SN + ISM
Discussion Session

Patrick Hennebelle & Eva Schinnerer

Questions to

theorists, simulators:

What observational constraints are missing?

observers:

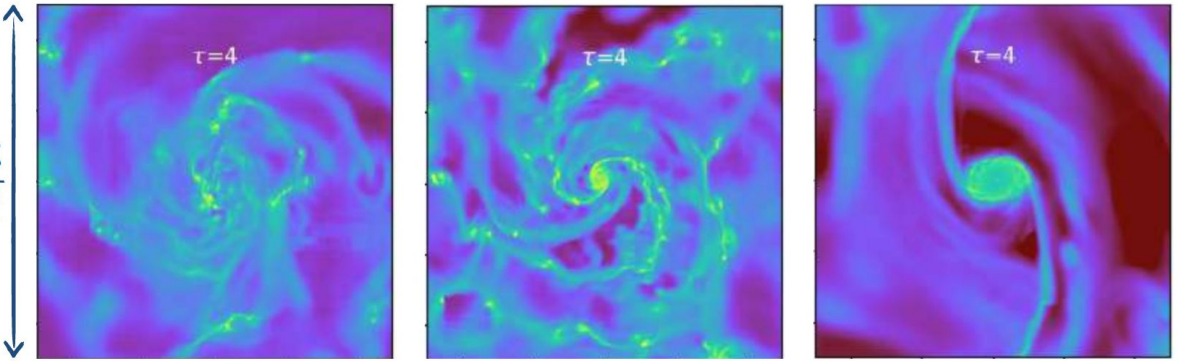
What kind of model predictions are missing?

will go from more global to local scales

What is setting galactic disk structure?

Slide borrowed from F. Renaud

Verwilghen, Emsellem, Renaud et al. (2025)



Formation of a central gas reservoir in $> 10^{10}\ M_\odot$ galaxies

see also Fraser-McKelvie et al. (2020)

Disruption of bar-driven inflows by feedback → more efficient in shallow potentials

also posters by M. Ruiz-Garcia, D. Jimenez-Lopez

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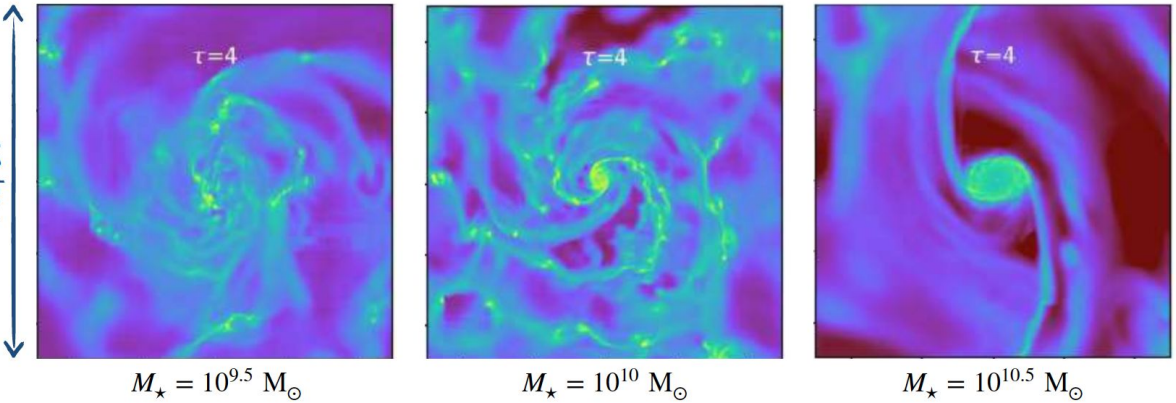

