Dusty & **Over-pressured**:
Pre-Supernova Stellar Feedback Pressures in NGC3256

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The Ohio State University/IPAC

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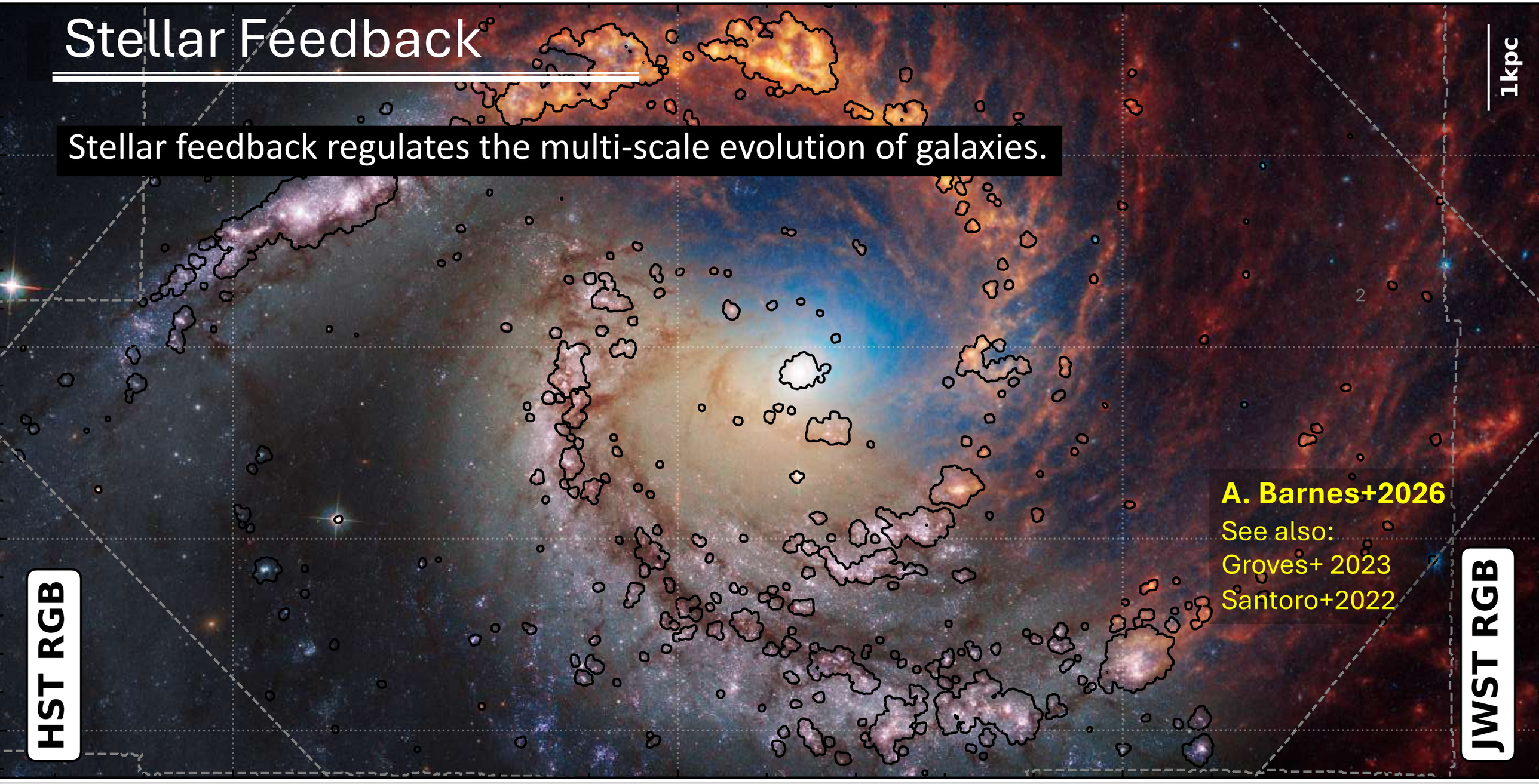
The GOALS Collaboration

NGC 1566
(PHANGS-JWST, Judy Schmidt)

Stellar Feedback

Stellar feedback regulates the multi-scale evolution of galaxies.



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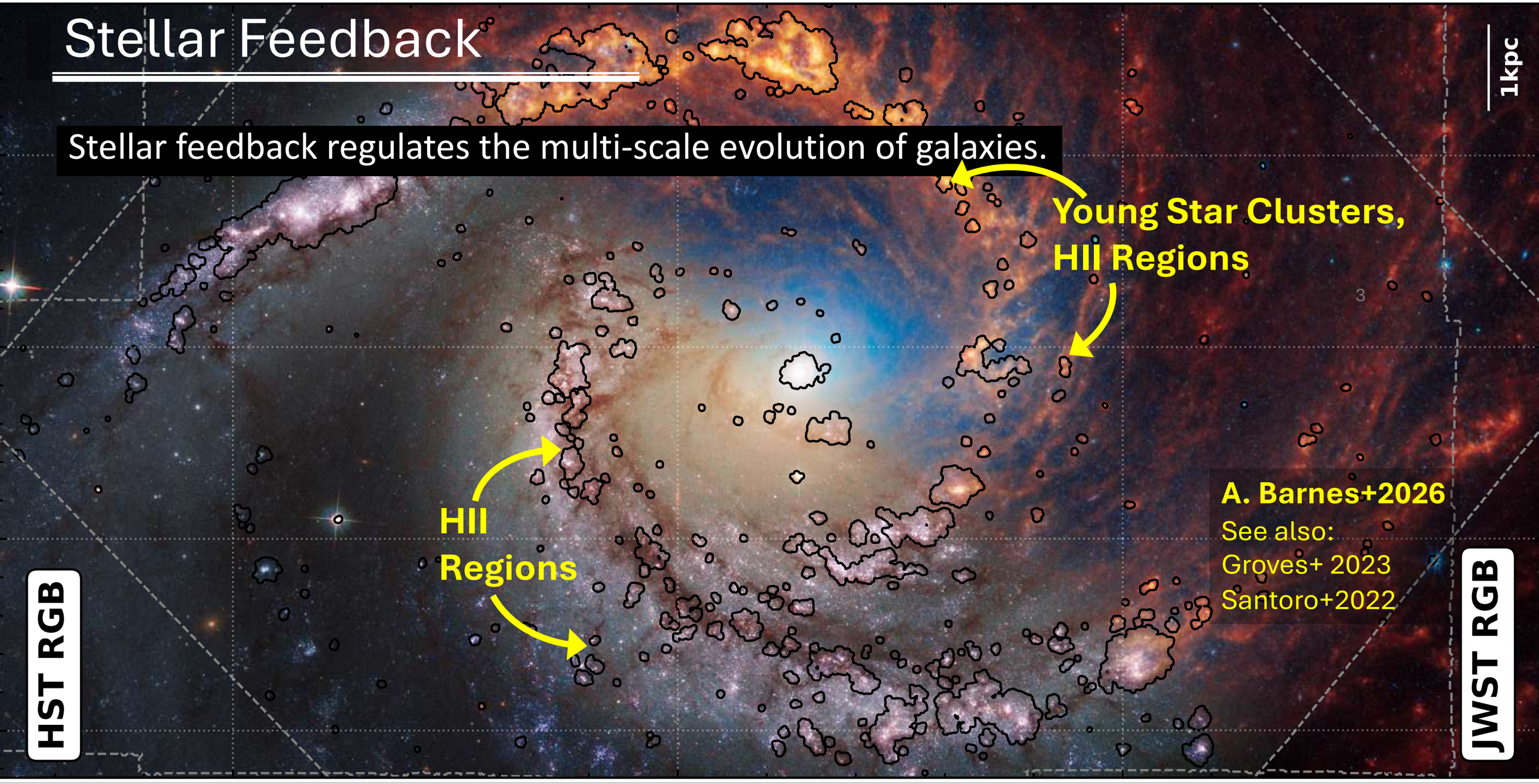

