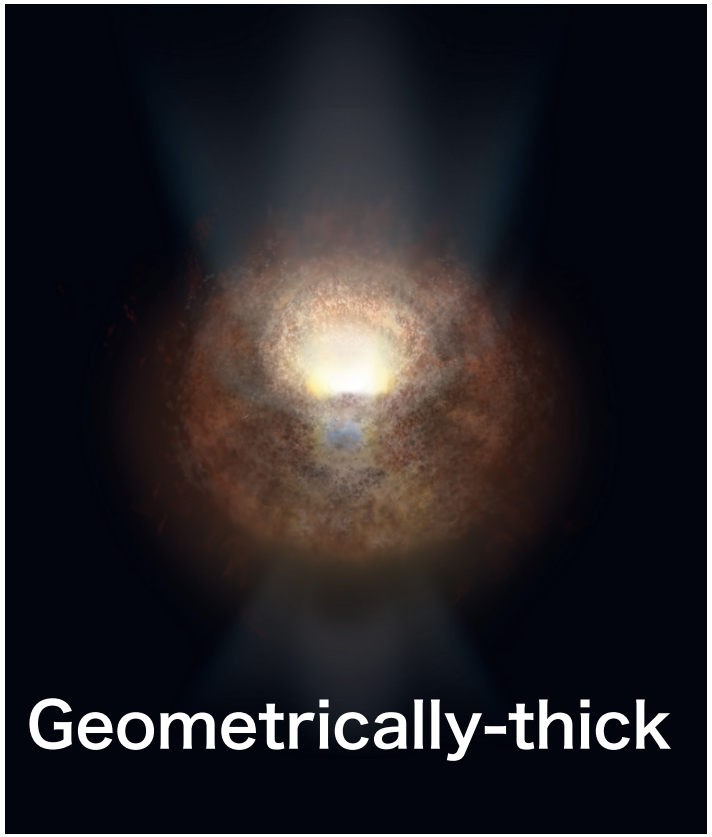
Do all the AGN effectively influence the host galaxy?

Likely, ***No***

- Even the simplified torus can obscure the AGN emission.
- **Hard X-ray surveys (> 10 keV)** have discovered buried AGNs.

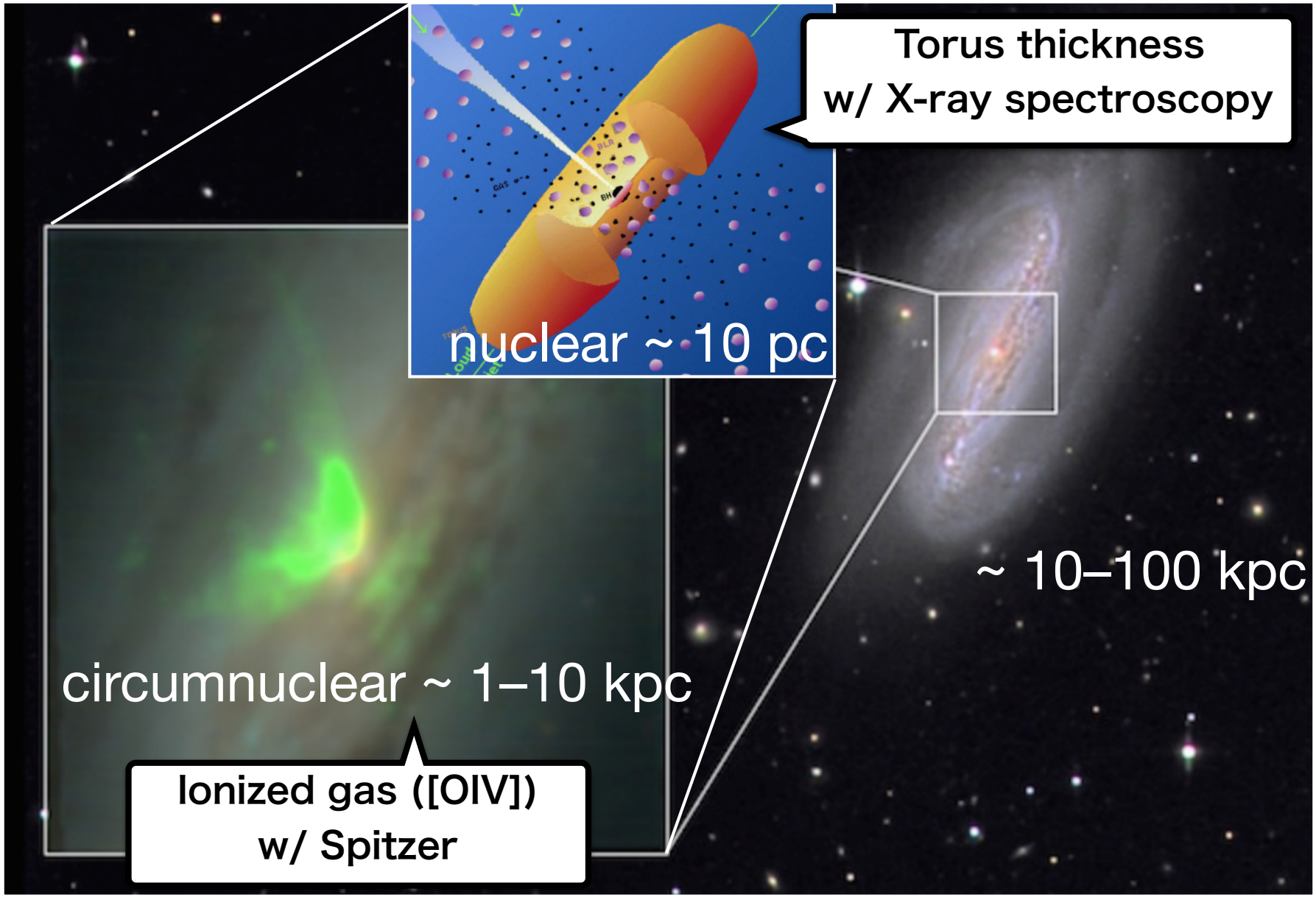
(e.g., Ueda+07, Winter+09, Ricci+17)