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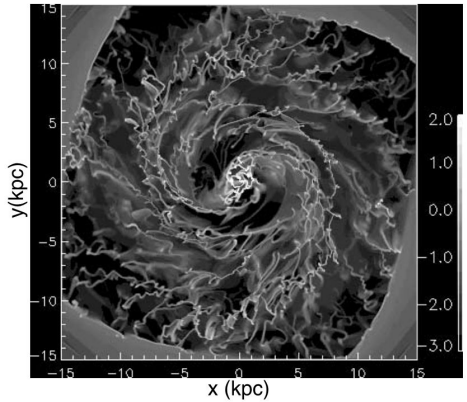
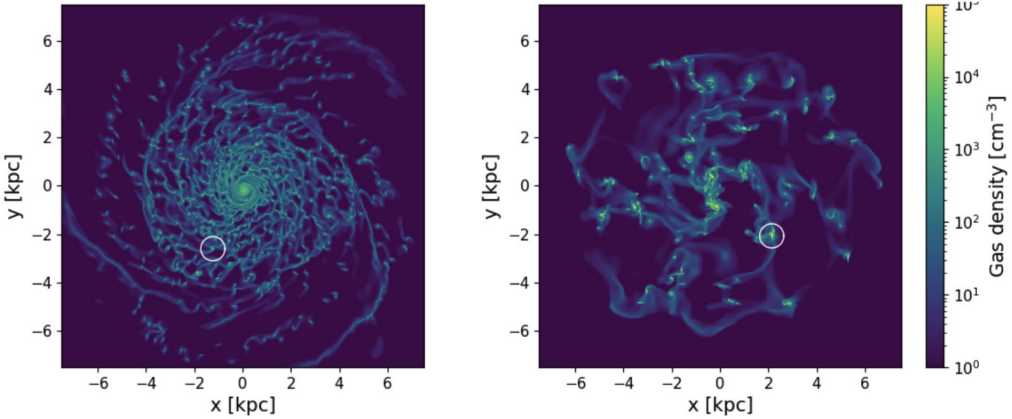
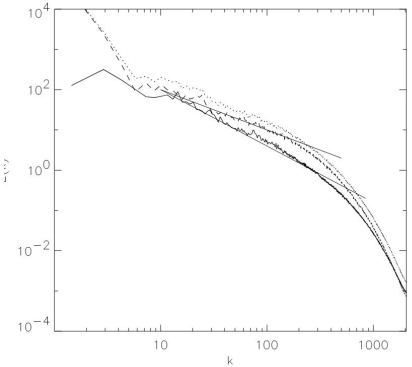
Barnes+2023, Watkins+2023
talk by Oleg Egorov

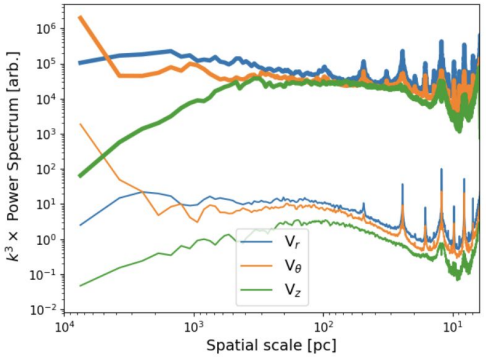
Energy injection and turbulent cascade from galactic large scales? Are SN really the main driver of turbulence in the ISM?







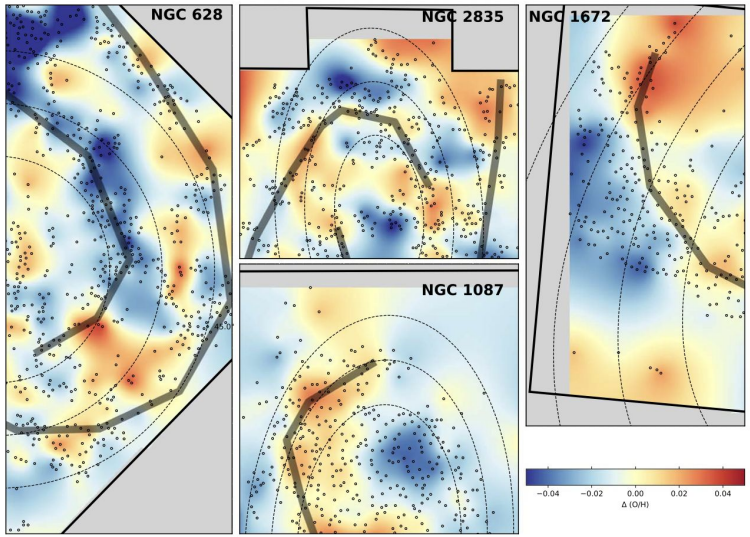
Wada et al. (2002)



