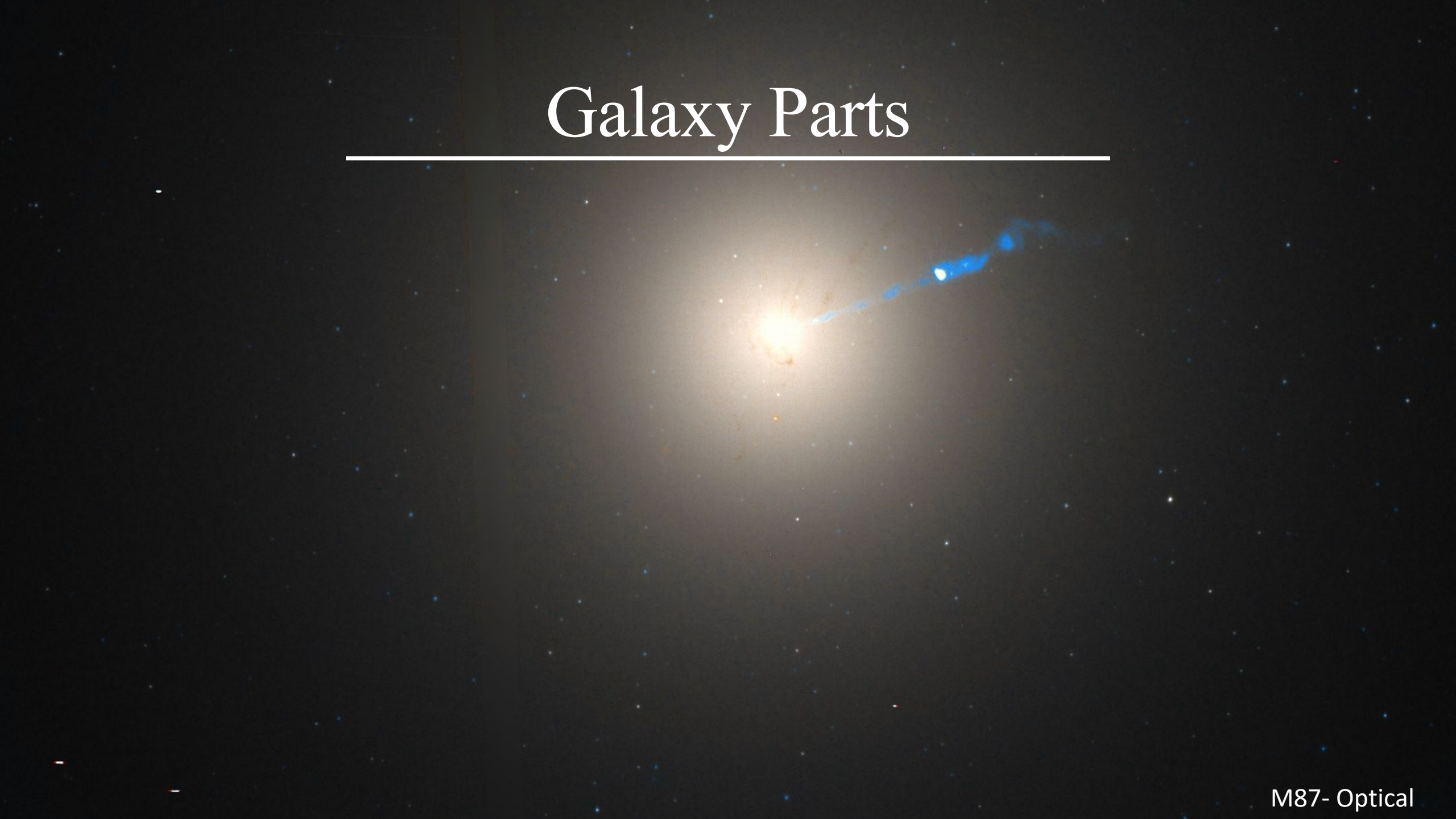
Luminous X-ray Selected AGN in Stripe 82X

Kurt Hamblin[1], D.B. Sanders[2], E. Glikman[3], Dr. Megan Urry[4], Dr. Allison Kirkpatrick[1]

[1]*Department of Physics and Astronomy, University of Kansas*
[2]*Institute for Astronomy, University of Hawaii*
[3]*Department of Physics, Middlebury College*
[4]*Department of Physics, Yale University*

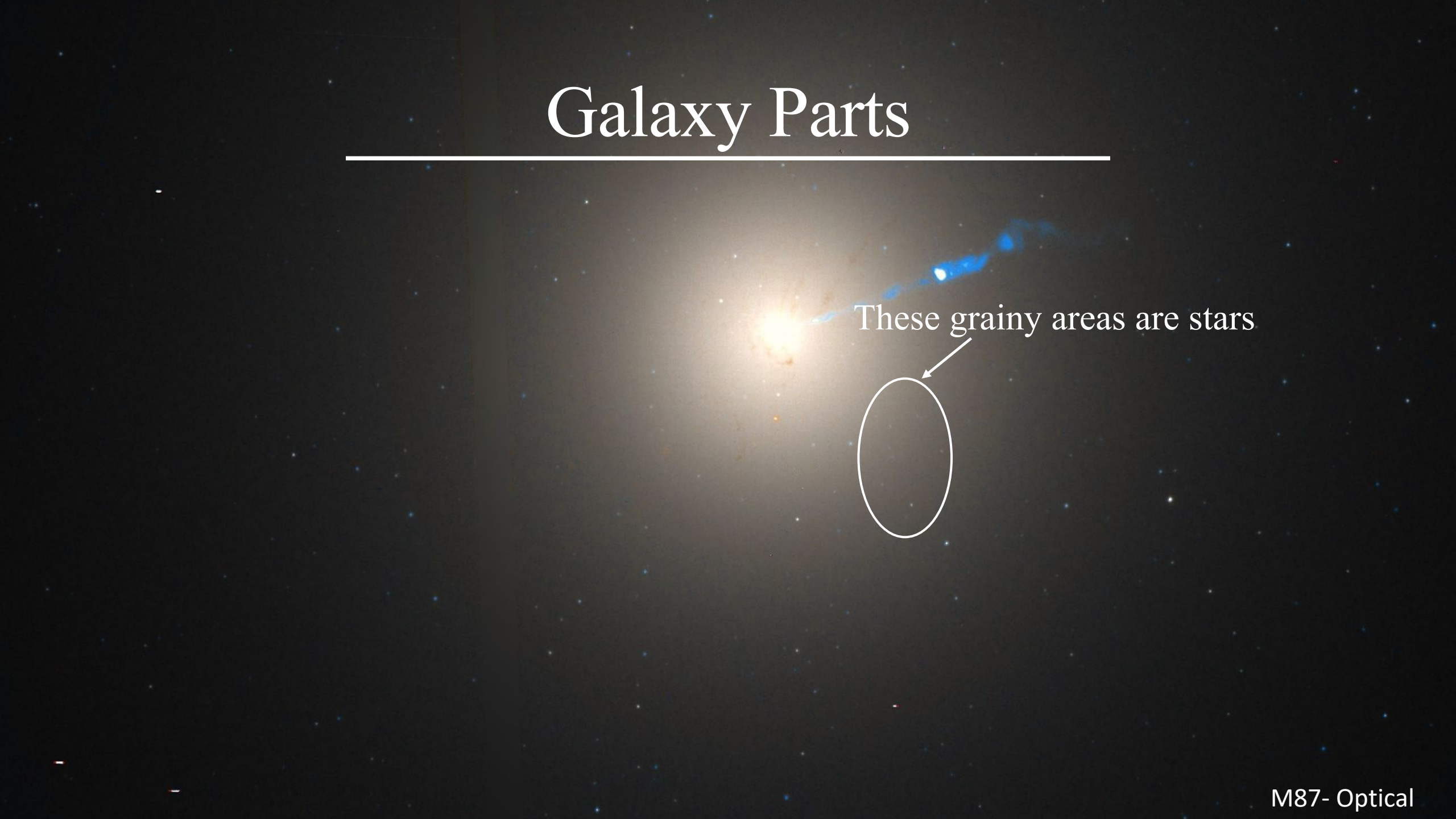


Galaxy Parts



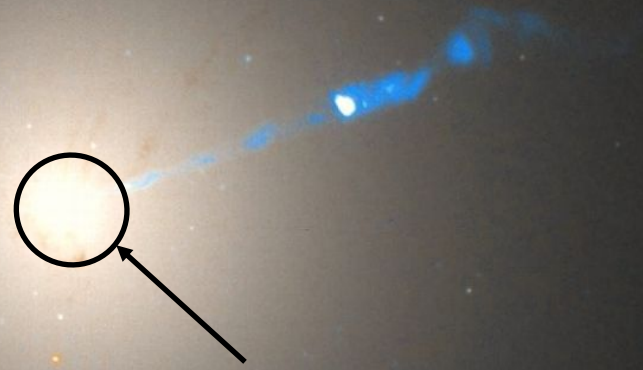
M87- Optical

Galaxy Parts



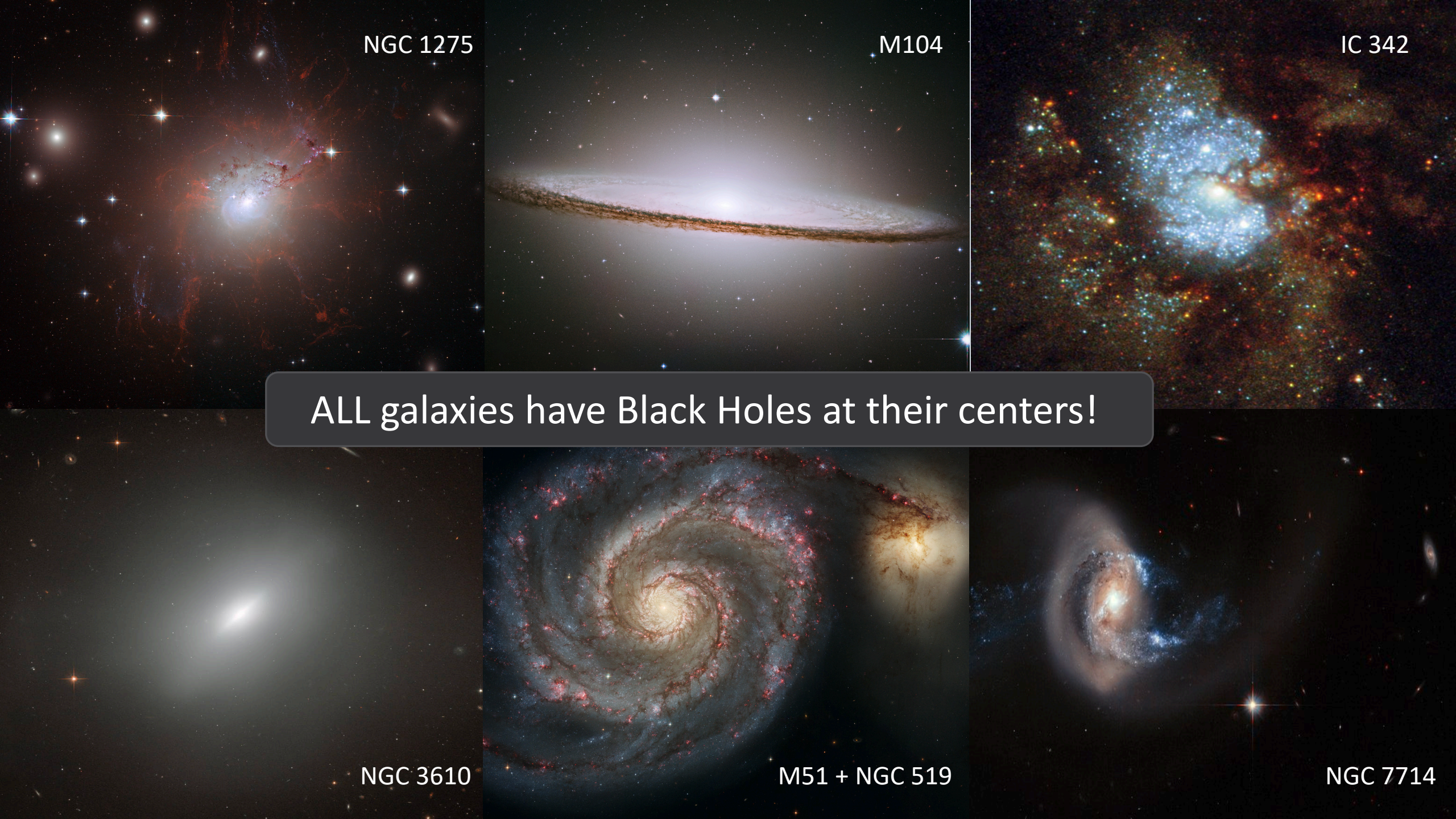
M87- Optical

Galaxy Parts



At the center is a supermassive black hole
(~6 billion solar masses)

M87- Optical

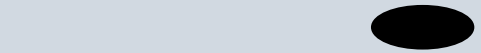

NGC 1275
M104
IC 342
ALL galaxies have Black Holes at their centers!
NGC 3610
M51 + NGC 519
NGC 7714

