Reflections on the Conference

Bruce Elmegreen
Katonah, NY

Orion, J.B. Home page

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The Astrophysical Journal, 983:20 (24pp), 2025 April 10 https://doi.org/10.3847/1538-4357/ad9d0b

The JWST-NIRCam View of Sagittarius C. II. Evidence for Magnetically Dominated H II Regions in the Central Molecular Zone

John Bally[1], Samuel Crowe[2], Rubén Fedriani[3], Adam Ginsburg[4], Rainer Schödel[3], Morten Andersen[5], Jonathan C. Tan[2,6], Zhi-Yun Li[2], Francisco Nogueras-Lara[5], Yu Cheng[7], Chi-Yan Law[8], Q. Daniel Wang[9], Yichen Zhang[2,10], and Suinan Zhang[11]

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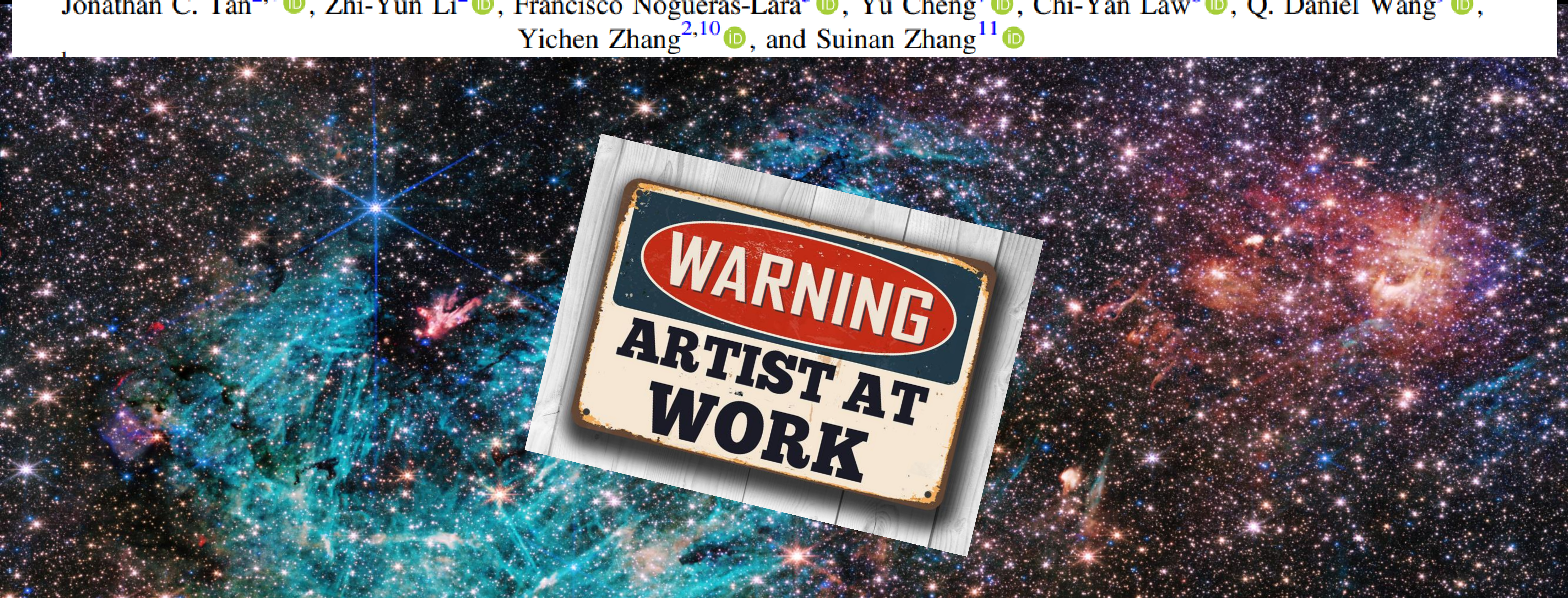
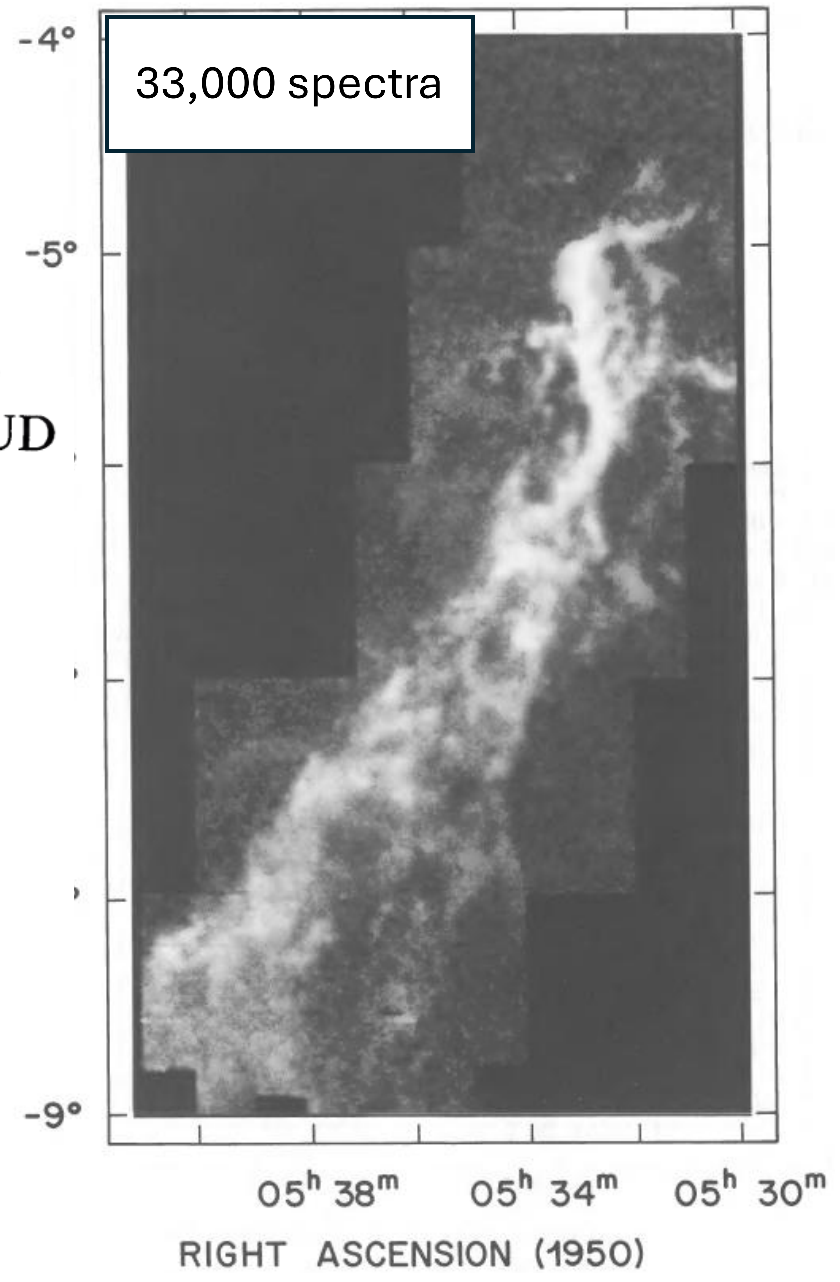


THE ASTROPHYSICAL JOURNAL, 312:L45–L49, 1987 January 15

FILAMENTARY STRUCTURE IN THE ORION MOLECULAR CLOUD

JOHN BALLY
AT & T Bell Laboratories
WILLIAM D. LANGER
Princeton University
AND
ANTONY A. STARK AND ROBERT W. WILSON
AT & T Bell Laboratories
Received 1986 September 2; accepted 1986 October 27



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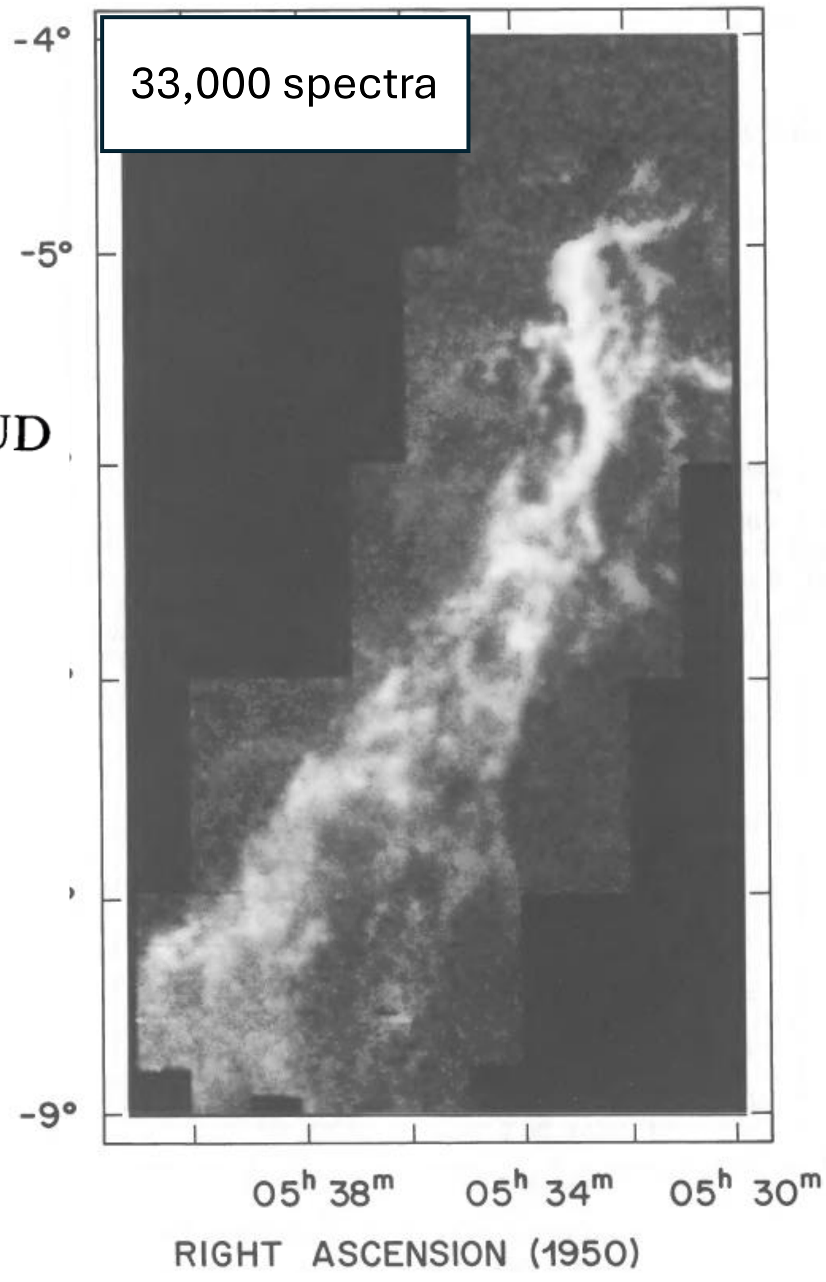
My first glimpse of structure in a turbulent gas



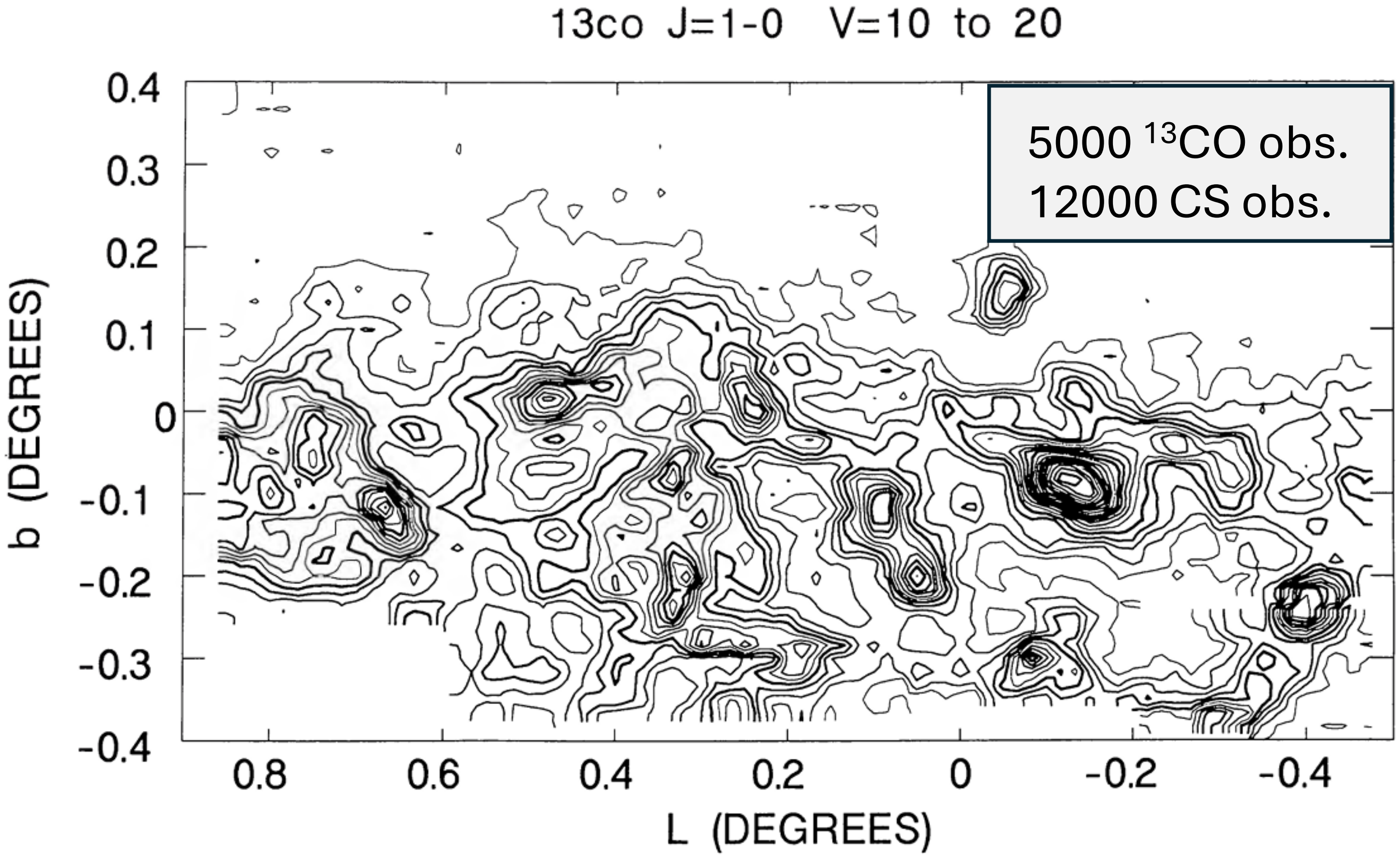
THE ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES, 65:13–82, 1987 September

GALACTIC CENTER MOLECULAR CLOUDS. I. SPATIAL AND SPATIAL-VELOCITY MAPS

JOHN BALLY, ANTONY A. STARK, AND ROBERT W. WILSON
AT&T Bell Laboratories, Crawford Hill

AND

CHRISTIAN HENKEL
Max-Planck-Institut für Radioastronomie, Bonn
Received 1986 May 5; accepted 1987 February 3



THE ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES No. 203, 24:15–47

II. GALACTIC 21-CENTIMETER OBSERVATIONS IN THE DIRECTION OF 35 EXTRAGALACTIC SOURCES

V. RADHAKRISHNAN, J. D. MURRAY, PEGGY LOCKHART, AND R. P. J. WHITTLE
Division of Radio Physics, CSIRO, Sydney, Australia
Received 1971 June 25

