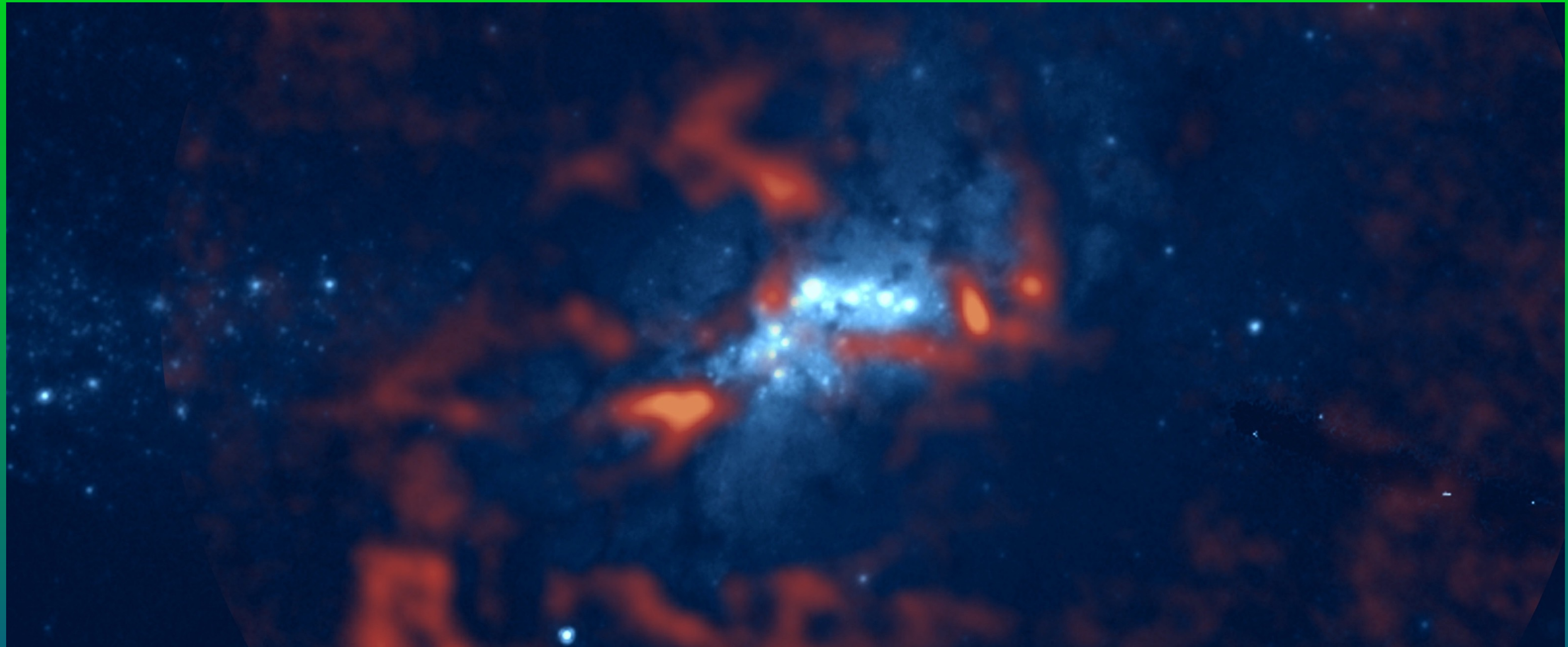


Caught in the Act!