Strategy using multi-wavelength data

Relation between the geometrical thickness of the torus and strength of ionized gas emission



X-ray Spectroscopy of AGN

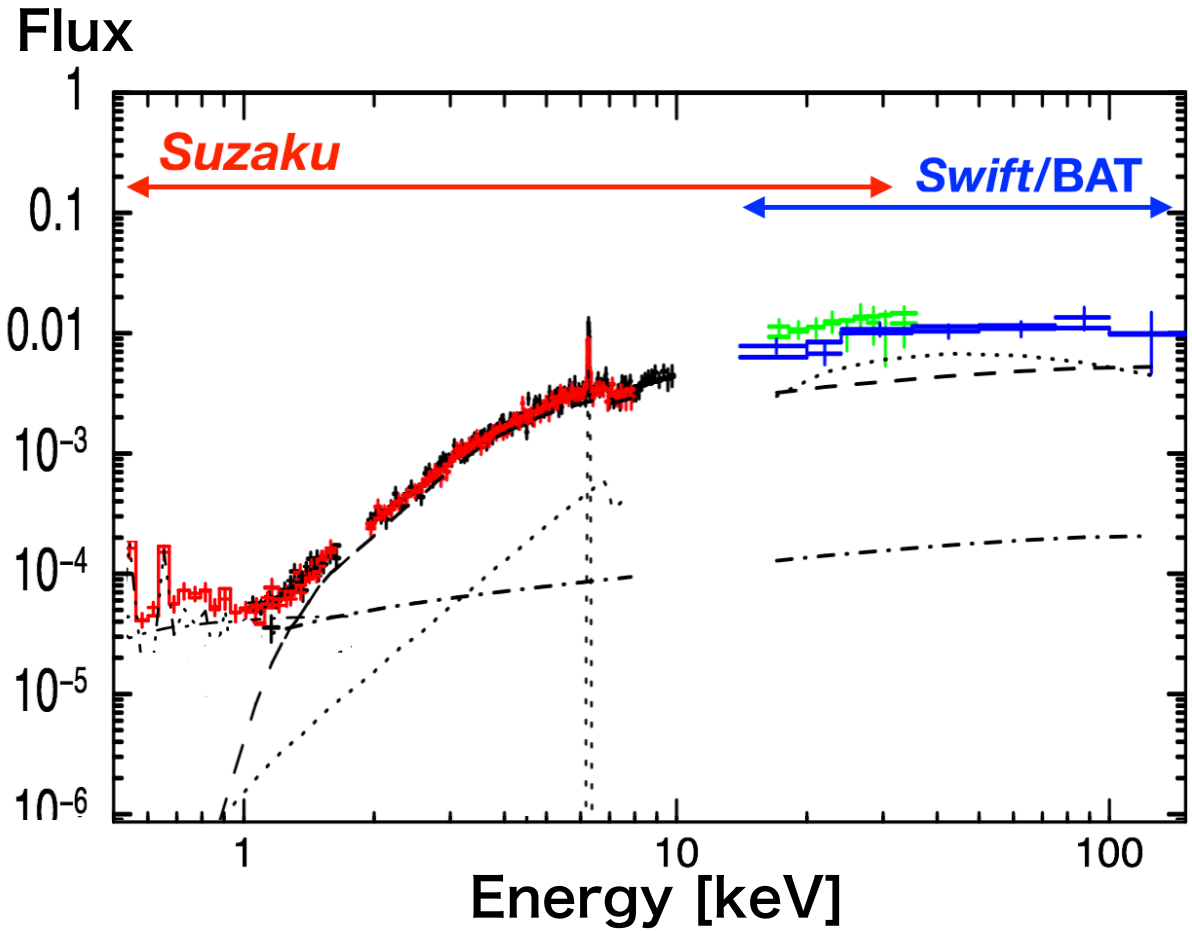
- A powerful tool to unveil the nuclear (< 10 pc) scale structure