1972

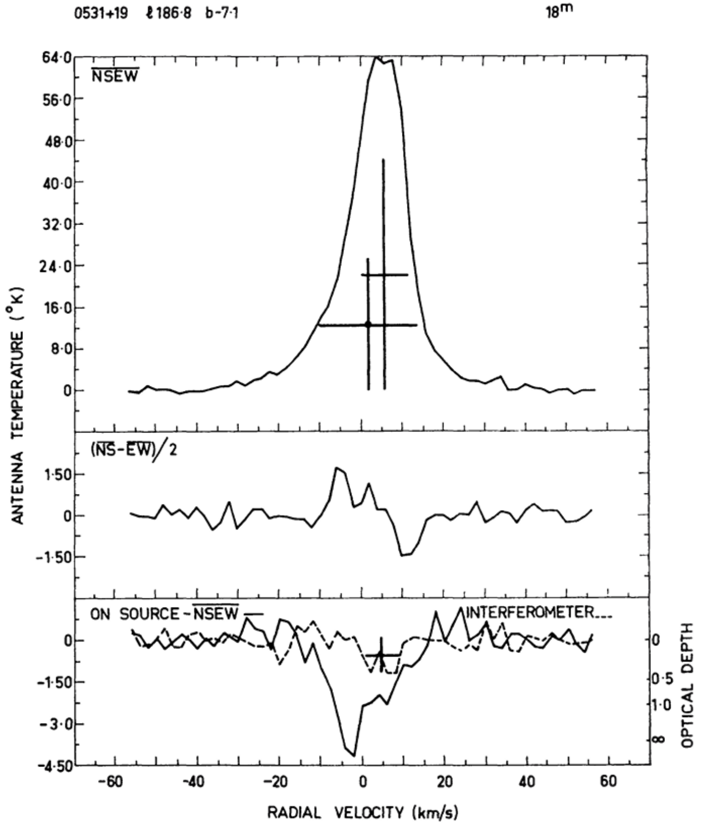


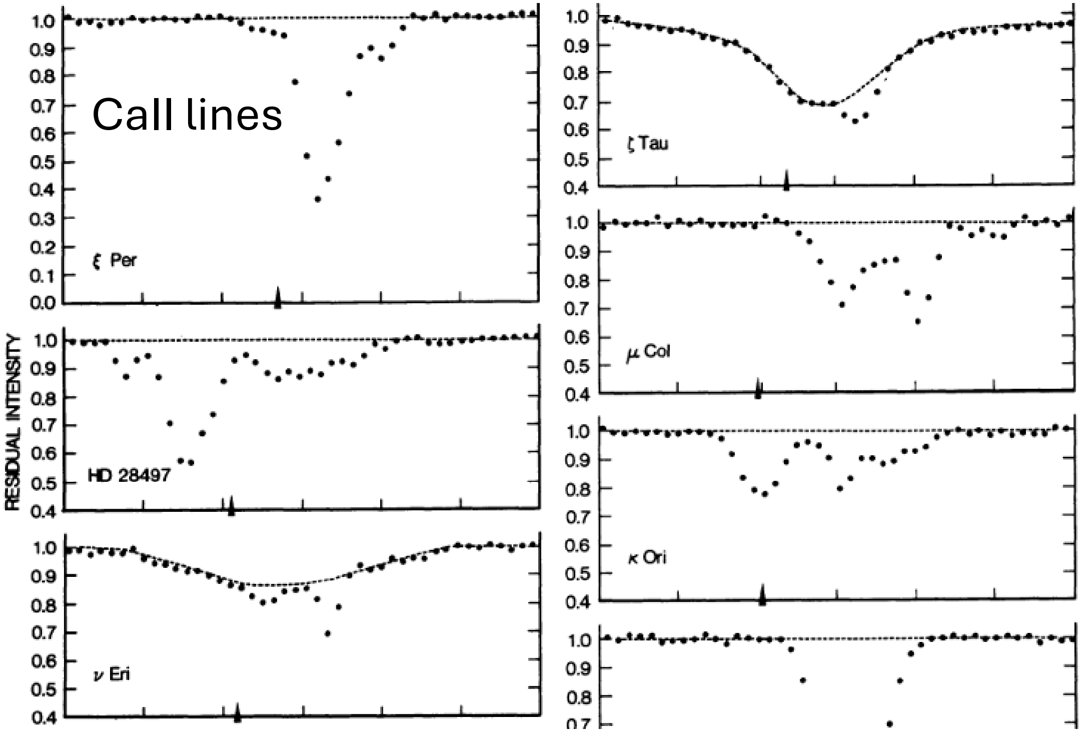
FIG. 11

THE ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES, 56:315–323, 1984 November

OPTICAL INTERSTELLAR ABSORPTION LINES TOWARD 29 STARS

L. M. HOBBS
Yerkes Observatory, University of Chicago
Received 1984 March 29; accepted 1984 May 14

1984



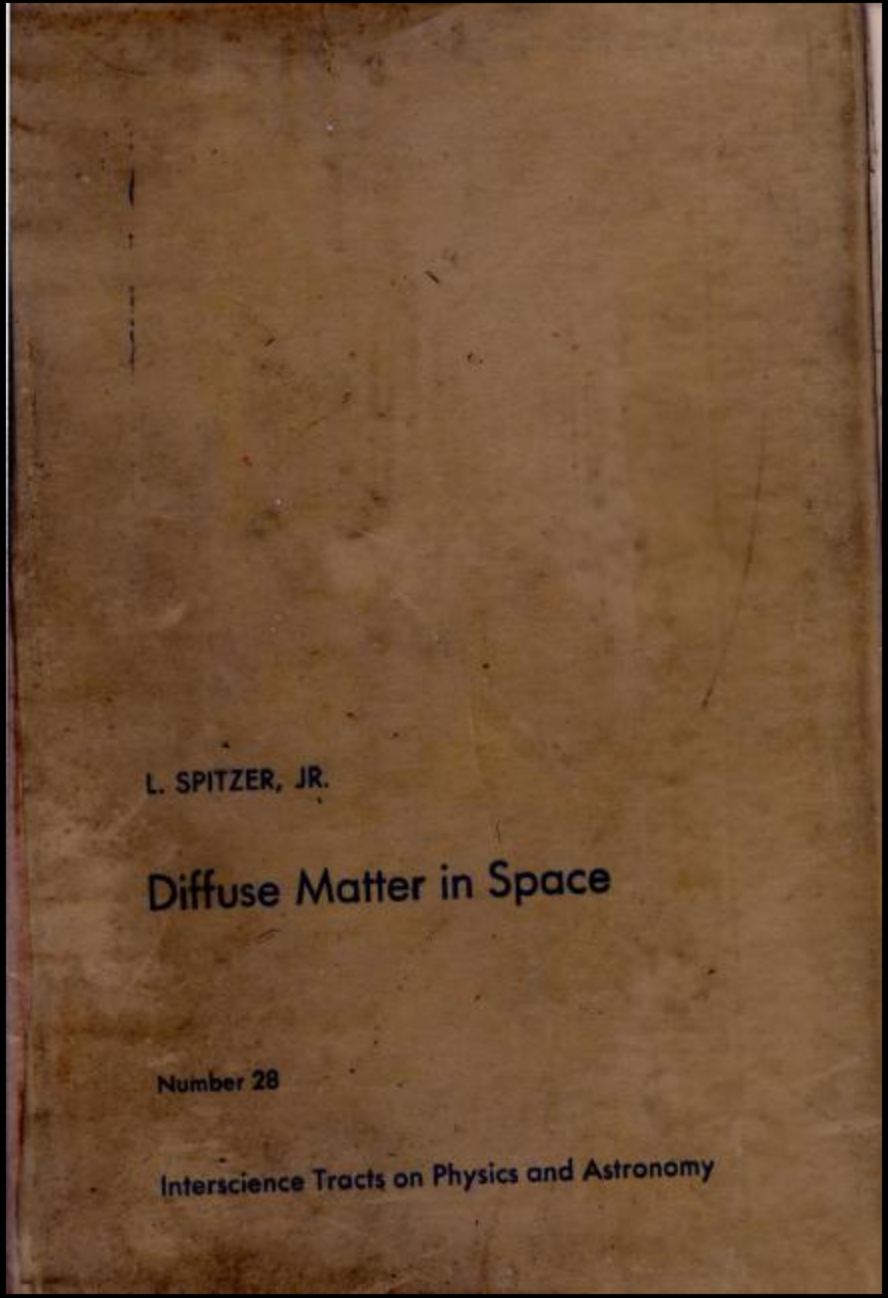
What John and I learned as graduate students

Statistical Properties of Dust Clouds

Type of cloud	Standard cloud	Large cloud
Mean $E_{B\text{-}V}$ per cloud, E_0	0.061 ± 0.006	0.29 ± 0.06
Number of clouds per kpc, k	6.2 ± 0.3	0.8 ± 0.2
Selective extinction per kpc, kE_0	0.38 ± 0.05	0.23 ± 0.01

Parameters of a Standard Cloud

Radius, R	7 pc
No. of clouds per (kpc)^3, n_s	5×10^4
No. in line of sight per kpc, $k = \pi R^2 n_s$	8
Fraction of volume occupied, $F_c = 4\pi R^3 n_s/3$	0.07
Visual extinction in a single cloud, A_c	0.2 mag
Density of H, n_{Hc}	10 cm^{-3}
Density of heavy ions, n_{ic}	5×10^{-3} cm^{-3}
Mass, M_c	400 $M_{\odot}$



The Physics of Star Formation & Early Stellar Evolution
NATO Advanced Studies Symposium, Agia Pelagia,
Crete, May 27 – June 8, 1990 (pub. 1991)
Editors, Charles J. Lada & Nikolaos D. Kylafis

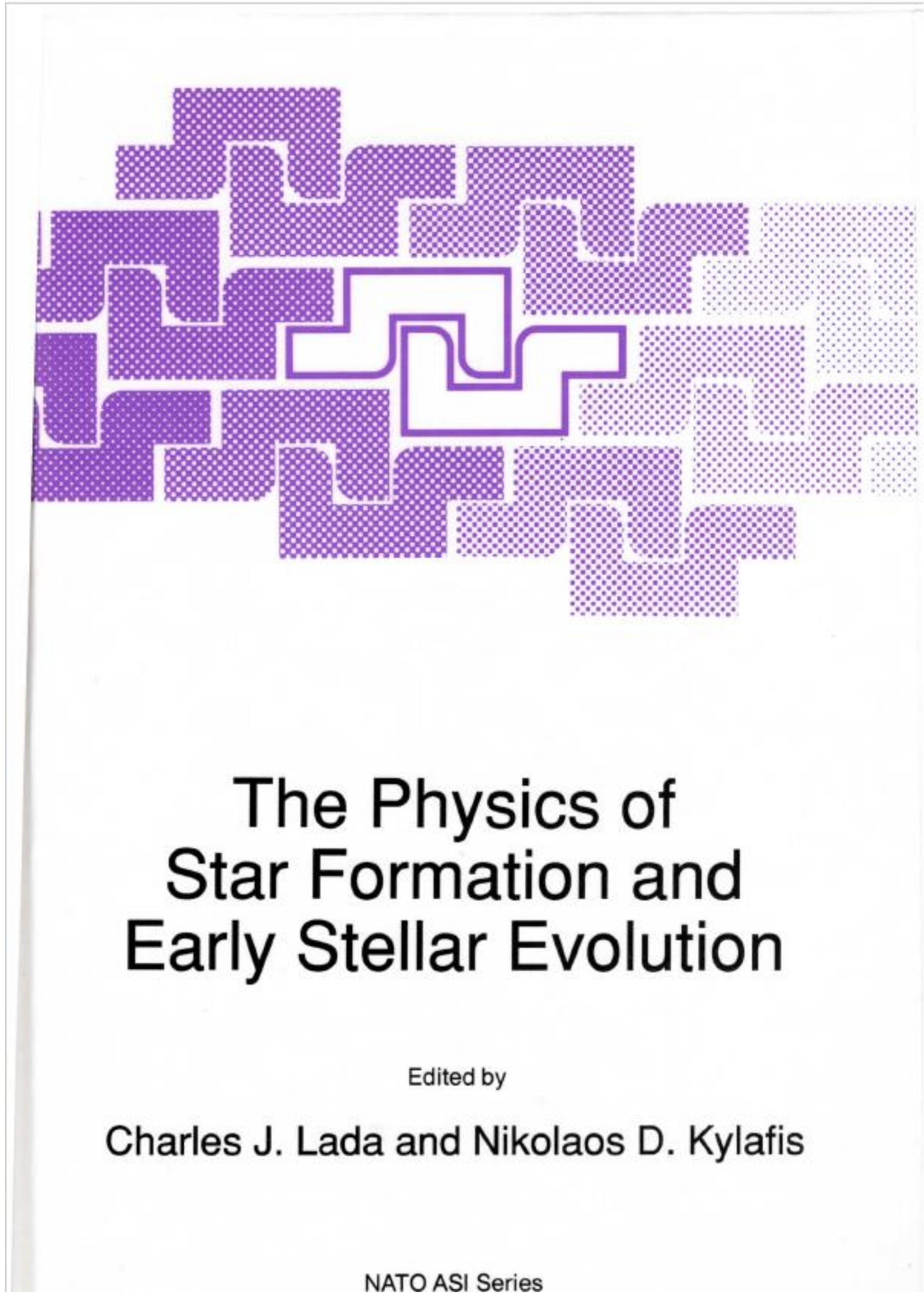
Molecular Outflows: Observed Properties
John Bally, Adair P. Lane

The Origin and Evolution of Giant Molecular Clouds
Bruce Elmegreen

Herbig-Haro Objects
Bo Reipurth

+ Other attendees: Hans Zinnecker, Suzanne Madden, Peter Schilke, Enrique Vasquez–Semadeni, Annie Zavagno

Also, John Scalo

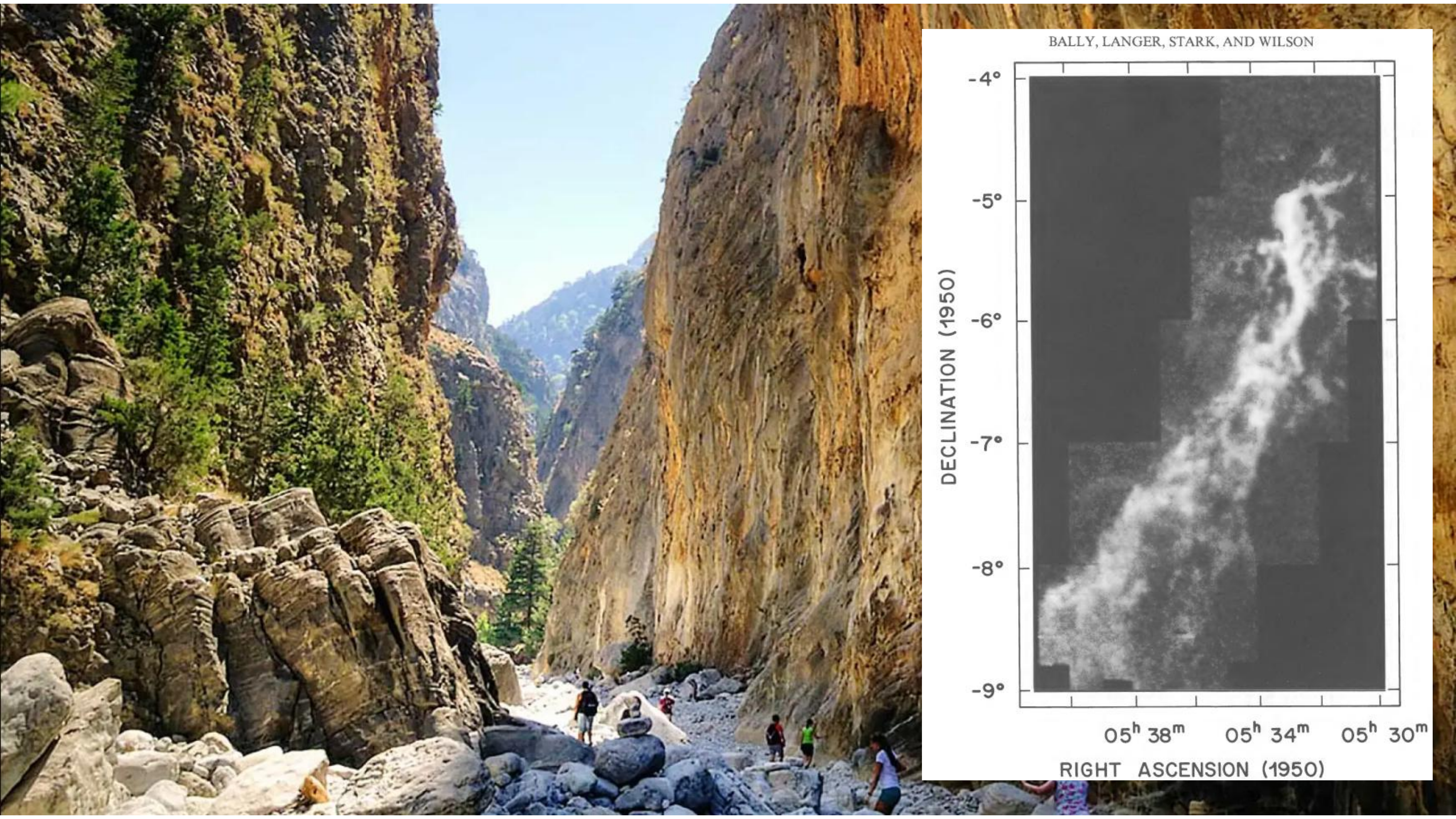


R. Pudritz, A. Blaauw, J. Bally, G. Fuller

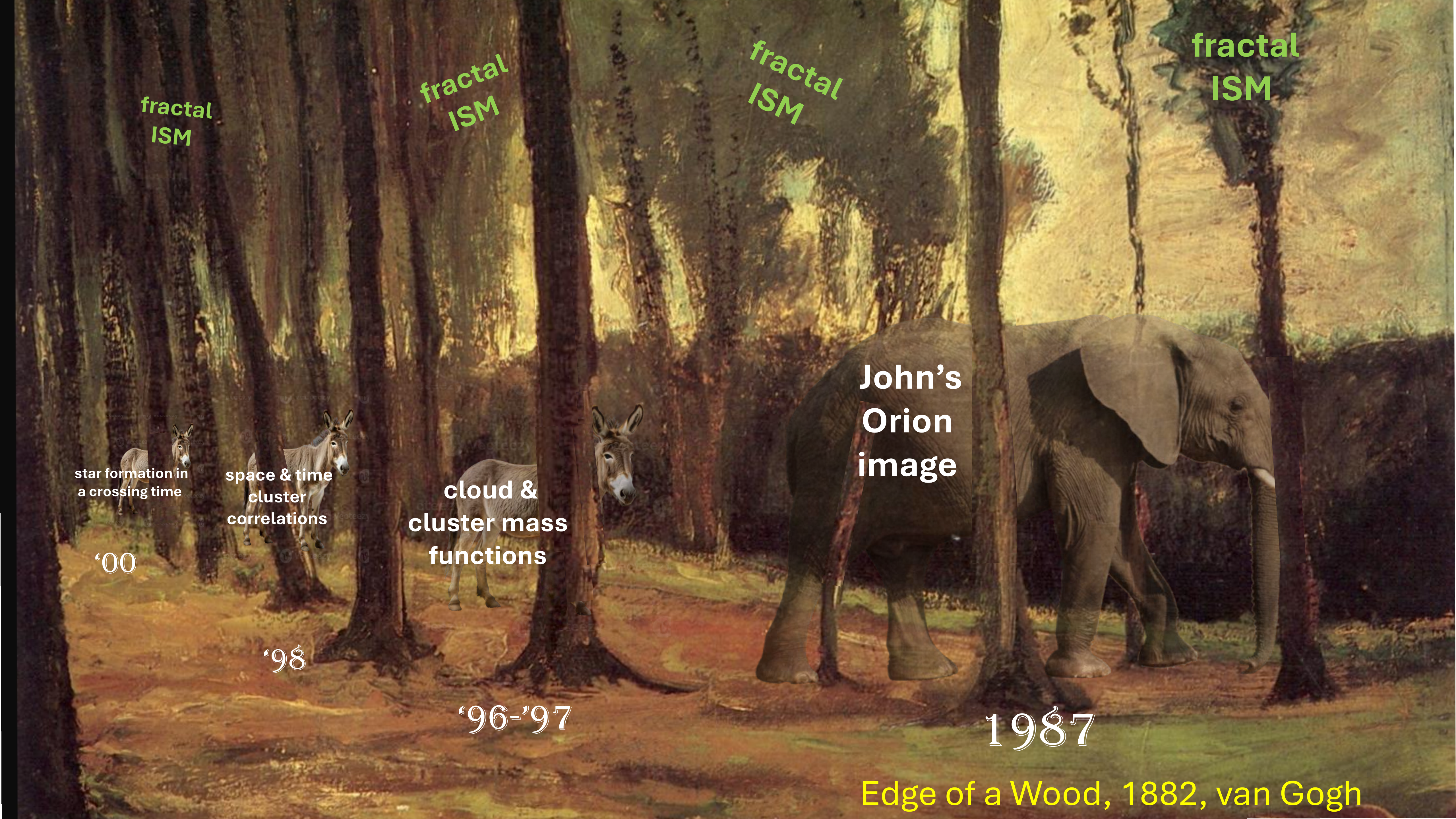
Bo Reipurth, Hans Zinnecker, and Charles Lada

At the end of my paper:

Acknowledgement: Many thanks to John Scalo for providing Figure 1 and for his stimulating company on the trek down Samaria Gorge.



