[CII] Map of NGC 7331

Sutter & Fadda, 2021.

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Why NGC 7331?

- Nearby (14 Mpc), highly-inclined (72°) galaxy
- Milky Way analog
- Molecular ring
- Wide range of archival data

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Why [CII]?

- Often brightest emission line
- Potential tool for measuring star formation rates, molecular gas in the early universe
- Still a lot of unknowns
- Currently only detectable by SOFIA in the local universe

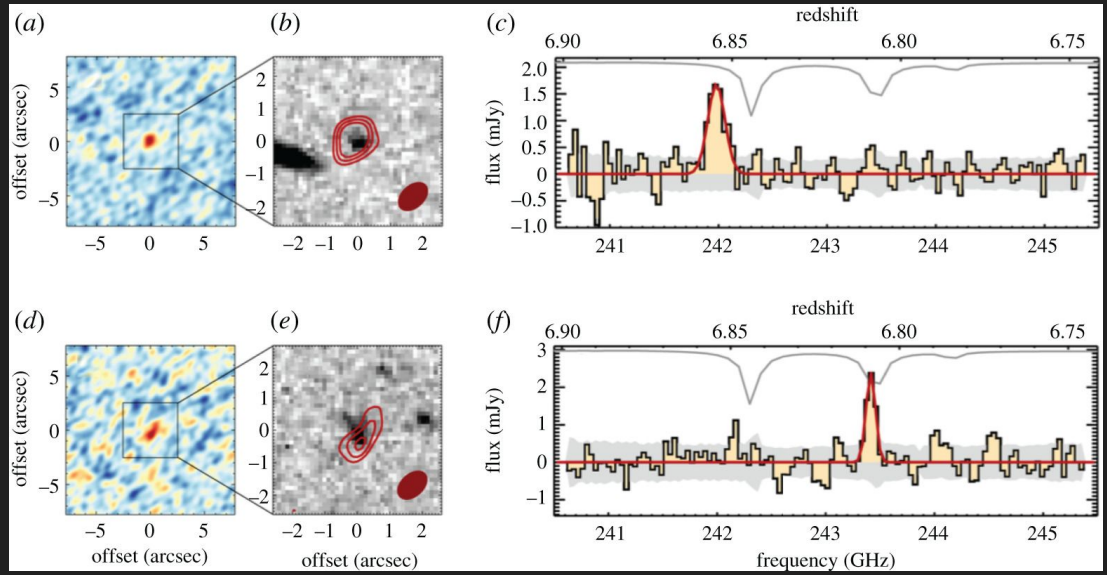

Image Credit: Hodge & da Cuhna, 2020

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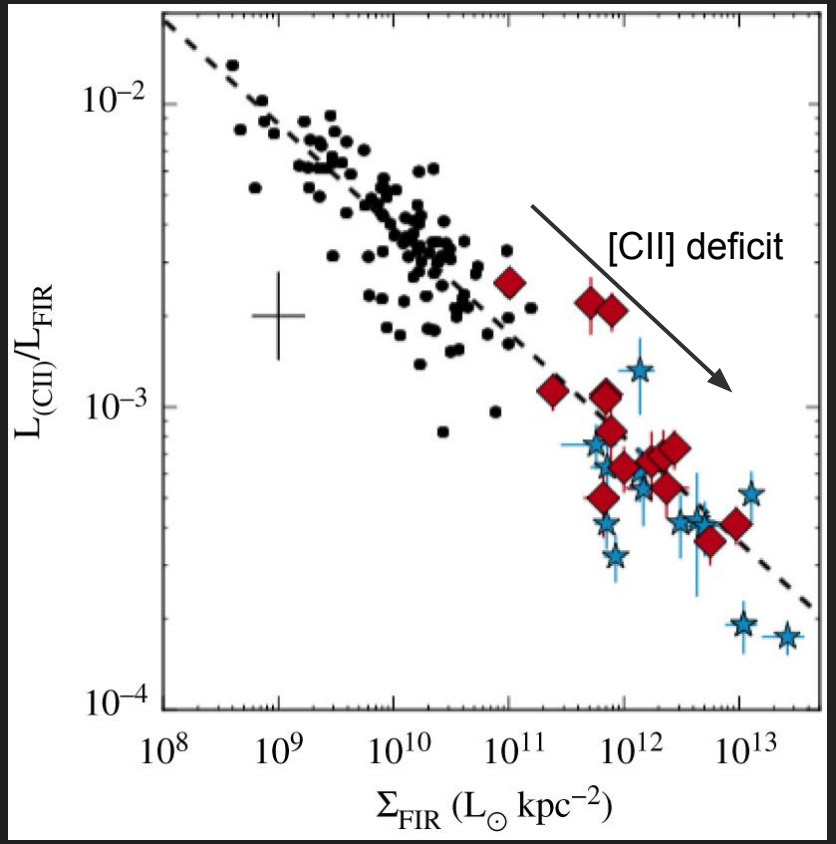