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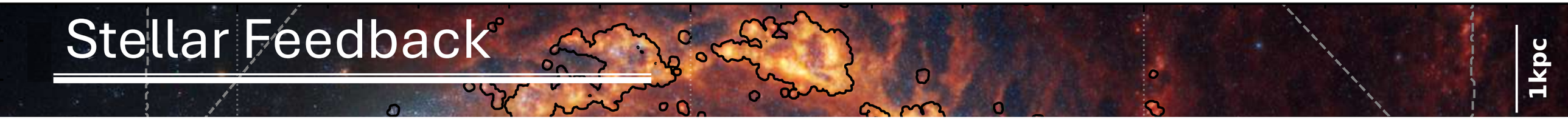
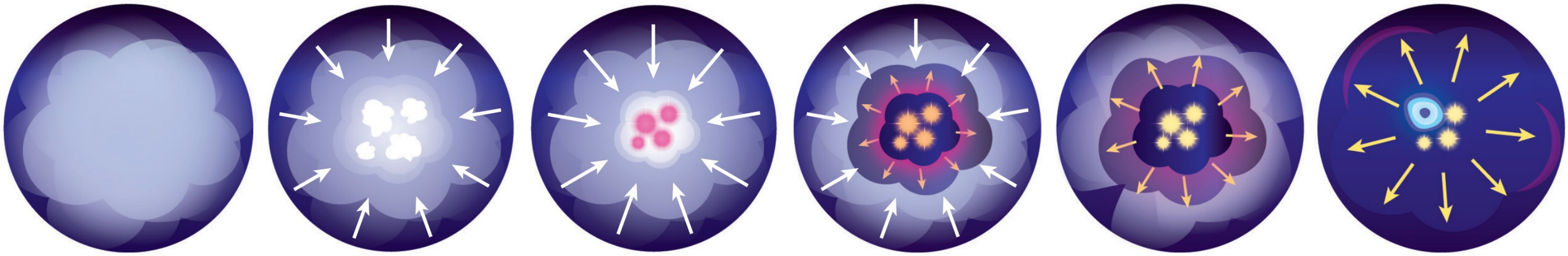
Stellar Feedback





Molecular cloud formation

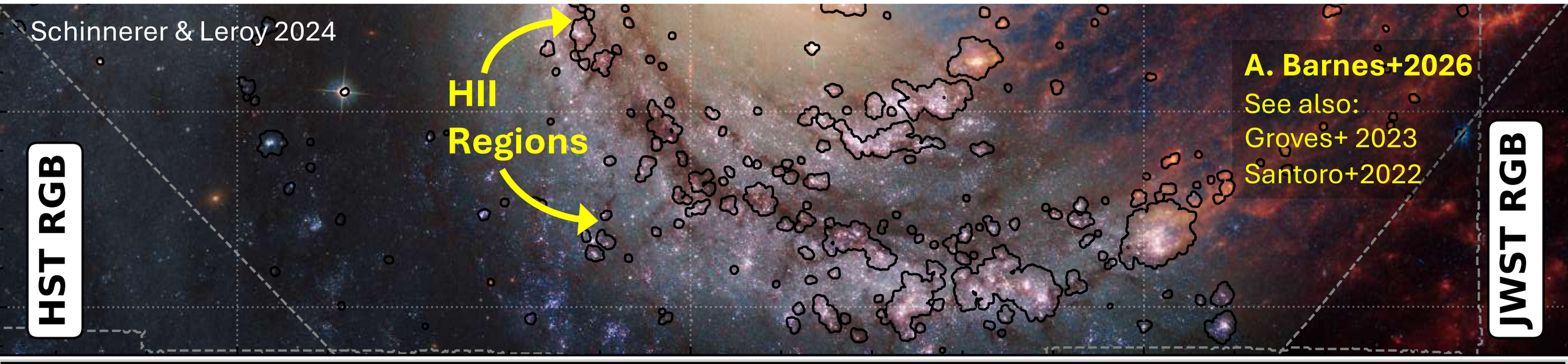
Dense gas formation

Onset of star formation

Pre-supernovae stellar feedback

Cloud disruption

Cloud dispersal and supernova explosions



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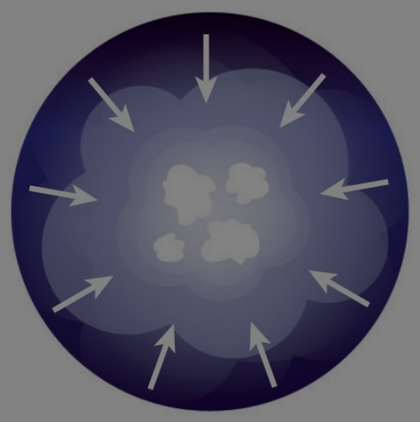
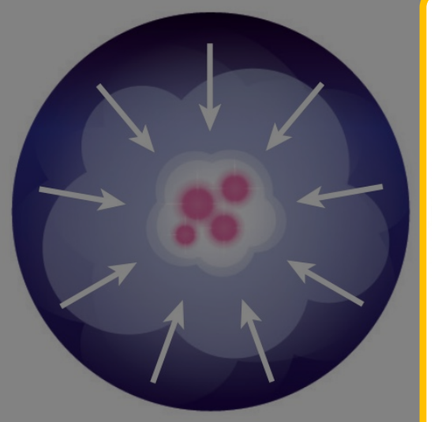
Pre-Supernova Stellar Feedback