Fensch et al. (2023)

What is the most important impact of stellar feedback?

chemical enrichment, mixing scale ~ 0.5 kpc

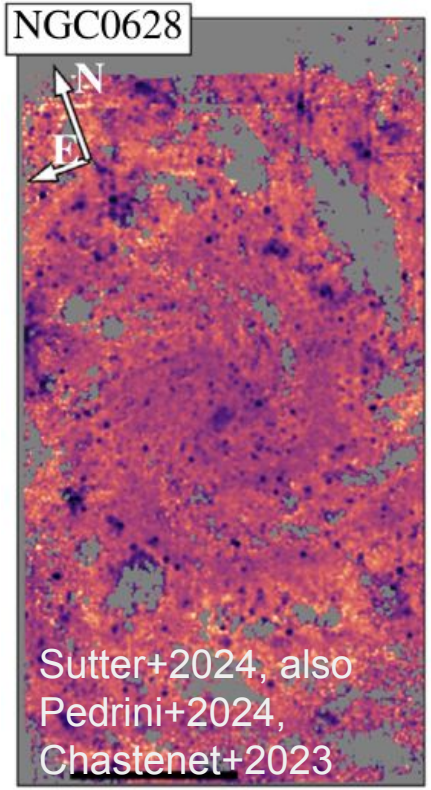


Kreckel+2019, 2020, also Williams+2022, CALIFA work, Metha+

locally halting SF

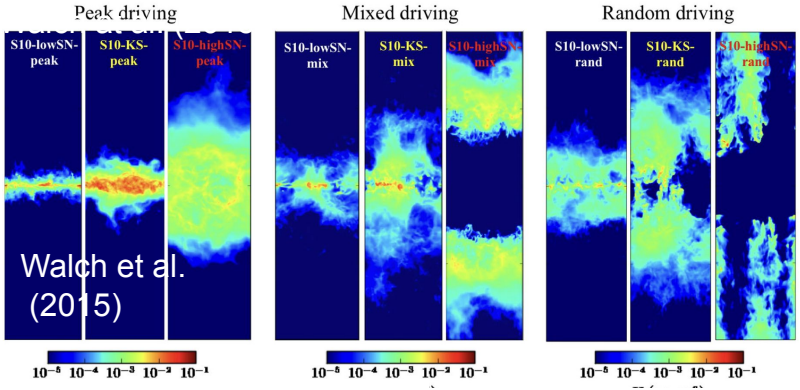
- **pre-SN feedback (talk by Lise Ramambason)**

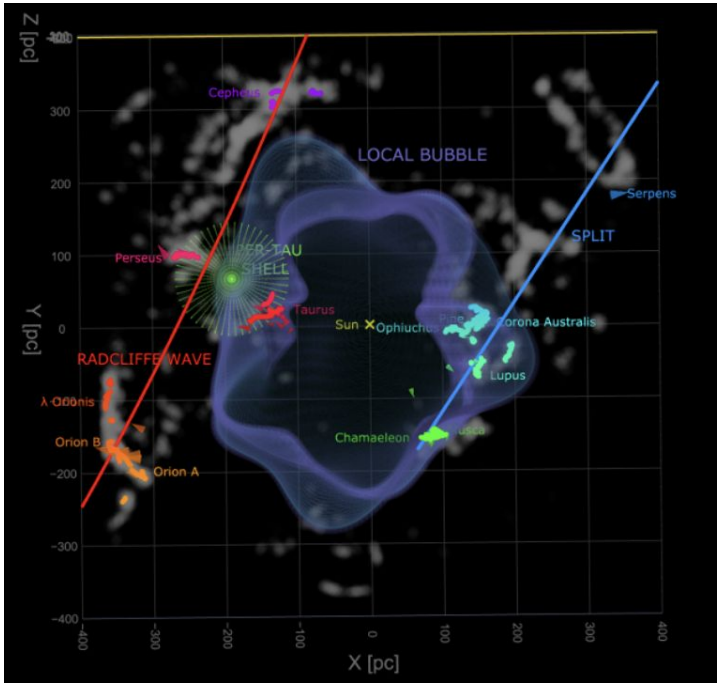
PAH destruction in HII regions



PAH/hot dust ratio map

What role do SNe play in the ‘disruption’ of the ISM?