Embedded Star Clusters Accreting and Expelling gas in He2-10



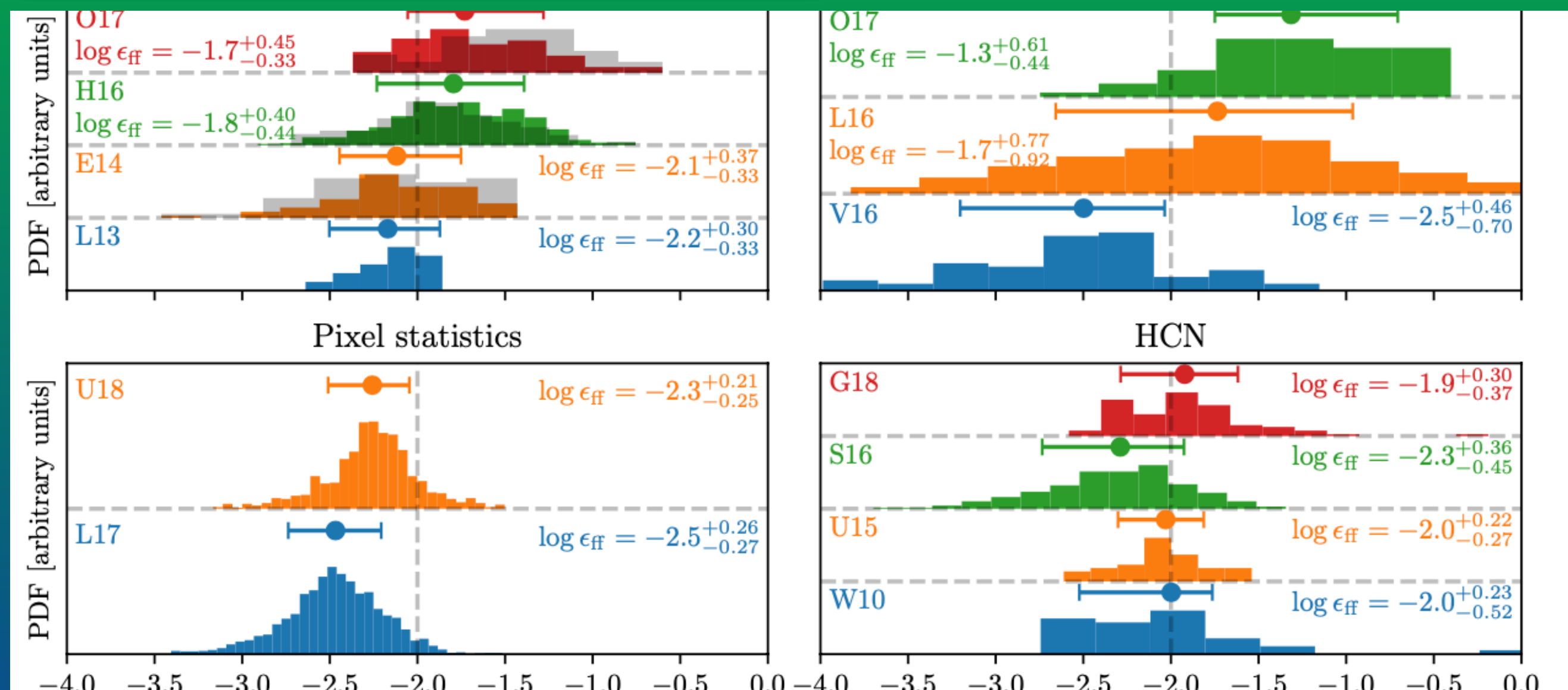
warm gas (red), optical-near IR (blue)

Sara Beck,—Tel Aviv University; with Jean
Turner, John Lacy, Dan Beilis

1970's—discovered star formation *and* protostellar outflows

*Two possible fates for every particle of gas in collapsing GMC:
accrete onto star, or be dispersed by stellar & protostellar
activity. Which will dominate?*