BALLY, LANGER, STARK, AND WILSON
-4°
-5°
-6°
-7°
-8°
-9°
DECLINATION (1950)
05^h 38^m
05^h 34^m
05^h 30^m
RIGHT ASCENSION (1950)


fractal
ISM
fractal
ISM
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ISM
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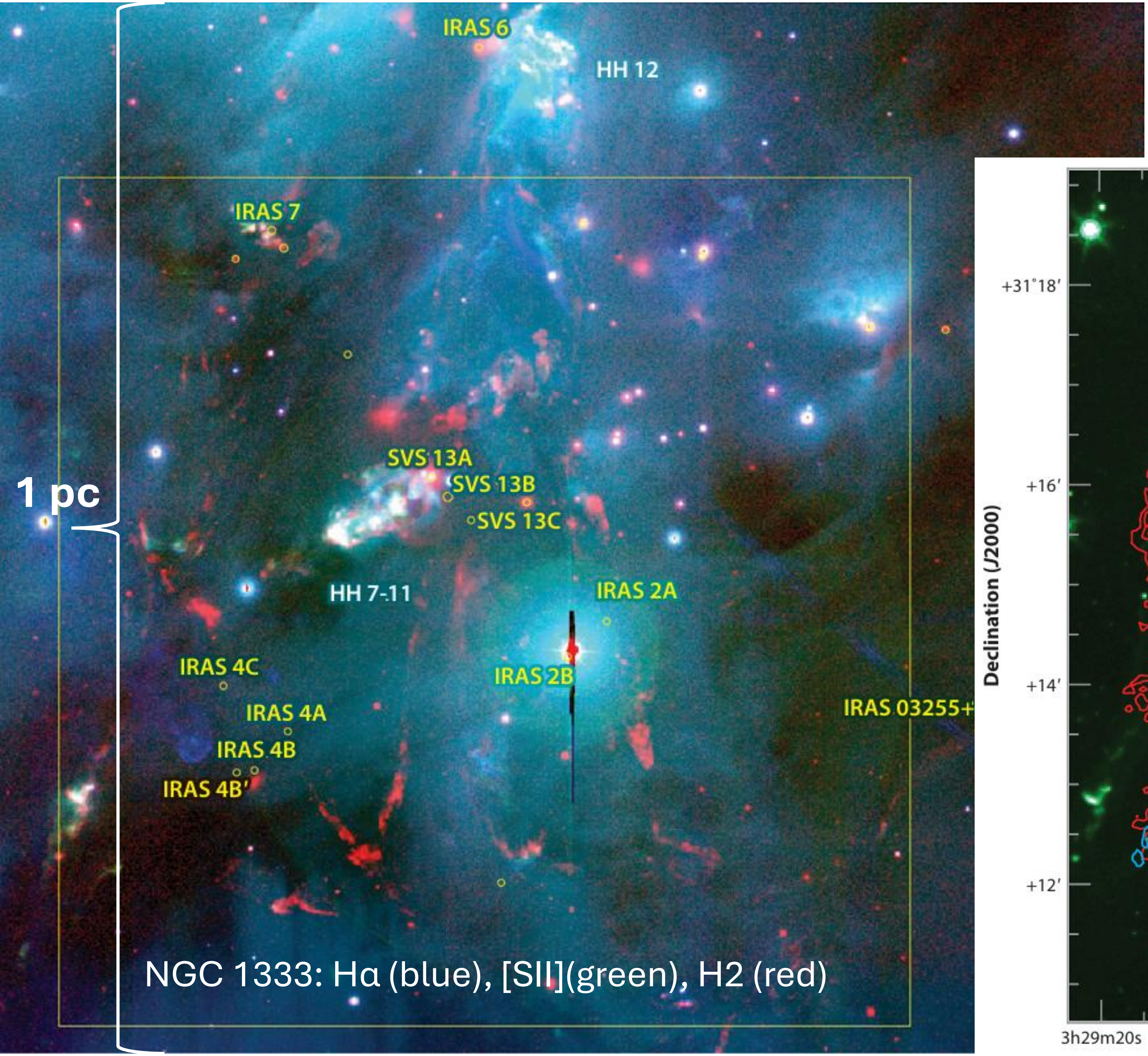
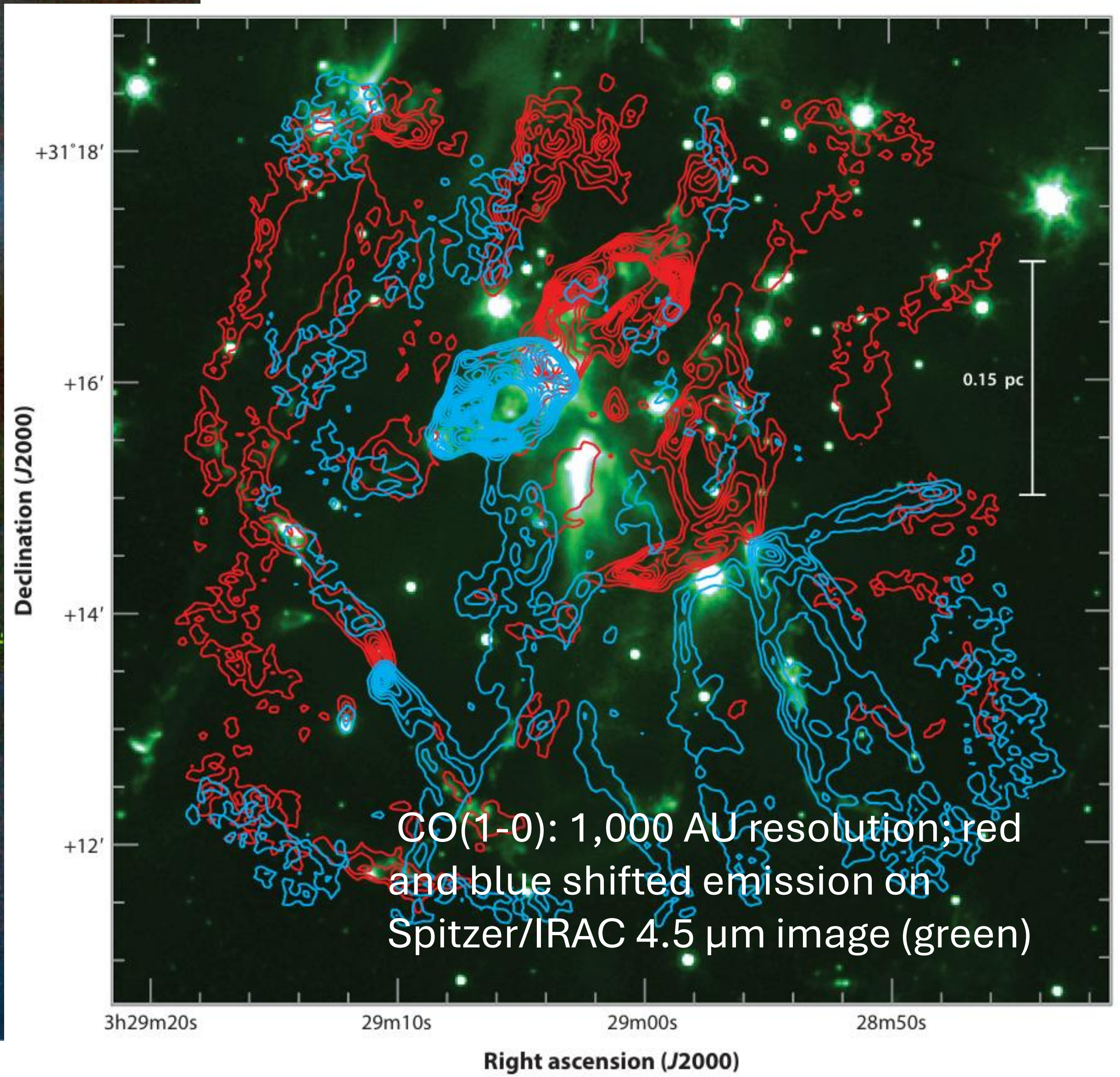
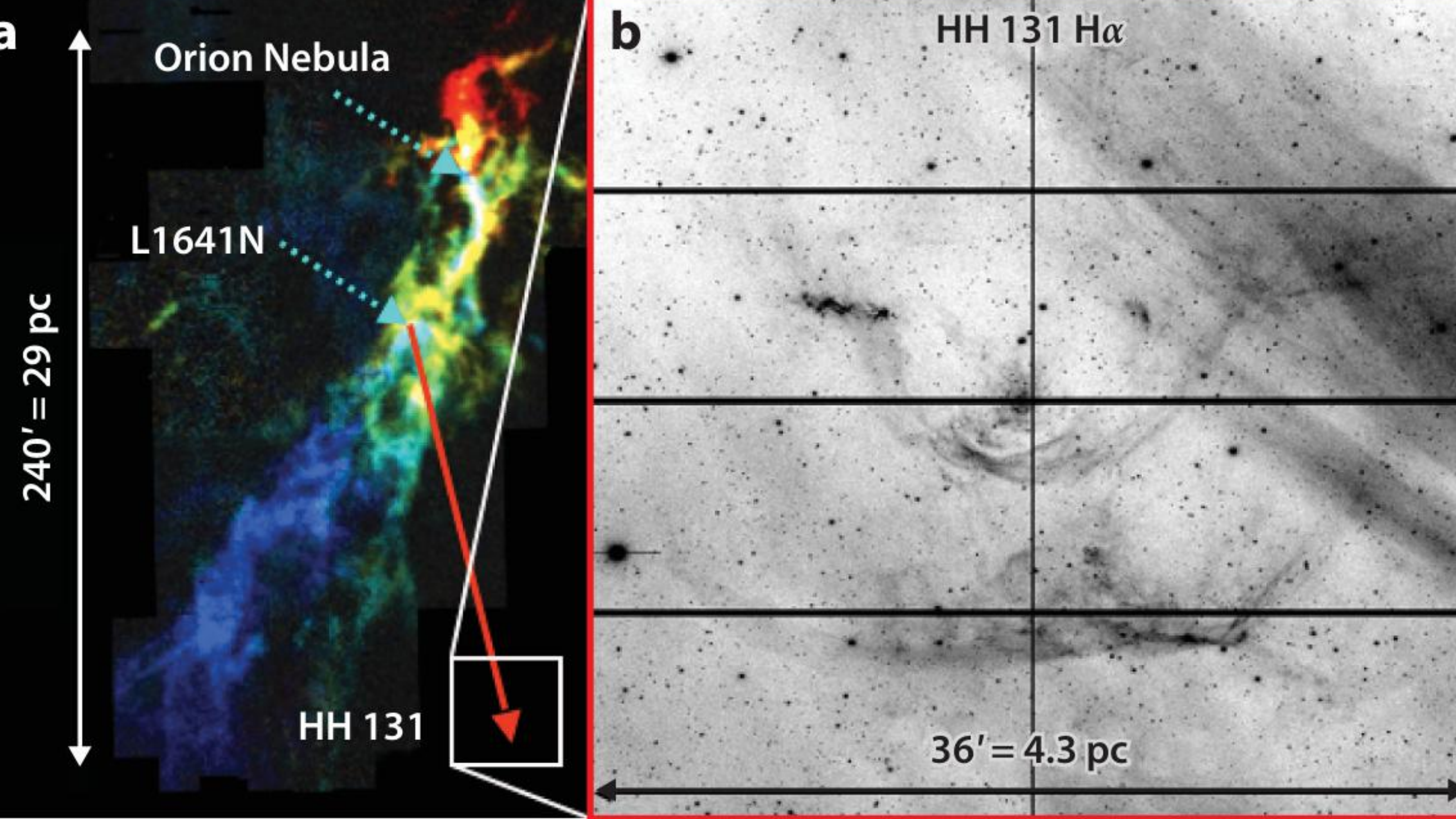
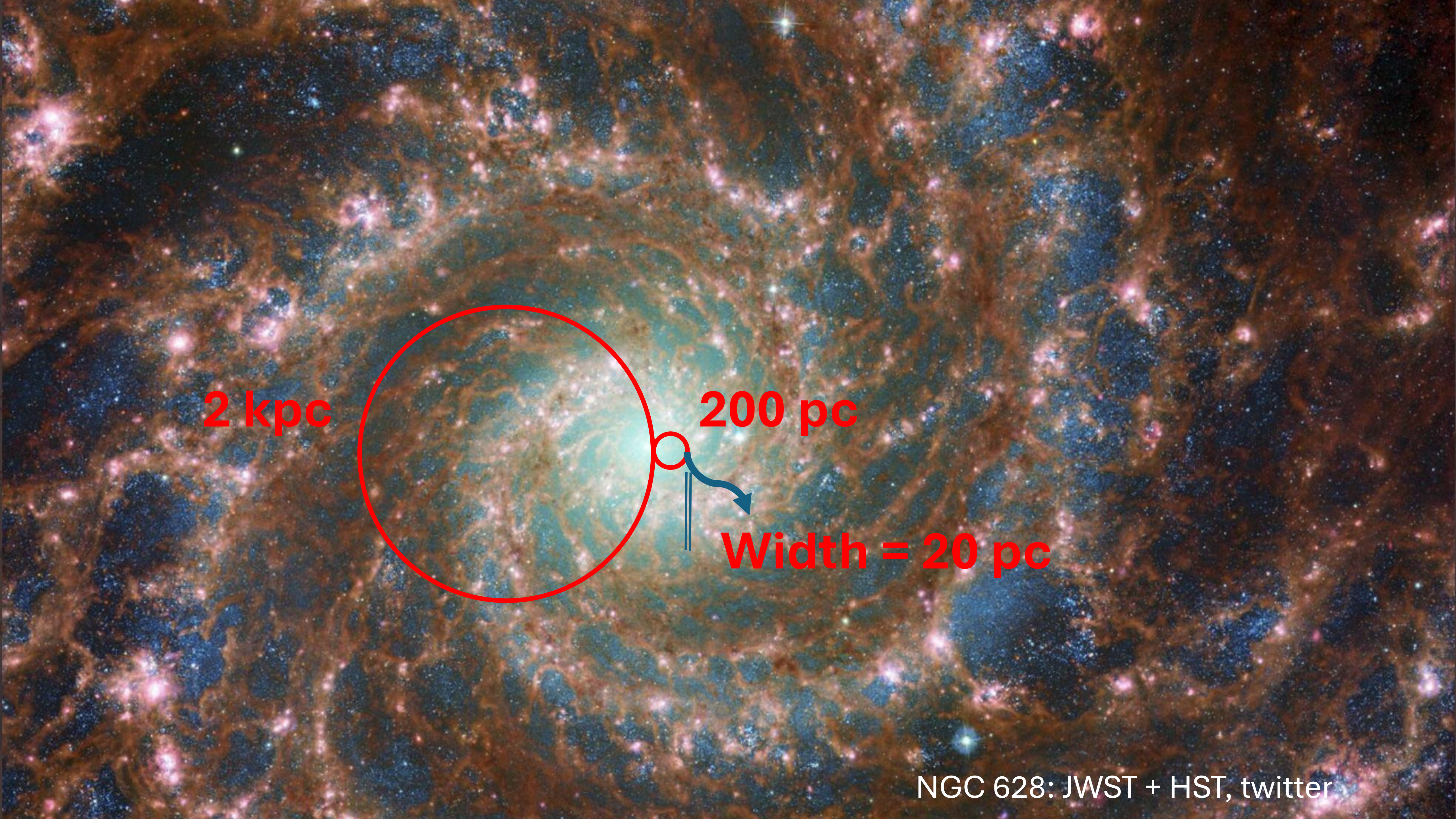
ISM
John's
Orion
image
star formation in
a crossing time
space & time
cluster
correlations
cloud &
cluster mass
functions
'00
'98
'96-'97
1987
Edge of a Wood, 1882, van Gogh