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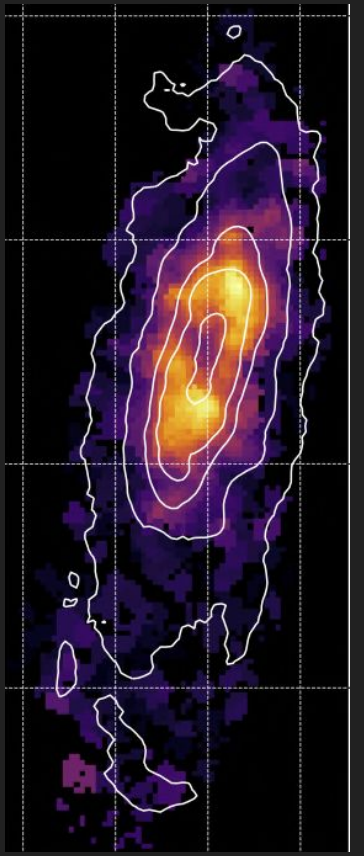
New FIFI-LS [CII] Map

- Obtained during Cycle 7
- 13 AORs, covering much of the disk
- Molecular ring is clearly visible

Optical
(SDSS)

Infrared
Spitzer
3.6 μm



FIFI-LS
[CII] 158

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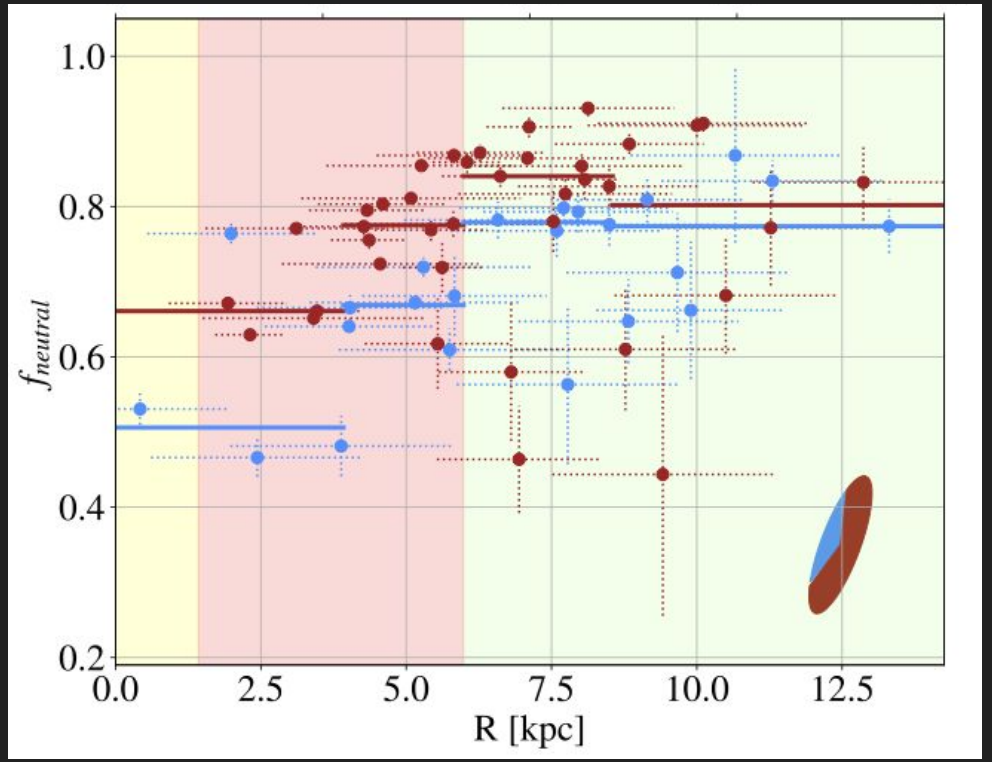
Origin of the [CII] Emission

- Use archival [NII] 205 data to determine the fraction of [CII] emission from neutral ISM
- Azimuthal and radial dependencies suggest environmental differences in [CII] origin location



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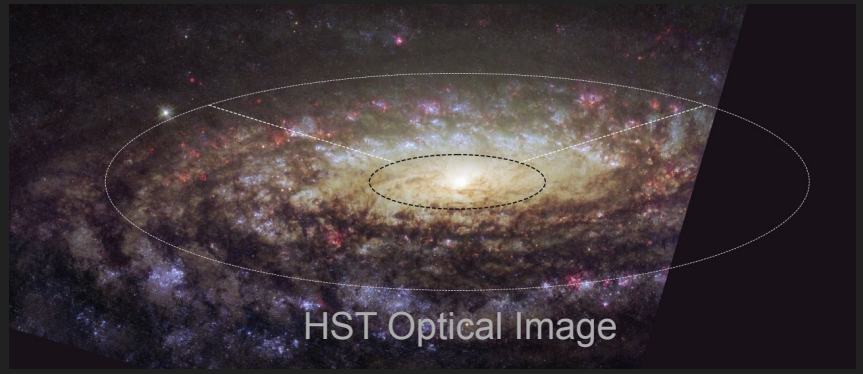

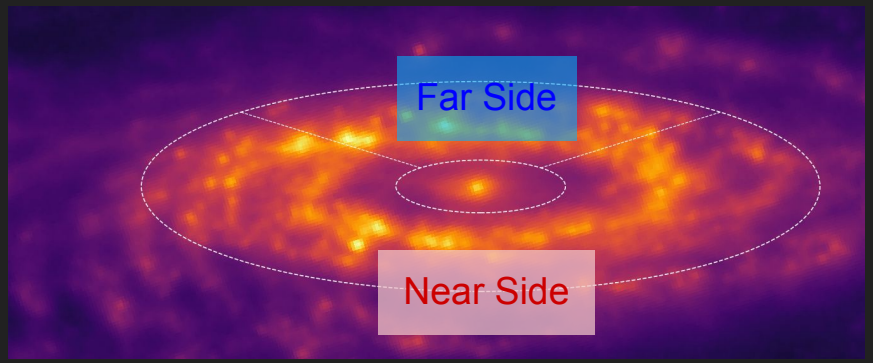

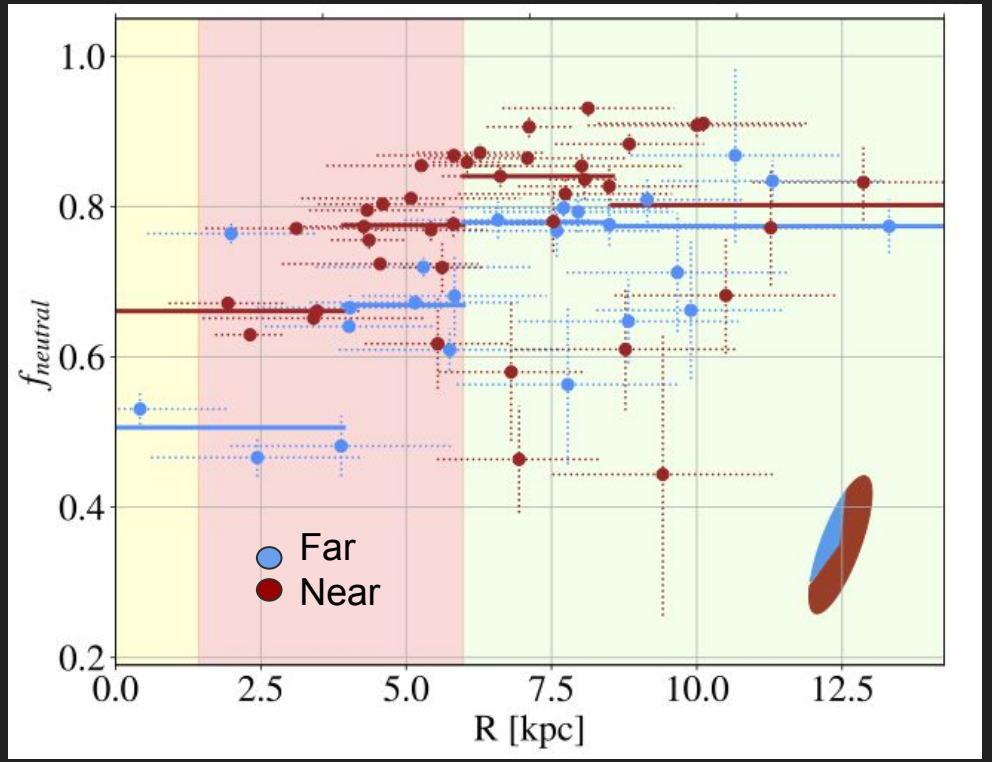

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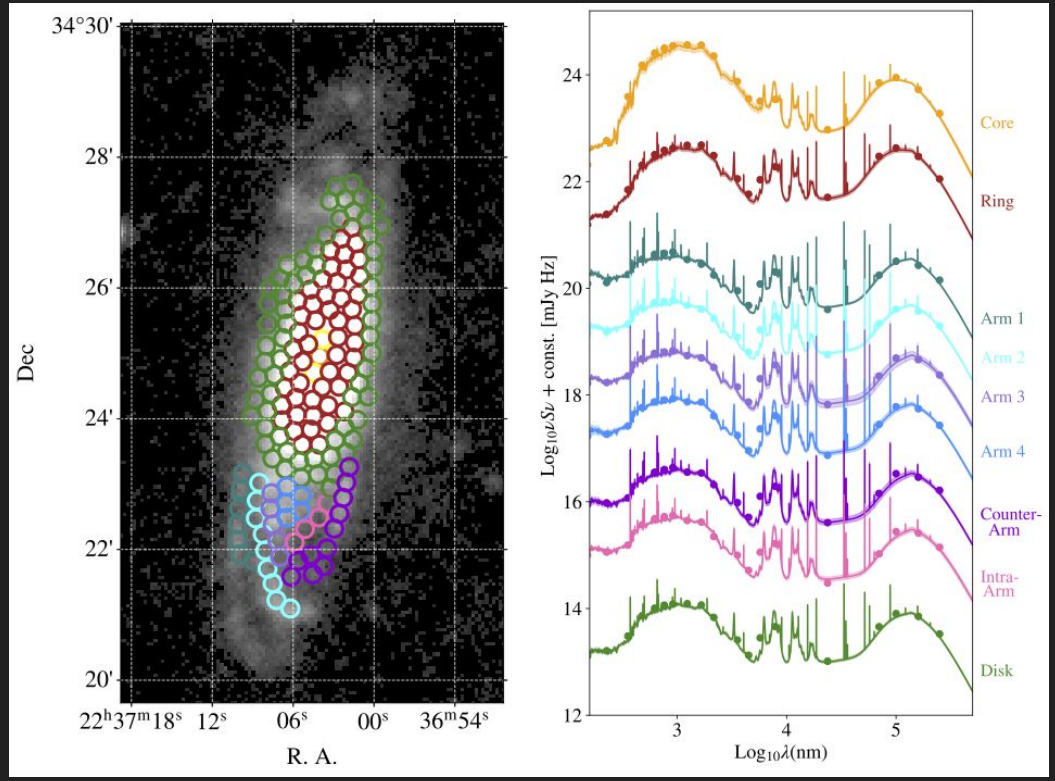
Isolating Environments