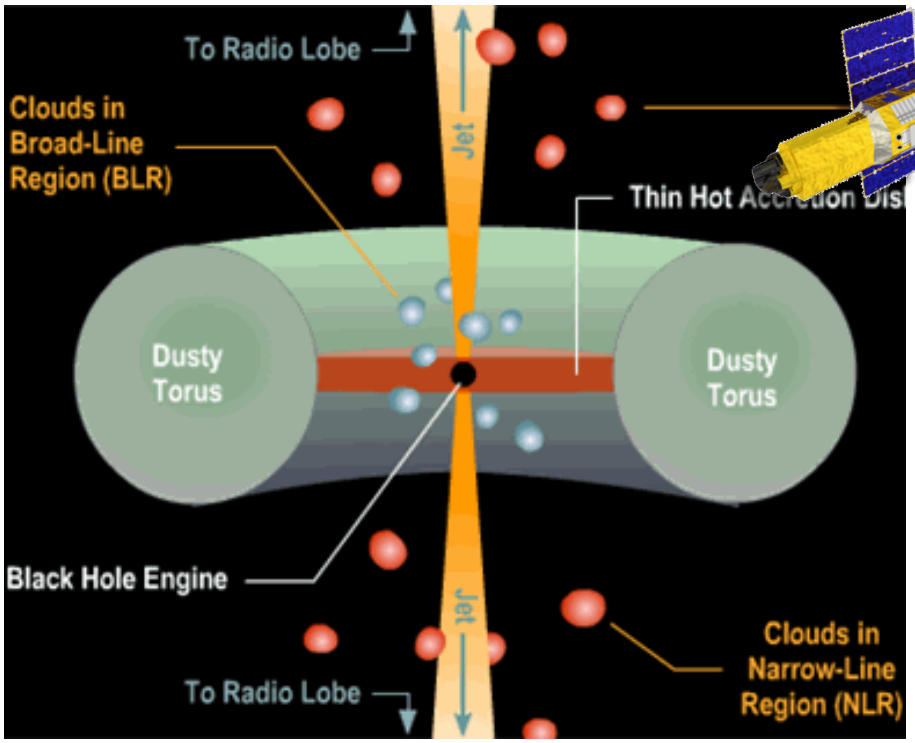
Inverse Compton (plus absorption)

(<~ 10 r_g; e.g., Morgan+08,12)

Reflection (~ 0.1-1 pc; e.g., Shemmer+10,11; Gandhi+15)

Soft scattered emission (> 1 pc; e.g., Bianchi+10, Go´mez-Guijarro+17)





(Brooks/Cole Thomson Learning)

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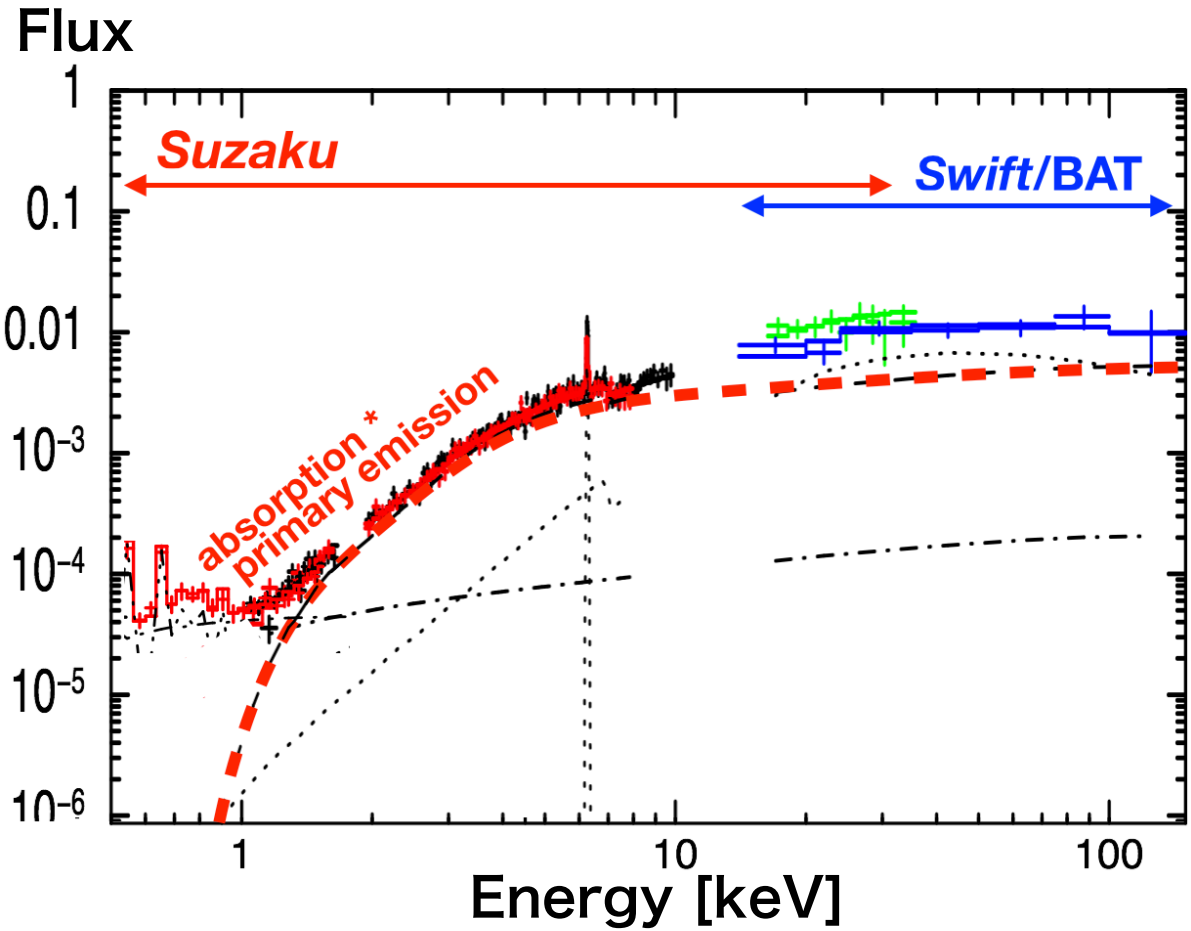

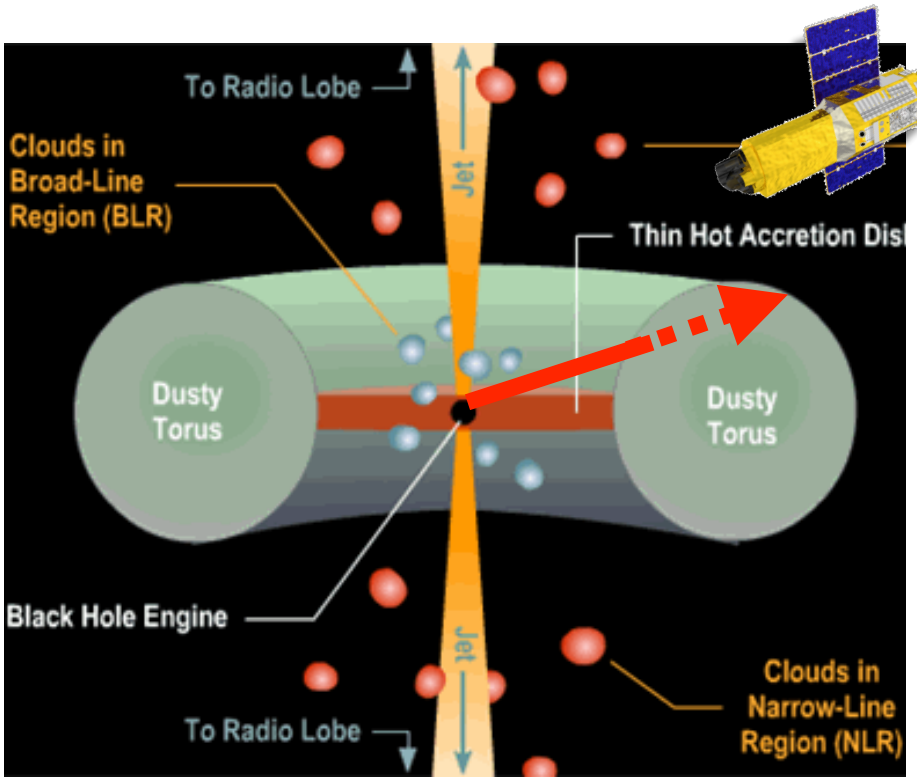

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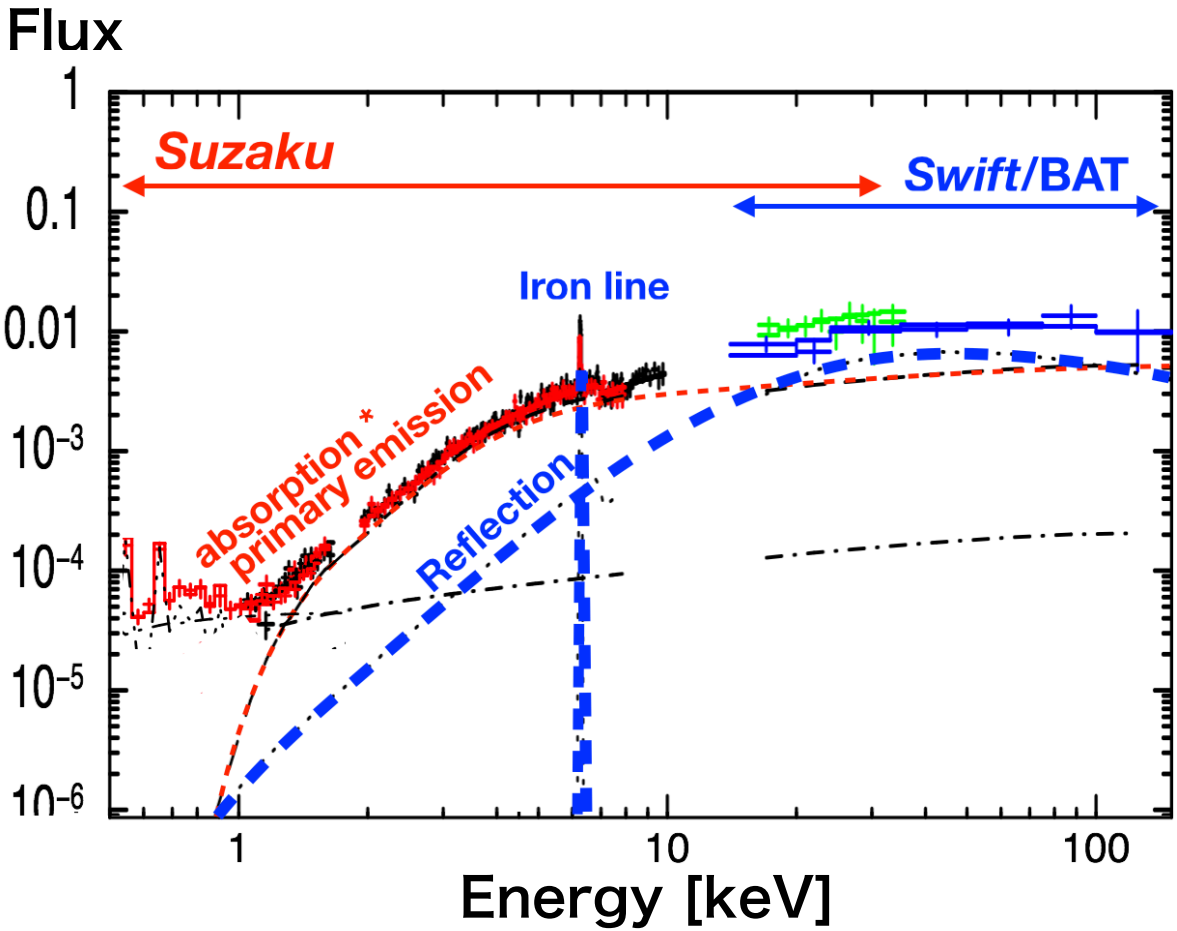

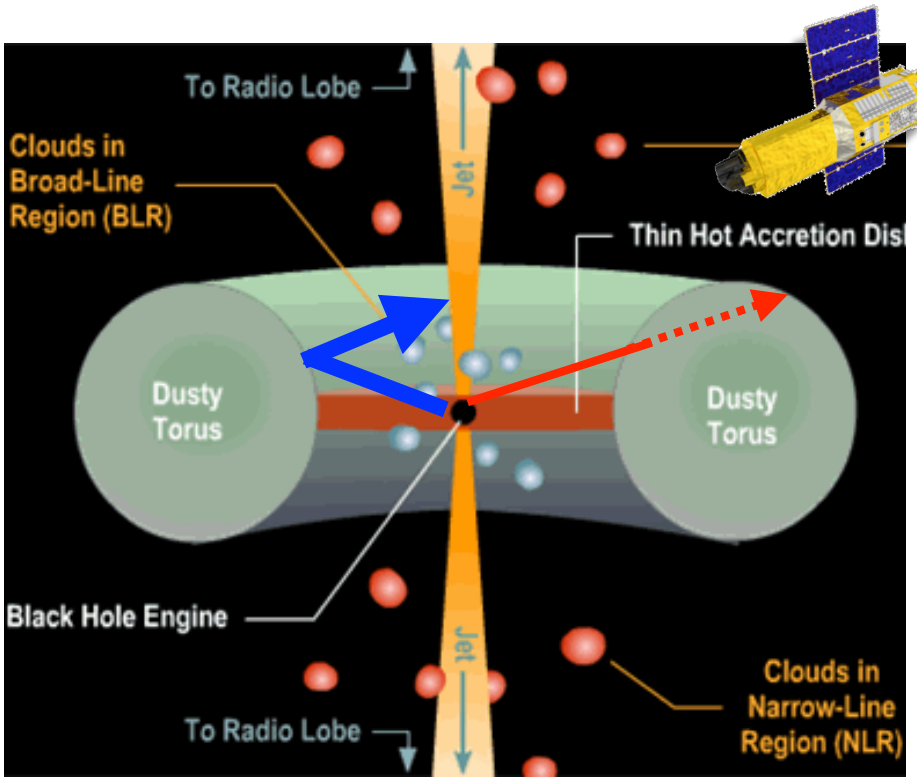

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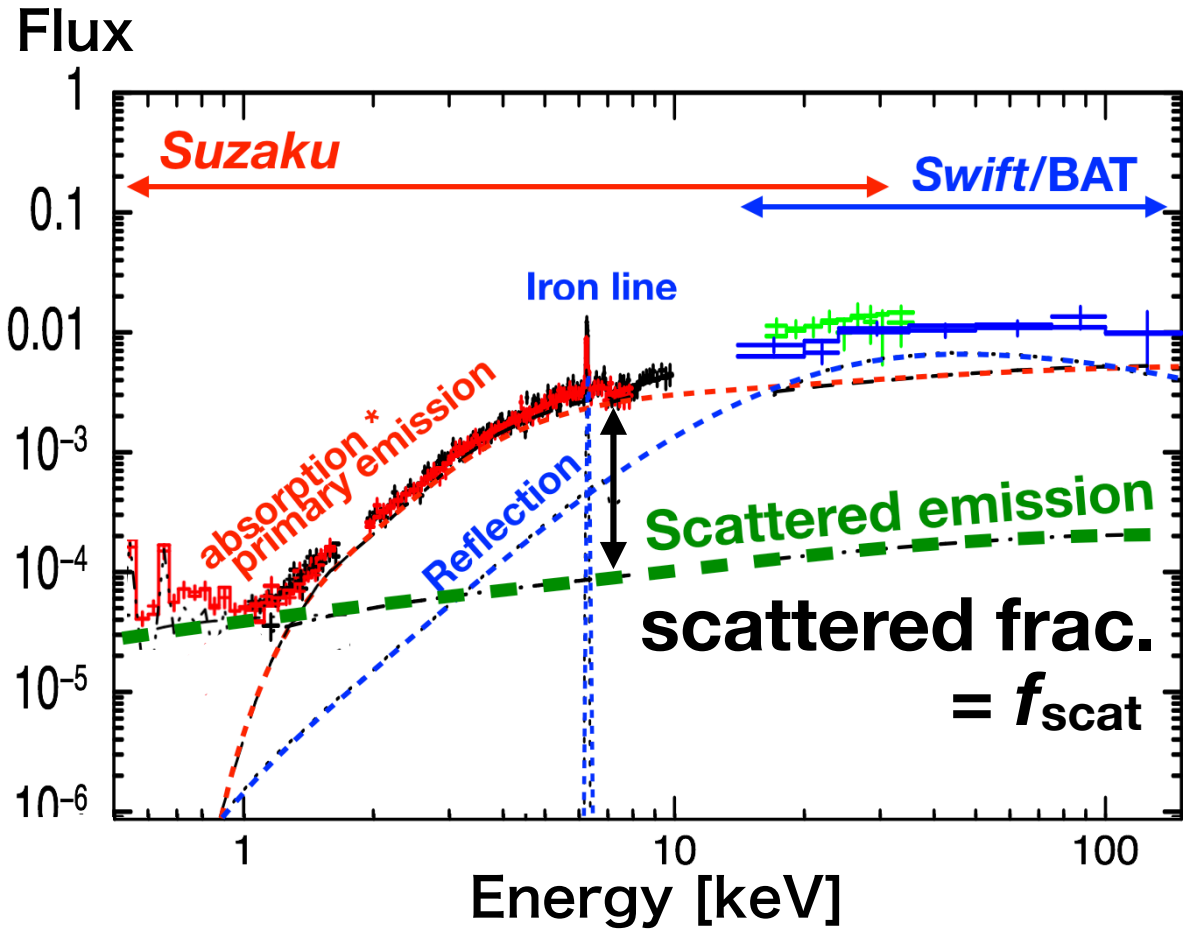