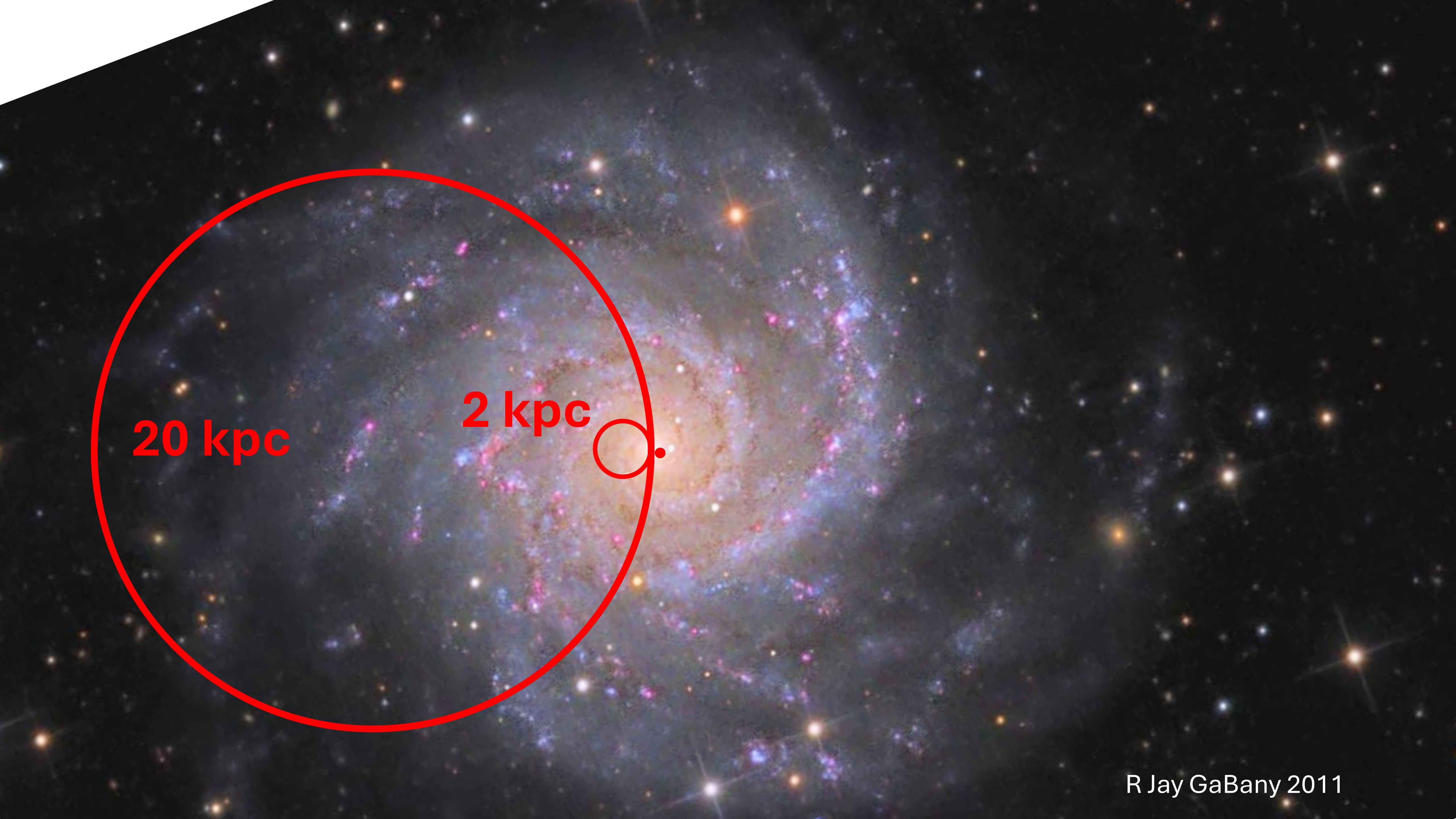
Bally 2016, ARAA 54, 491



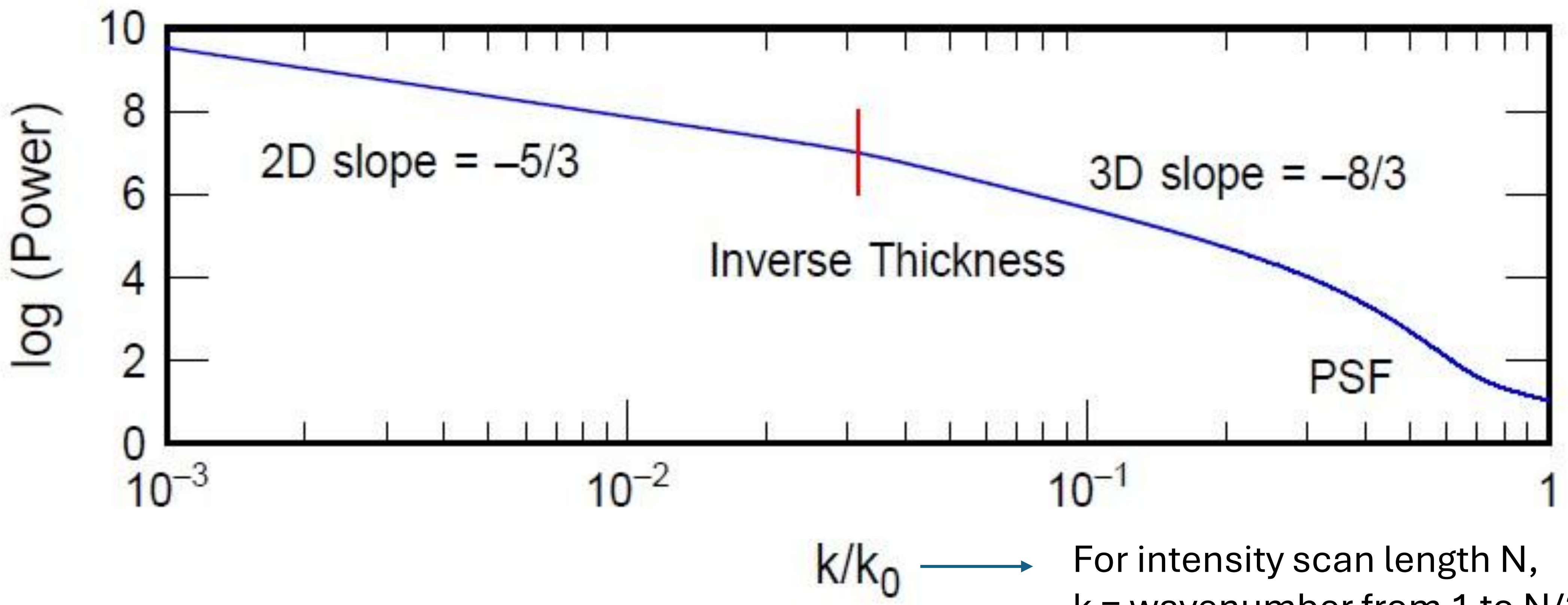



a
Orion Nebula
L1641N
240′ = 29 pc
HH 131
b
HH 131 Hα
36′ = 4.3 pc


2 kpc
200 pc
Width = 20 pc
NGC 628: JWST + HST, twitter


20 kpc
2 kpc
R Jay GaBany 2011

Power spectrum with break at the scale of the disk thickness



For intensity scan length N,
k = wavenumber from 1 to N/2
and k_0 = N/2

$$P(k) = S^2(k) + C^2(k) \quad \begin{cases} S(k) = \dfrac{1}{N} \displaystyle\sum_{m=1}^{N} I(m) \sin(2\pi k m / N), \\ C(k) = \dfrac{1}{N} \displaystyle\sum_{m=1}^{N} I(m) \cos(2\pi k m / N) \end{cases}$$

LMC: Elmegreen +01,
Block +10
NGC 1058: Dutta +09
M33: Combes +12

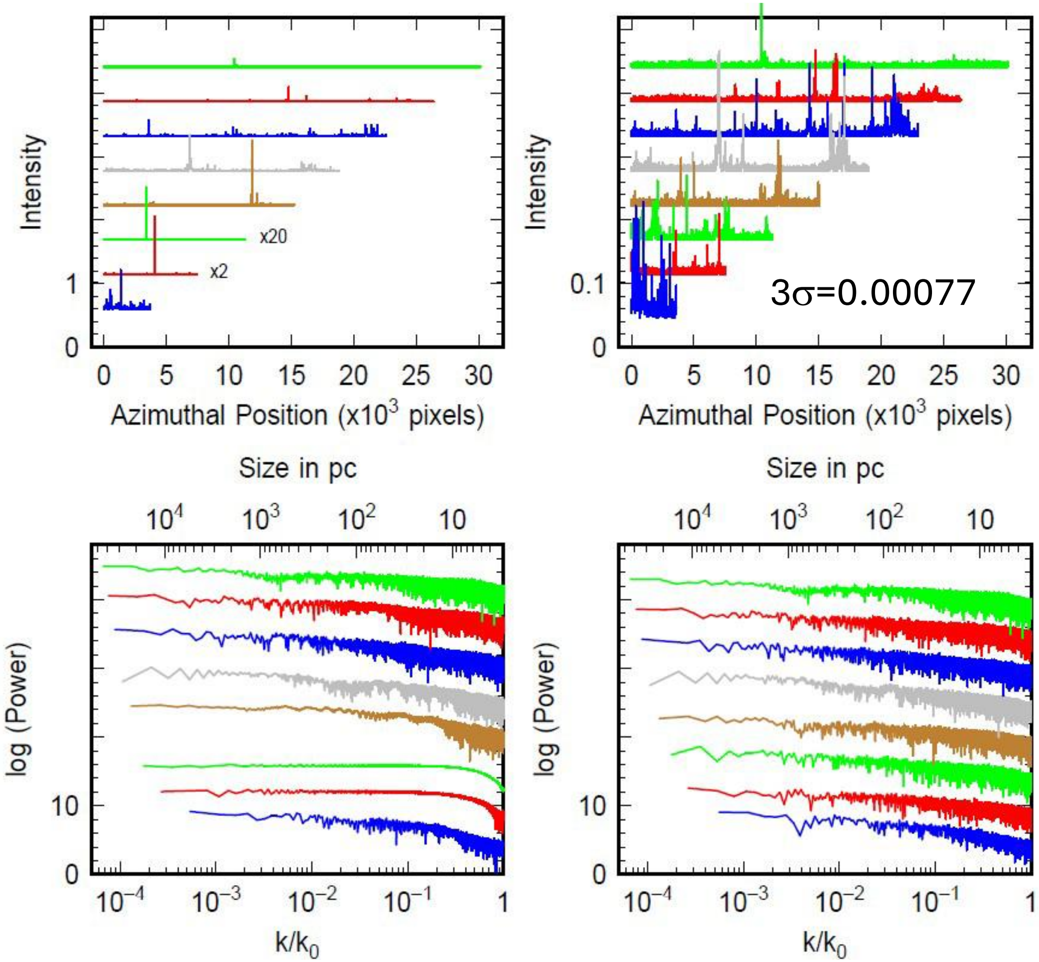
M51 HST Hα, circles every 600 pixels (872 pc), intensity scan every 3rd pixel

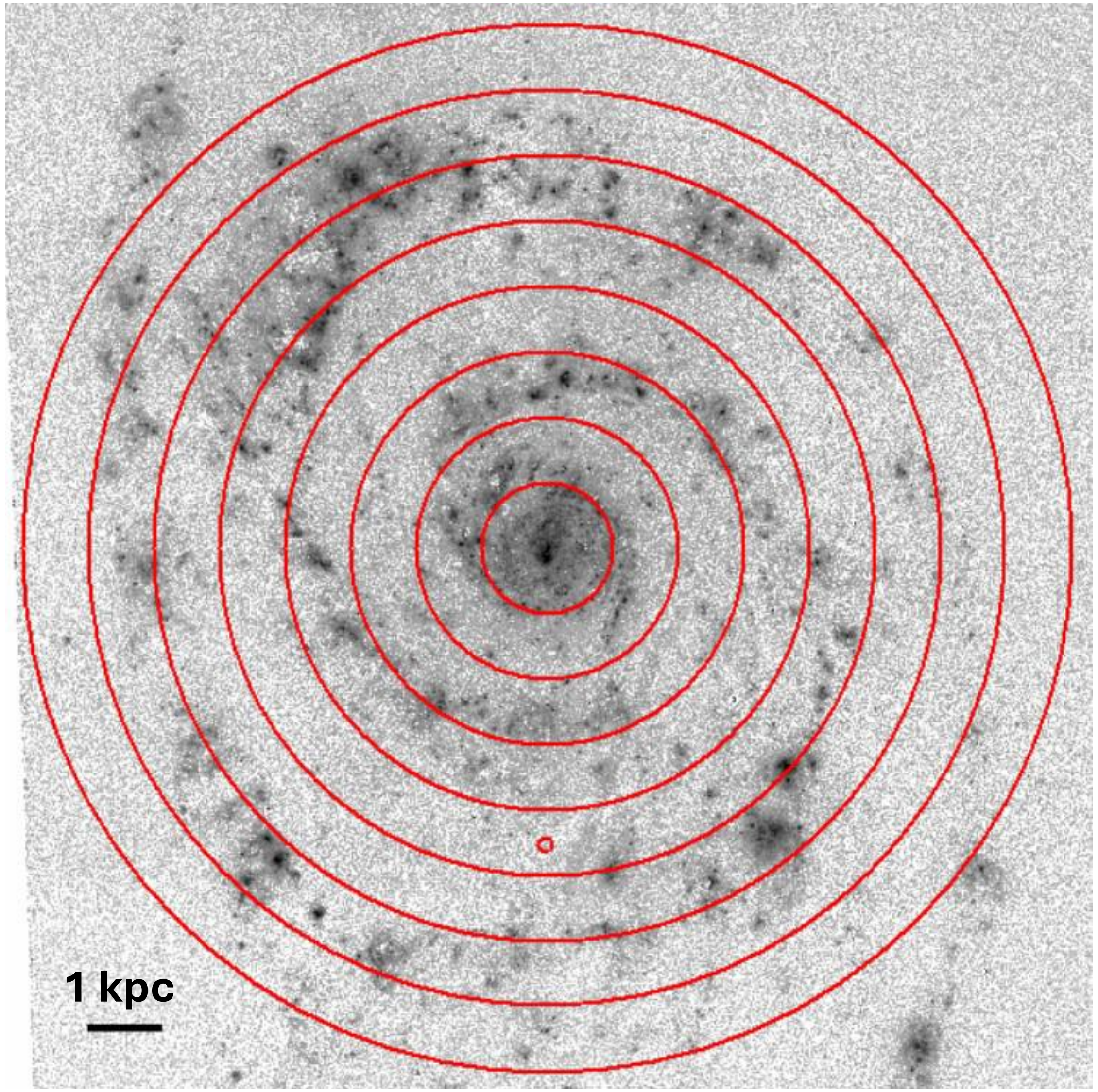
Small circle has a diameter of 200 pc.

Elmegreen +25

Left: Intensity scans (in 10^{-13} erg s^{-1} cm^{-2} $arcsec^{-2}$) and PS at circles.

Right: Nearby scans with no strong sources (10x scale) and more uniform PS





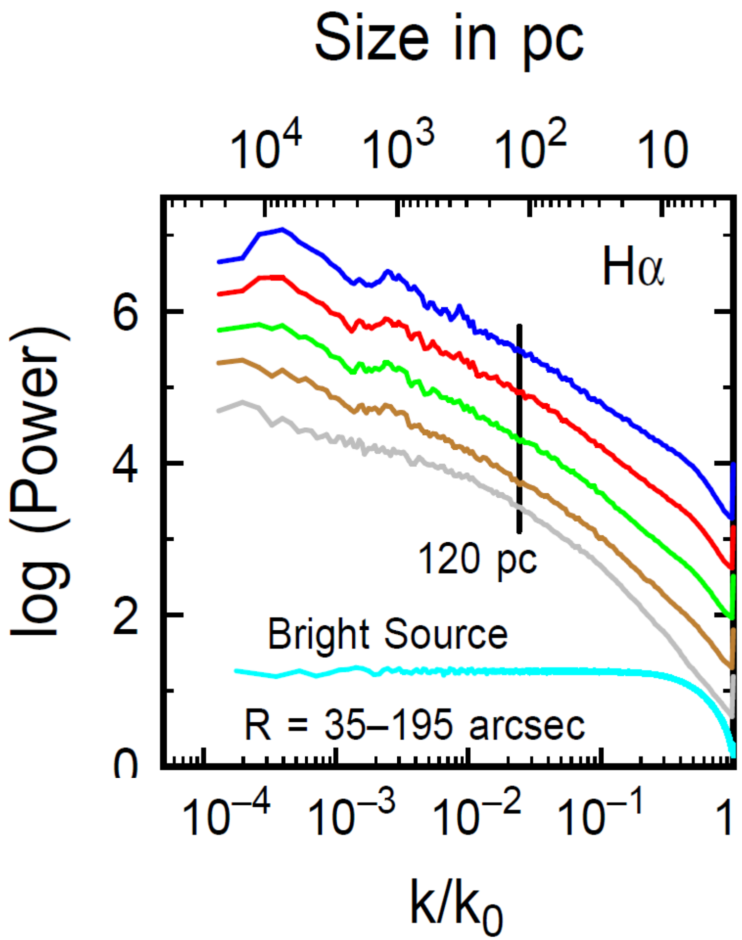
0.07” resolution = 2.55 pc; 0.04” pixels.