1kpc

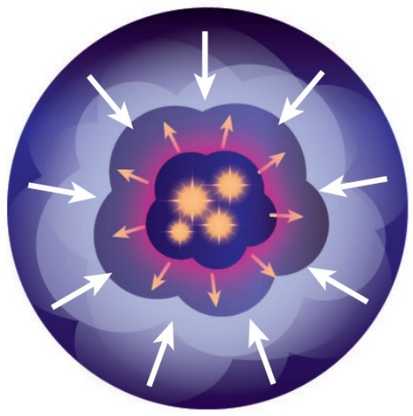
Molecular cloud



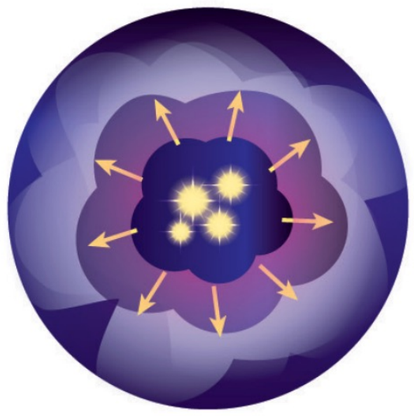
Dense gas formation



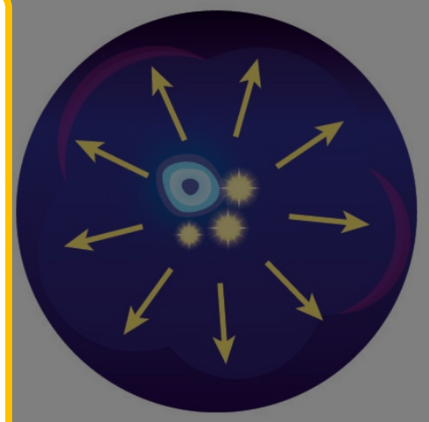
Onset of star formation



Pre-supernovae stellar feedback



Cloud disruption



Cloud dispersal and supernova explosions

Schinnerer & Leroy 2024

~1–4 Myr after star-formation

HII Regions

A. Barnes+2026

See also:
Groves+ 2023
Santoro+2022

HST RGB

JWST RGB

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Pre-Supernova Stellar Feedback

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UV Radiation Pressure on dust

IR Radiation Pressure on dust

Star(s)

UV & Optical

Dust + Gas

UV & Optical

Infrared

Ionized (Warm) Gas Pressure

External ISM Pressure

HII Regions

HST RGB

JWST RGB

A. Barnes+2026

See also:
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In Normal Galaxies…

1. Ionized (warm) gas pressure is the primary mode of feedback.

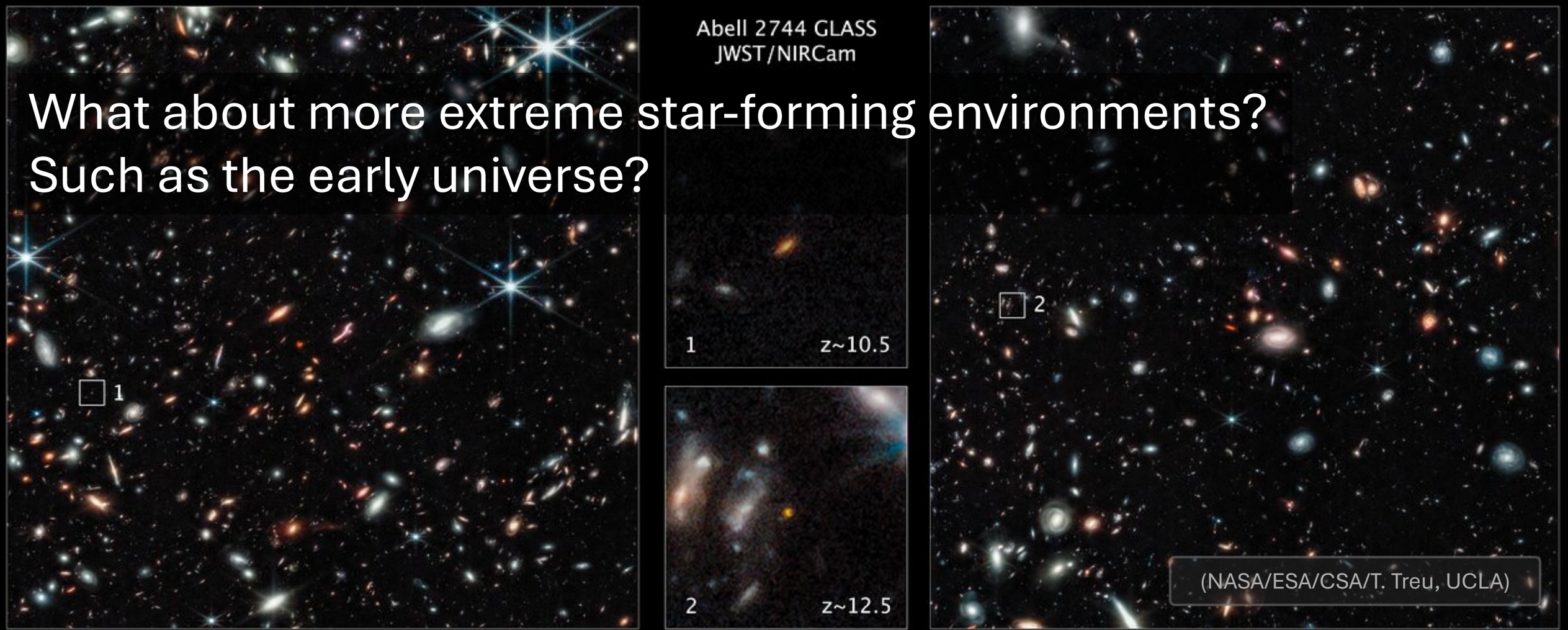
2. HII region self-gravity is weak.

3. Most HII regions are over-pressured and likely expanding into their surroundings.

Barnes+21,22; Pathak+25a,c

(PHANGS-JWST, STScI/NASA; Judy Schmidt)

Does Feedback Look the Same Everywhere?



What about more extreme star-forming environments?
Such as the early universe?