Active Galactic Nuclei (AGN)

Supermassive Black Holes that are actively accreting (“eating”) gas

Active Galactic Nuclei (AGN)

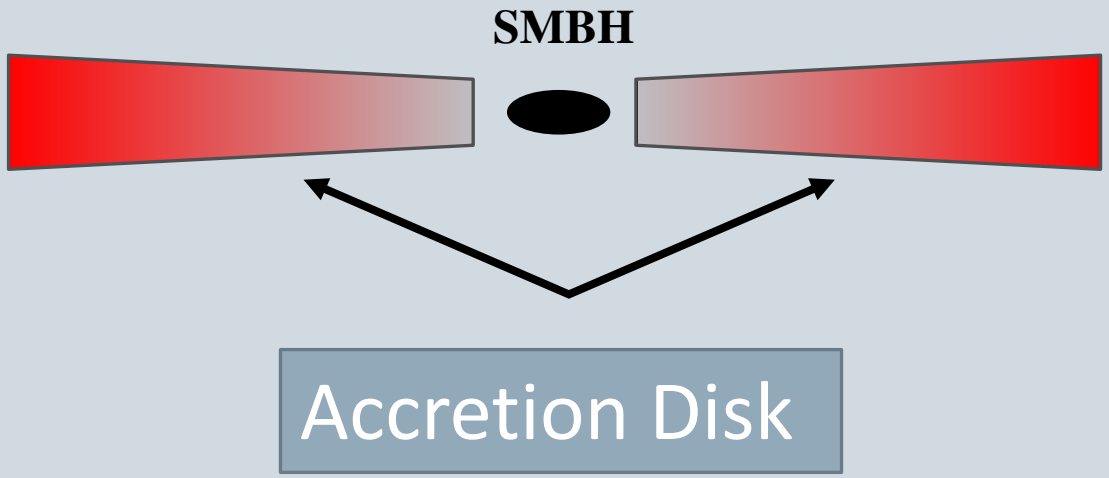
Supermassive Black Holes that are actively accreting ("eating") gas



Supermassive Black Hole

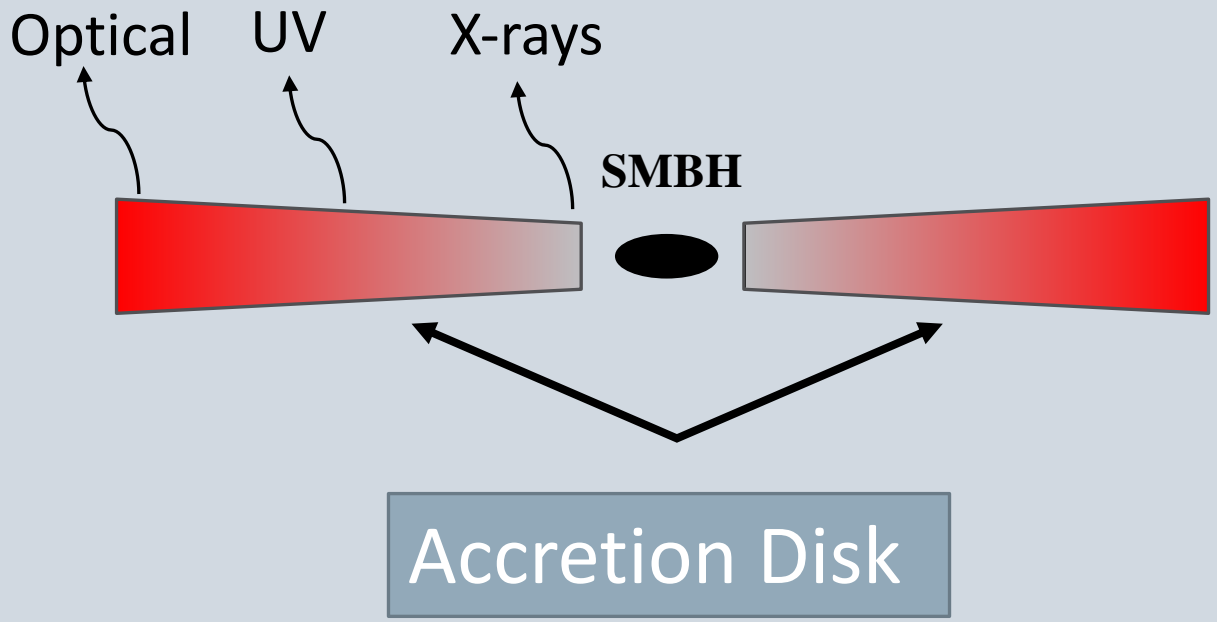
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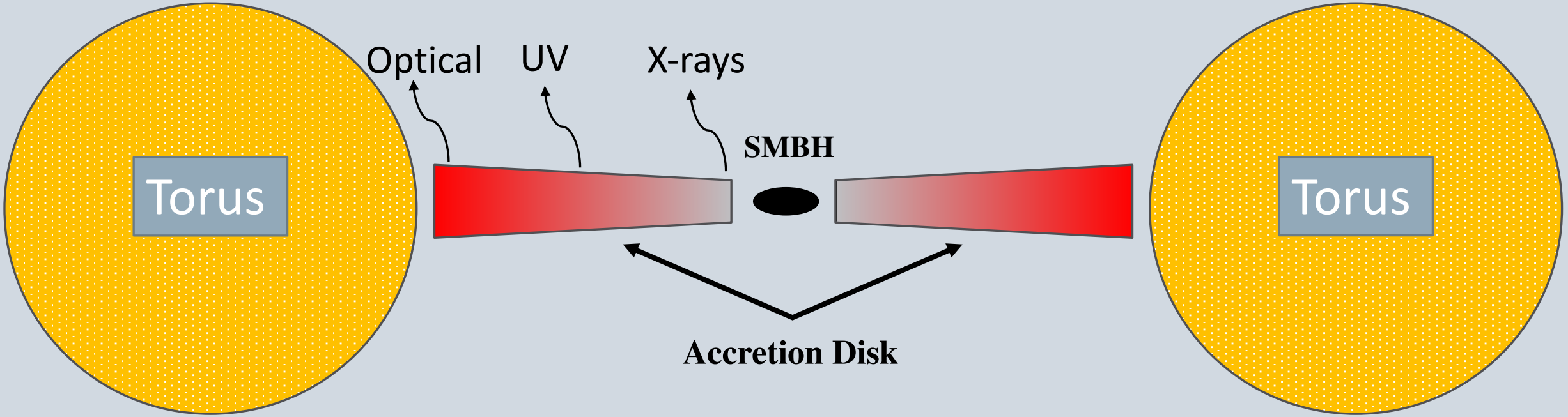
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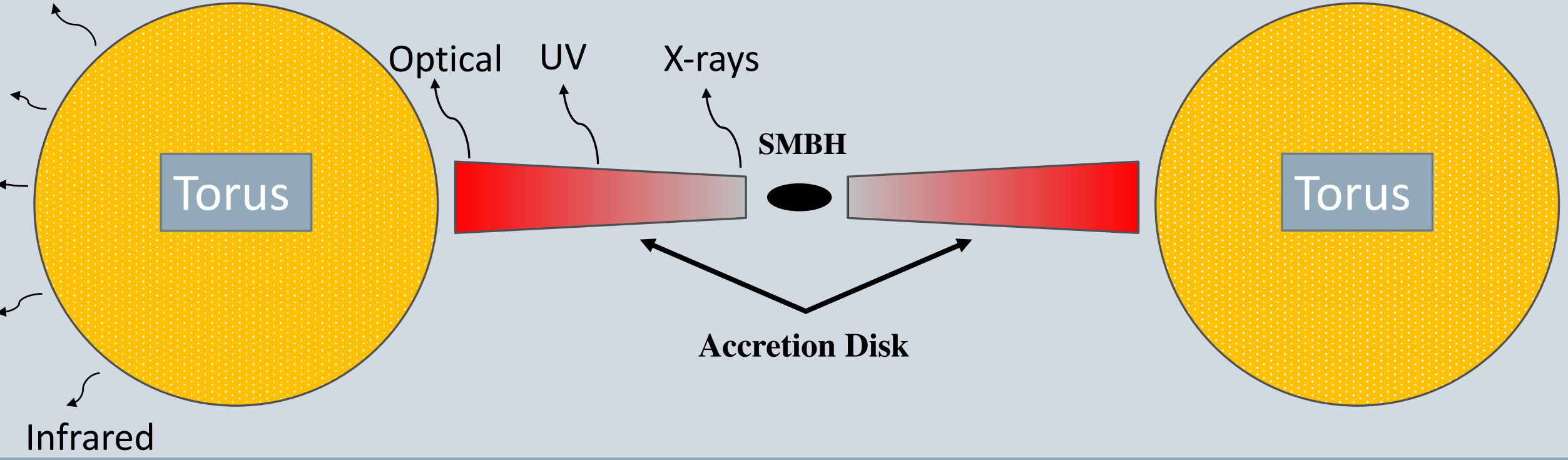
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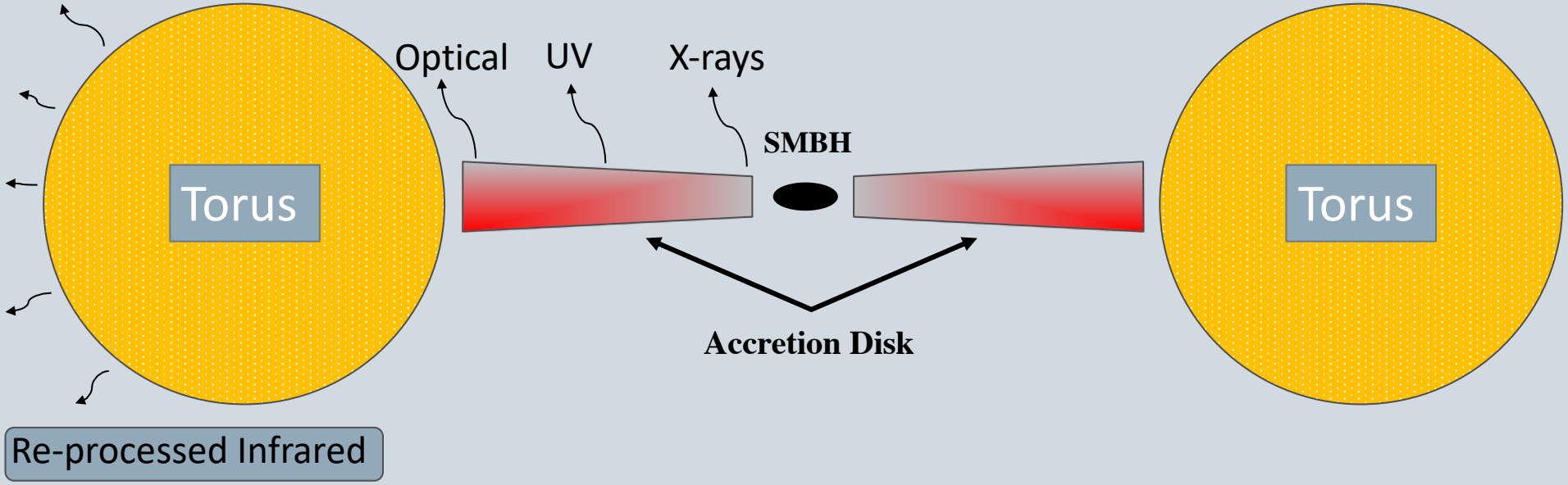
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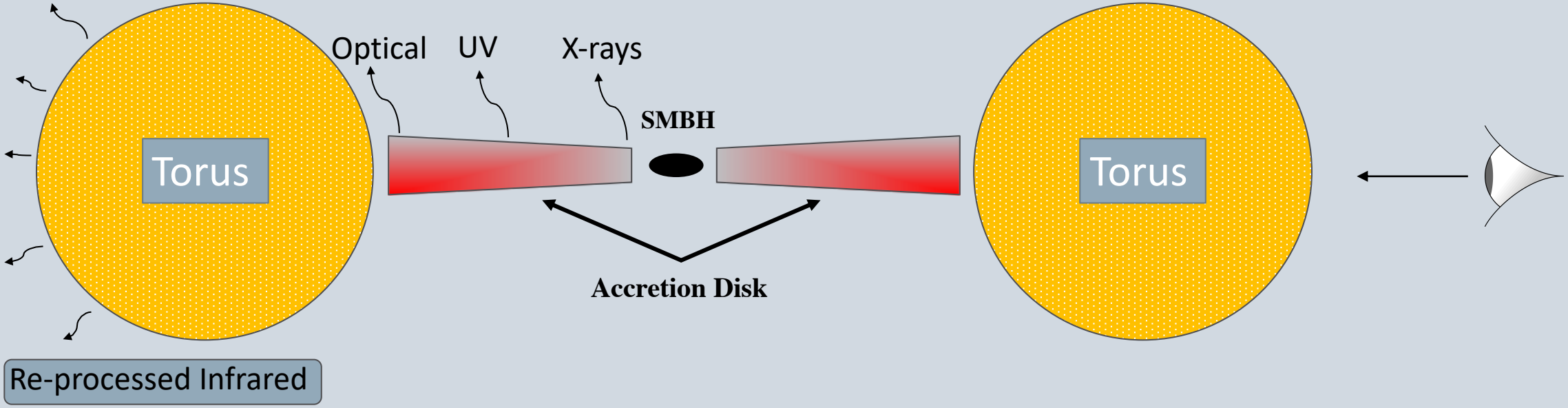


The Torus

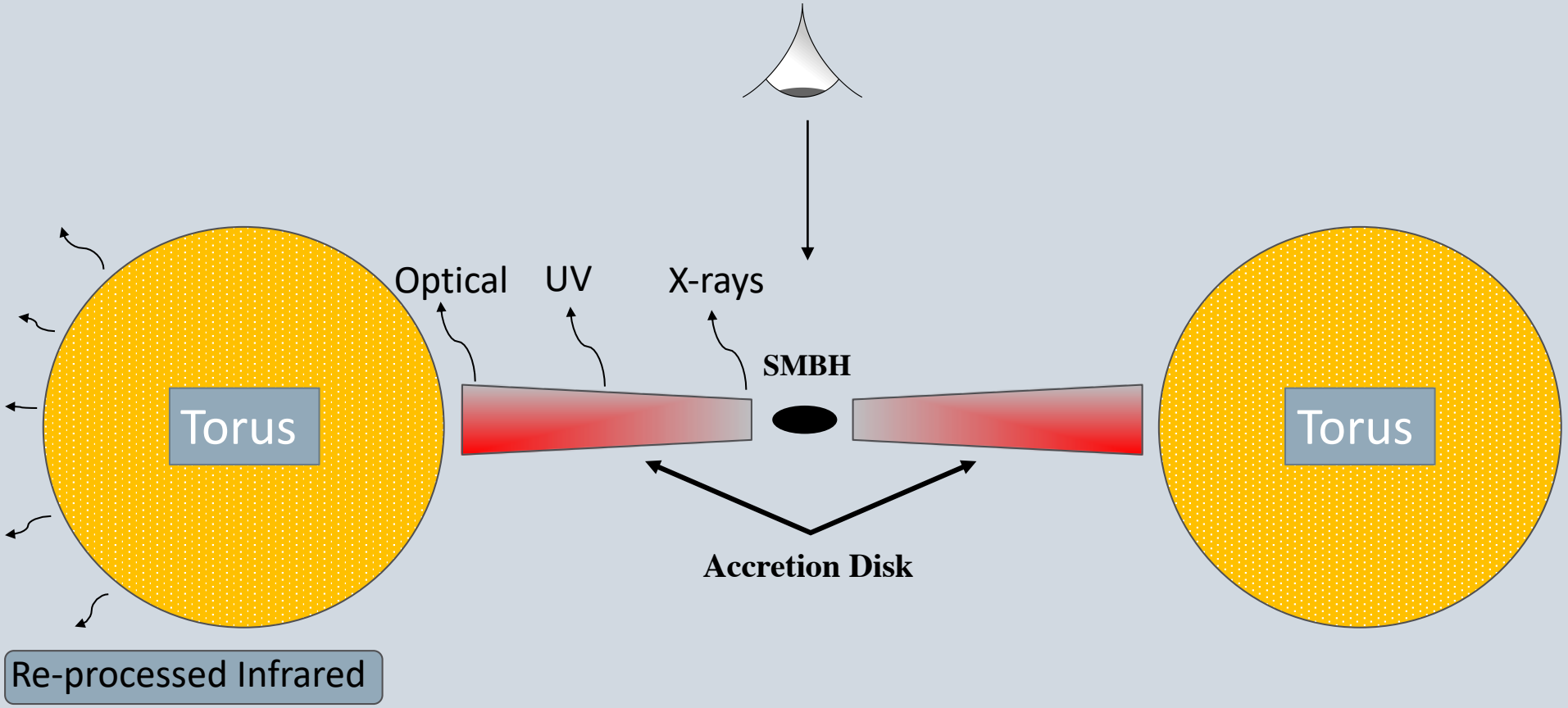
- Obscuring dust makes it difficult to observe AGN:
  - The dust absorbs emissions from the AGN
  - Extremely dense and thick dust regions can even obscure energetic X-ray emissions

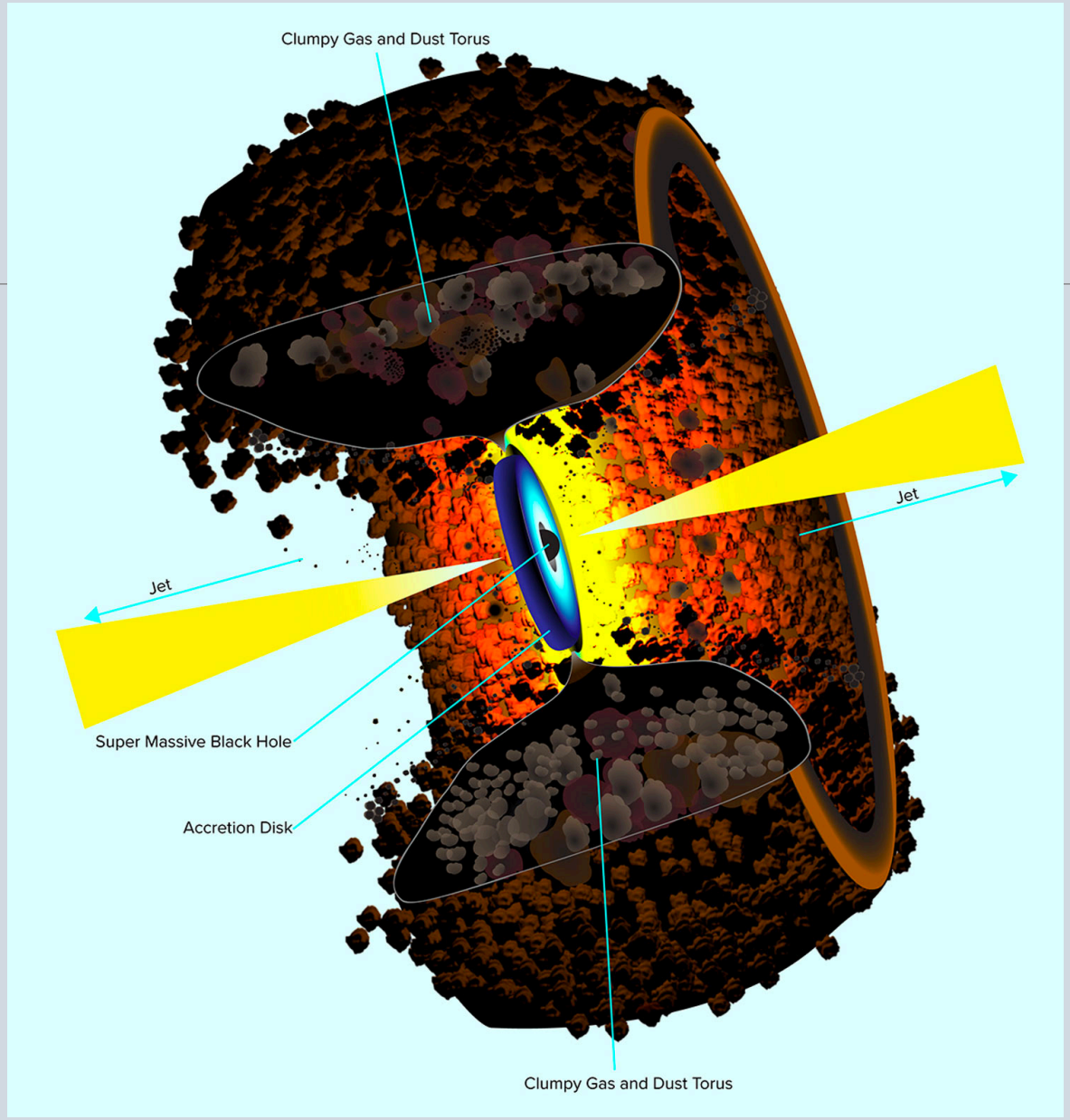


Viewing Differences



Viewing Differences





Bill Saxton / NRAO / AUI / NSF

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    - **~1600 with Spectroscopic redshifts**

Significance

- Multi-wavelength coverage allows detailed study of these sources
- X-ray data (Chandra, XMM) allows easy and reliable AGN selection
- Wide coverage finds a large amount of luminous sources
  - X-ray surveys are usually narrow and deep
    - Only find low-luminosity sources

First Steps

- We will analyze the sources in this sample with Spectral Energy Distributions (SEDs)
  - SEDs are plot of energy vs. wavelength
  - The shapes of SEDs inform us about the processes occurring in galaxies