SF slow, inefficient, gas disperses



Galactic clusters, $\text{SFE} < 0.01$ —no bound clusters today in MW

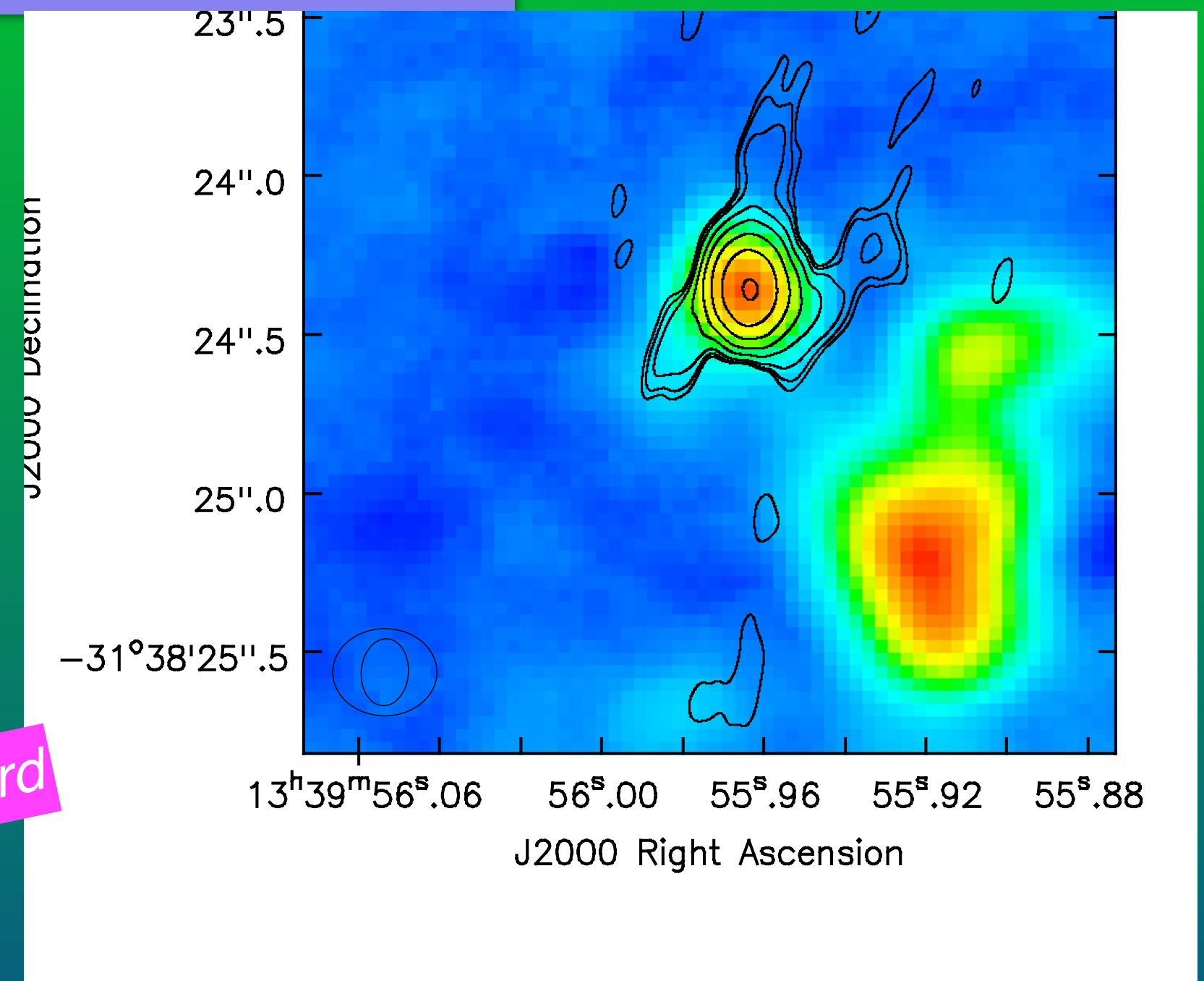
*Rapid, efficient SF-
clusters? Extragalactic
only!!*

*High pressure conditions of
starbursts →
rapid and efficient collapse →
cluster creation*

*Local Starburst Galaxies:
Young Super Star Clusters
0.5–10 Myr old
Embedded ($A_V \sim 2\text{--}50$ mag)
 $10^2\text{--}10^4$ OB stars, $10^4\text{--}10^6$ M_\odot , 1–10 pc*

*observationally: very compact, strong
IR, thermal radio, thick@6cm, Giant UC
HII regions*

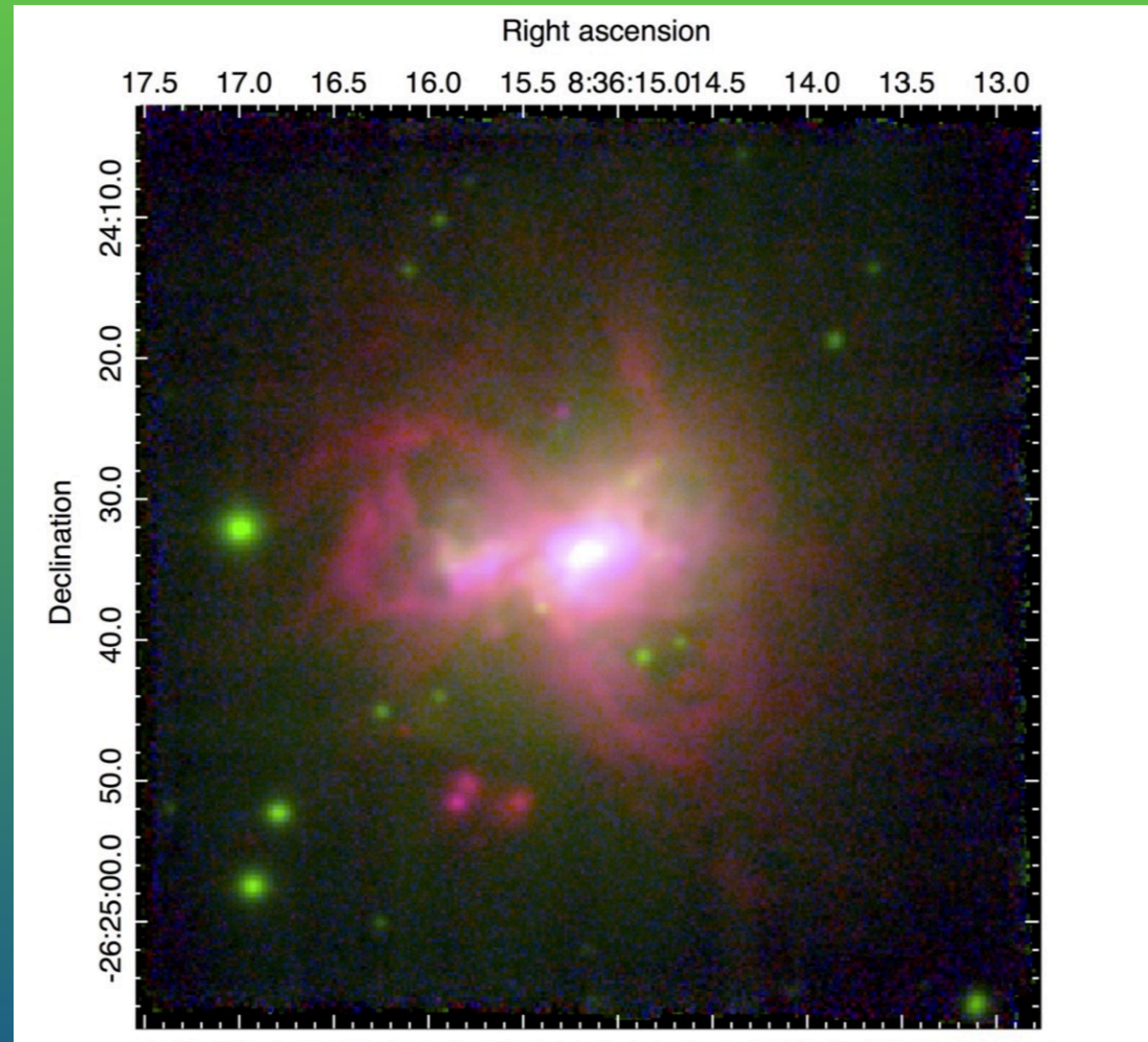
dwarf galaxies—the early universe in your backyard



Great Nebula in NGC 5253—proto-GC, 10^6 M_\odot ,
1 Myr—QUENCHED—no cluster wind!