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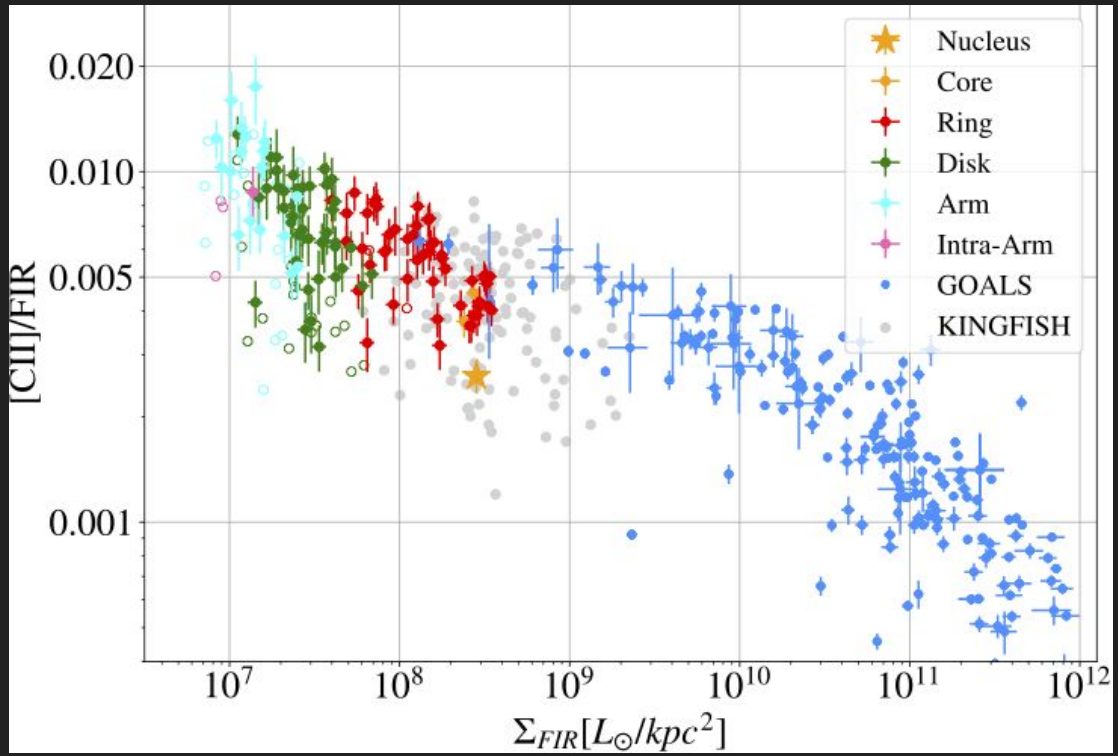
Local extension of the [CII] deficit

- [CII] deficit is a frequently cited issue with using [CII] as SFR indicator
- Adding data from NGC 7331 to plots of [CII]/FIR shows clear extension from ULIRGS to NGC 7331's quiescent disk



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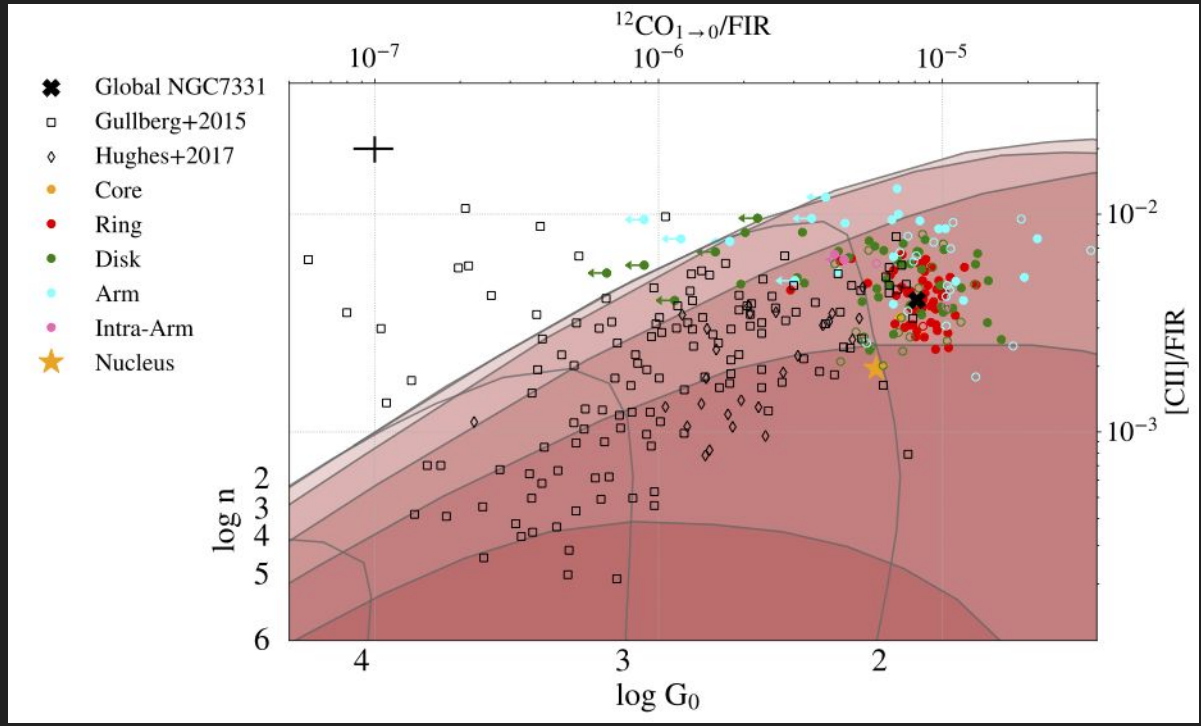
Comparisons to CO

- Use HERACLES CO map to compare [CII] and CO
- See areas with [CII] emission but no CO emission
  - Potentially CO-dark molecular gas?



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Conclusions

- We present a new [CII] map of NGC 7331
  - See effects of observing perspective
  - Measure local, low luminosity extension of [CII] deficit
  - Measure [CII] emission across bright molecular ring
- Further [CII] maps are needed to demystify high-z counterparts

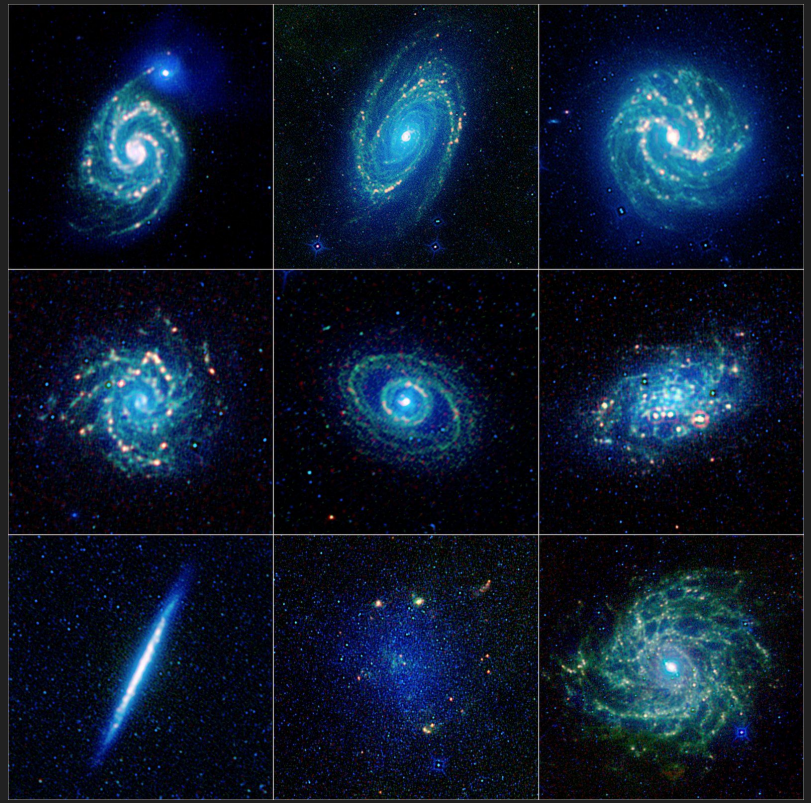

Image Credit: NASA/JPL-Caltech/UCLA

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Thanks!

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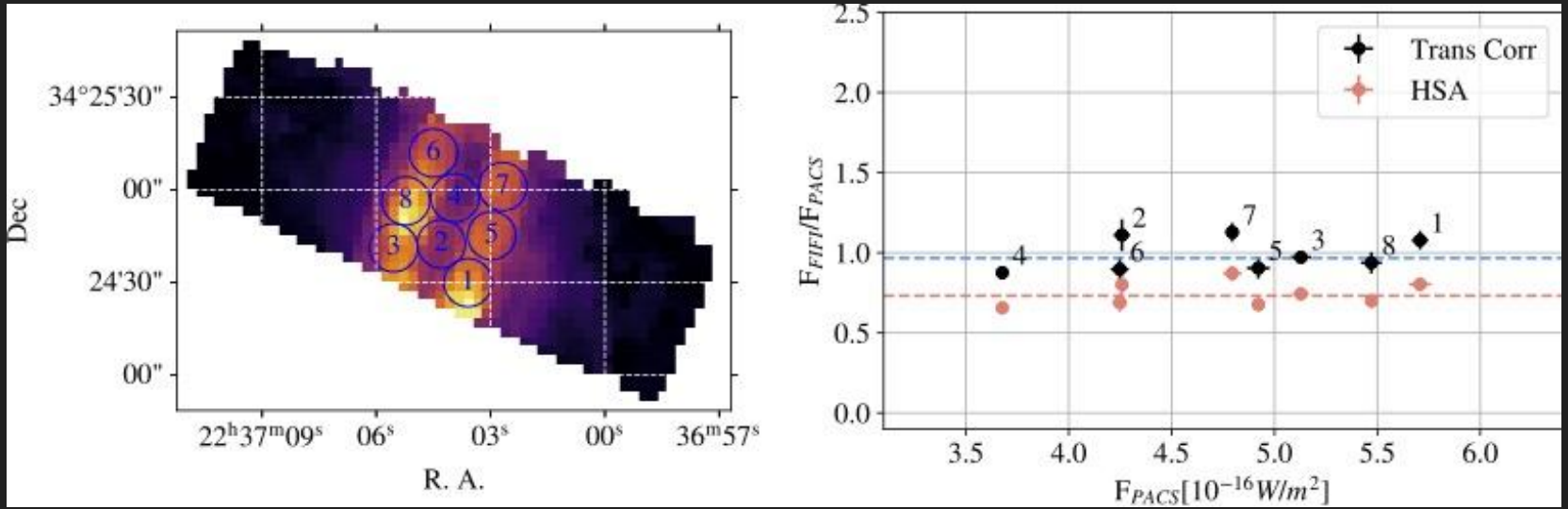
Comparison with PACS data

- A strip of NGC 7331 has been previously observed by PACS



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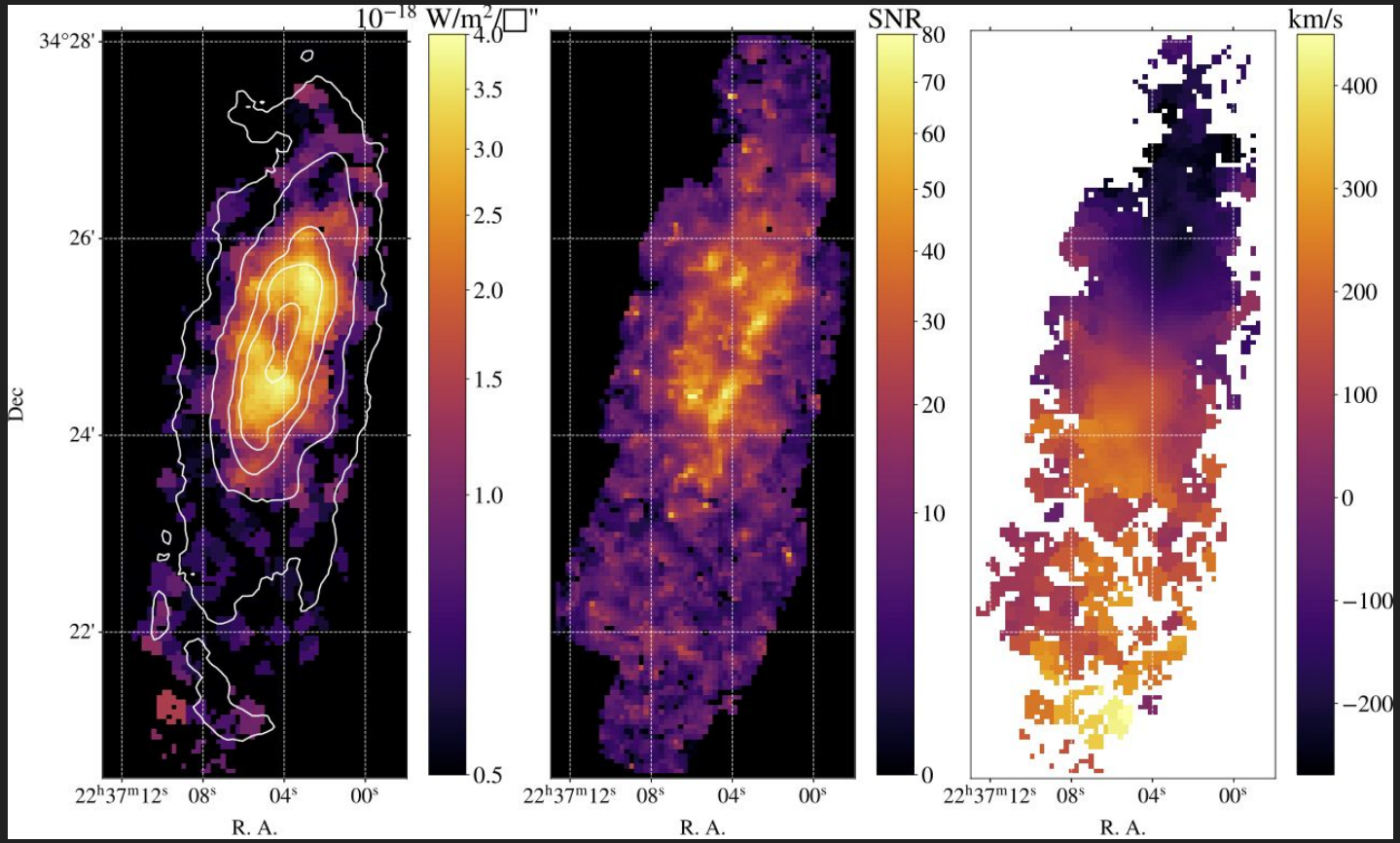

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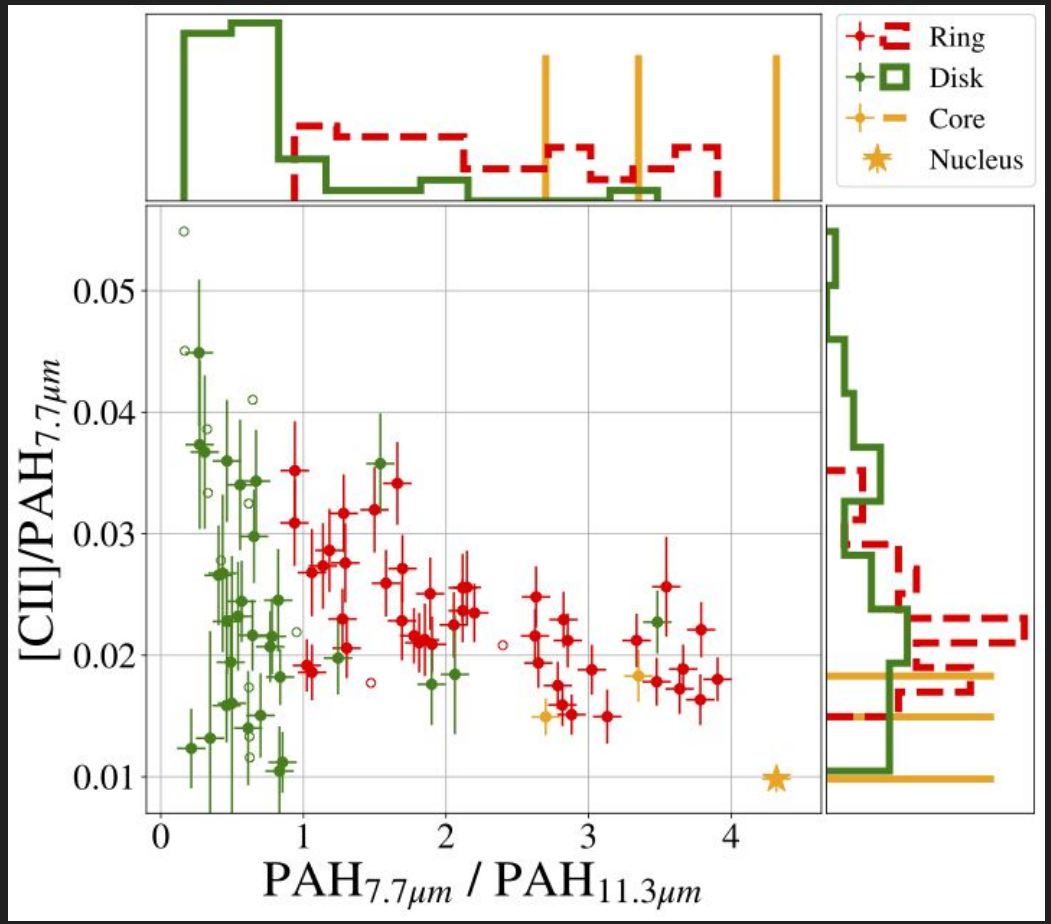

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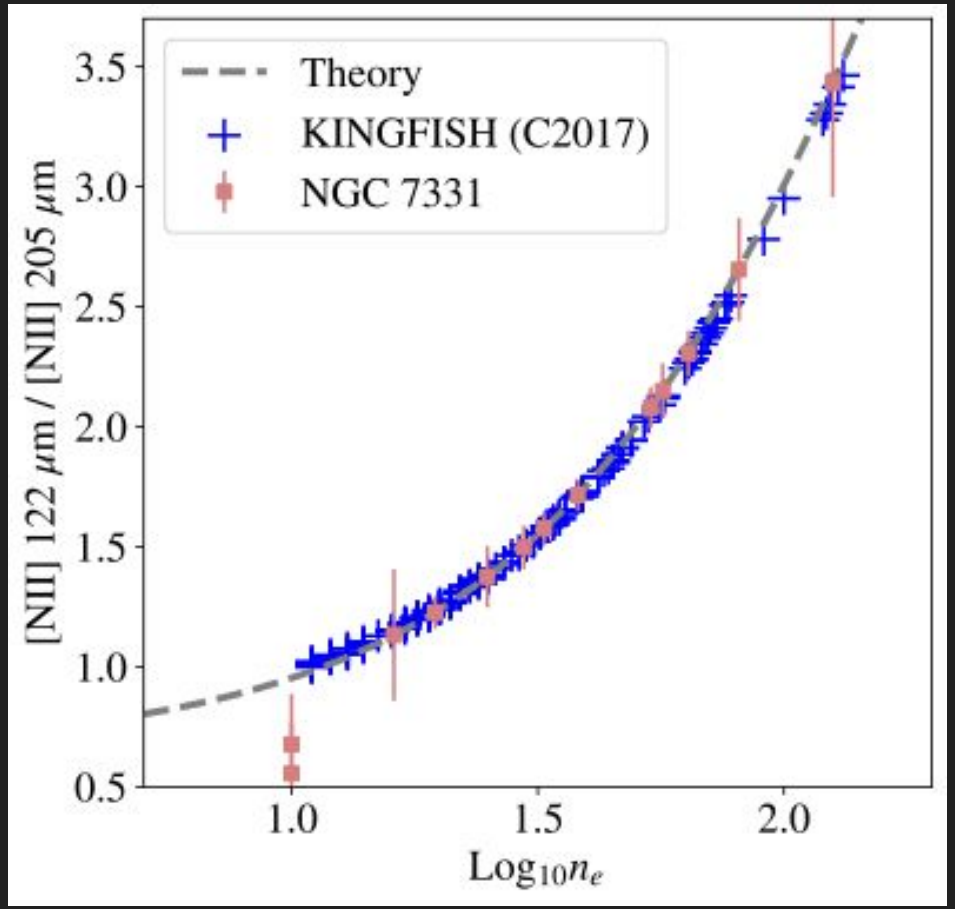

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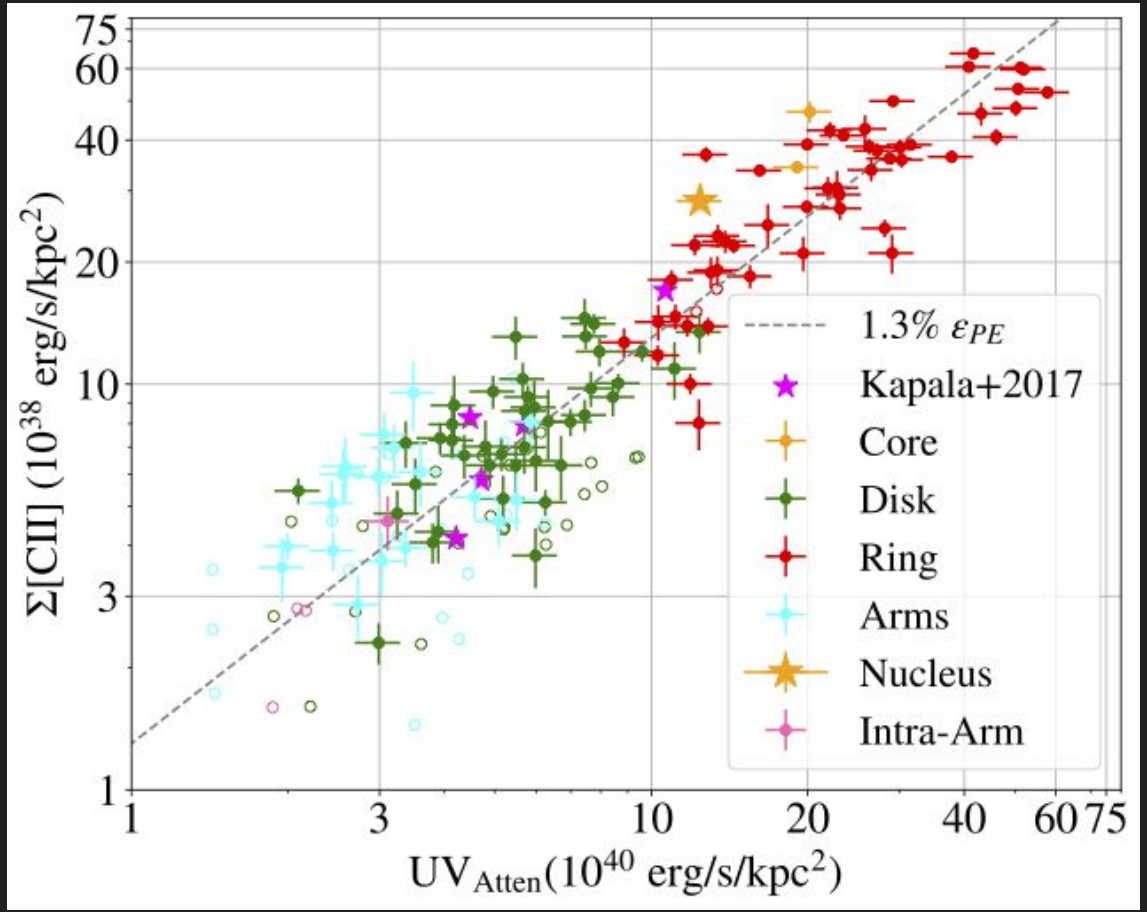

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