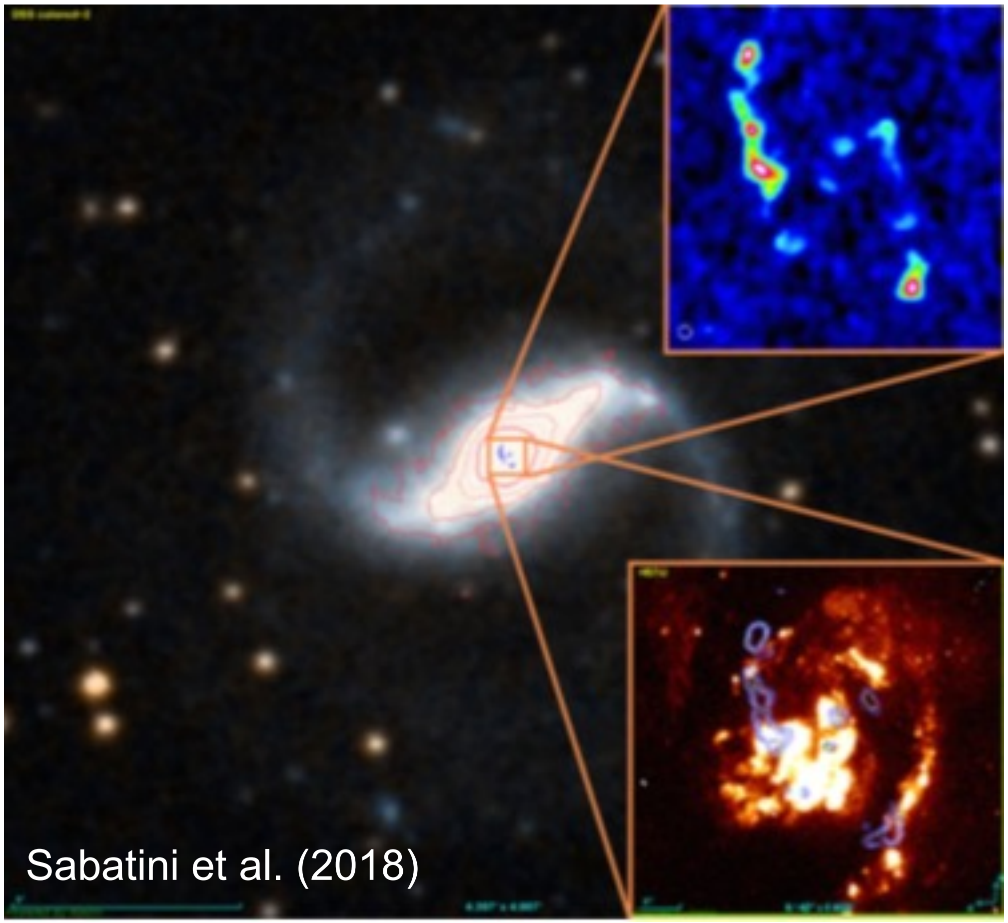
NGC 5135: the Chandra and NuSTAR view of a heavily obscured AGN at z=0.0137



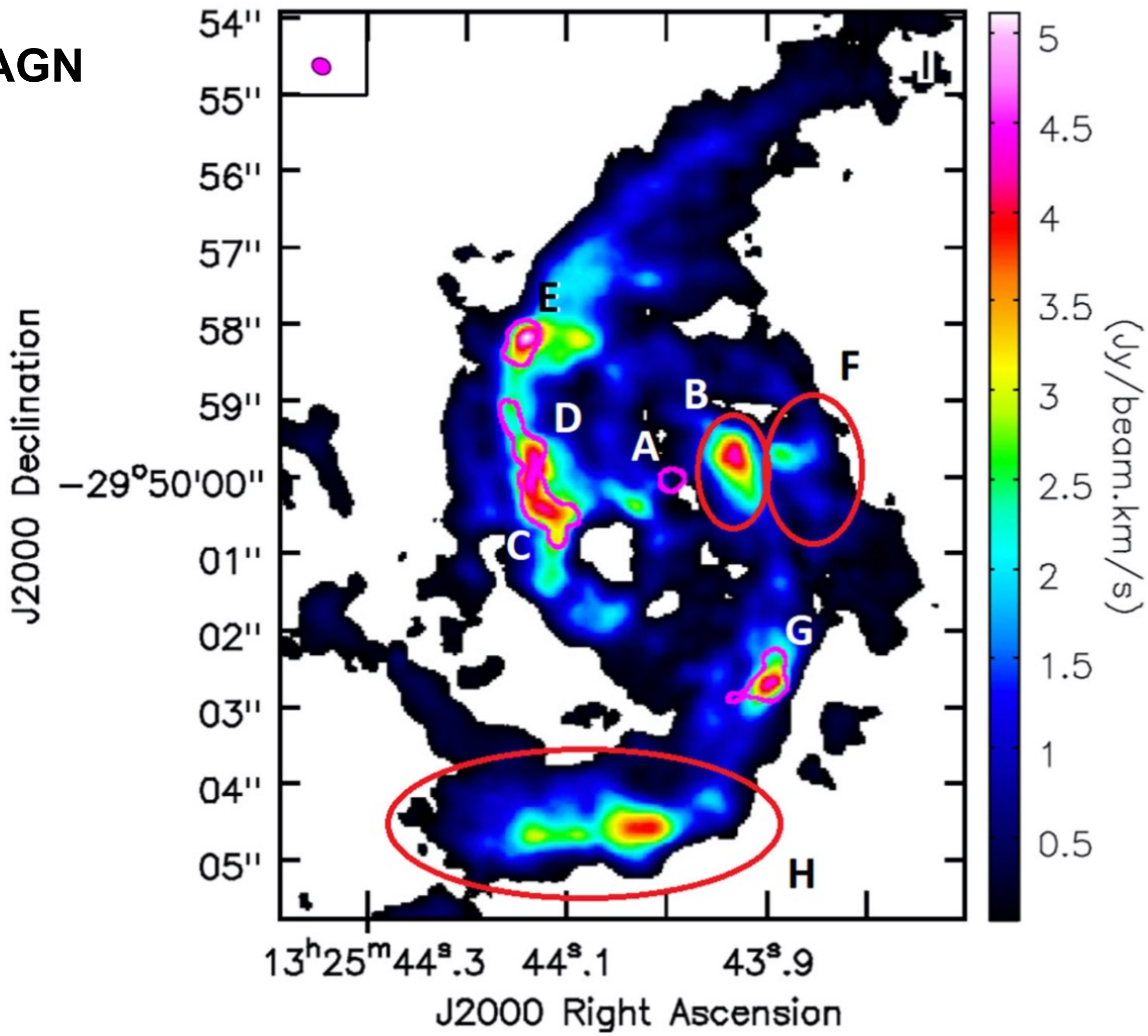
ALMA band 9 (~500μm) continuum

ALMA band 9 CO(2-1) line contours overlaid on HST/F606W image

Image: optical (DSS)
Contours: near-IR (2MASS)

The ALMA view

A: AGN

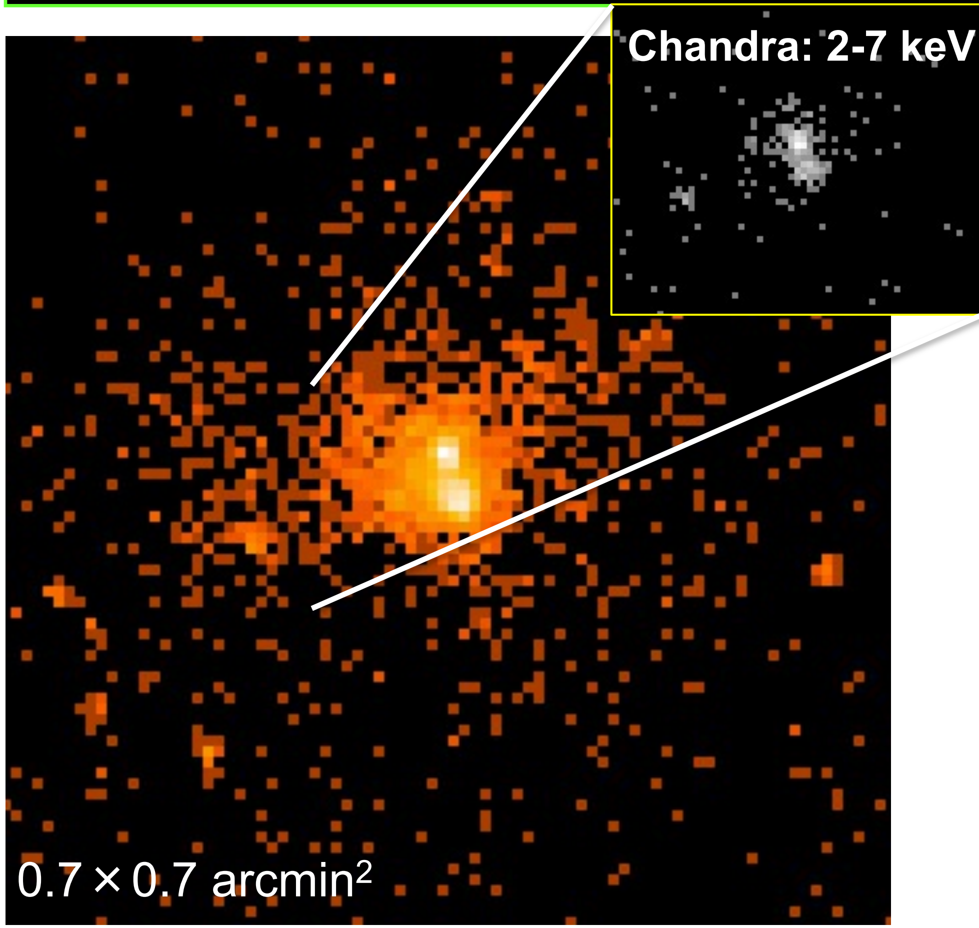


Molecular gas distribution

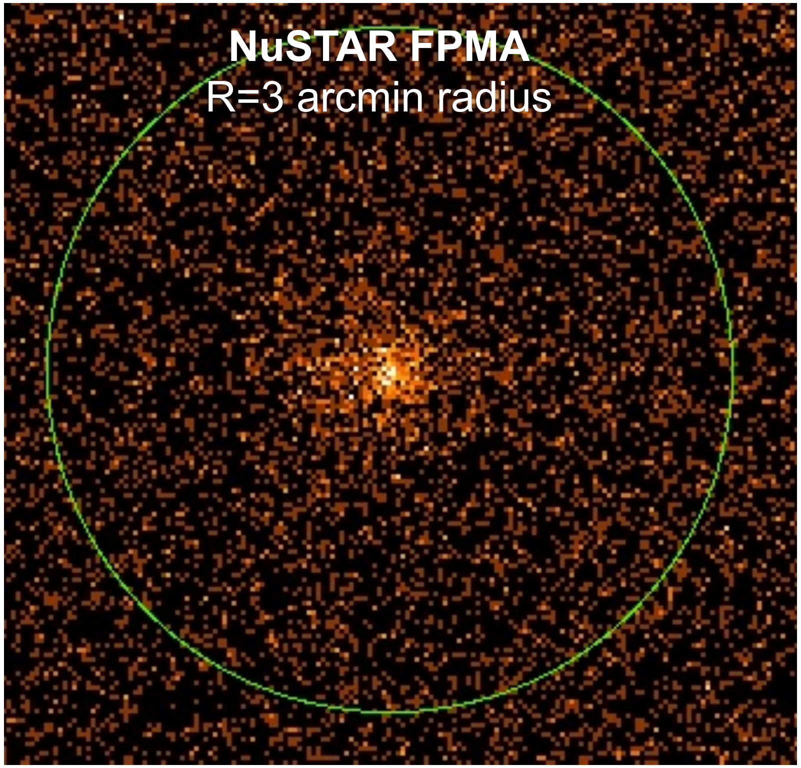
ALMA band 6 (~240 GHz, ~1.2 mm) CO(2-1) line emission

Complex gas structure following the spiral pattern + gas clumps (Sabatini et al. 2018)

X-ray data: *Chandra* and *NUSTAR* observations



***Chandra*: 0.3-7 keV – 29.3ks**



NuSTAR (2 cameras): ~4-40 keV – 33.4ks

- **Chandra**: good spatial resolution (on-axis PSF FWHM~1”), fine to distinguish close pointlike emitting regions and pointlike vs. extended emission
- **NuSTAR**: high-energy spectral coverage, needed to properly constrain the continuum

MAIN PLAN

1. Reprocess the Chandra data and produce a new event file

2. Visualize the Chandra data in different bands (e.g., 0.5−2 keV vs. 2−7 keV) to distinguish the pointlike innermost emitting regions in the galaxy (including the AGN) from the diffuse component

3. Verify the presence of variability in the Northern nucleus during the Chandra observation

4. Extract the Chandra spectra of the two central, apparently pointlike sources and perform an X-ray spectral analysis. *What is the likely nature of the Southern component?*

5. Analyze the already extracted NuSTAR FPMA and FPMB spectra (from a R=30” region including the two central components visible in the Chandra data) and perform an X-ray spectral analysis. *Which of the two pointlike sources contribute most to the NuSTAR spectrum?*

OPTIONAL PART

- Extract the Chandra spectrum using a R=30” circular region (adopted for NuSTAR spectra); compare Chandra vs. NuSTAR spectral results

or

- Use more physically motivated absorption models (e.g., MYTorus, BORUS) applied to the obscured AGN spectrum to place constraints on the properties of the absorber (e.g., geometry, covering factor, …)

References

- Yamada et al. 2020, ApJ, 897, 107
- Sabatini et al. 2018, MNRAS, 476, 5417
- Levenson et al. 2004, ApJ, 602, 135