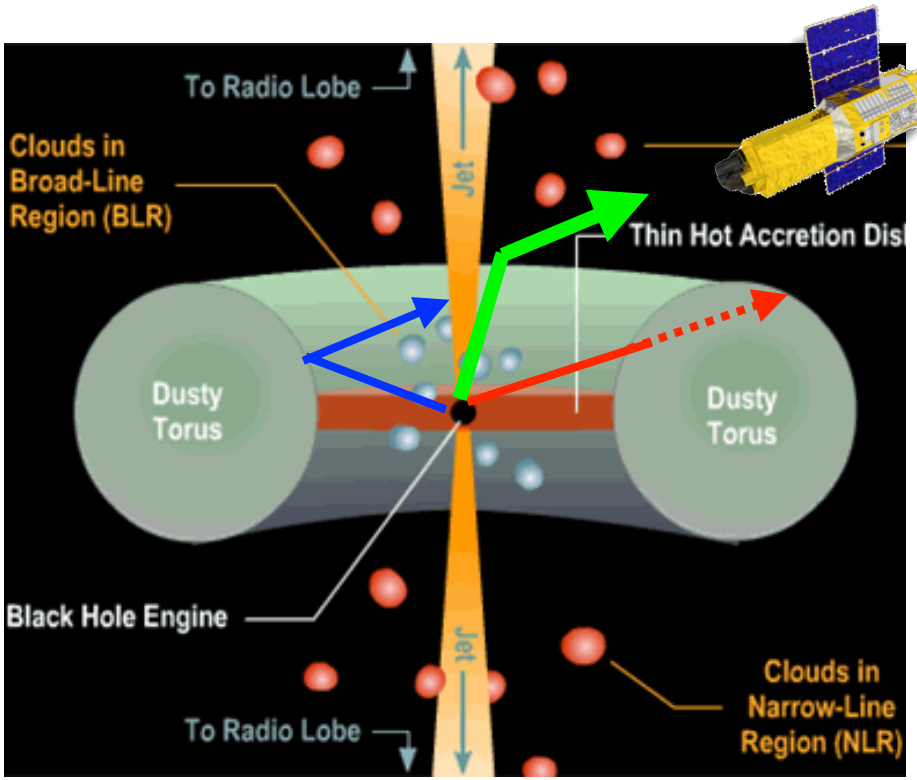

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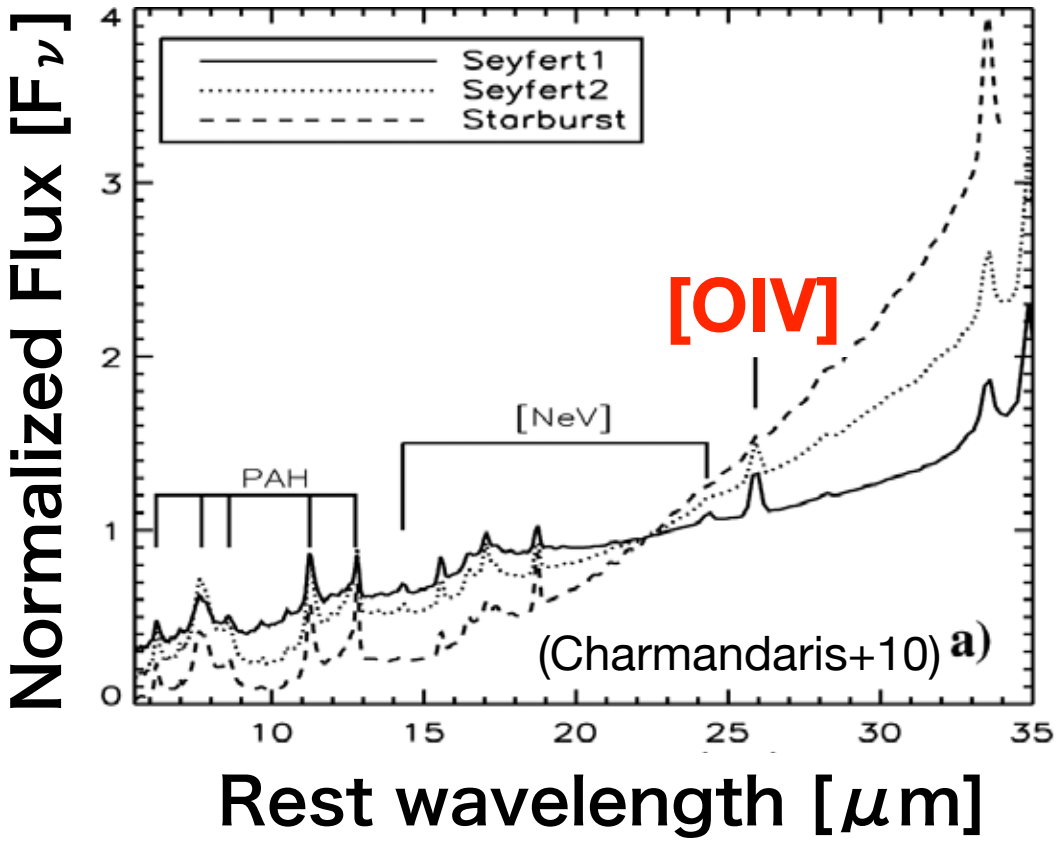
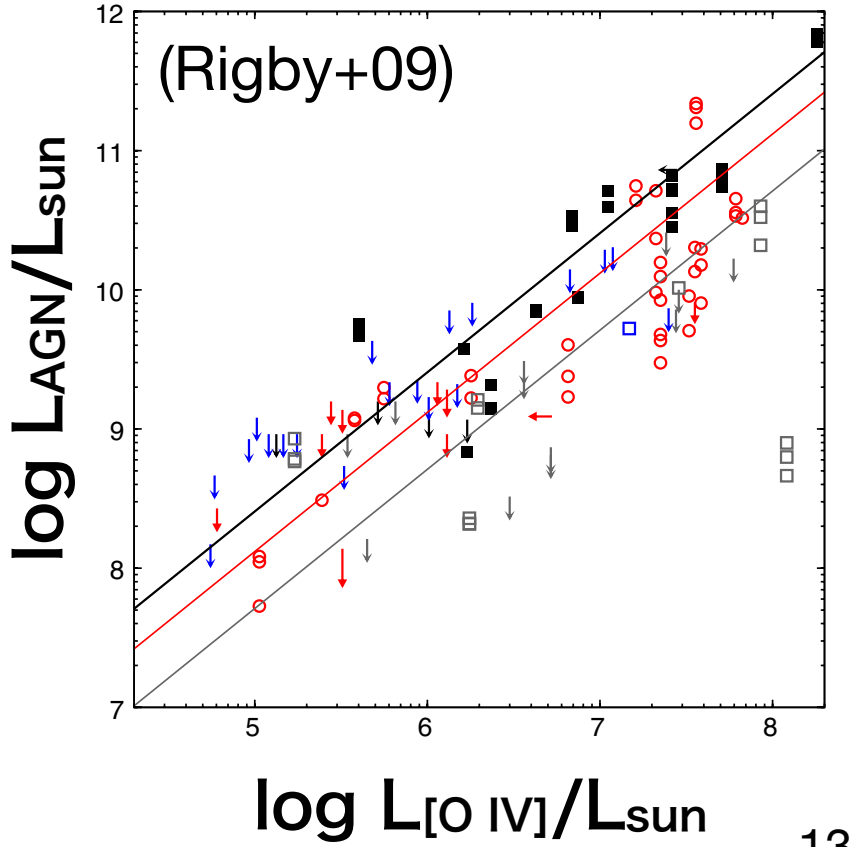
[O IV] line, a proxy of the AGN accretion power

- **[OIV]λ 25.89 um**

  A proxy of the AGN power ? (e.g., Rigby+09, Melendez+09)