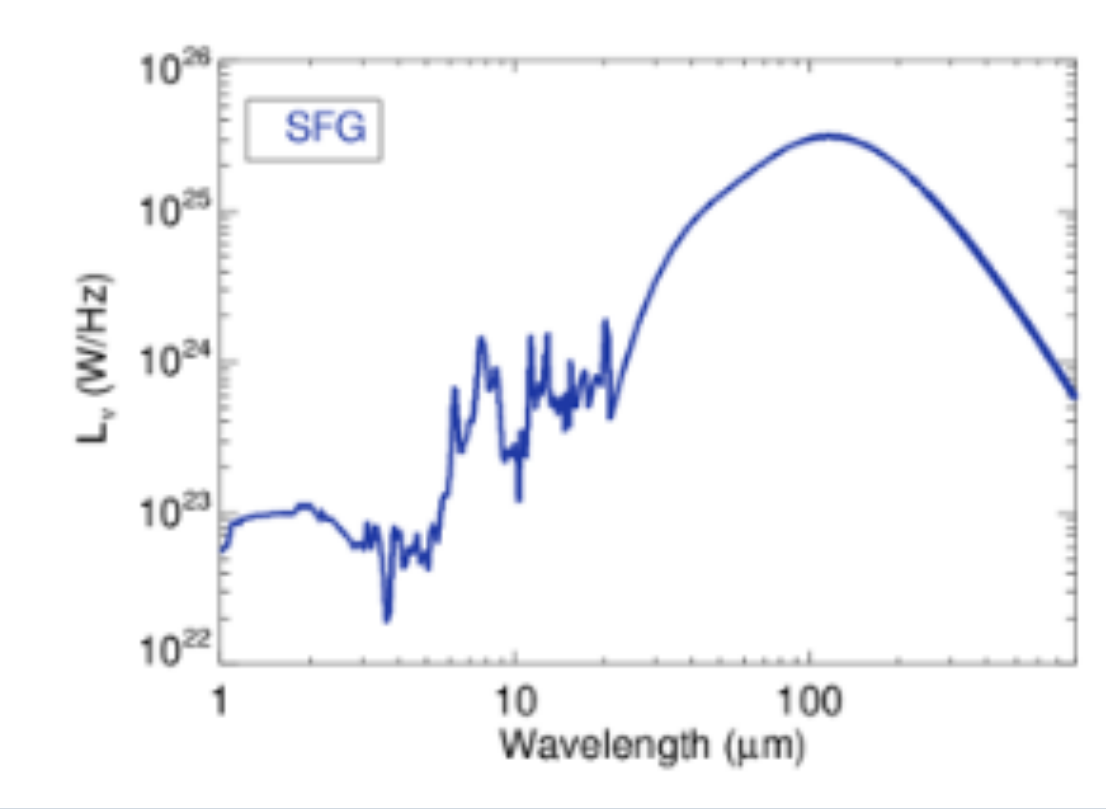
SED: AGN and SF Breakdown

Star-Forming Galaxy

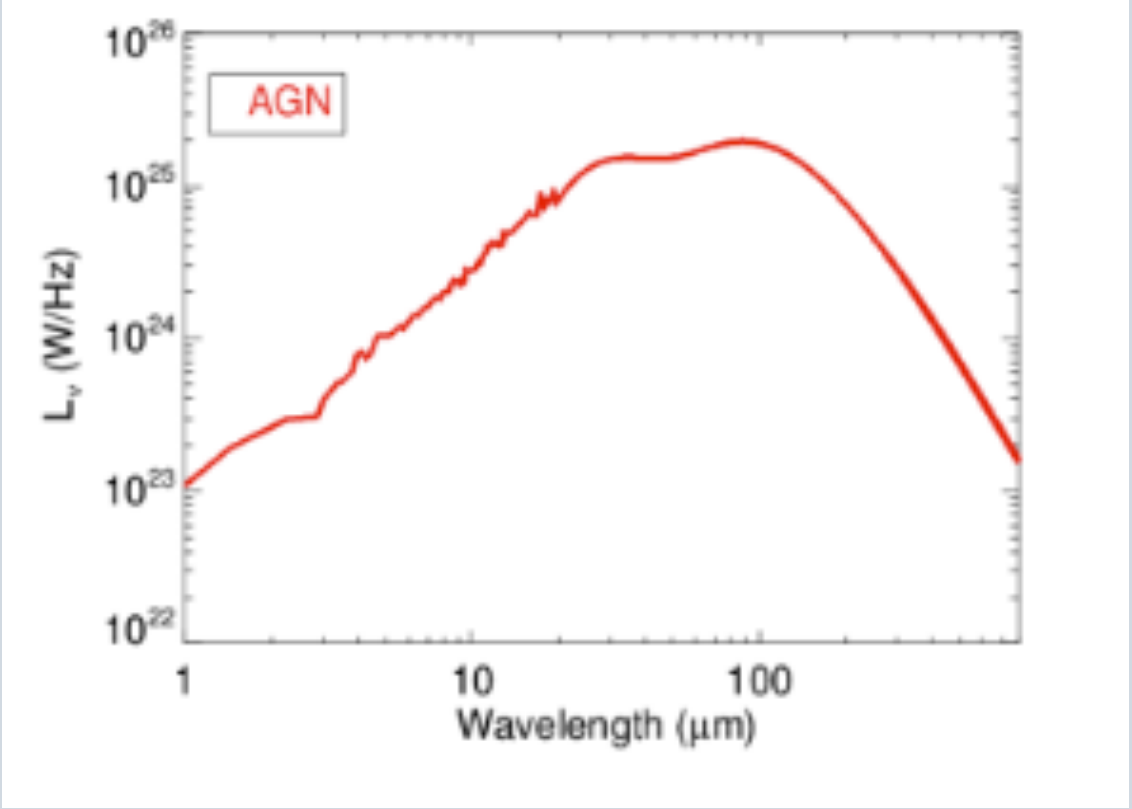
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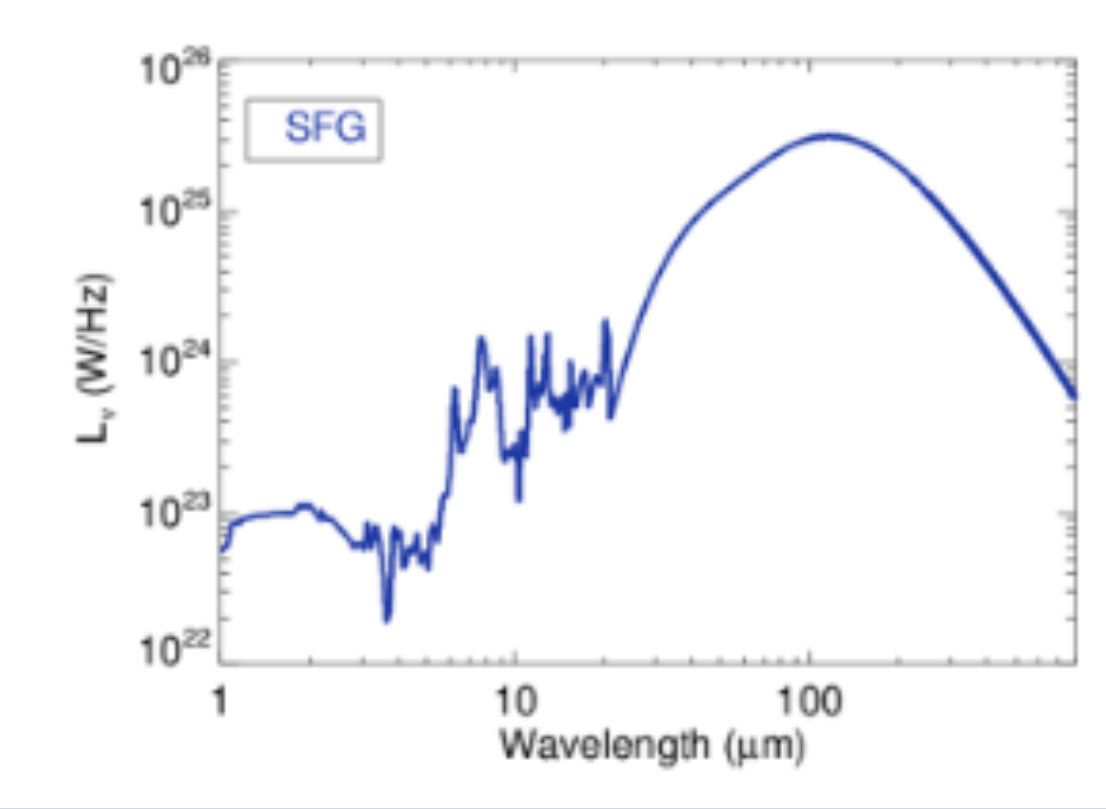


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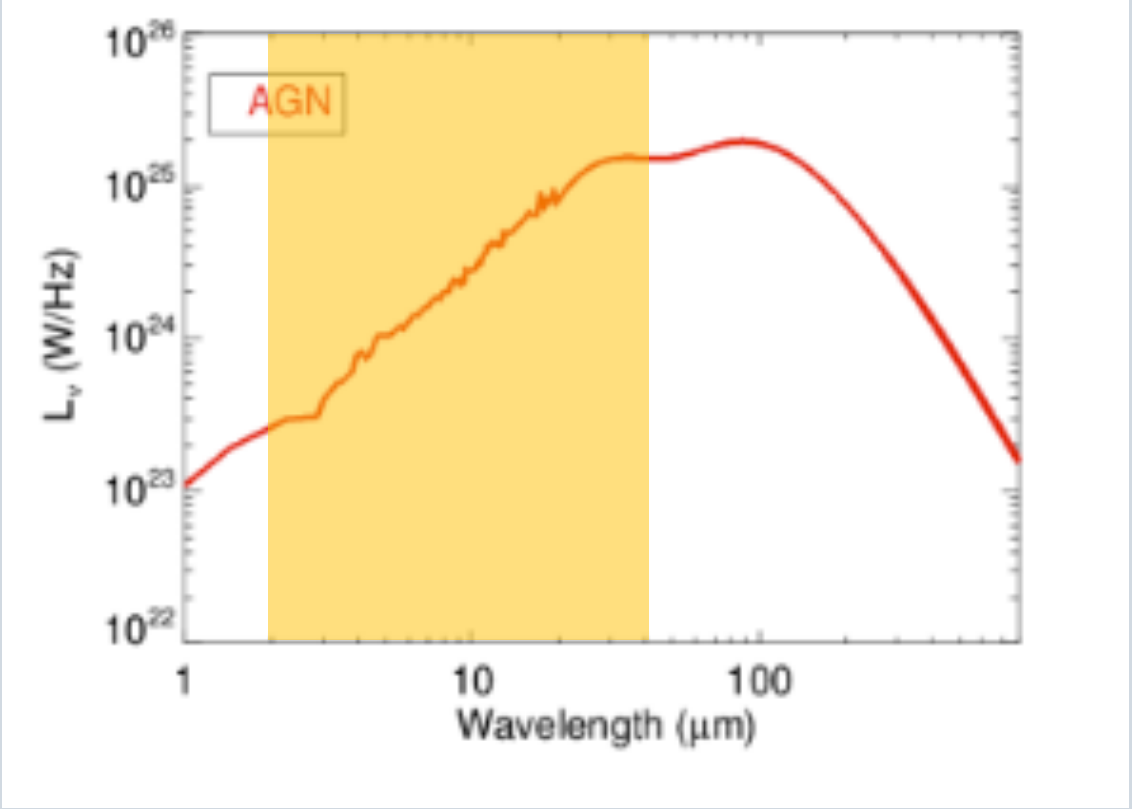


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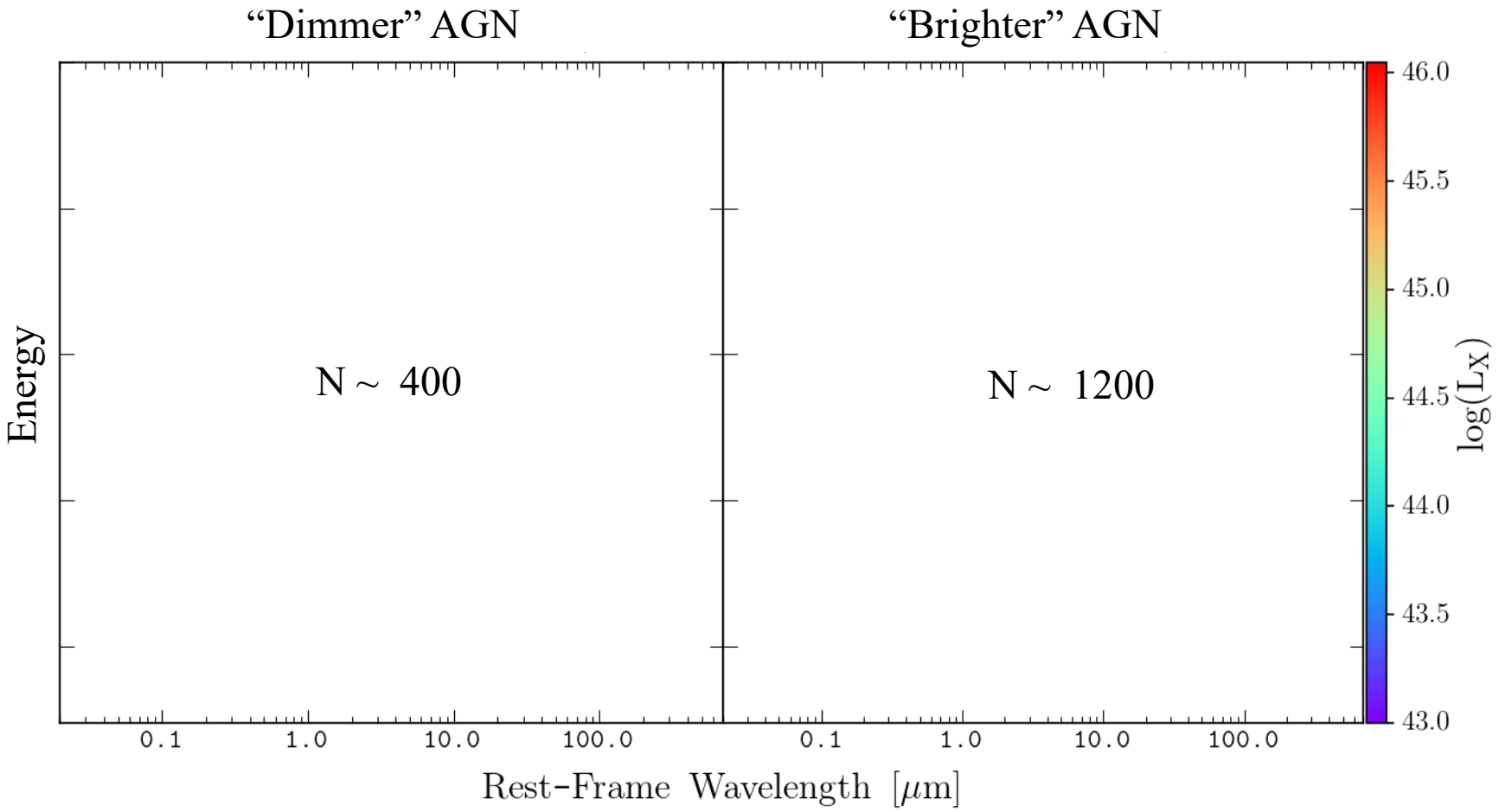
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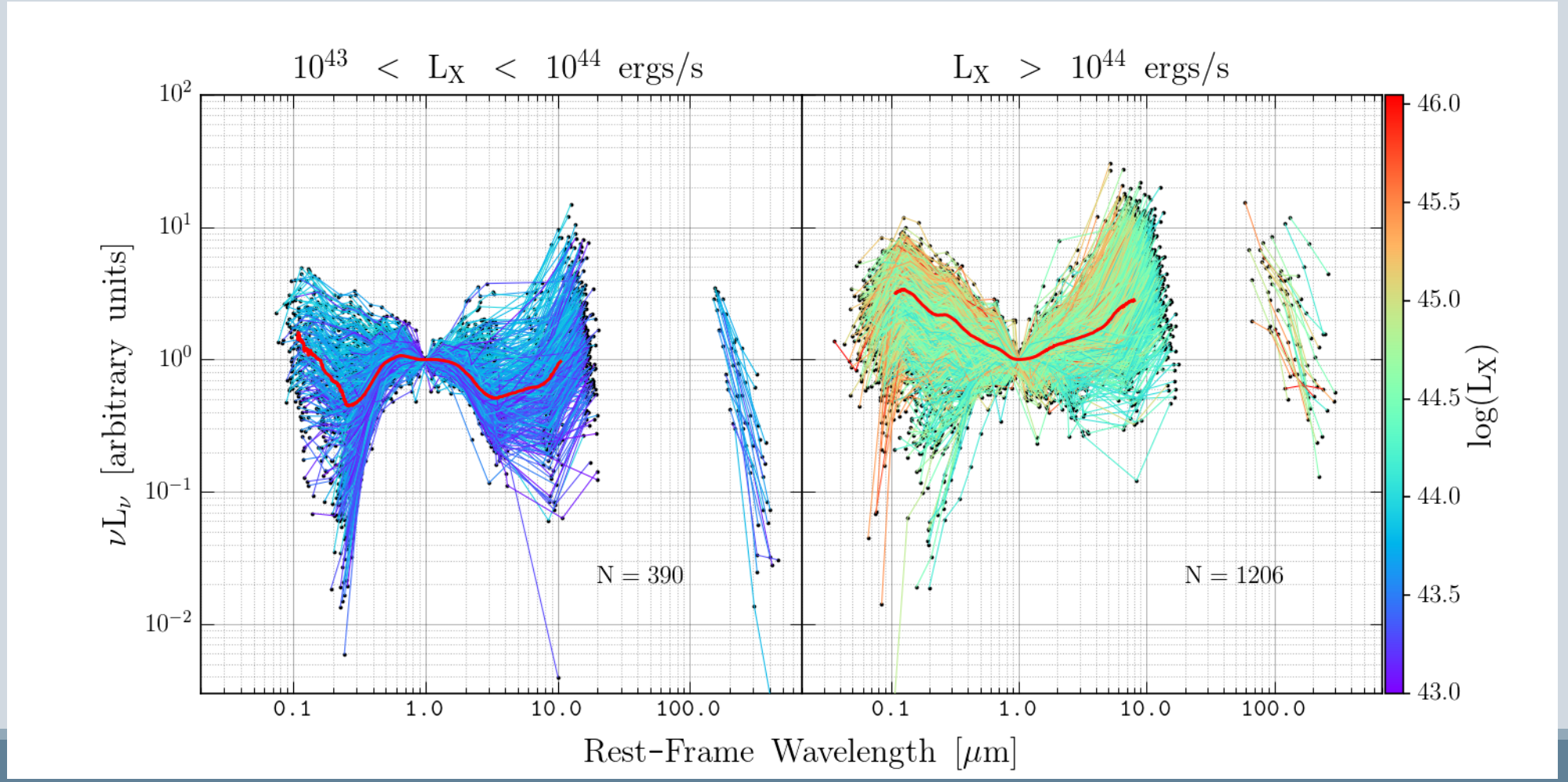
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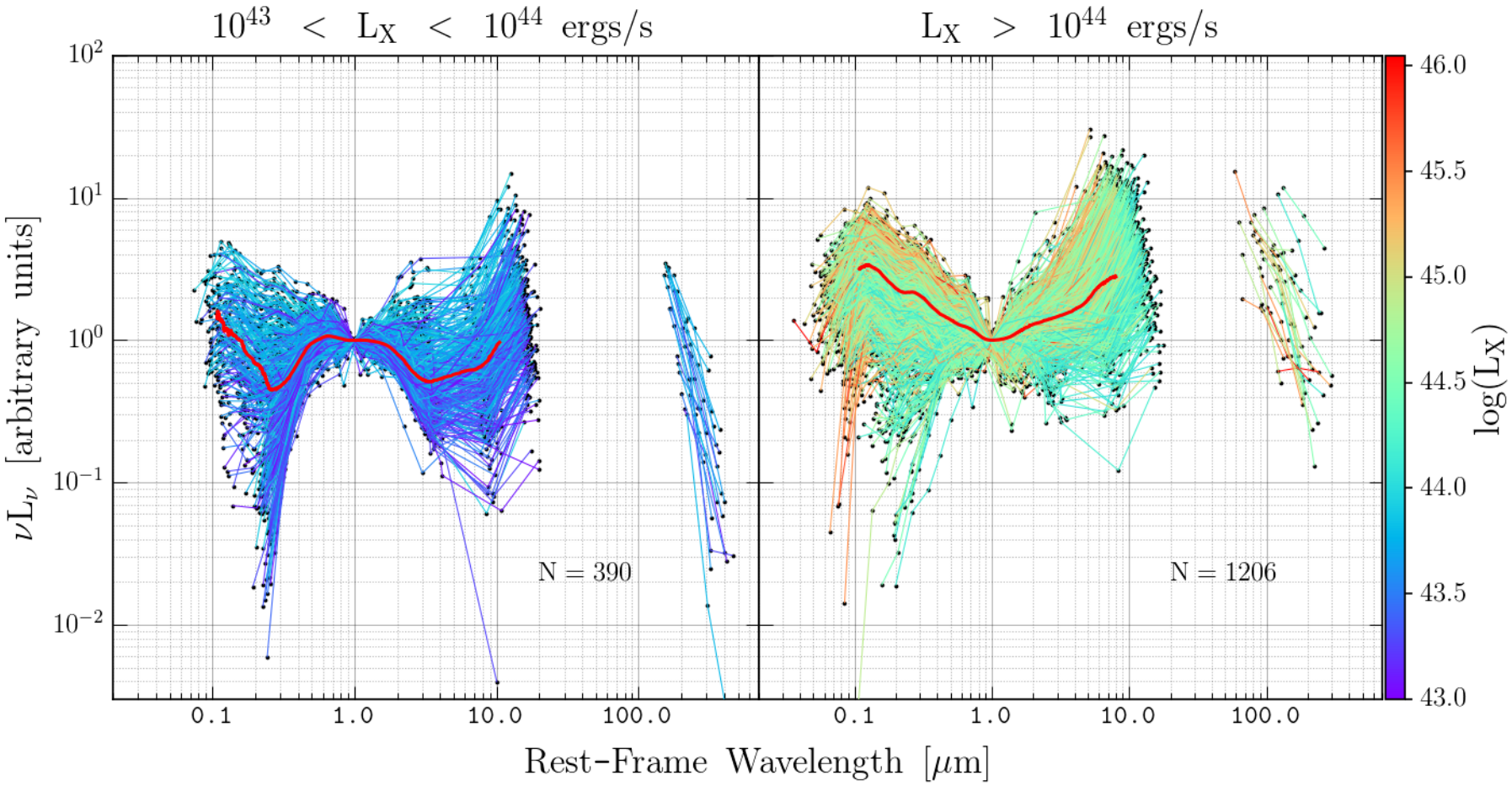
Spectral Energy Distributions



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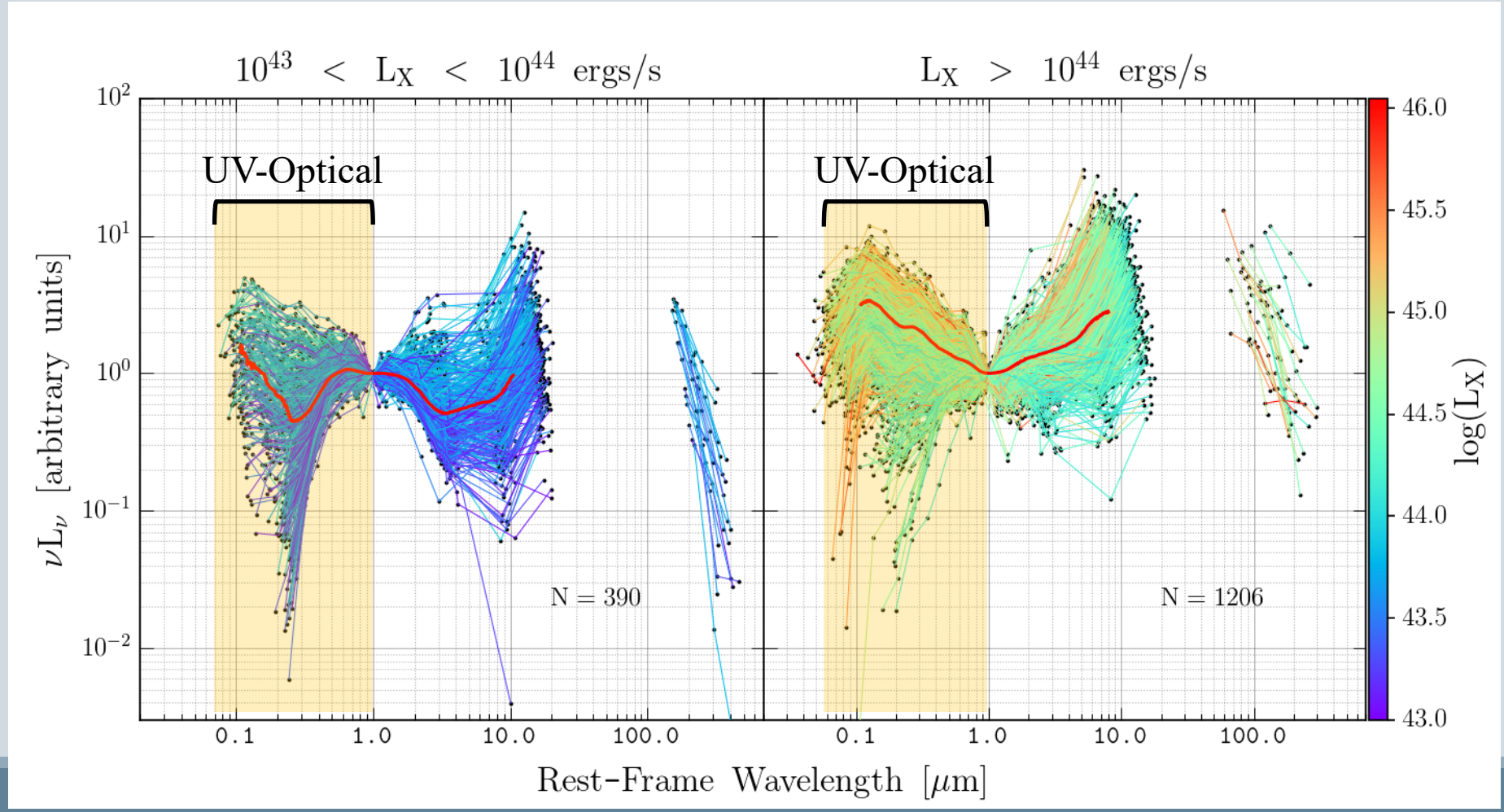


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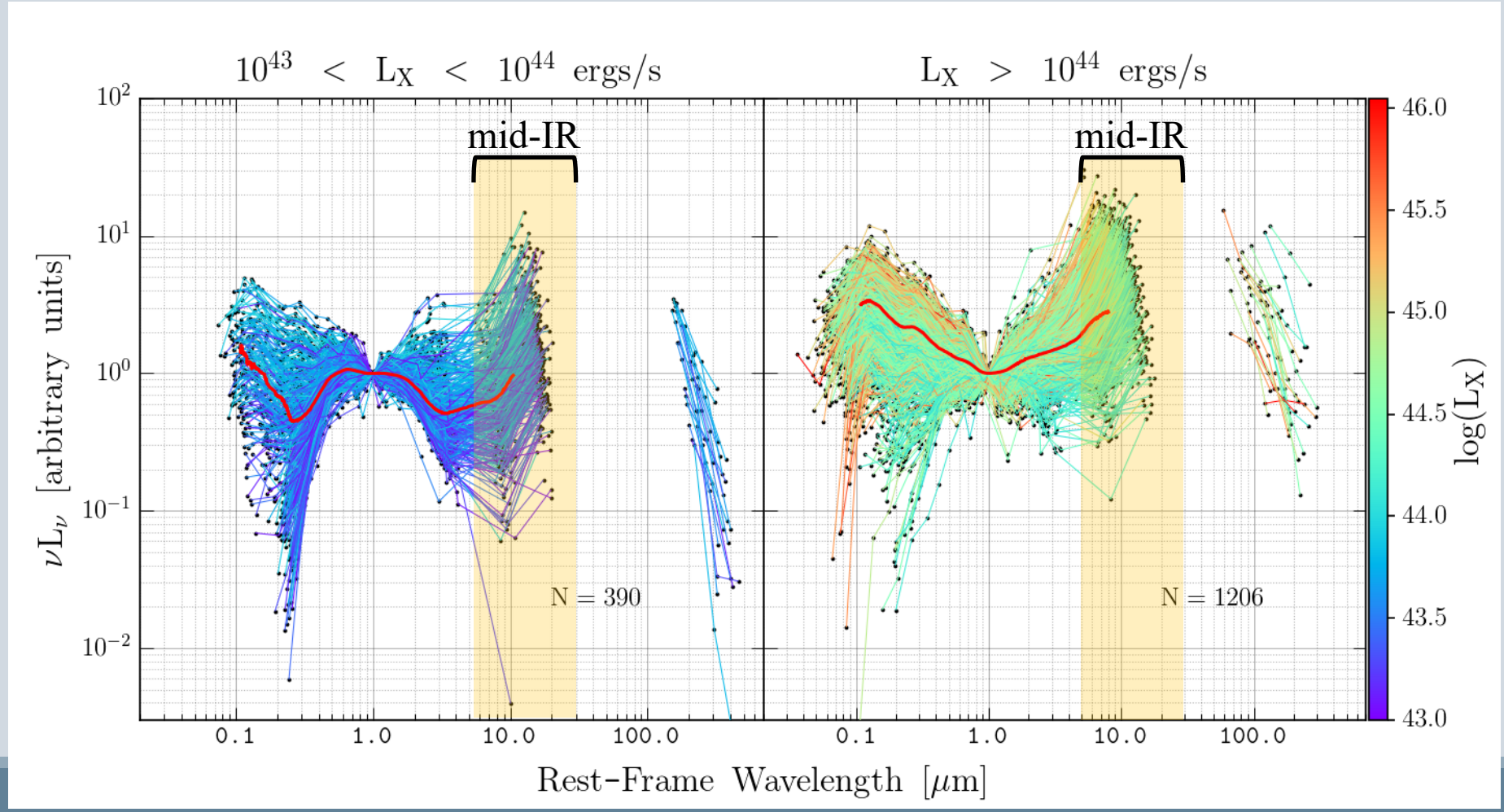