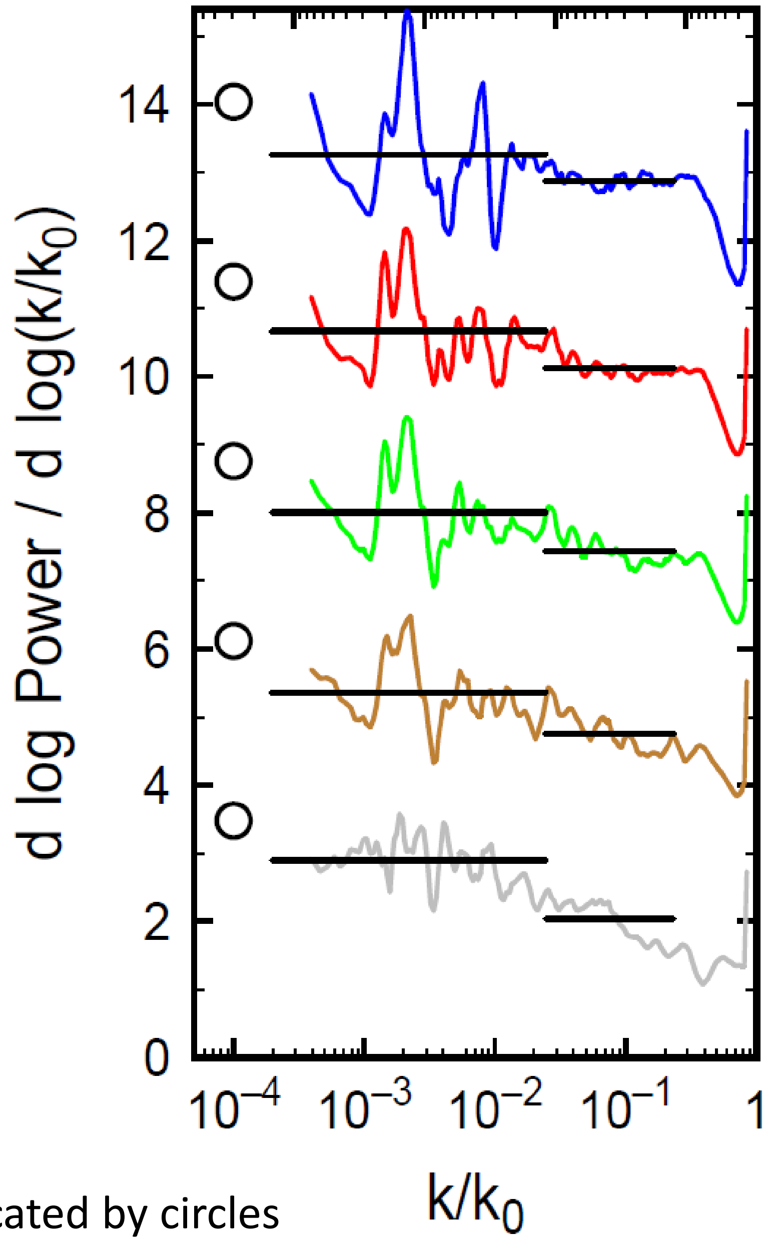
Distance assumed to be 7.5 Mpc

Hα PS and running slopes

PS from top to bottom have higher cutoffs, including more scans with higher peaks

A break at 1/k ~ 120 pc is in the top three Hα PS





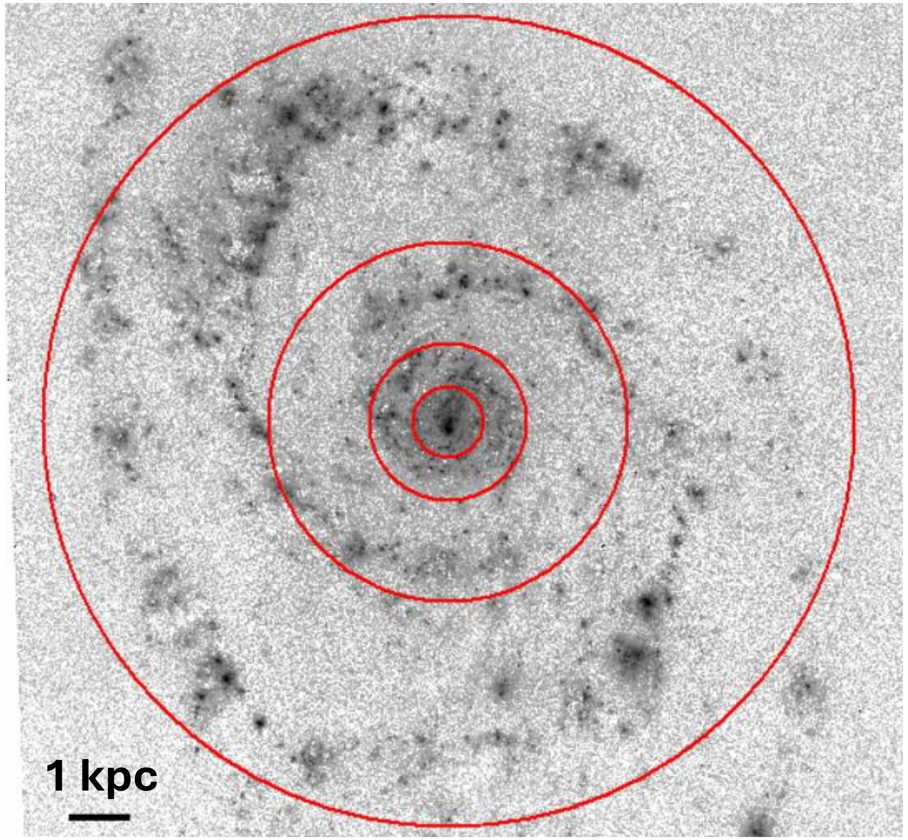
zero-levels indicated by circles

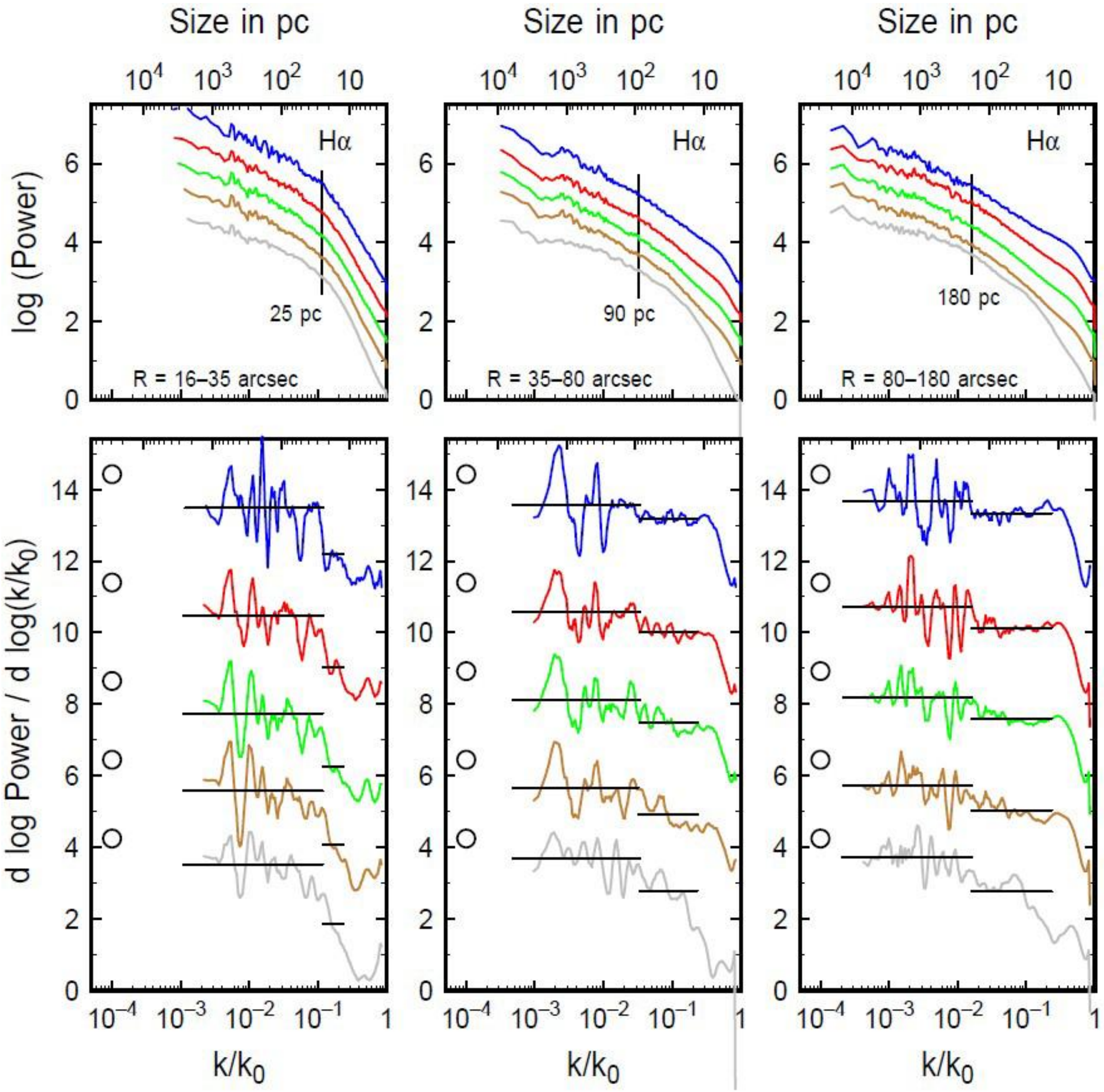
Elmegreen +25

3 intervals of galactocentric radius

peak intensities and the number of PS in the averages increase from the top to bottom

PS break scale increases with radius.





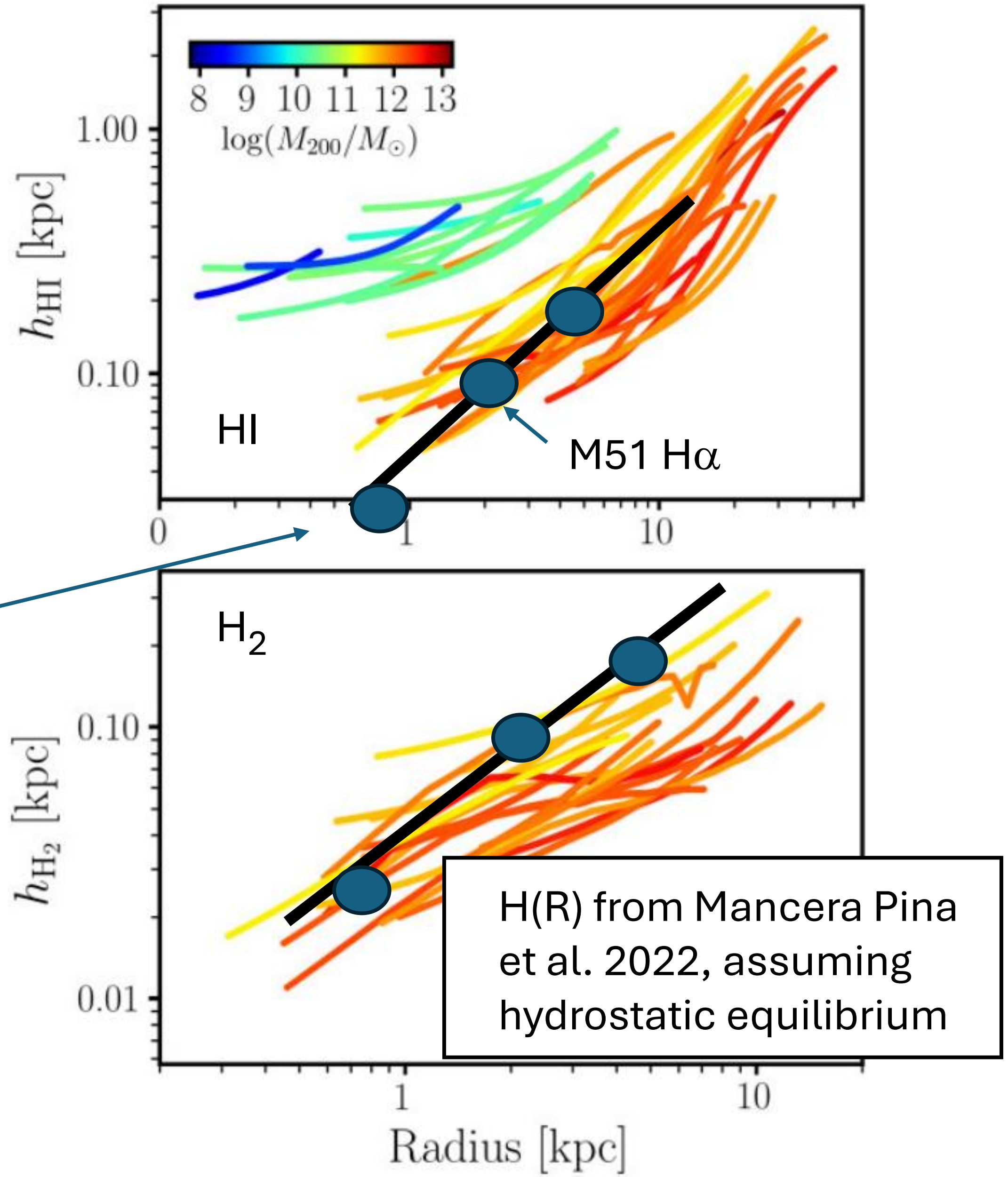
The scale for Hα increases with radius,

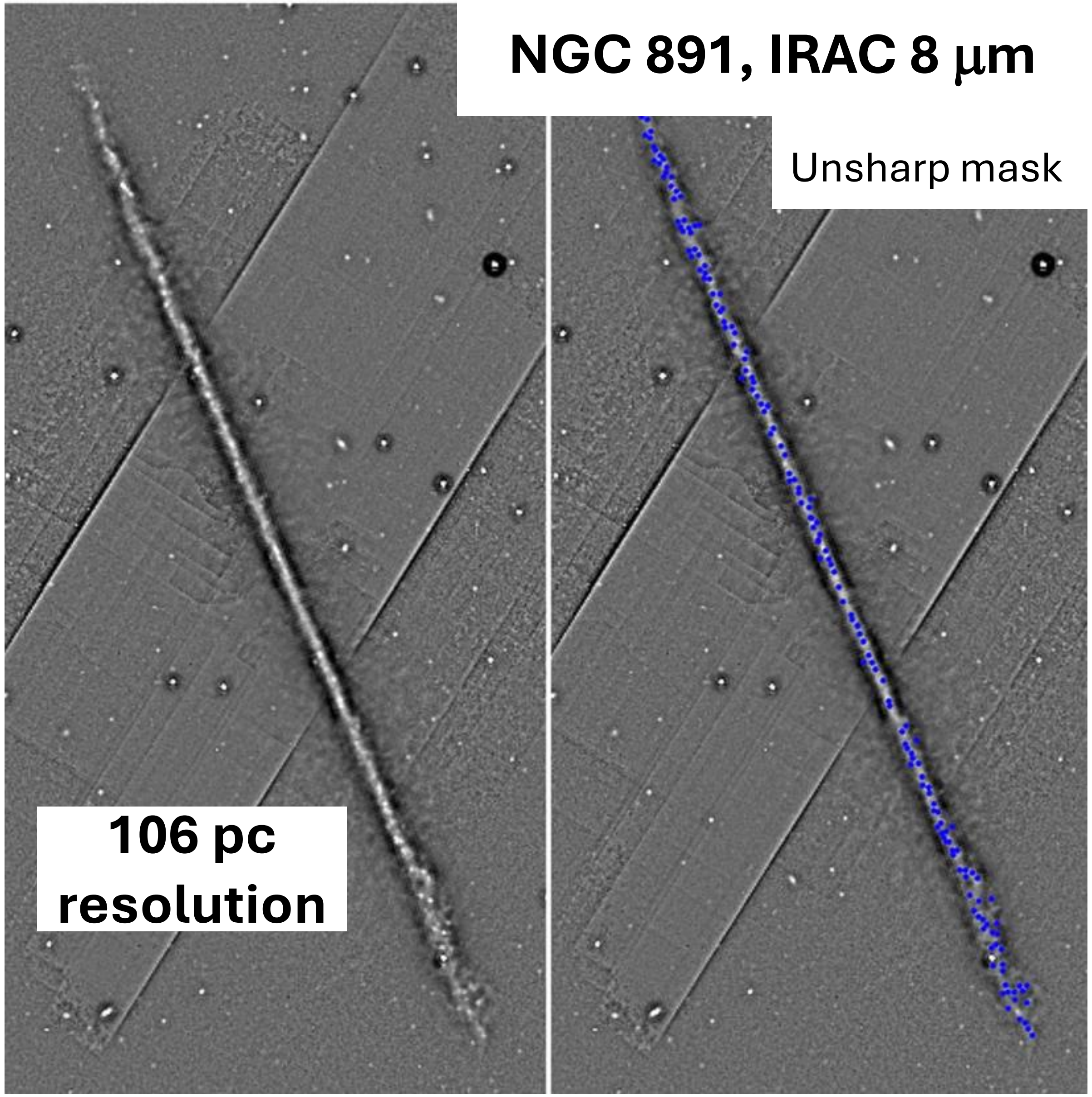
from

~ 25 pc at 0.5-1 kpc radius to
~ 90 pc at 1.27-2.91 kpc to
~ 180 pc at 2.91-6.54 kpc