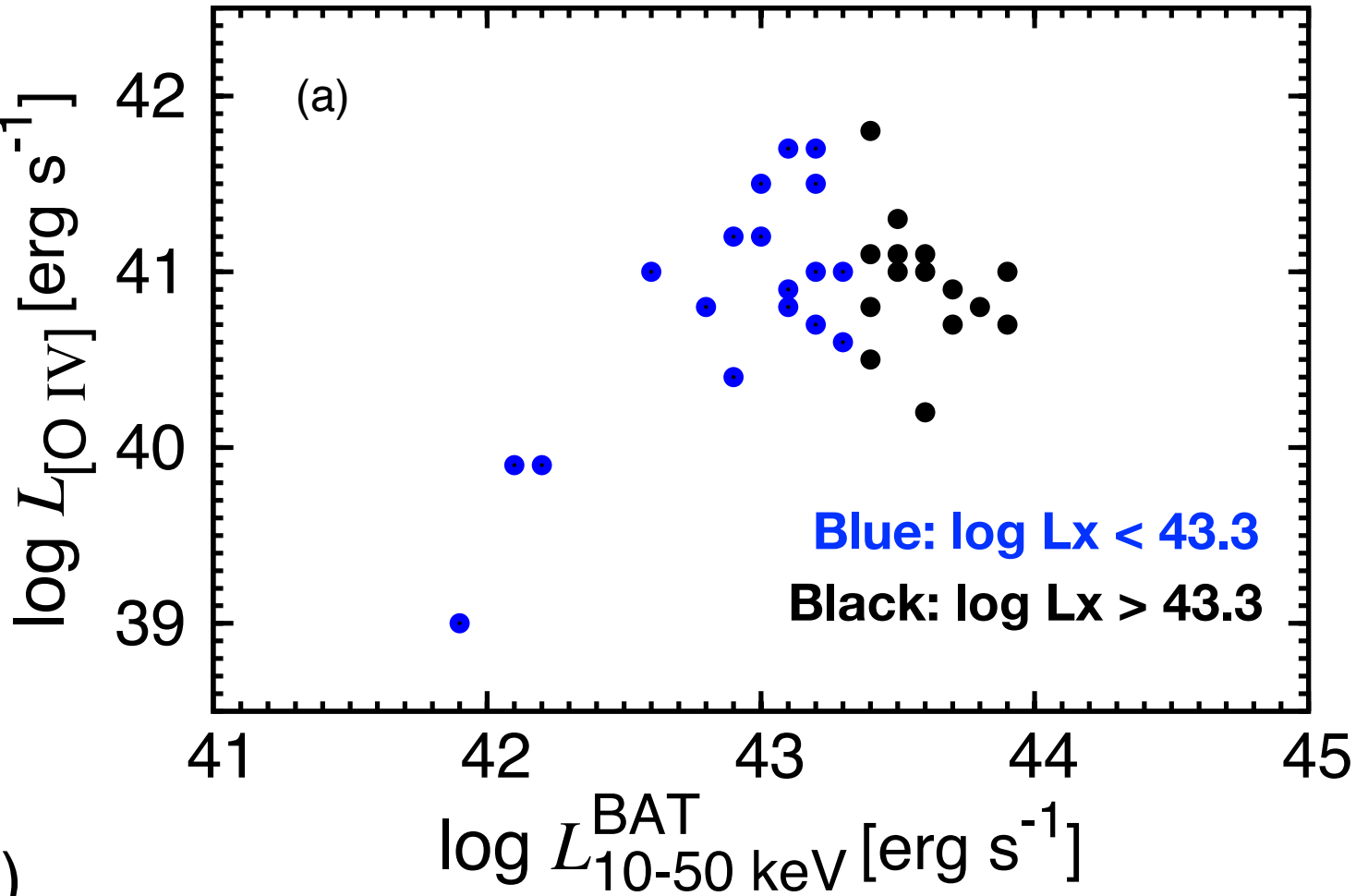
  - High Ionization potential energy = 54.9 eV
    → less contamination from starburst
  - low dust extinction





Correlation between L_X and $L_{[OIV]}$

- Hard X-ray (E = 14-200 keV) *Swift*/BAT 70-m Catalog
  - ***Sample includes AGNs w/ the geometrically-thick torus***
- Obscured AGNs obs. by *Suzaku* X-ray satellite (0.5–40 keV)
  - ***Scattered fraction (or torus thickness) can be estimated***



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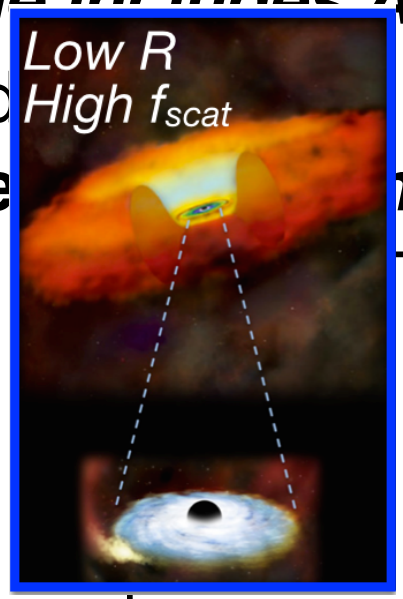

(TK+16a)

Summary

- We studied the connection between the geometrical thickness of the torus and ionized gas strength/morphology
- ***AGN effects on surrounding material could depend on the nuclear obscuration.***