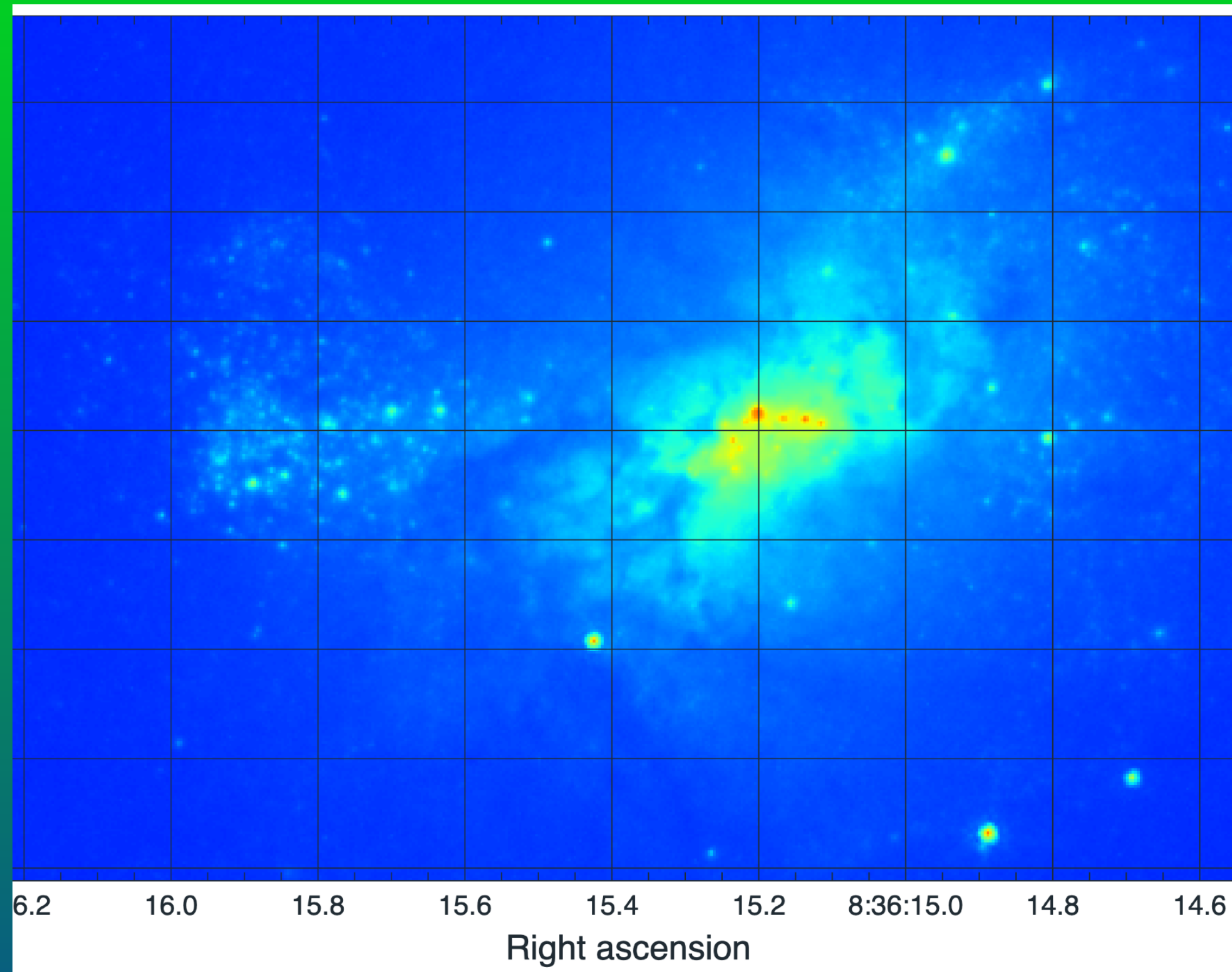
He2-10: Showcase of Young Super Star Clusters

- dwarf merger product, ~ 10 Mpc
- near-solar metallicity
- 2 giant clouds, ~ 40 km/s velocity offset
- > 100 super star clusters, all stages
- unusual IMBH
- giant $H\alpha$ shells