- Effective separation method
- Notable Differences in shape

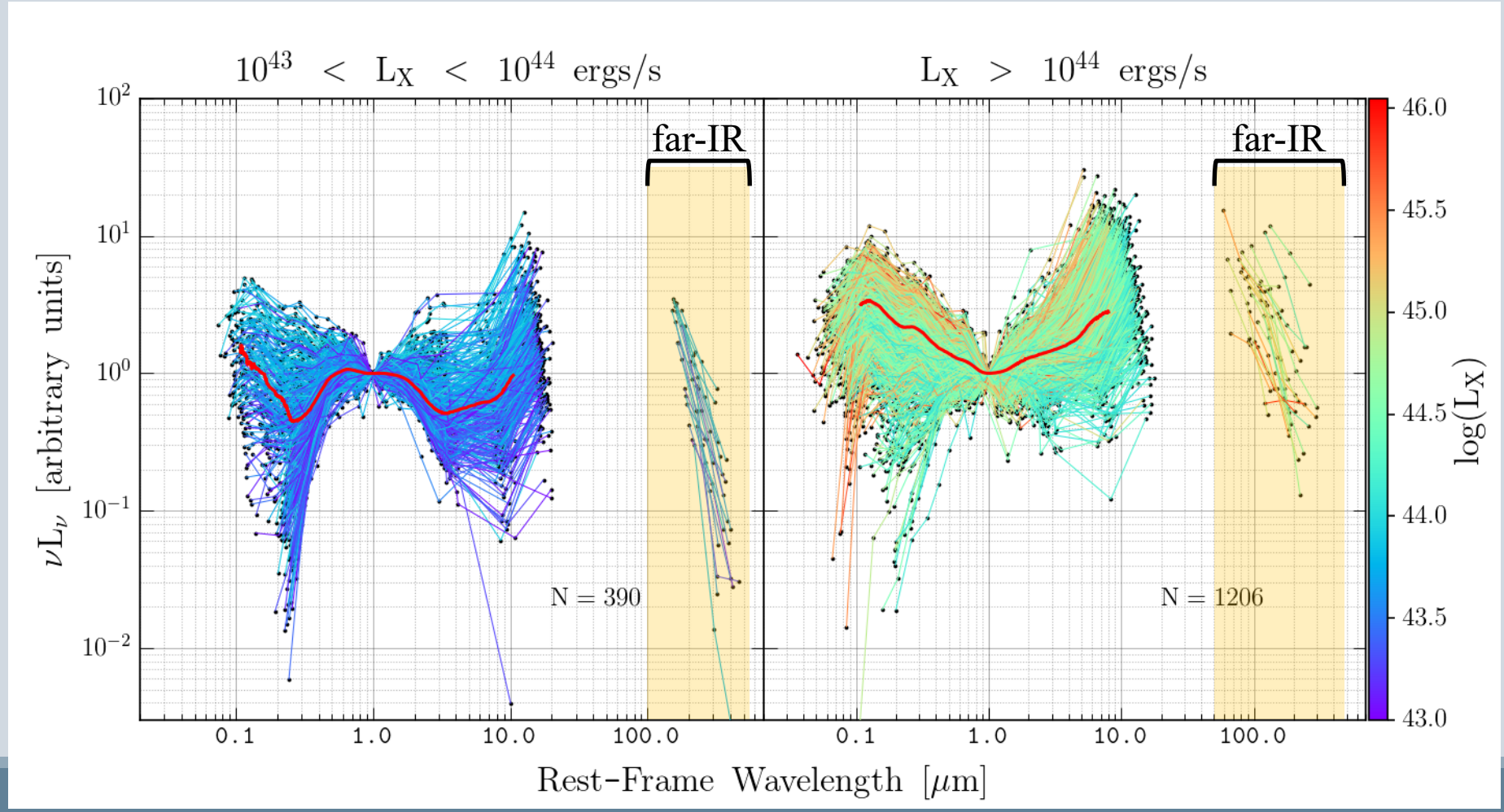
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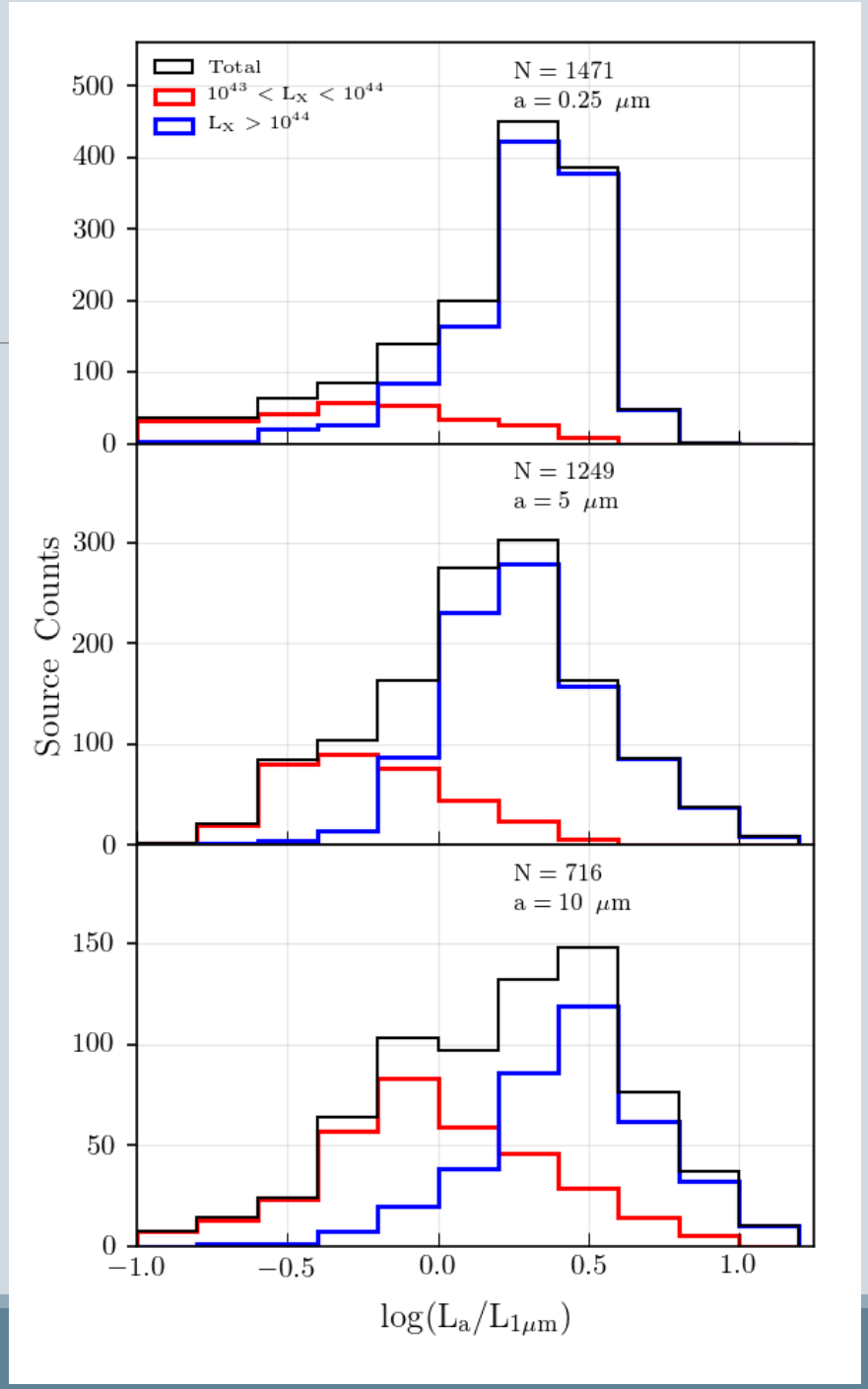
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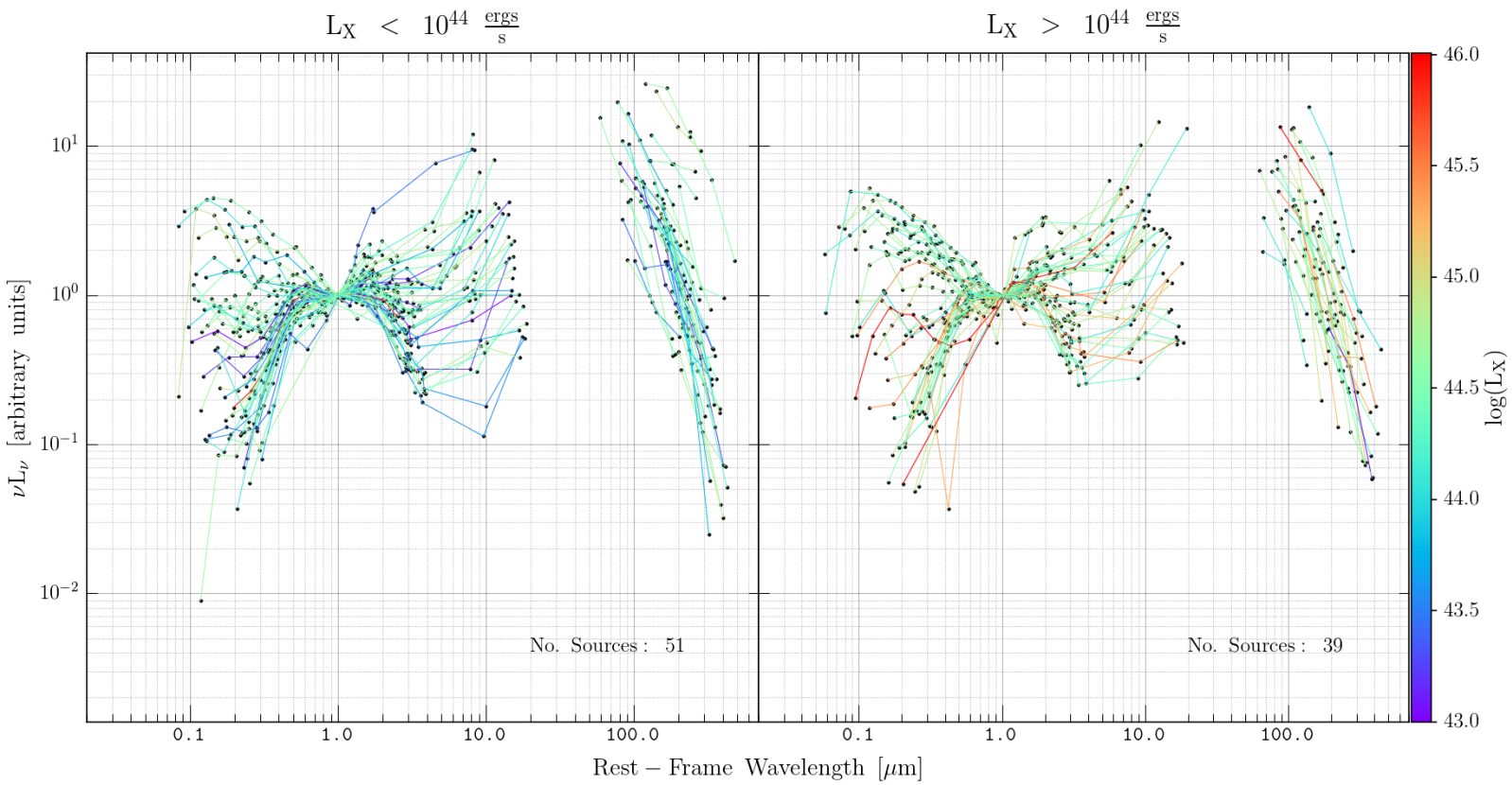
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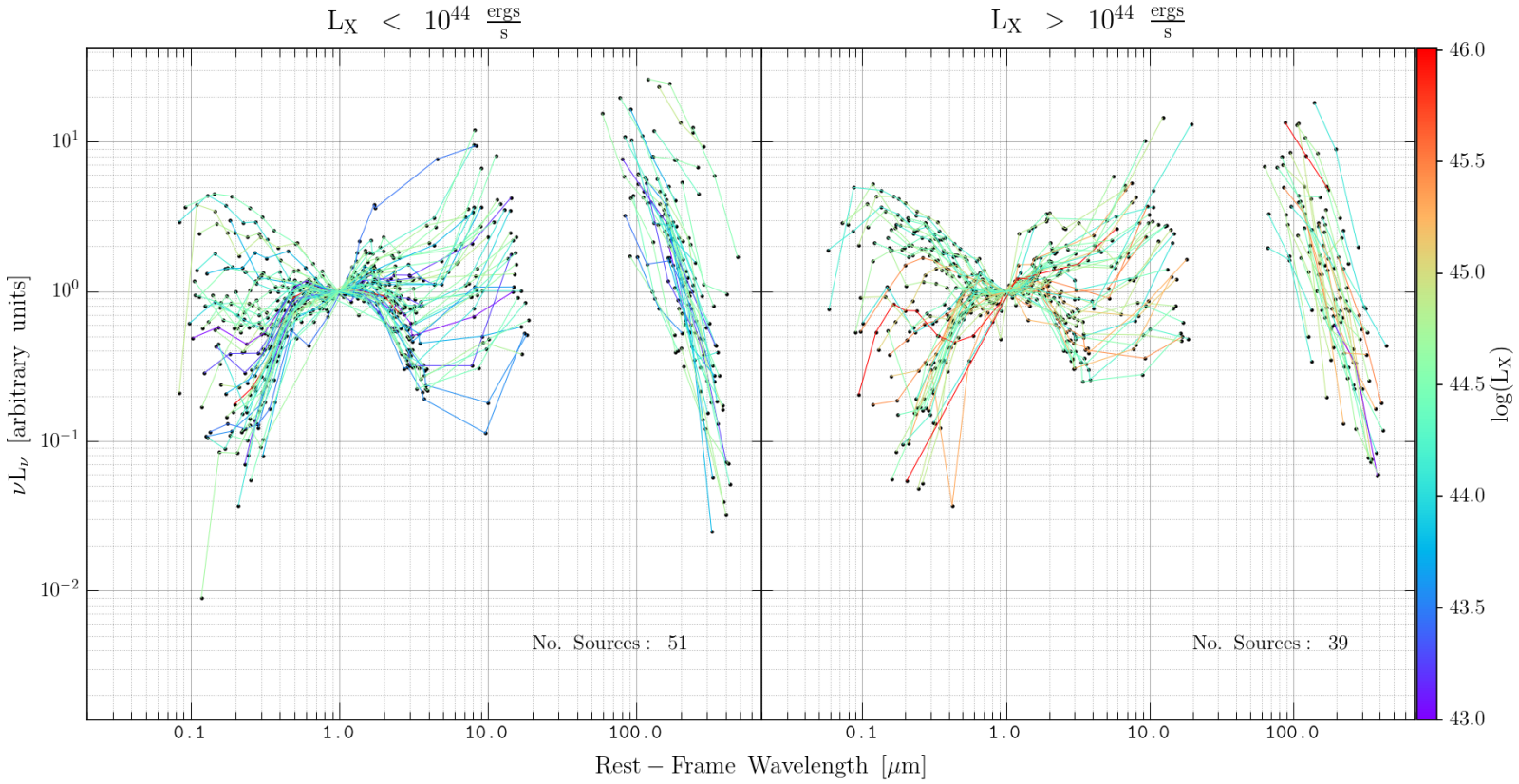
Flux Ratios


Total
$10^{43} < L_X < 10^{44}$
$L_X > 10^{44}$
N = 1471
a = 0.25 μm
N = 1249
a = 5 μm
N = 716
a = 10 μm
Source Counts
log(La/L1μm)

Far-IR Detected Sample



Far-IR Detected Sample



- No difference between Luminosity bins
- Suggests that these are a different type of source
  - Galaxy Dominated

Future Work

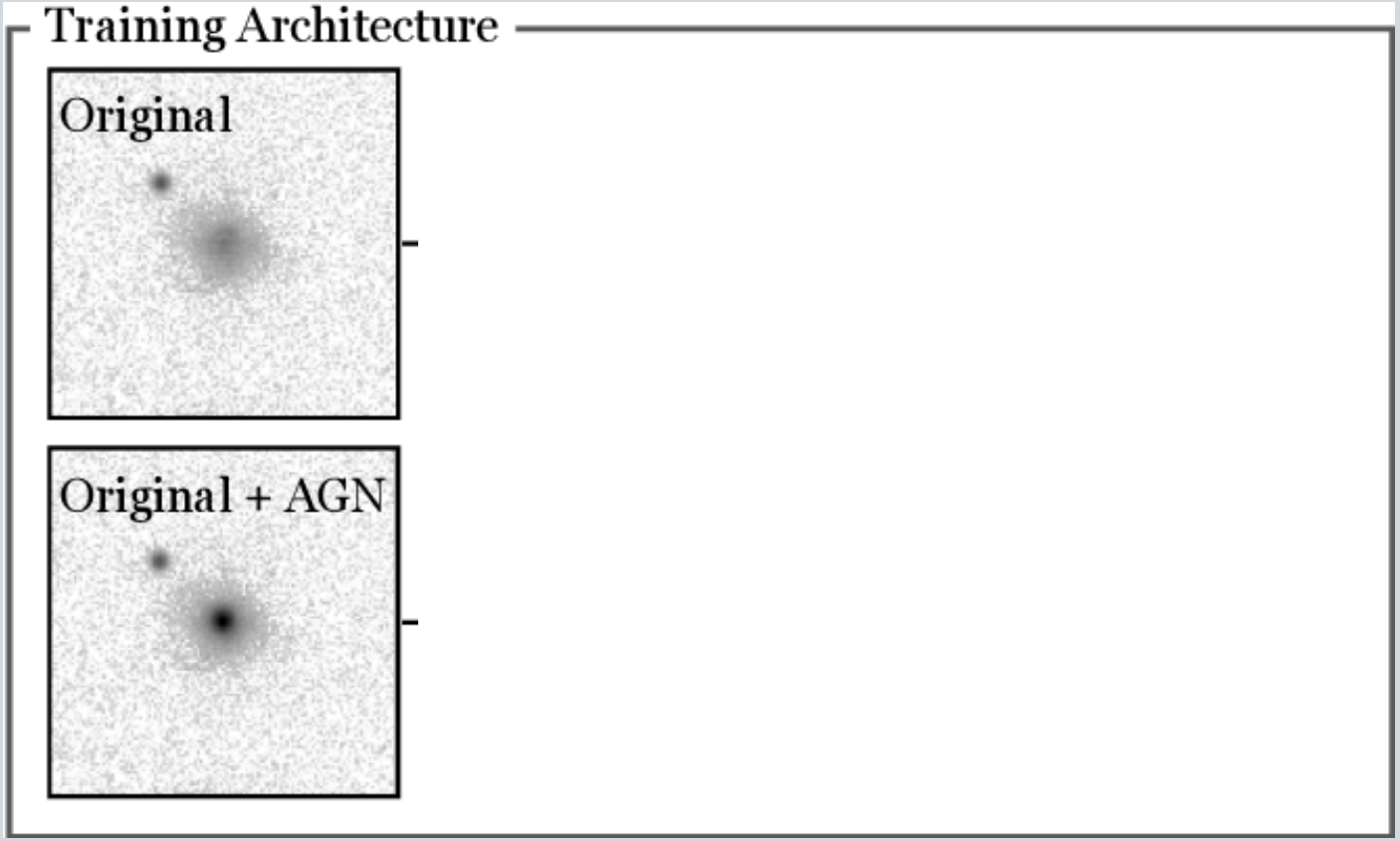
- Investigating obscuration in AGN

- Need method to separate light from host galaxy + AGN
  - Needs to be efficient for large data sets
  - Apply to Hubble imaged AGN in CANDELS survey

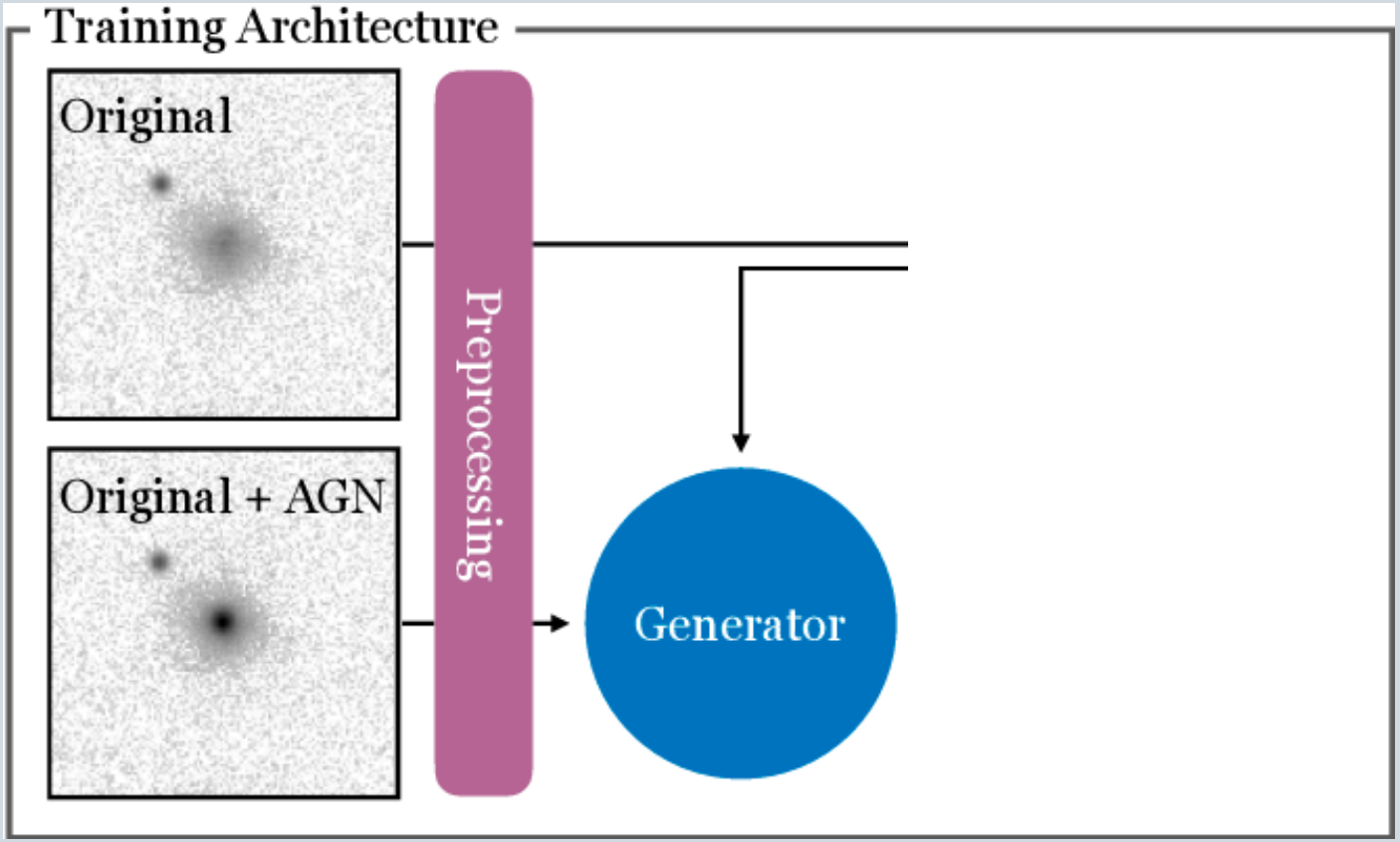
PSFGAN

- Makes use of a Generative Adversarial Network (GAN)
  - Consists of 2 networks: Generator + Discriminator
    - Generator: creates artificial datasets
    - Discriminator: classifies a set as real or fake