→ Scale increase ~ 40 pc/kpc

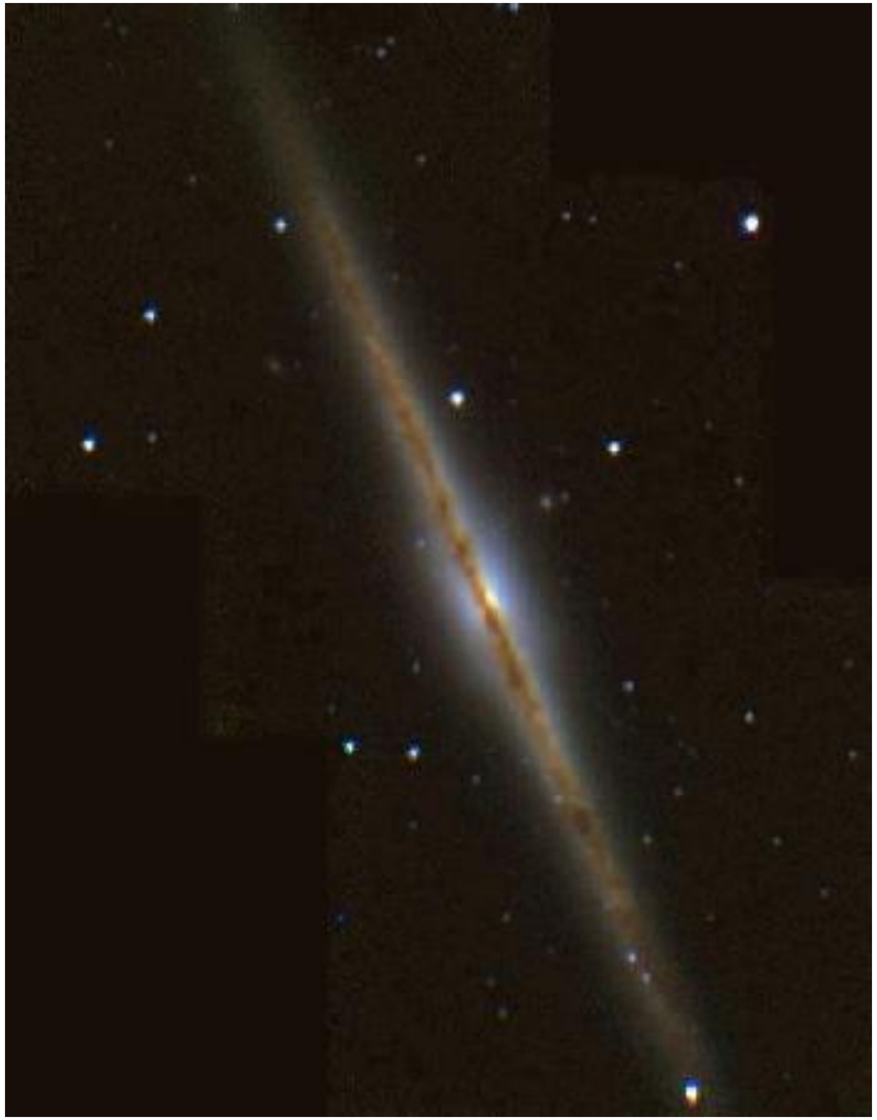
Looks **typical** for spiral galaxies.



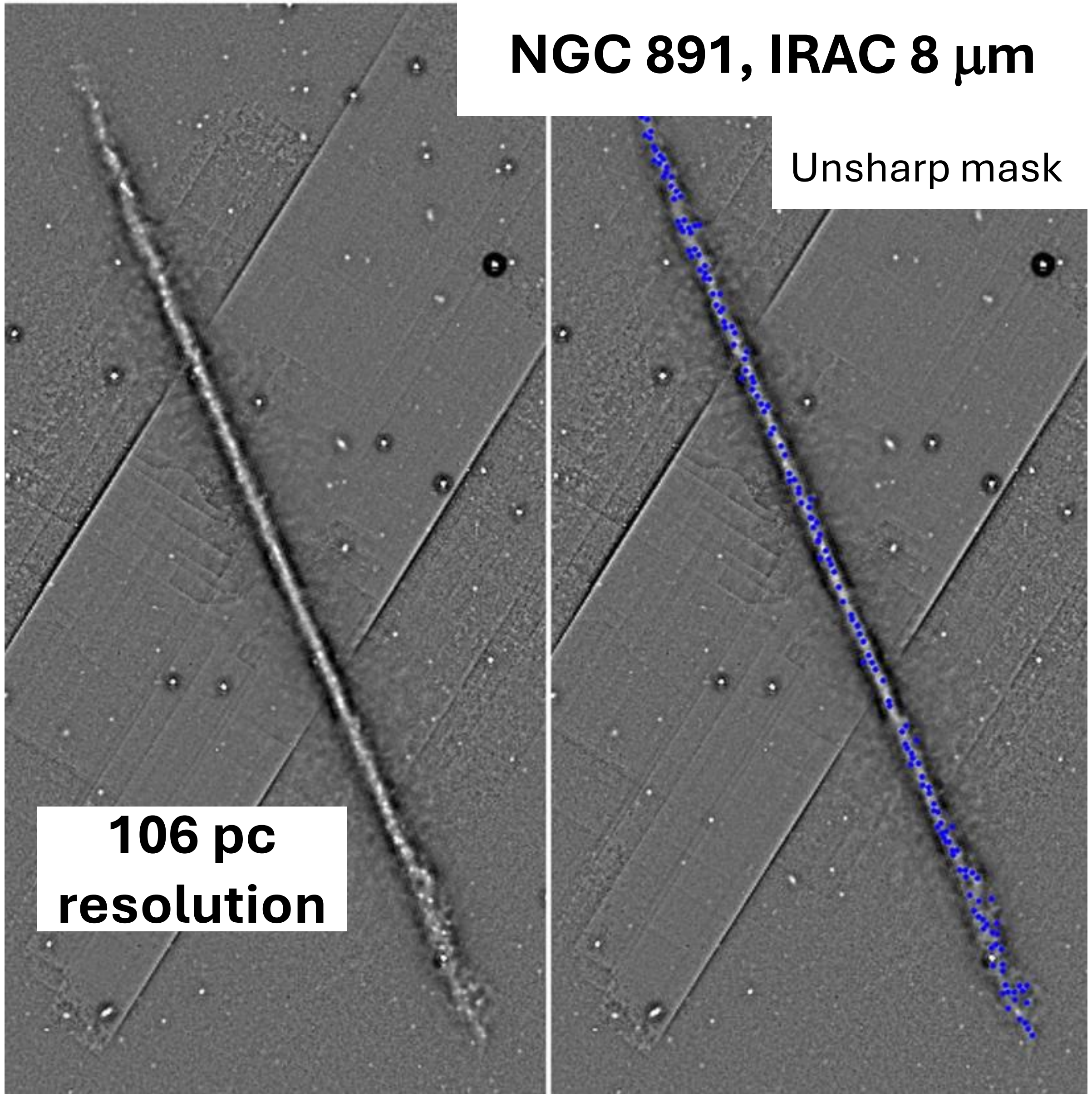


B.G. Elmegreen & D.M. Elmegreen 2020 ApJ , 895, 17

NGC 891: APOD Feb 28, 1997

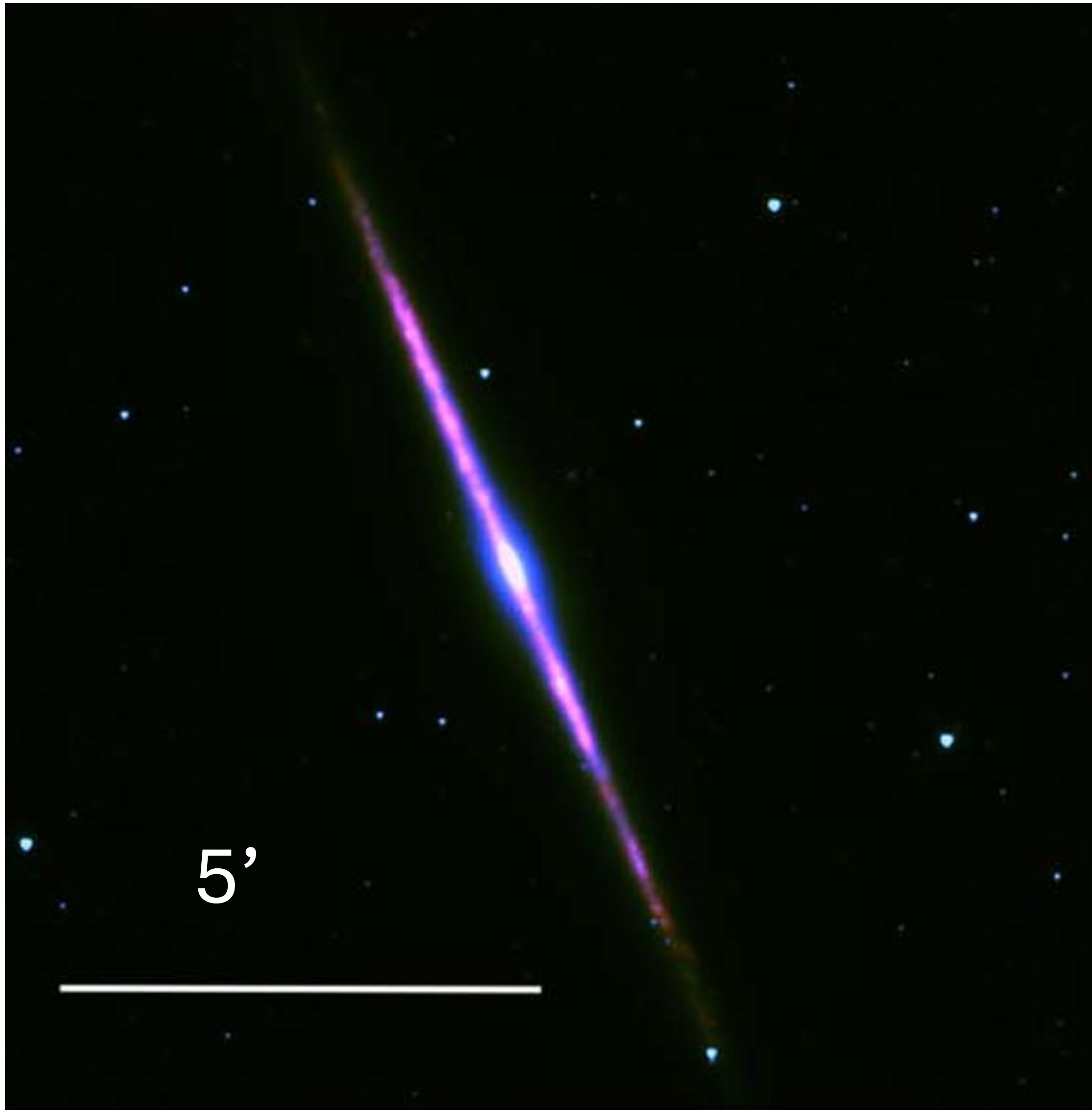


J. C. Barentine & G. A. Esquerdo (PSI), 1.3-m Tel., Kitt-Peak, NOAO



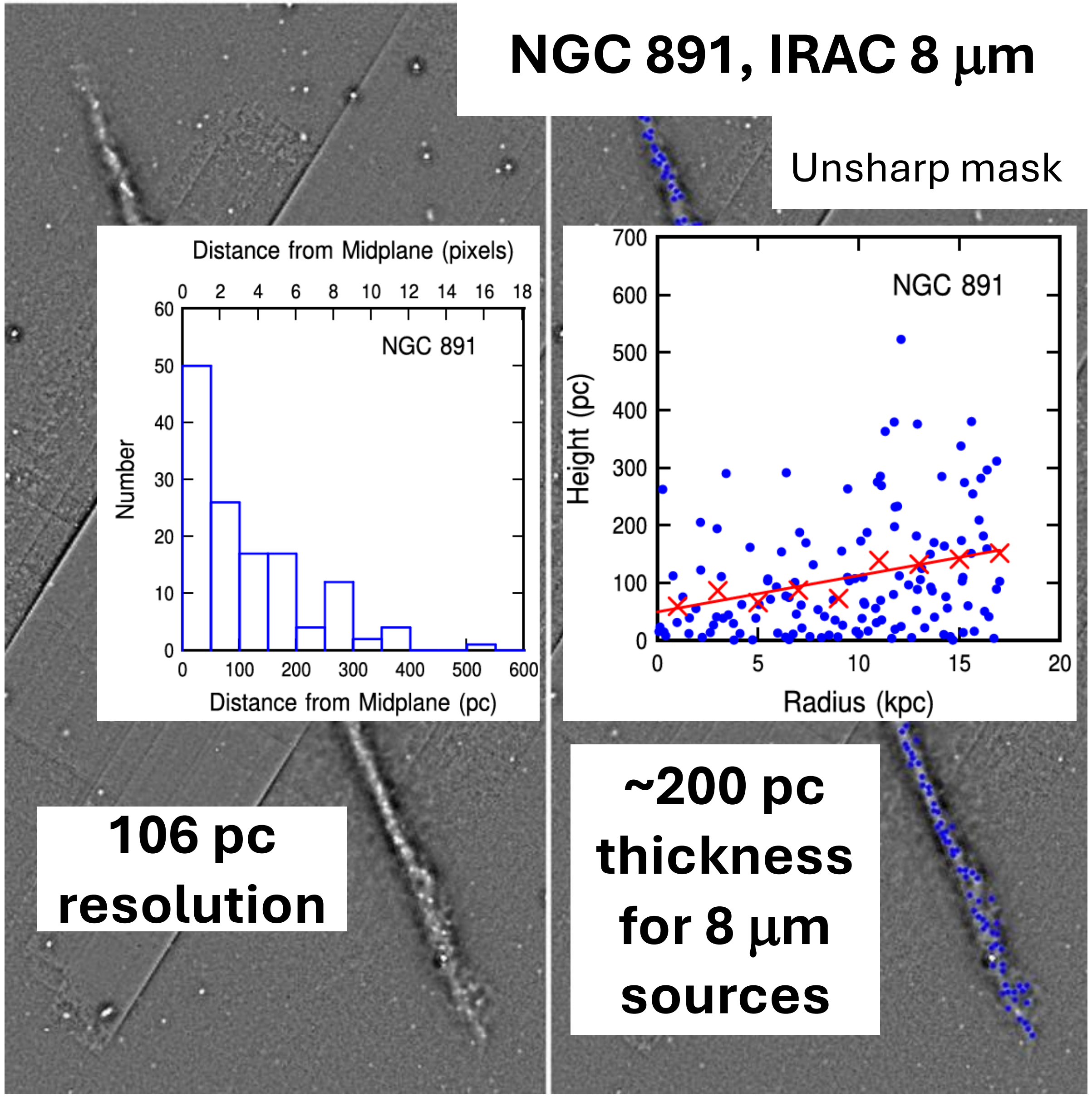
B.G. Elmegreen & D.M. Elmegreen 2020 ApJ , 895, 17

Spitzer: 3.6 μ (B), 4.5 μ (G), 8 μ (red)