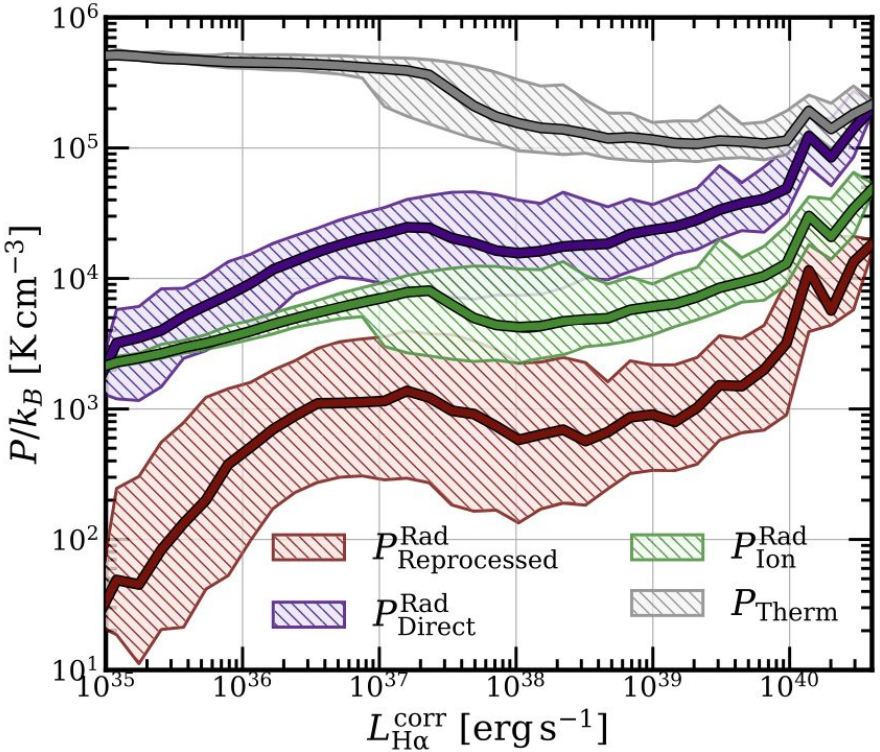


Strong dependence on supernova position

Local Bubble – Zucker at al. (2022)

Do we understand the evolution of HII regions?

What causes HII region expansion?



Coupling to ISM

talk by Oleg Egorov

Pathak+2025, also
Barnes+2022,23

(poster by Deb Pathak)

More generally, do we control sufficiently SN parameters?

-SN clustering in space and in time (=> leads to superbubble)

Observations: CC-SNe in lower gas density environments (Mayker Chen+23,24)

-numerical resolution within and around the SN

-others?

-could we quantify the numerical/theoretical accuracy of supernova feedback?

Factor ~2 ?

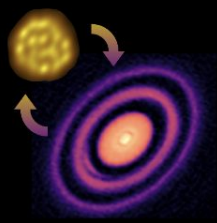
Do we detect all expected supernova remnants?

-Missing supernova remnant problems (~1000 expected about ~300 detected, Green 2014)

-Thor may have detected many new ones but still factor of 2 missing Anderson+2023

=> Do we understand SN sufficiently well?

ALMA2040 Key Science Drivers



The life cycle of planetary systems & stars

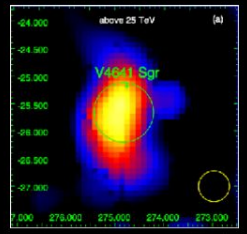
Including the formation of rocky planets down to ~AU scales

The formation and evolution of structure

Including primordial galaxies and black holes out to z~20

Evolution of the cosmic baryon cycle

Including dust & the development of chemical complexity that leads to life



Cosmic explosions and acceleration

Including multi-messenger astronomy in the 2040s

Foreseen capabilities:

> 5-10× line sensitivity

> 3-5× angular resolution

Simultaneous multi-band observing

On-the-fly calibration

ALMA 2040

THE NEXT-GENERATION (SUB-)MILLIMETER INTERFEROMETER

Learn more / join the effort: