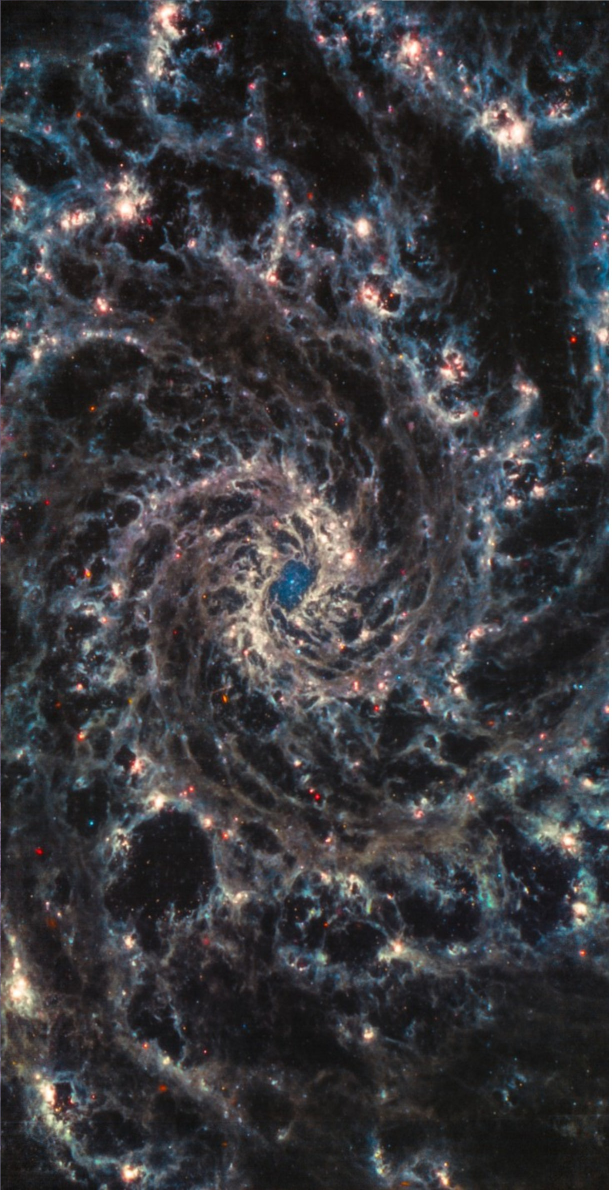

Tracing Embedded Star Formation in PHANGS Galaxies with JWST, HST and MUSE.

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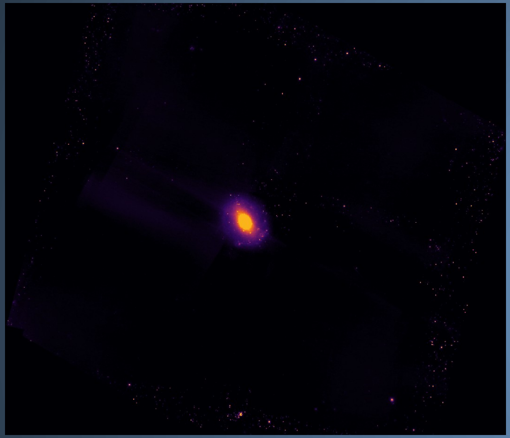
My PhD project focuses on very young star formation that is hidden by dust