B.G. Elmegreen & D.M. Elmegreen 2020 ApJ , 895, 17

NGC 891, IRAC 8 μm



B.G. Elmegreen & D.M. Elmegreen 2020 ApJ , 895, 17

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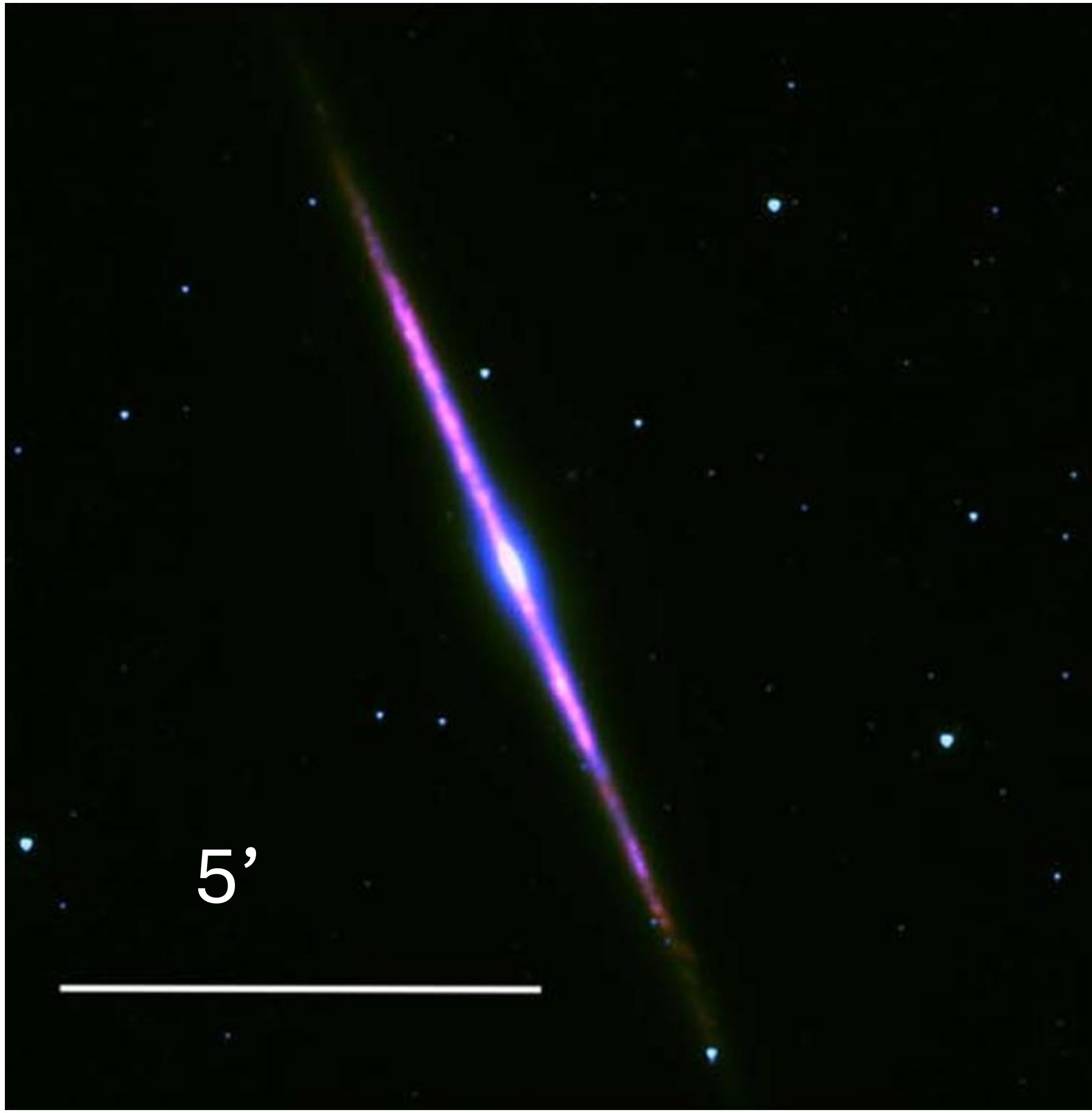
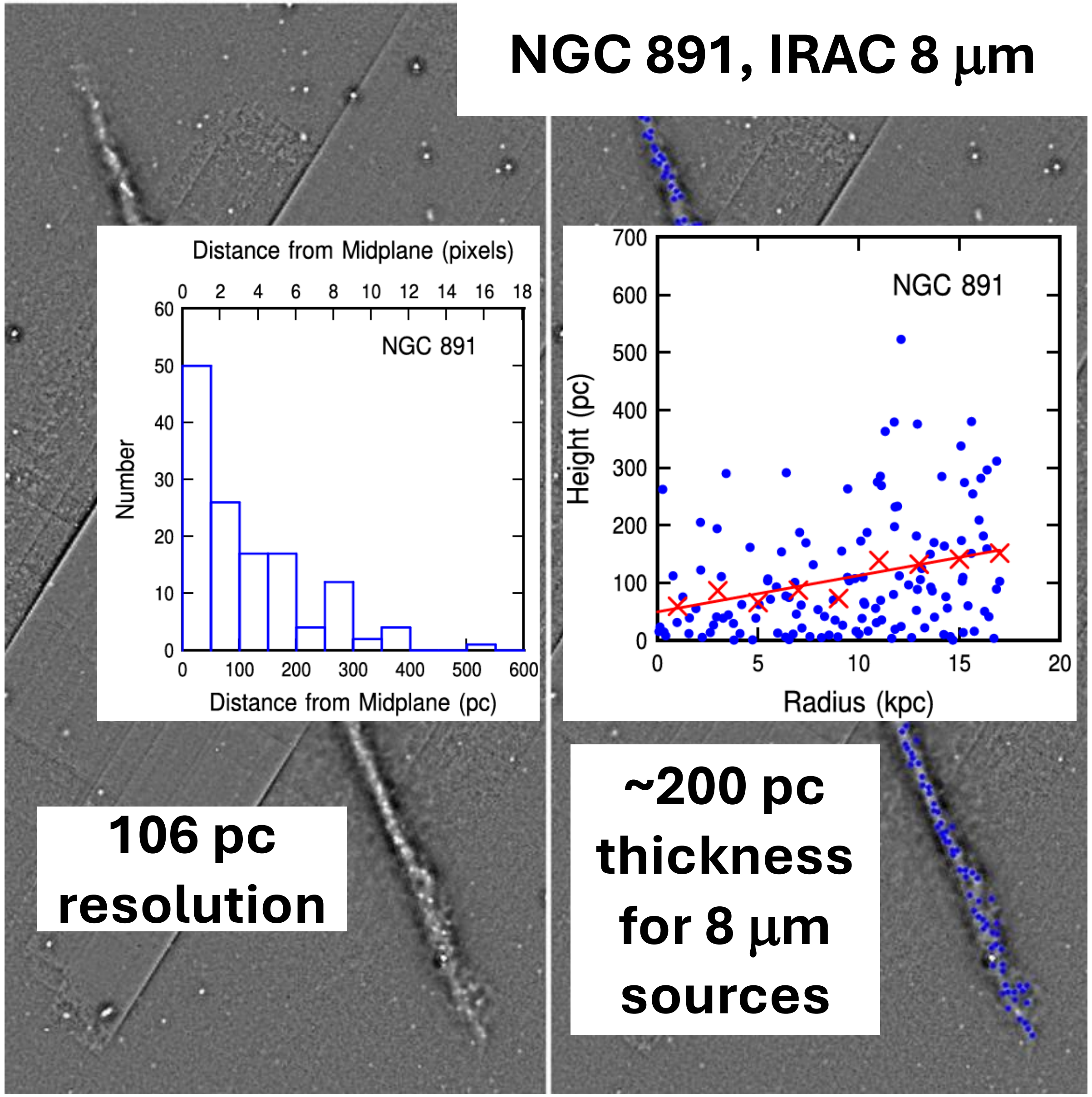
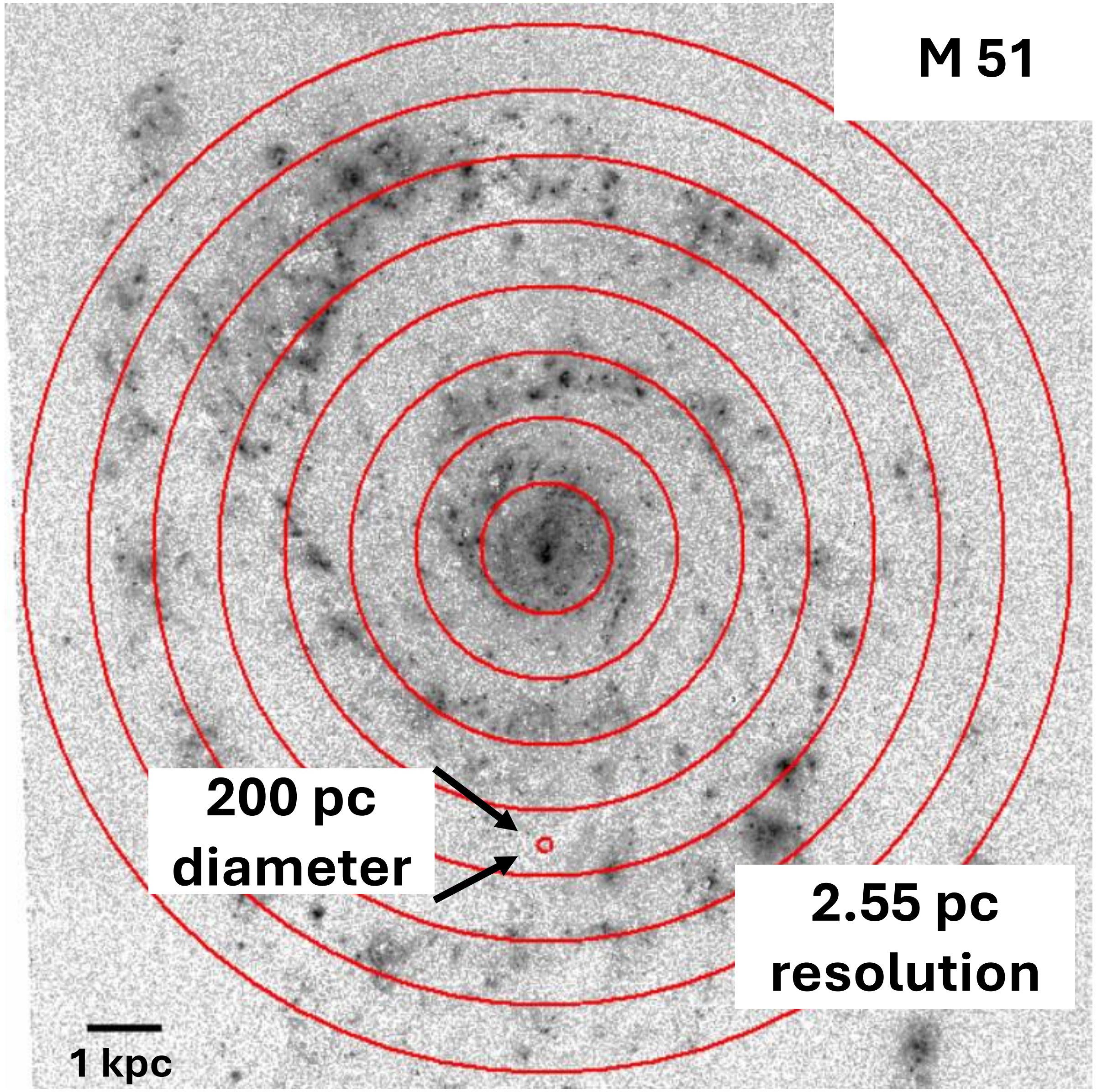


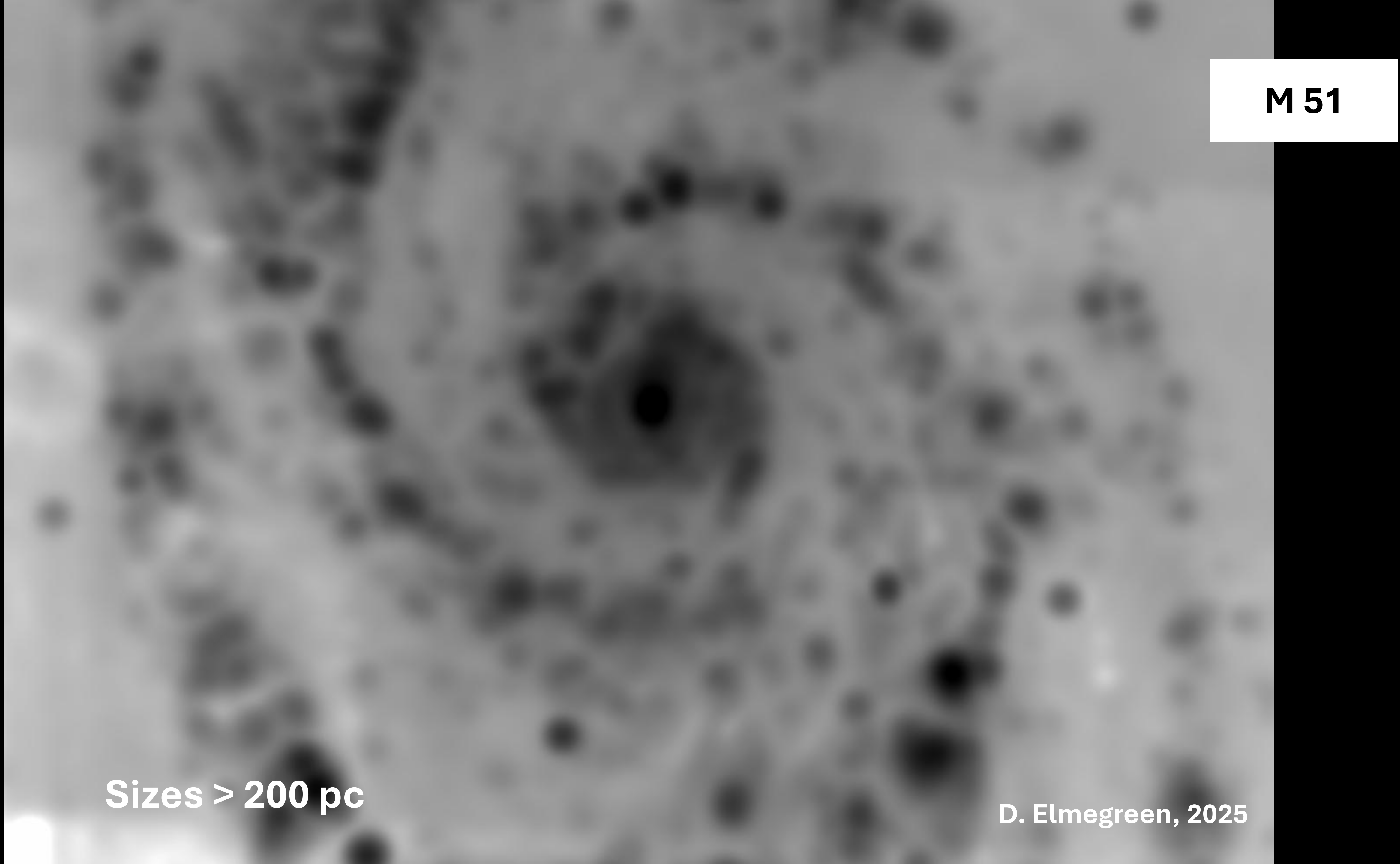
B.G. Elmegreen & D.M. Elmegreen 2020 ApJ , 895, 17