(GOALS-ERS, L. Armus, A. Evans)

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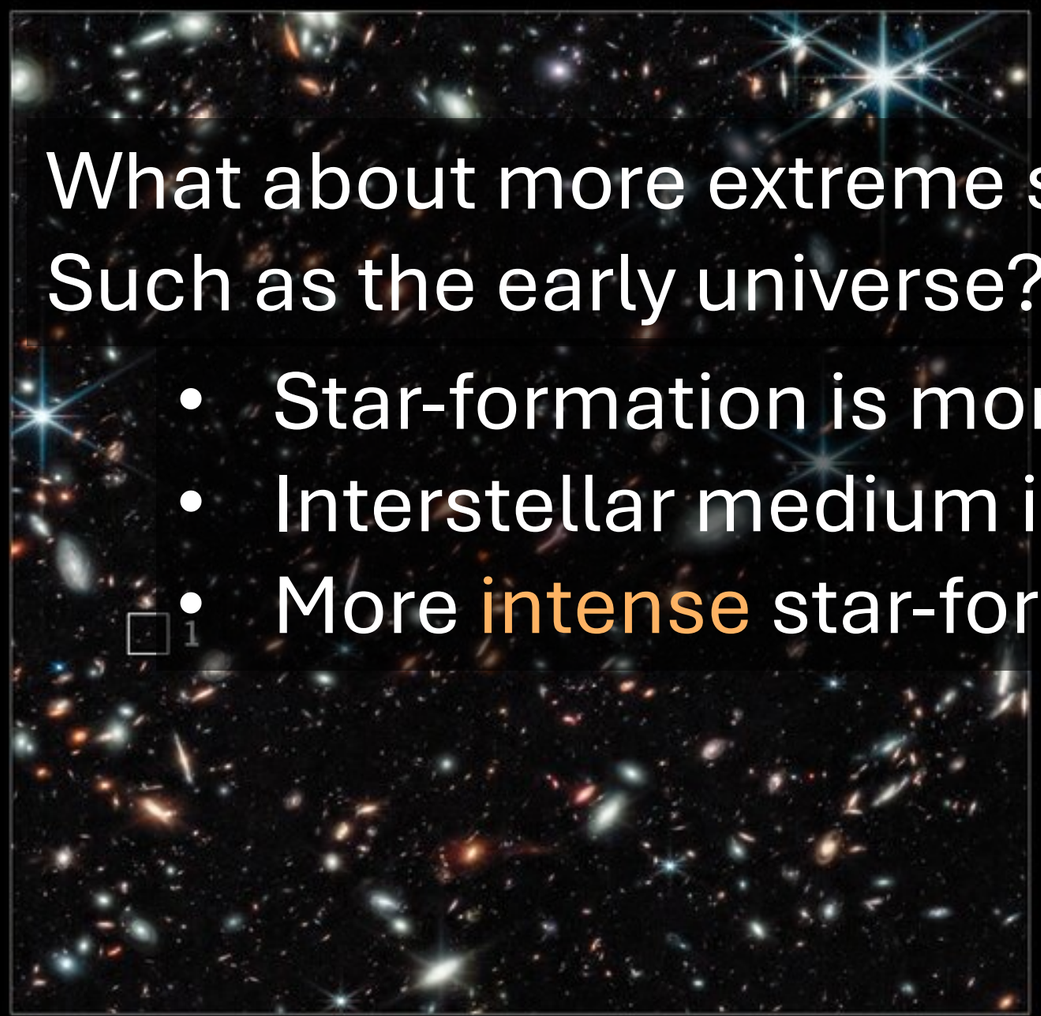
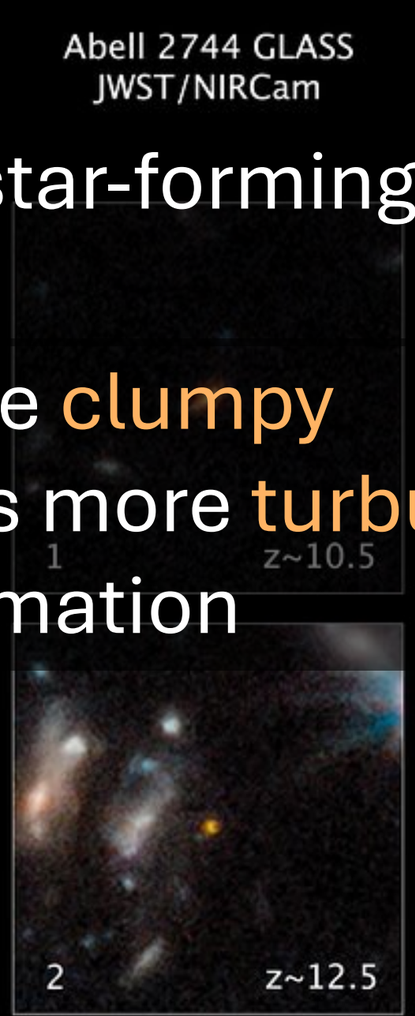
Does Feedback Look the Same Everywhere?