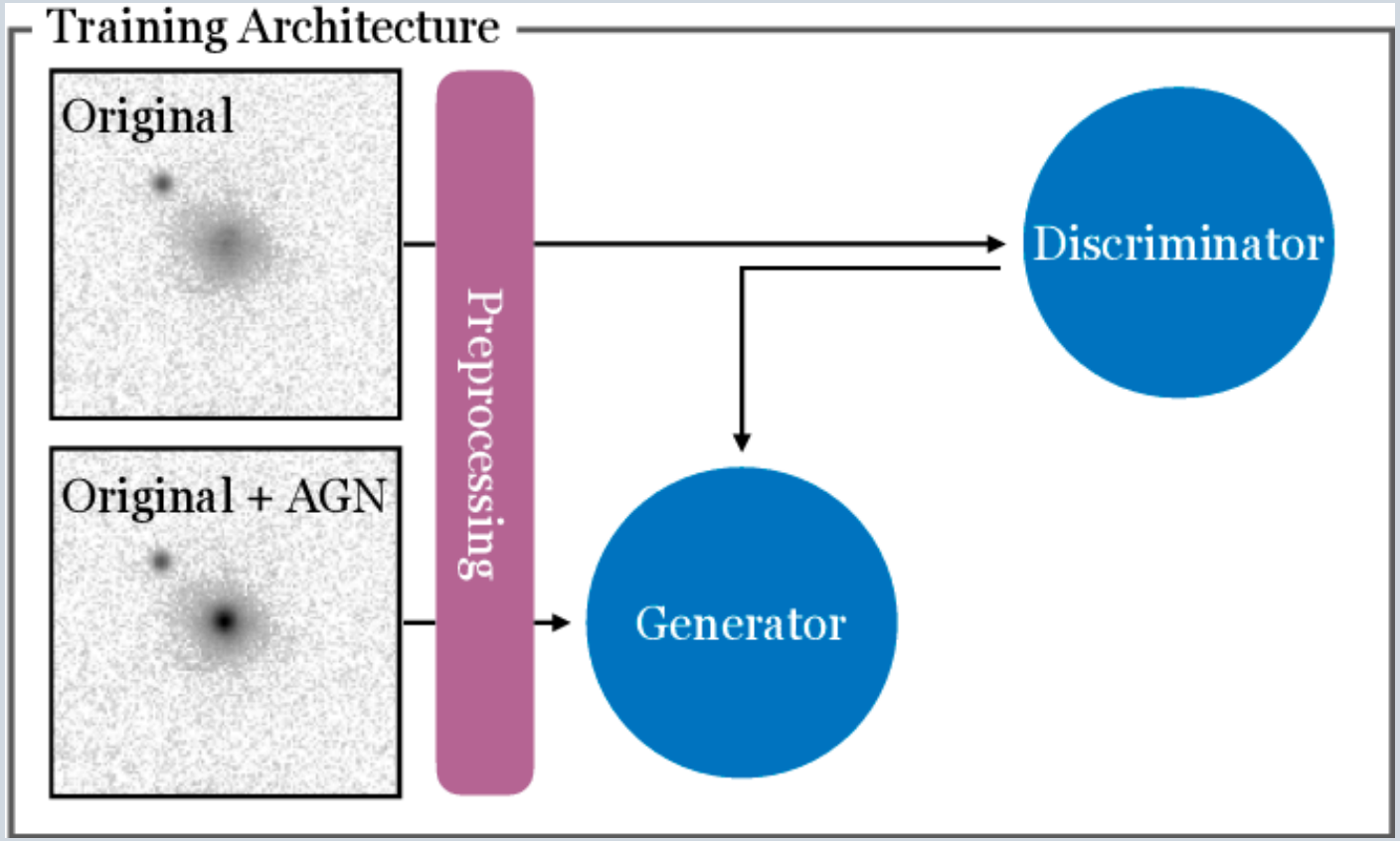
PSFGAN Procedure



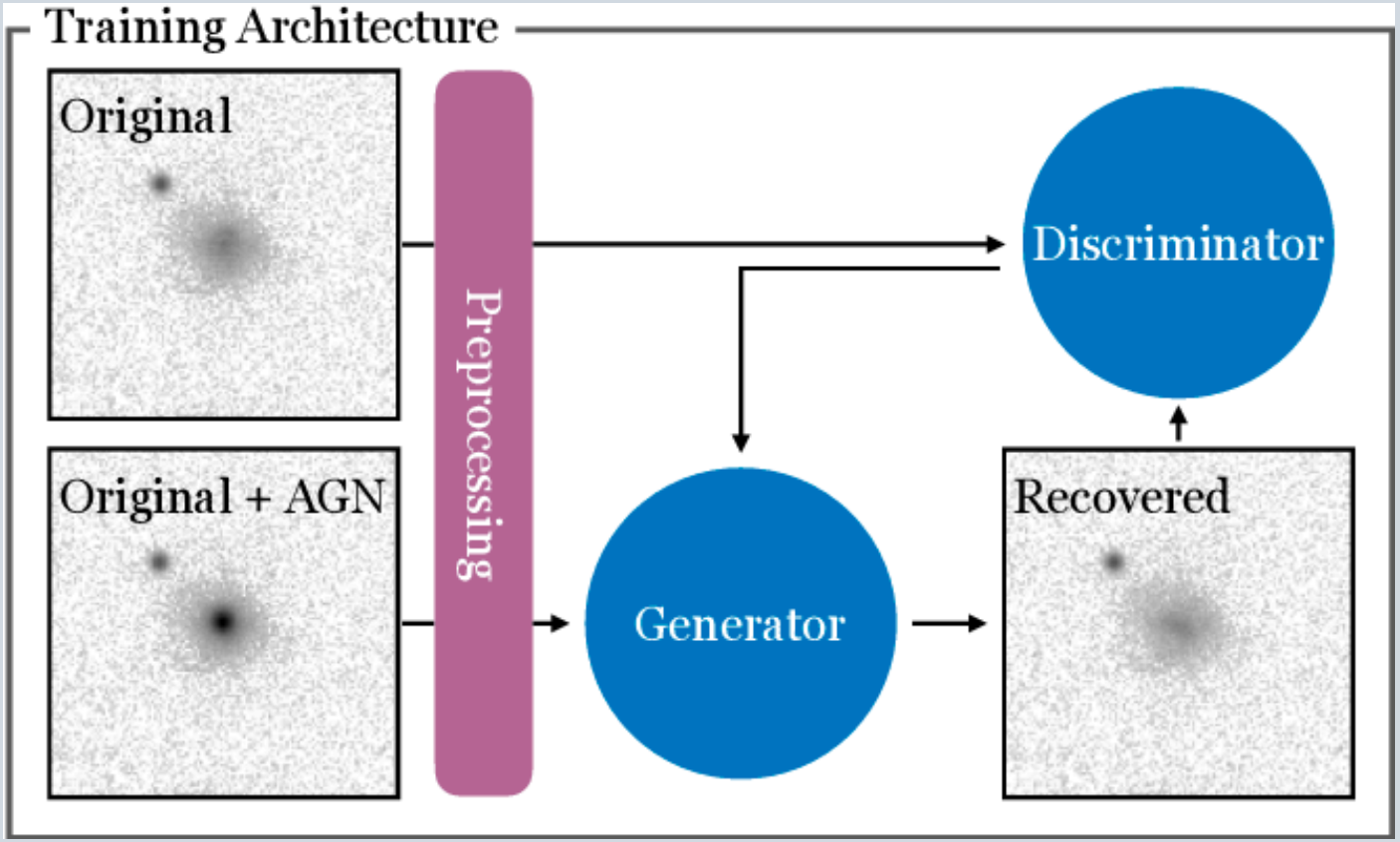
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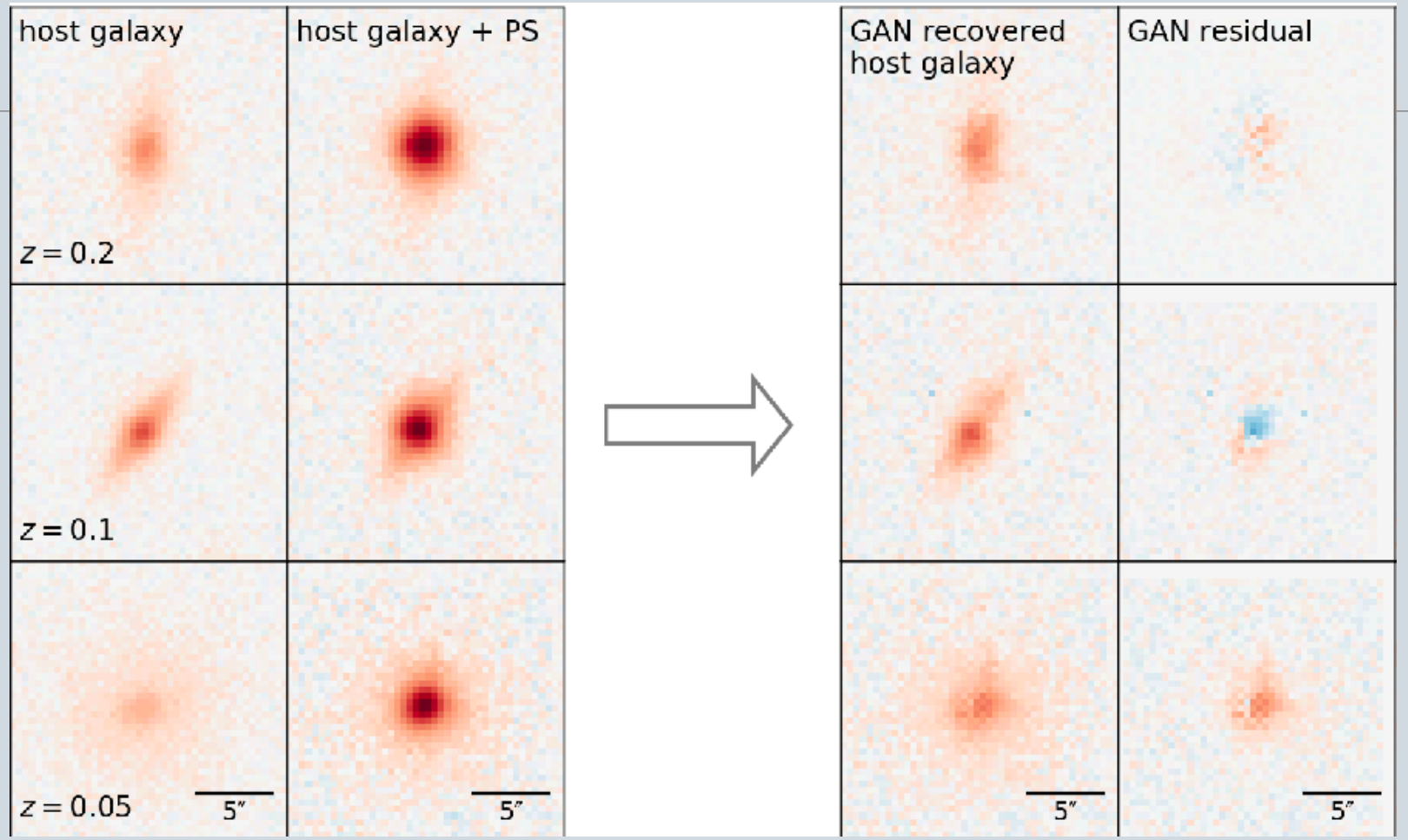
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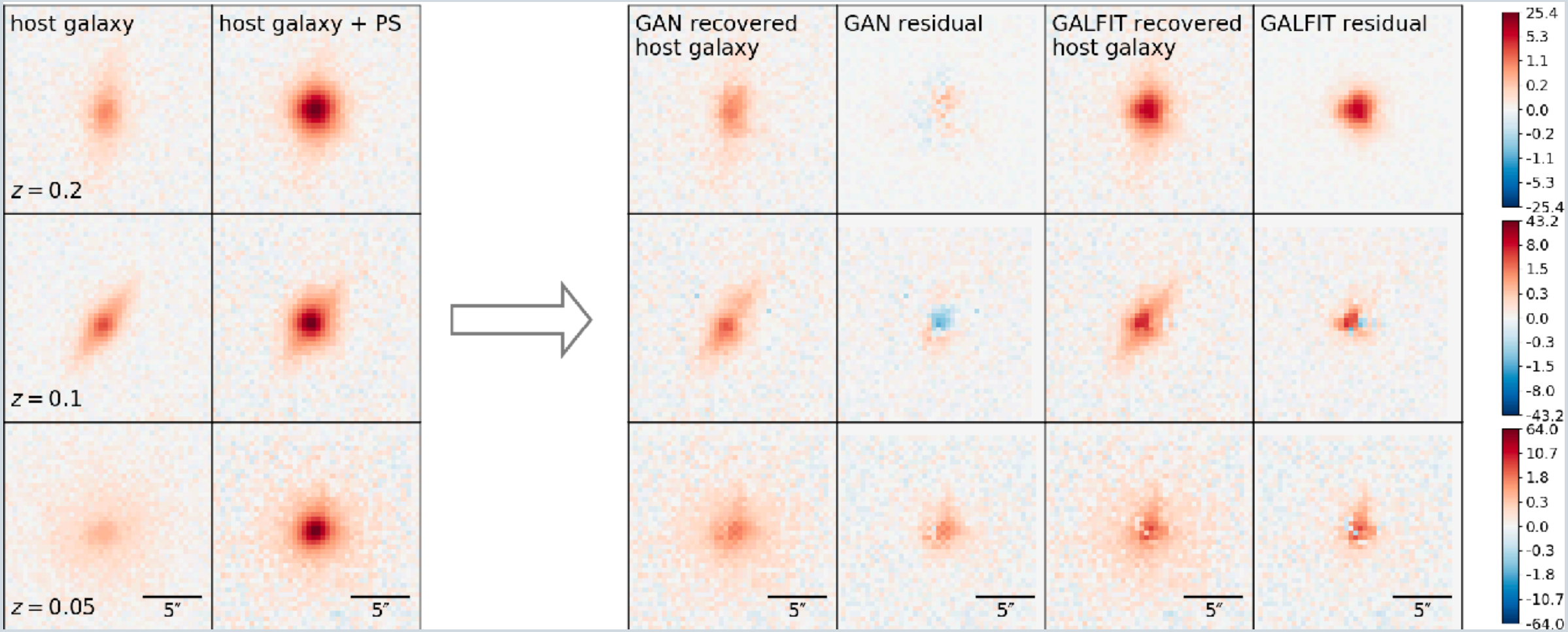
PSFGAN Procedure



PSFGAN Procedure



PSFGAN Procedure



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   - **High L_X (~75%): unobscured, AGN dominated**
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3. Separate sample of galaxy-dominated, potentially heavily-obscured sources

Acknowledgements

- I would like to thank the National Science Foundation (NSF) for their support, and the Institute for Astronomy, University of Hawaii, and the Yale Summer Undergraduate Research Fellowship (SURF) program for their kind hospitality over the course of this project in the Summers of 2017 and 2016, respectively.

- I would also like to thank all of my mentors over the last two summers for their incredible support and guidance.