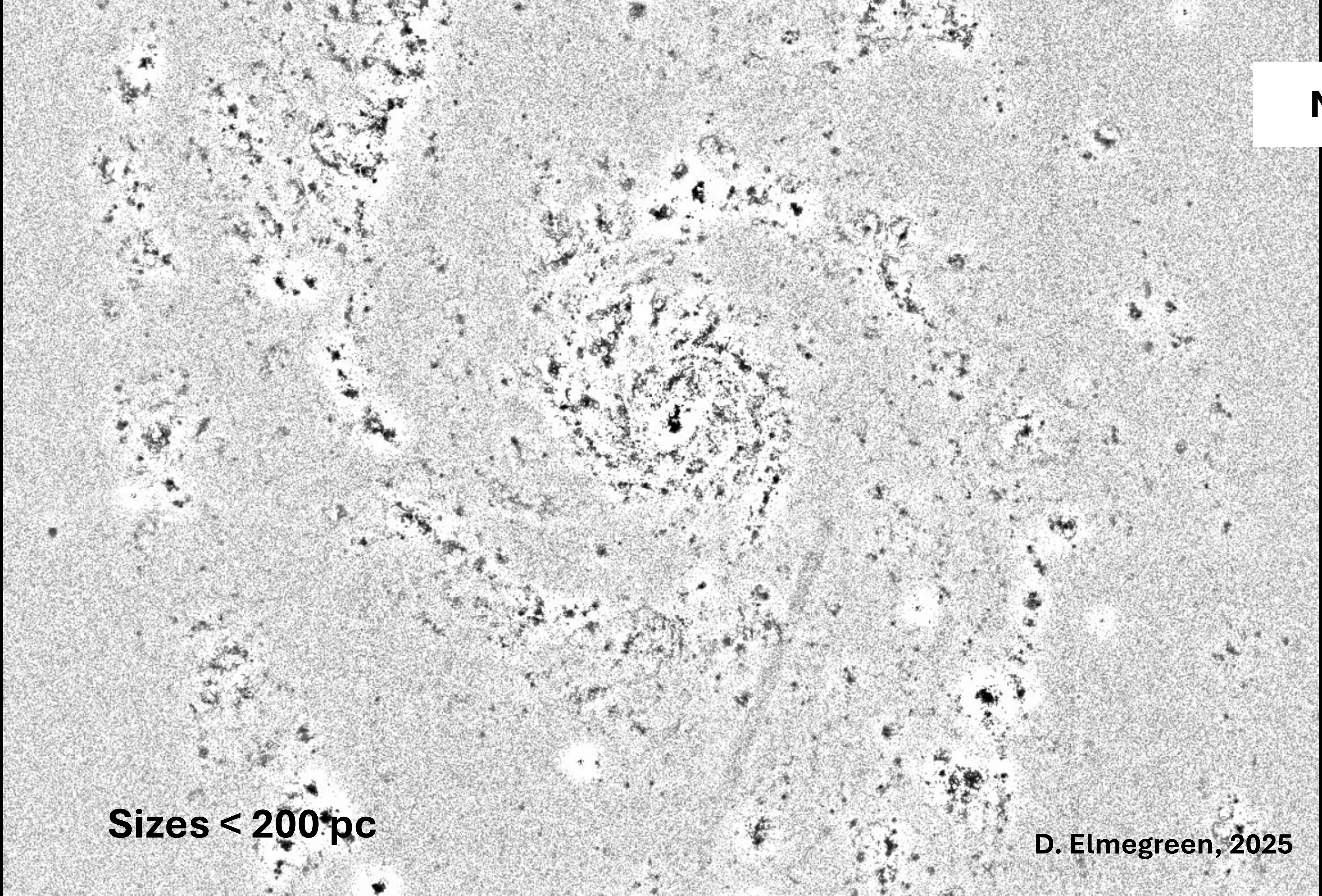


B.G. Elmegreen & D.M. Elmegreen 2020 ApJ , 895, 17

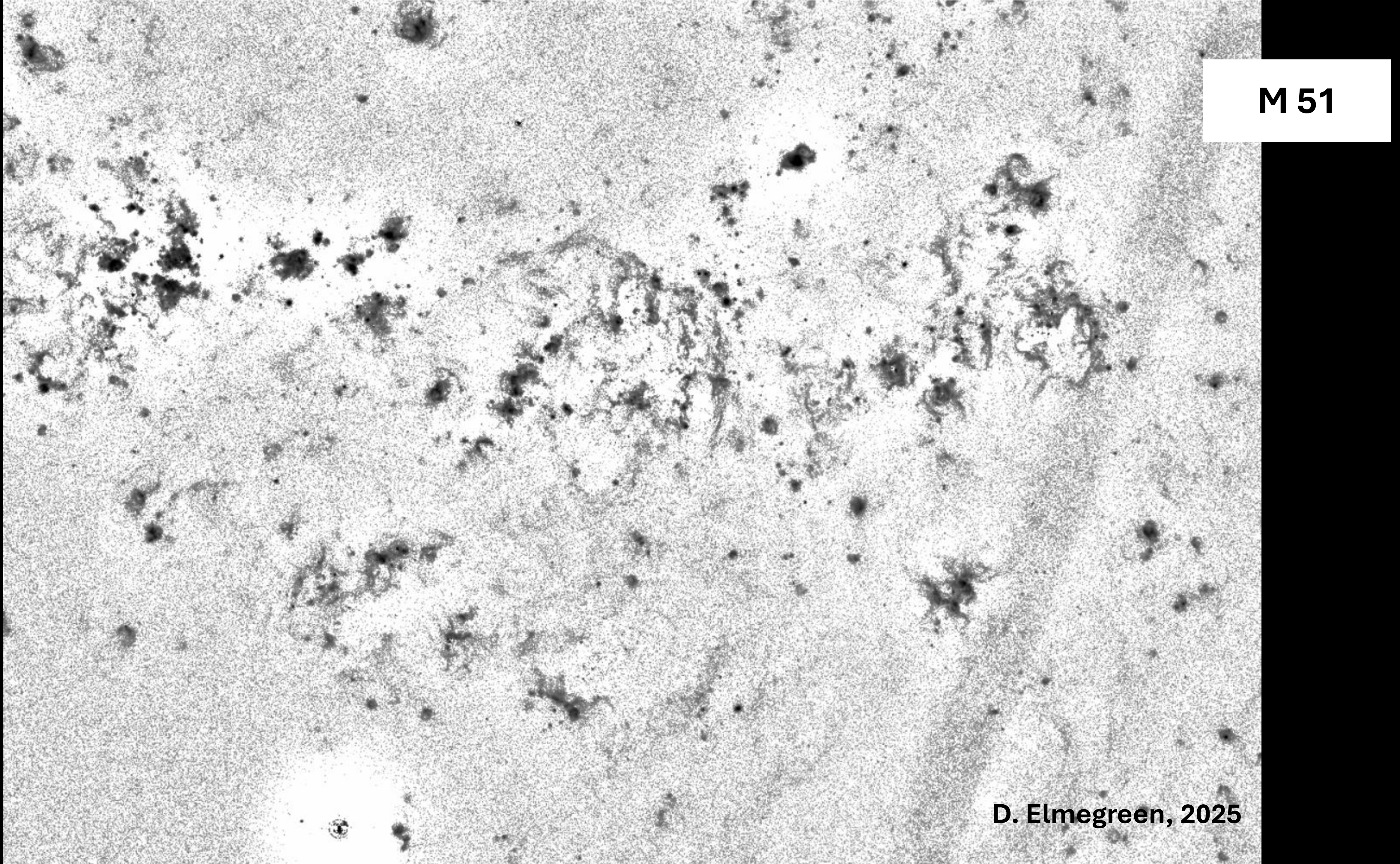


M51 is 35x bigger than circle and resolution is 78x smaller


M 51
Sizes > 200 pc
D. Elmegreen, 2025

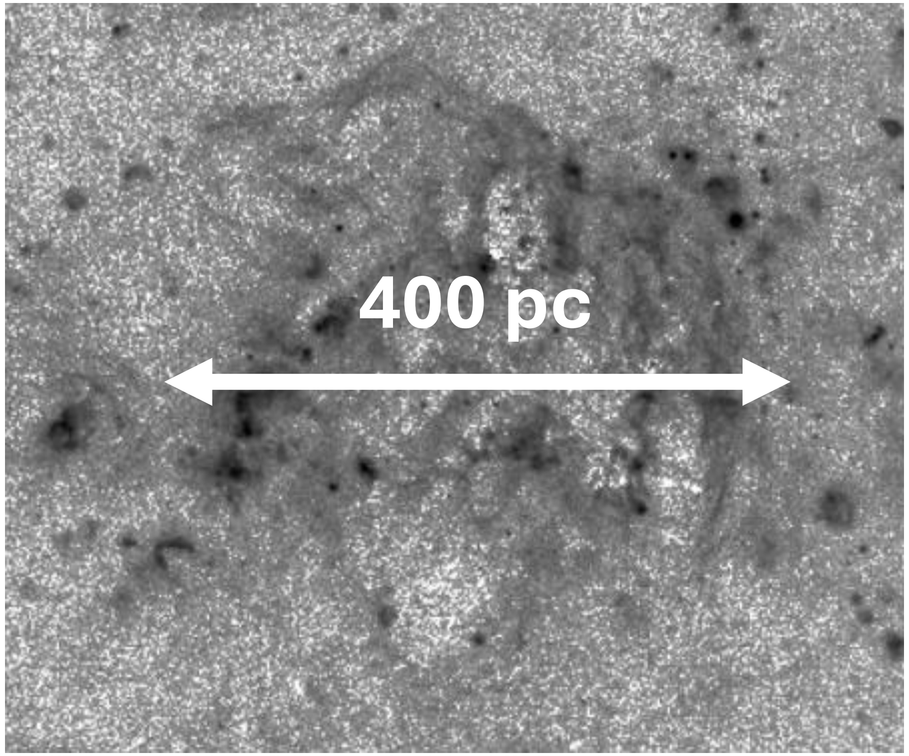

M 51
Sizes < 200 pc
D. Elmegreen, 2025

M 51

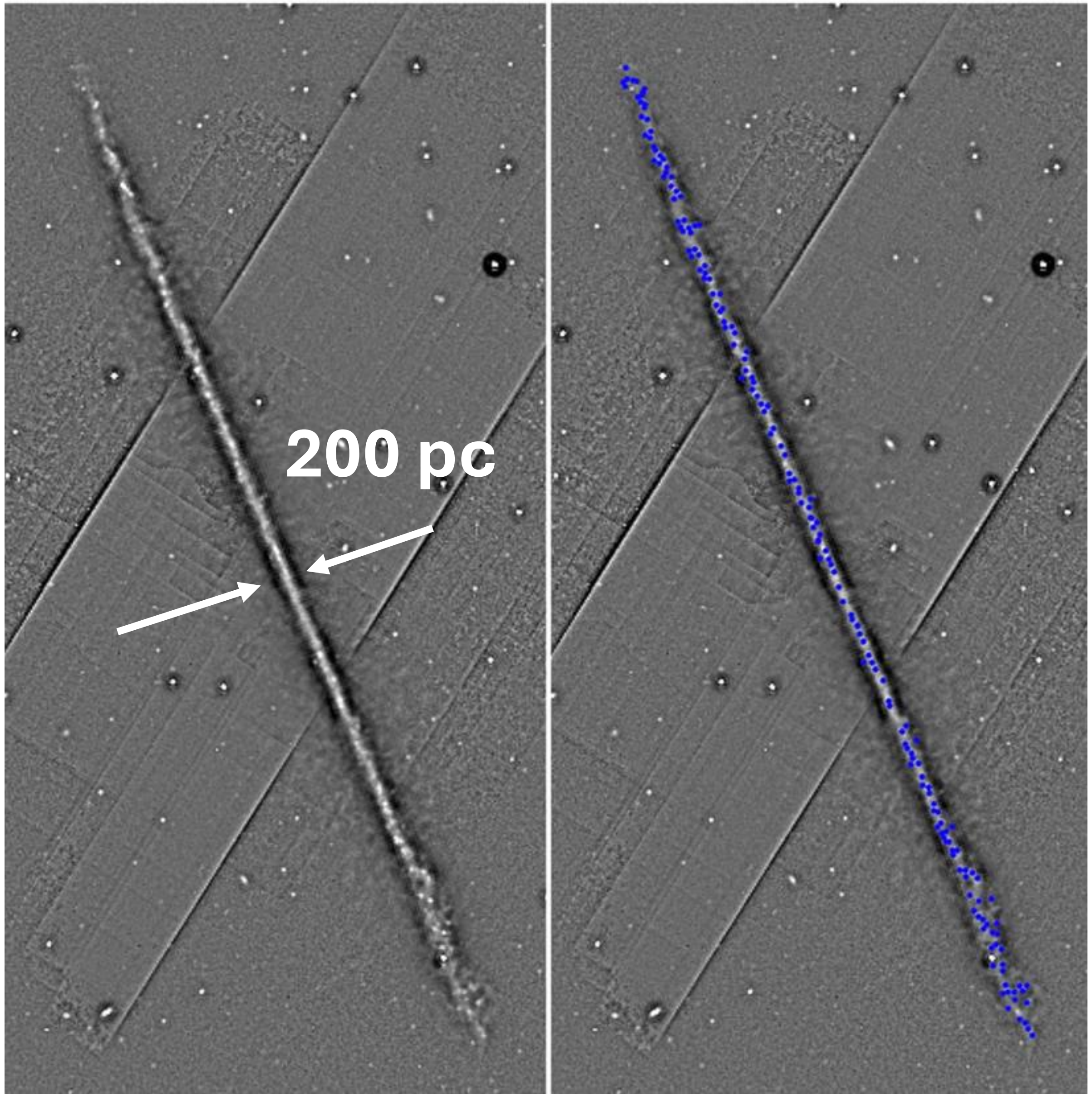

M 51
D. Elmegreen, 2025

Where does star formation feedback go?

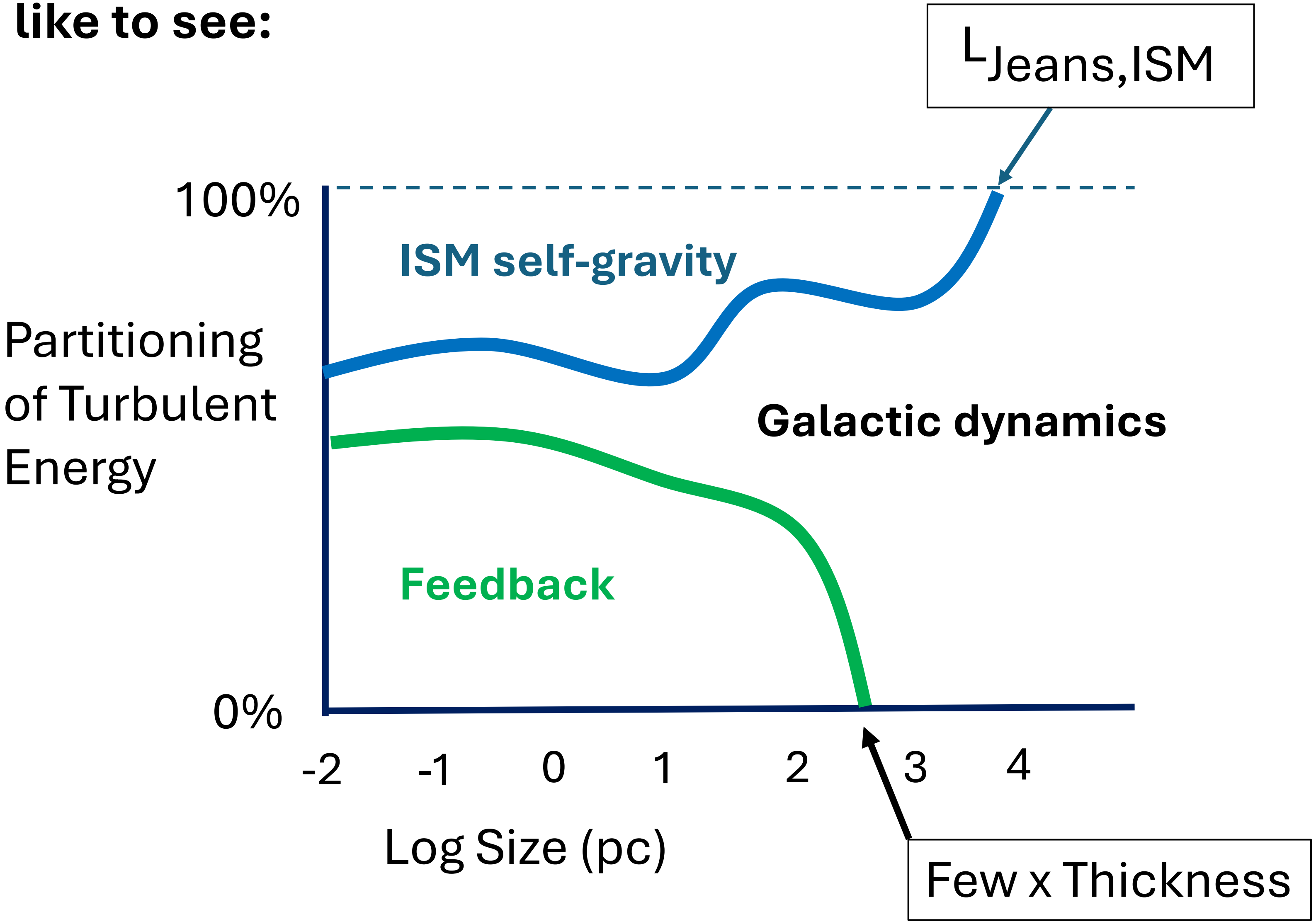
M51



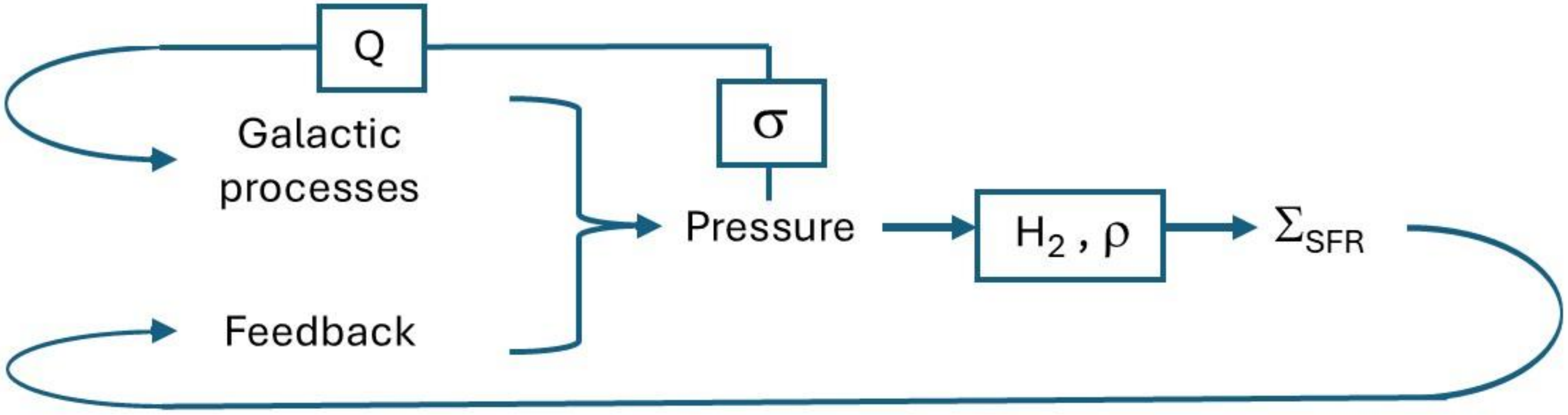
NGC 891



A plot I would like to see:



Star formation feedback is not the only feedback



Other Reflections on Feedback … climbing John's ladder

Do jets/flares affect: rocky planet formation (boiling off volatiles from the inner disk)?
water on planets (boiling off hydrogen)?

Do nearby SNe (e.g., ^{26}Al enrichment) affect planet melting, differentiation, outgassing?

Do the first massive stars in a cluster destroy lower mass cores and affect the IMF?
Do massive stars have to form last to make a complete IMF?
If a massive star forms relatively early, does it end up isolated?

Why does the mass function of embedded clusters have the same slope as exposed clusters ($\sim M^{-2}$)?

- The ratio of feedback energy to binding energy increases with cluster mass
- More massive clusters (with their more massive stars) should be more disruptive than low-mass clusters, and therefore less likely to survive gas removal

Other Reflections on Feedback … climbing John's ladder

Is some star formation triggered? – the persistent debate

Proposal: if the surrounding gas (CO, HI,…) is **not** strongly self-gravitating, then **yes**

if this gas **is** strongly self-gravitating, then **no**

The related question: Are GMCs self-gravitating? Or just their dense regions?

Are the 200 pc complexes ("superclouds") self-gravitating, but …

most of the molecules inside them are not (i.e., diffuse H_2 & CO gas), yet …

the dense molecular cores inside the diffuse parts are … and

that is where stars form.

If so, then star formation can be *triggered* by turning the non-self-gravitating gas that is near the young stars into self-gravitating gas.

But if it is all self-gravitating, then spontaneous gas collapse will take over.

COMSTAR Experiment: The Crawford Bill 7-Meter Millimeter Wave Antenna

01 May 1978

NOKIA BELL LABS

"The Crawford Hill 7-meter antenna was built for propagation measurements with the COMSTAR beacons at 19 and 28.5 GHz, and for radio astronomy at frequencies from 70 to 300 GHz."

https://www.nokia.com/bell-labs/publications-and-media/publications/comstar-experiment-the-crawford-bill-7-meter-millimeter-wave-antenna/

Thanks to John, Kim, and the LOC for this wonderful meeting


I look forward to the next one
Visegrad
05/28/2025