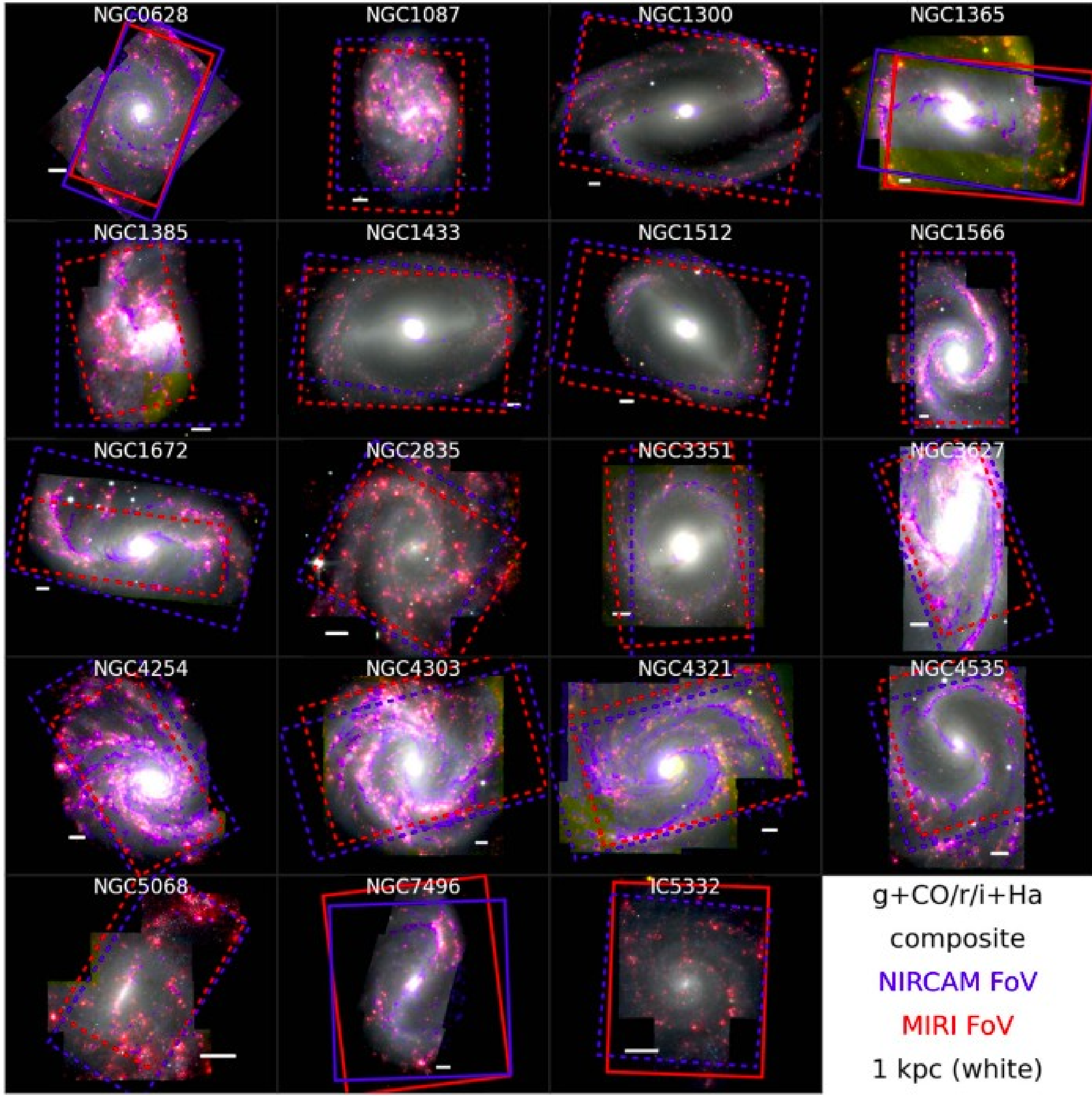
Optical tracers like Hα miss embedded regions

JWST Paα allows us to see ionized gas even in dusty environments



Example: NGC 1433 is a nearby galaxy with PHANGS multiwavelength coverage

Composite gri+Hα+CO images for the 19 galaxies in the PHANGS–JWST Treasury program. The gri+Hα images are constructed from VLT-MUSE fullfield spectral mapping (Emsellem et al. 2022), with Hα line emission in red, and combined with ALMA CO(2–1) (Leroy et al. 2021) maps, with CO(2–1) flux in blue. The JWST NIRCam and MIRI footprints have been defined to overlap existing MUSE, ALMA, and HST data (Lee et al. 2023)



Built a Paα-based source catalog for NGC 1433

Matched Paα sources to:

- HST clusters (ages, masses, EBV)

- PHANGS Hα nebular regions

- Environmental information (disc, interarm, bar)

Goal is to connect morphology, extinction, and age

Measured concentration indices (CI) for:

Paα (ionized gas)

Hα

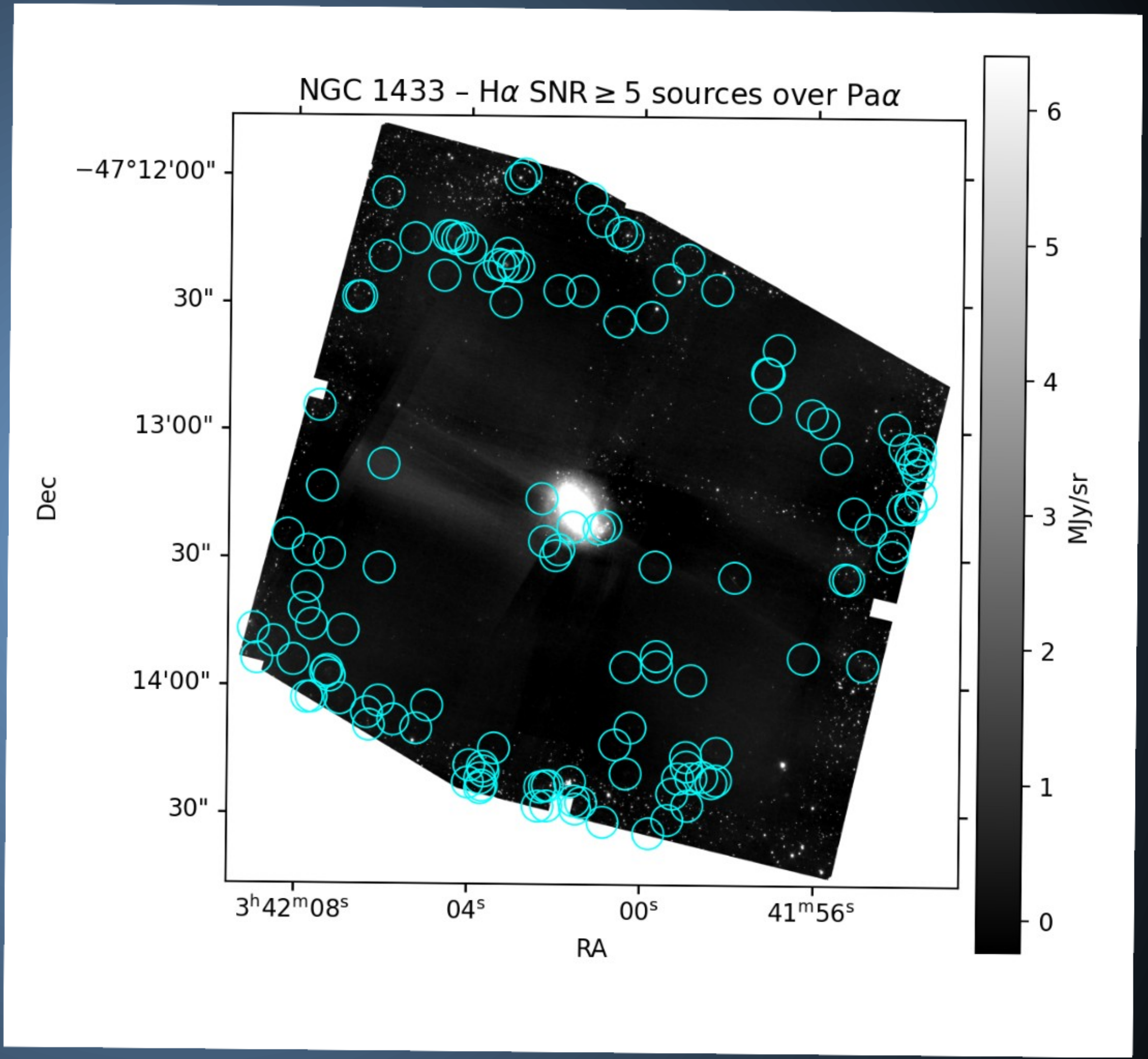
Continuum

Computed:

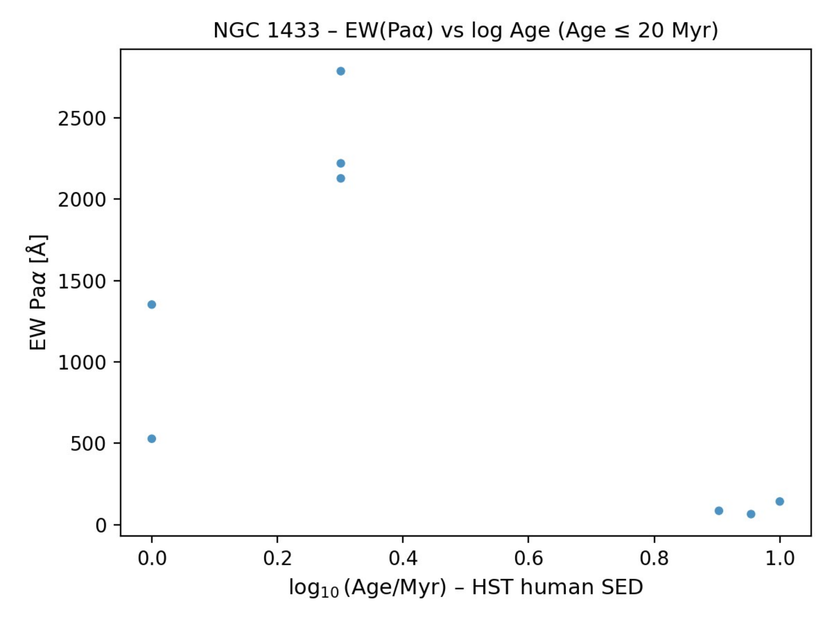
- Paα/F150W → youth diagnostic

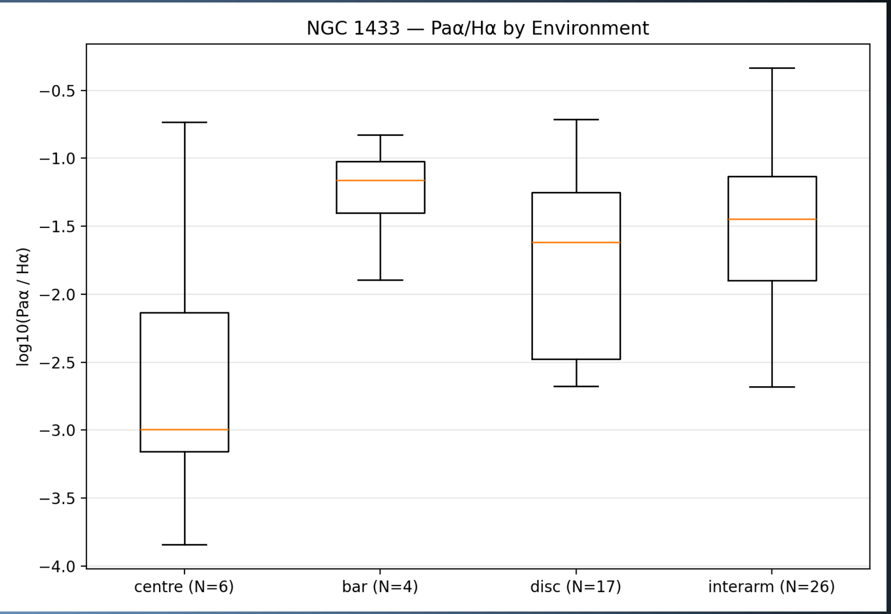
- Paα/Hα extinction tracer

- Equivalent width of Paα



Paα/Hα gives us a direct handle on nebular extinction that optical tracers miss.





I computed equivalent width of Paα for young clusters

After careful cleaning:

EW declines monotonically with age

This matches stellar population models

Shows Paα EW can be used as an age indicator for <10 Myr clusters

Paα/Hα increases in more obscured regions

Confirms Paα is sensitive to embedded ionized gas

Trends depend on environment

1. Paα Source Detection and Catalog Construction

Build validated JWST Paα catalogs and cross-match with HST and PHANGS data.

2. Gas and Stellar Morphology

Measure and compare concentration indices of Paα, Hα, and stellar continuum.

3. Nebular Extinction from Paα/Hα

Use Paα/Hα ratios to quantify dust obscuration in star-forming regions.

4. Paα Equivalent Width as an Age Tracer

Link Paα equivalent width to cluster age and early evolutionary stages.

5. Environmental and Multiwavelength Context

Study how environment, nebular complexity, and PAH emission affect young regions.

6. Extension to the PHANGS-JWST Sample

Apply the pipeline to multiple galaxies to build a legacy Paα catalog and constrain cluster evolution.

Thank you so much for your attention.

Dust is not just a passive tracer it actively shapes the evolution of galaxies.

Bruce T. Drane

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