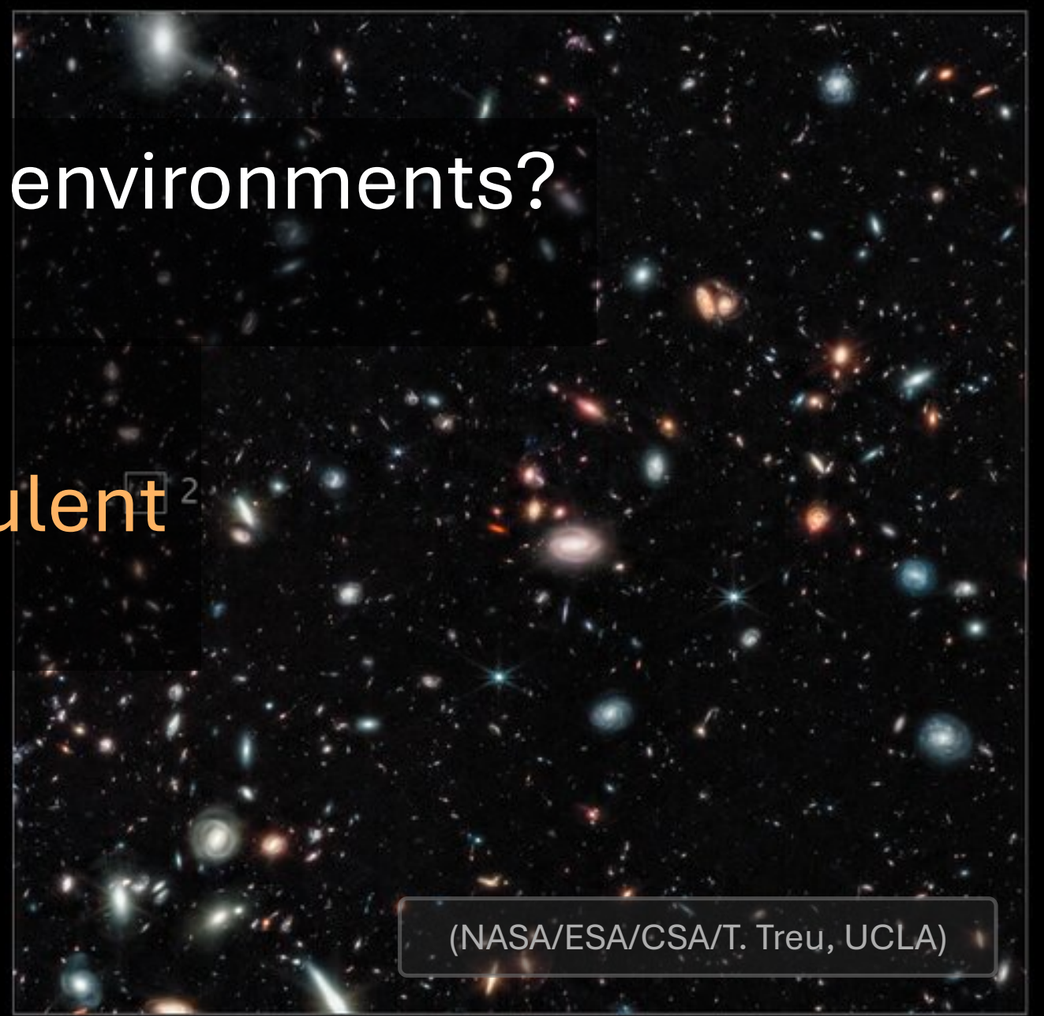
Abell 2744 GLASS
JWST/NIRCam

What about more extreme star-forming environments?
Such as the early universe?

- Star-formation is more clumpy
- Interstellar medium is more turbulent
- More intense star-formation







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These are conditions analogous to nearby Luminous Infrared Galaxies (LIRGs)!

(NASA/ESA/CSA/T. Treu, UCLA)

(GOALS-ERS, L. Armus, A. Evans)

Measuring Feedback in a LIRG

NGC 3256

(GOALS-ERS, L. Armus, A. Evans)

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Measuring Feedback in a LIRG

NGC 3256

- Nearest merger-driven starburst LIRG (~120 million light-years)
  - ~60x the star-formation rate of the Milky Way
  - Merger between two ~Milky Way mass galaxies

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Measuring Feedback in a LIRG

NGC 3256

- Nearest merger-driven starburst LIRG (~120 million light-years)
  - ~60x the star-formation rate of the Milky Way
  - Merger between two ~Milky Way mass galaxies
- We have measured feedback pressures around ~1,700 young star clusters* in NGC 3256 and compare against normal star-forming galaxies.

*Clusters from S. Linden+2024

(GOALS-ERS, L. Armus, A. Evans)

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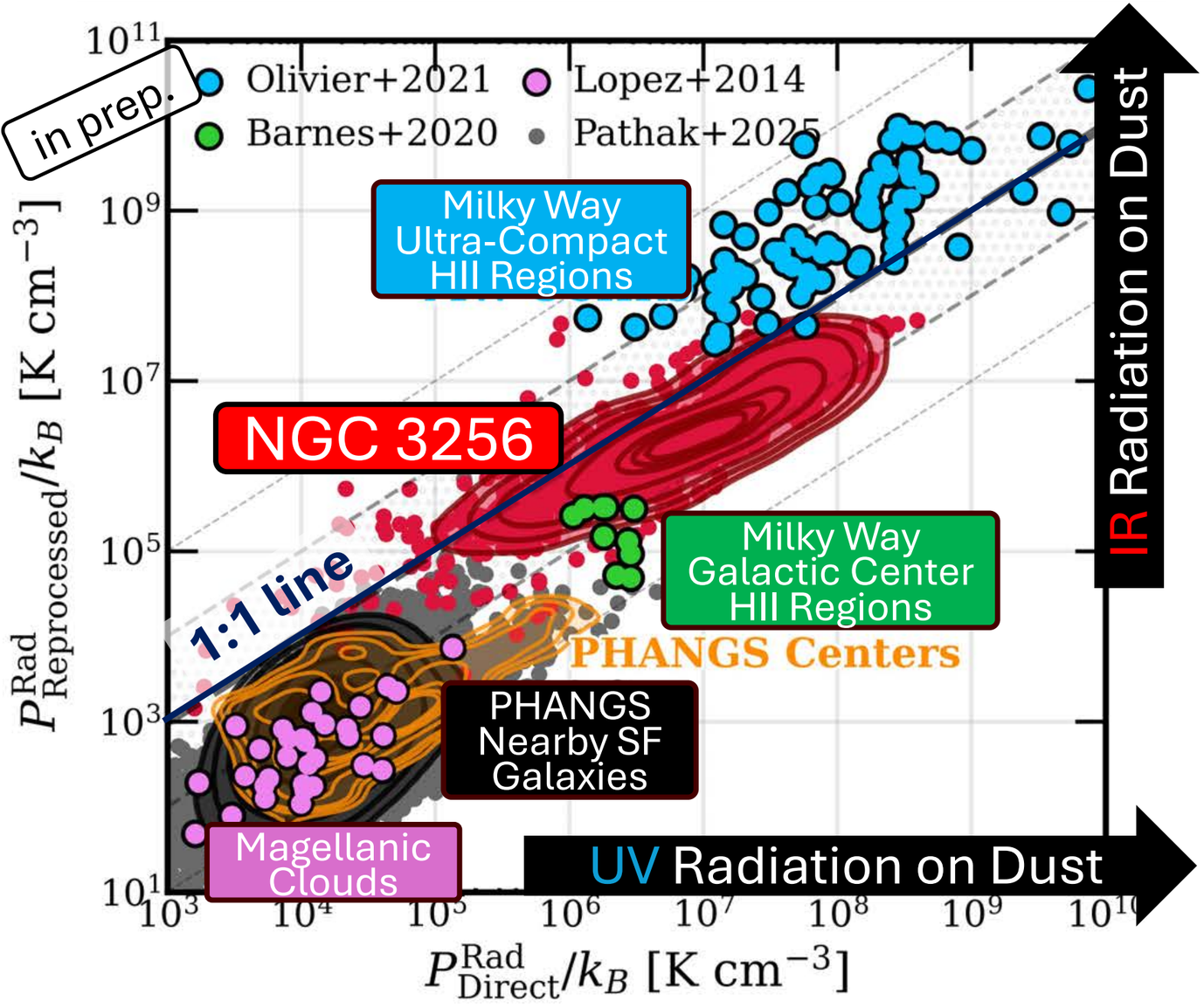
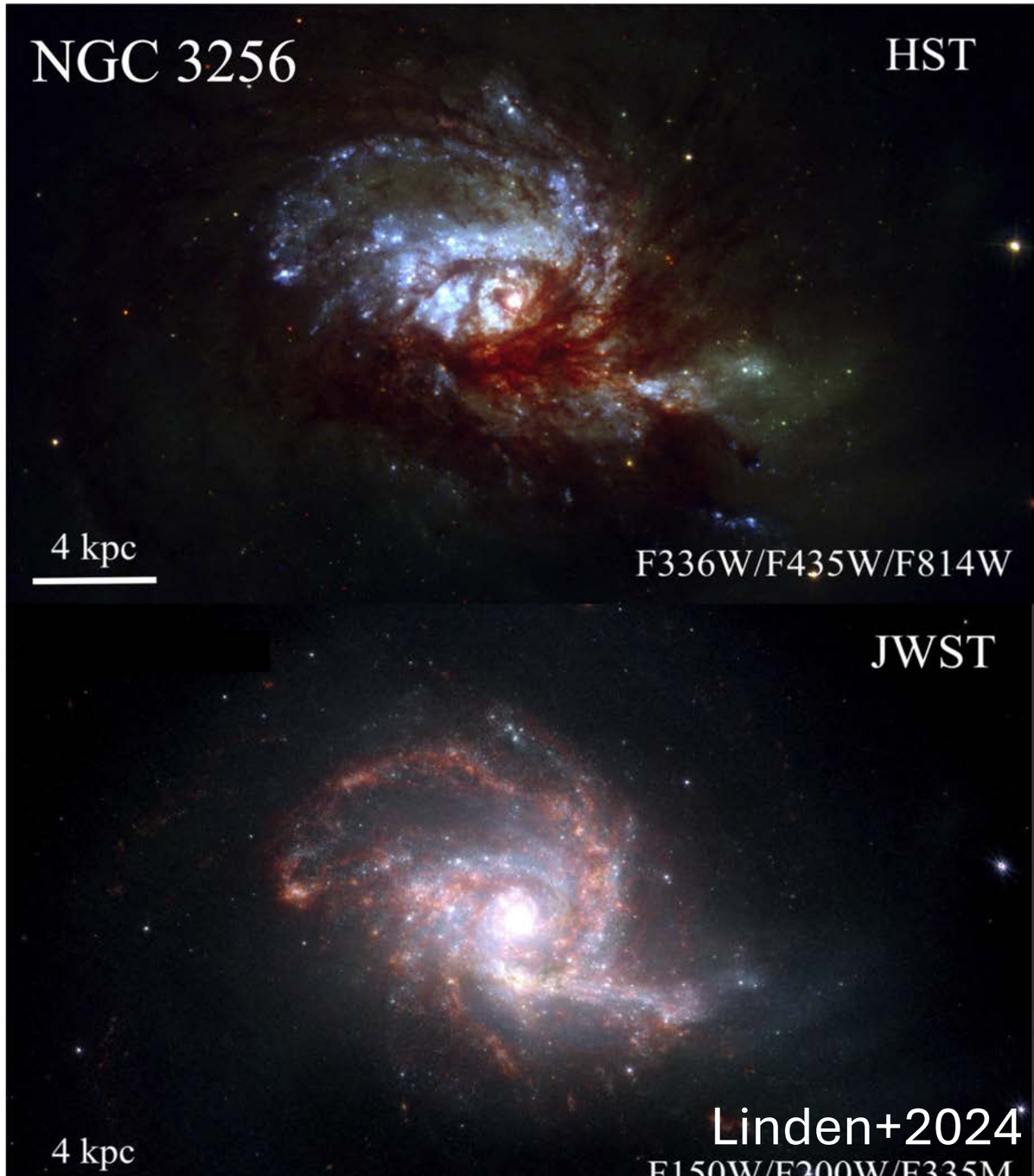
Feedback Modes Vary with Environment





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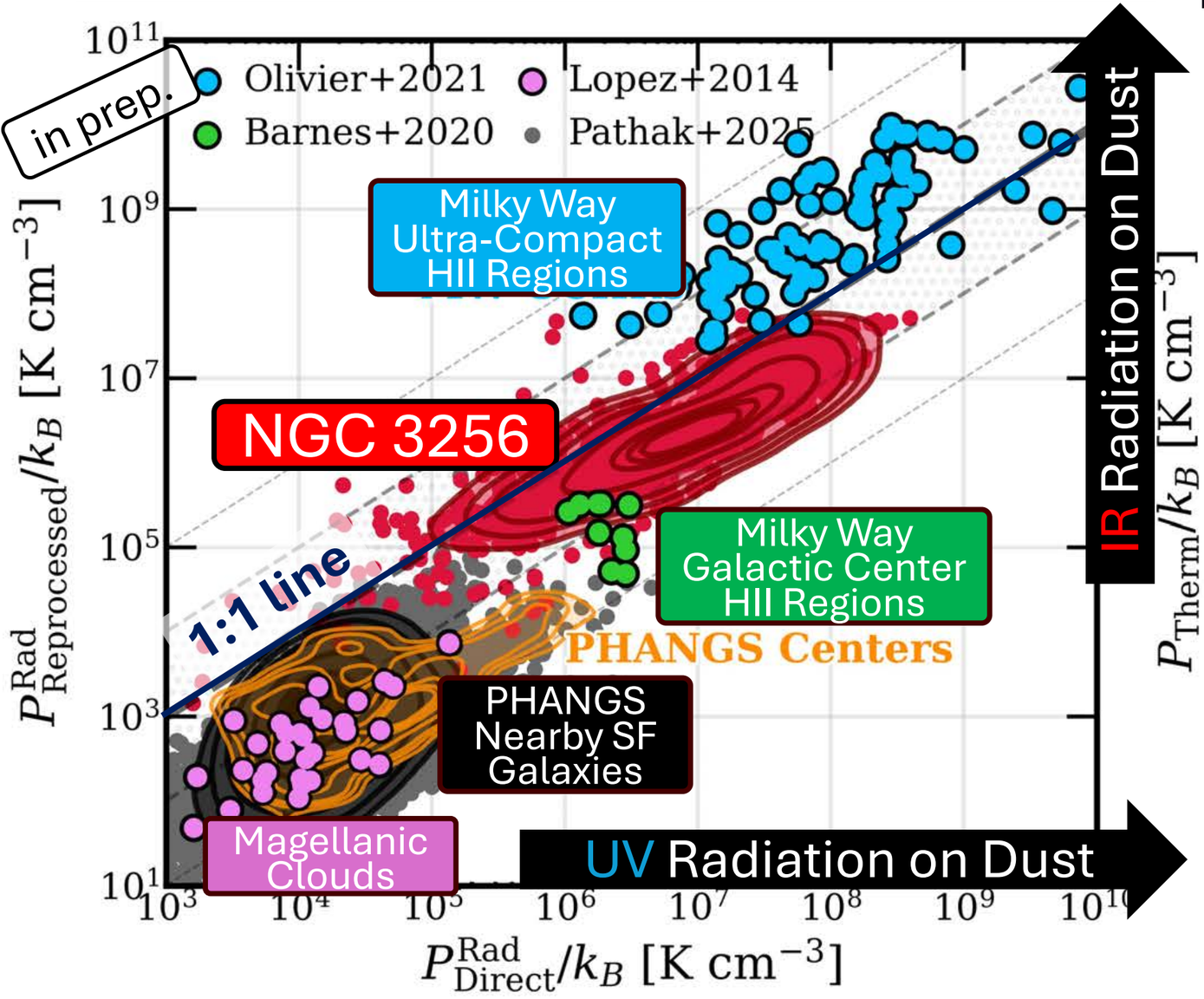

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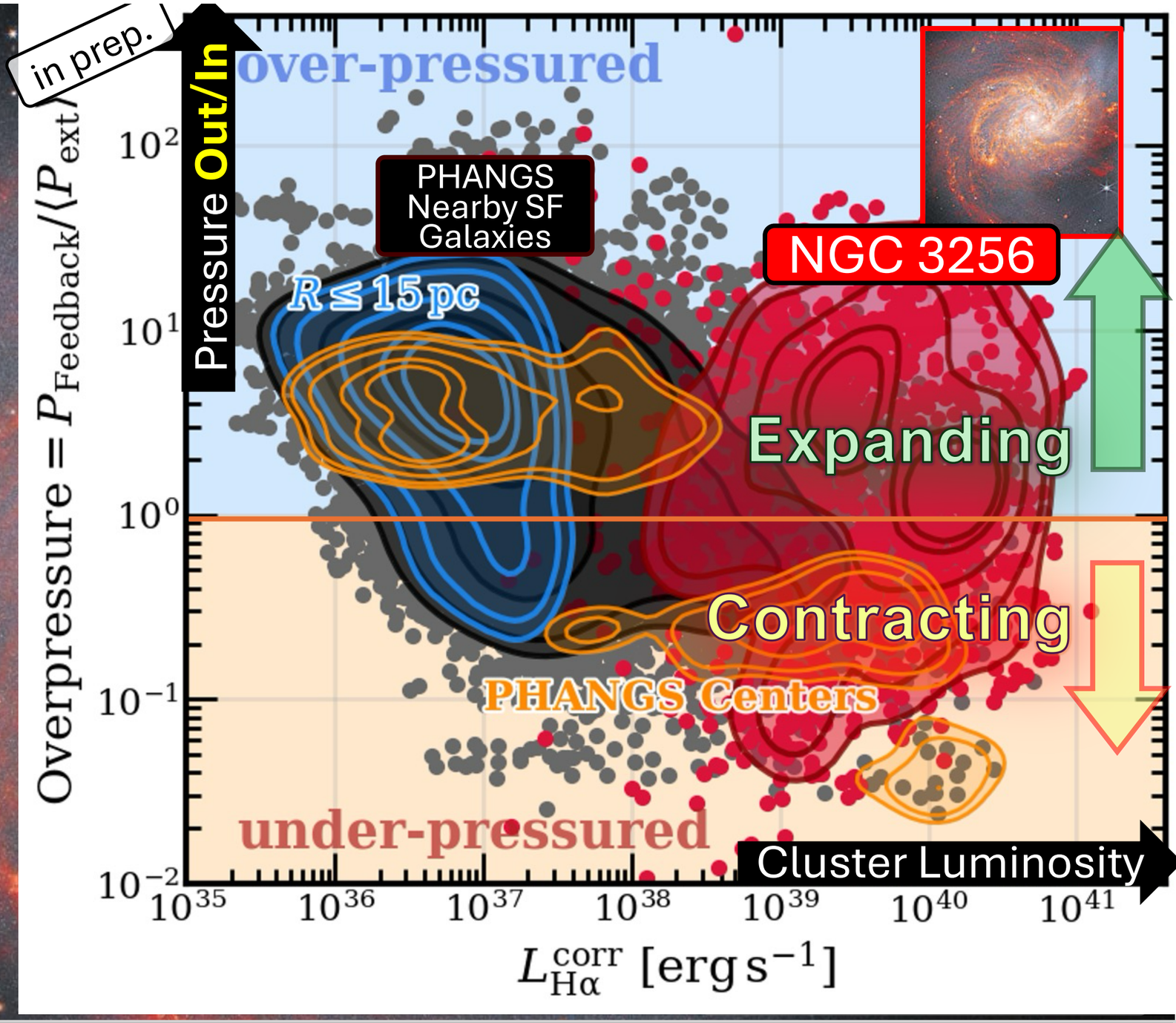
Summary: Most Clusters in NGC 3256 are **Dusty** & **Over-pressured**

1. ~100x higher feedback & ISM pressures than normal star-forming regions.



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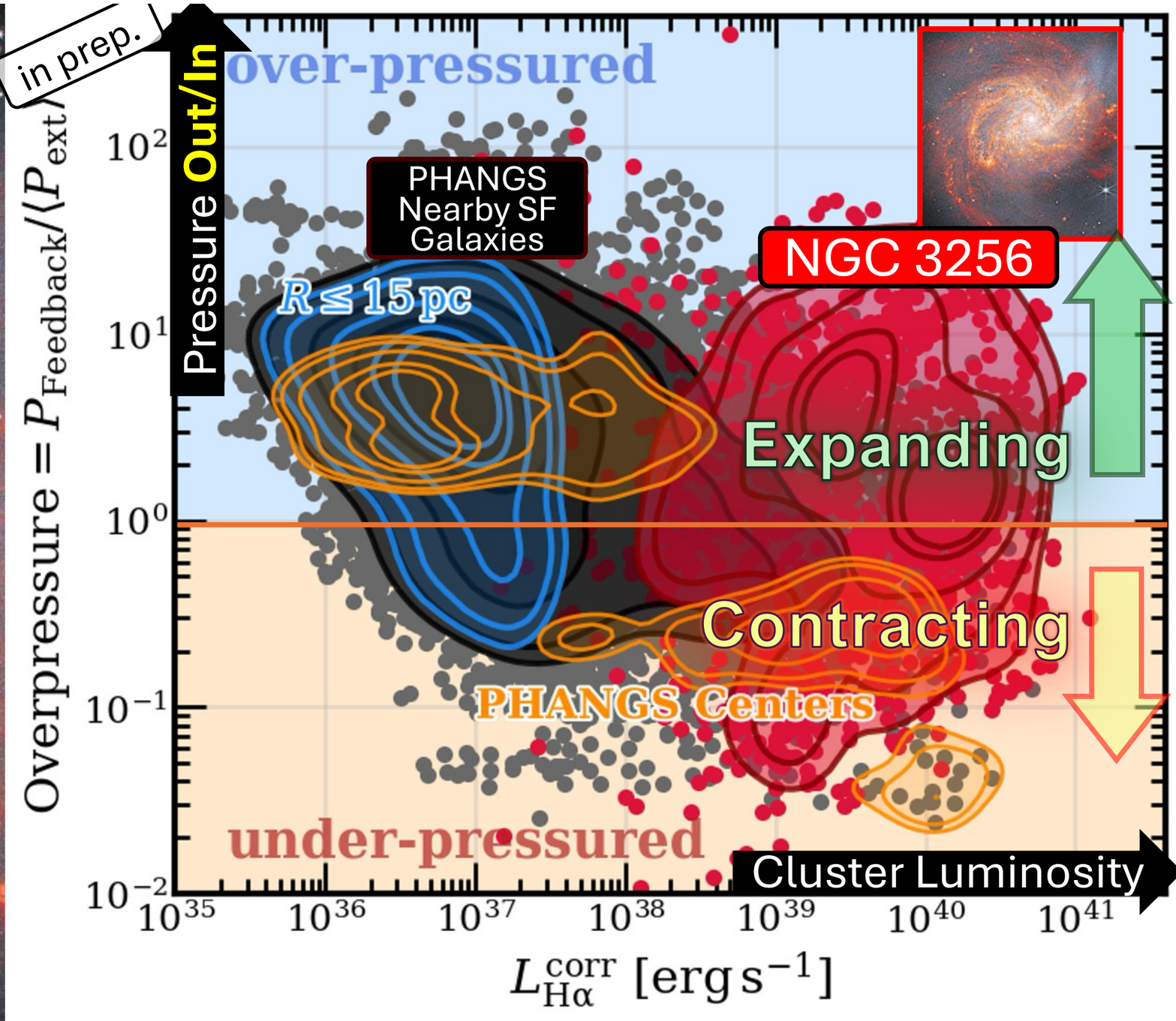
Summary: Most Clusters in NGC 3256 are **Dusty** & **Over-pressured**

1. ~100x higher feedback & ISM pressures than normal star-forming regions.

2. Primary mode of feedback in dusty environments is radiation pressure.



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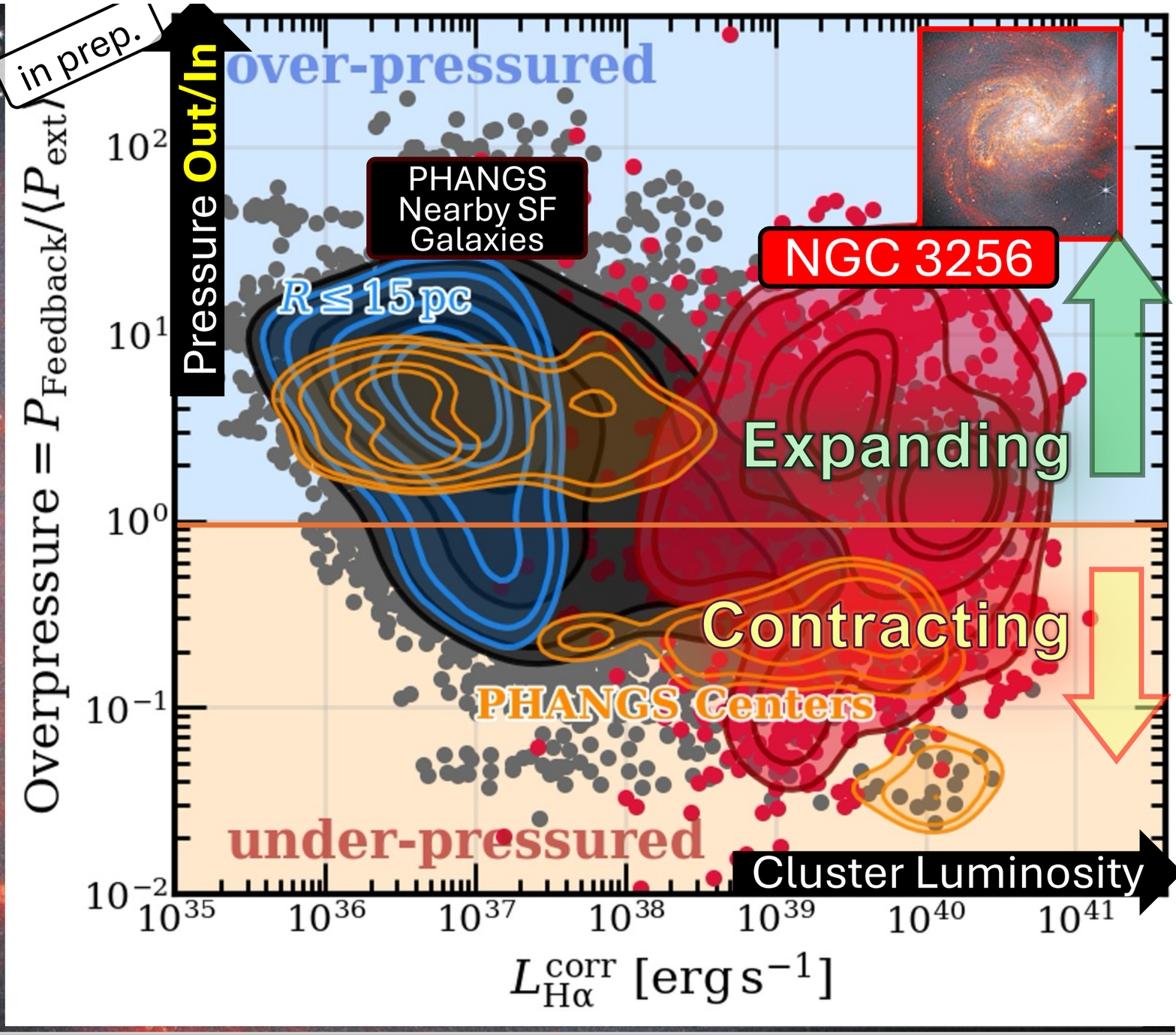
Summary: Most Clusters in NGC 3256 are **Dusty** & **Over-pressured**

1. ~100x higher feedback & ISM pressures than normal star-forming regions.

2. Primary mode of feedback in dusty environments is radiation pressure.

3. Pre-supernova feedback is generally stronger than ambient ISM pressures.



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