Star Clusters with Many Ages and Stages of Formation

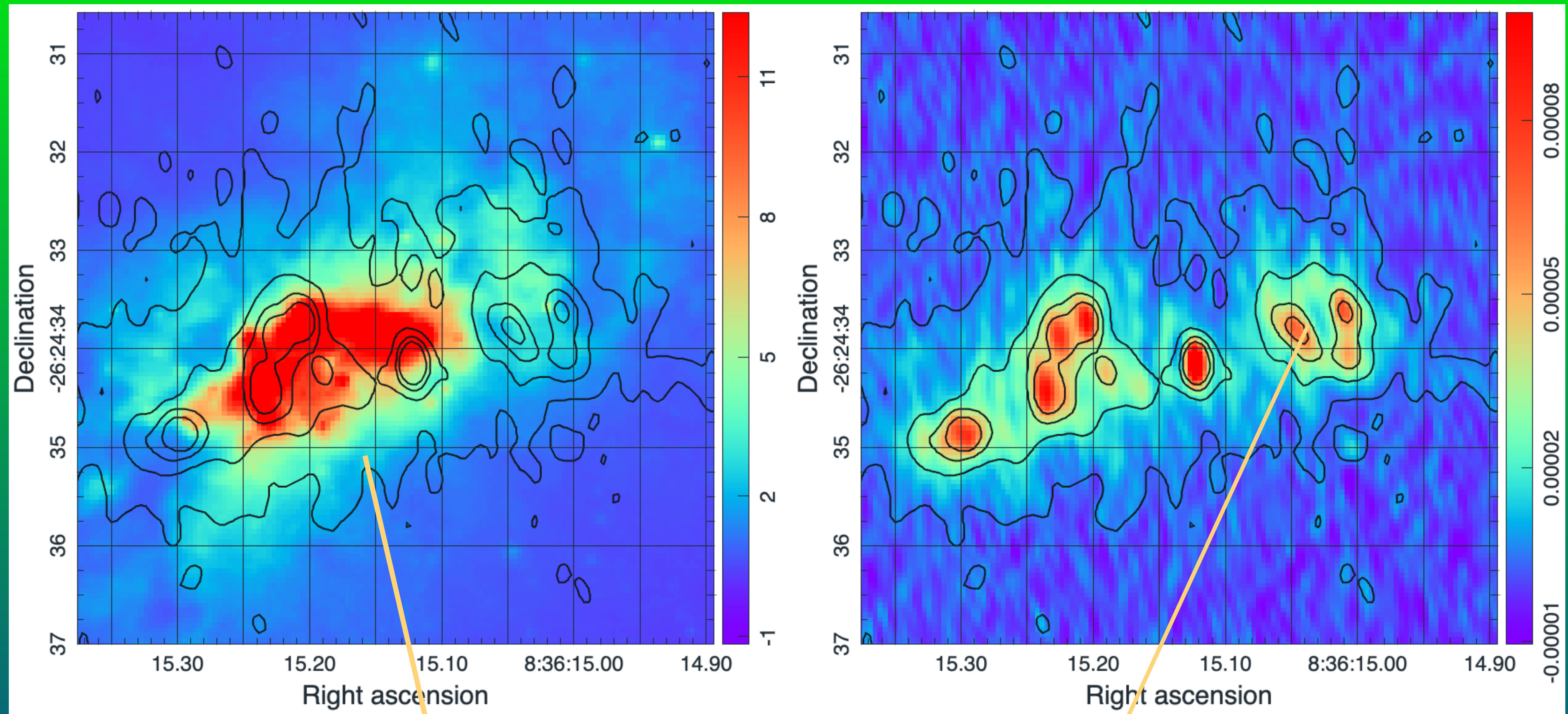
- dwarf merger product, ~10 Mpc
- near-solar metallicity
- 2 giant clouds, ~40km/s velocity offset
- >100 super star clusters, all stages
- unusual IMBH
- giant H α shells



SSCs young to old and west to east

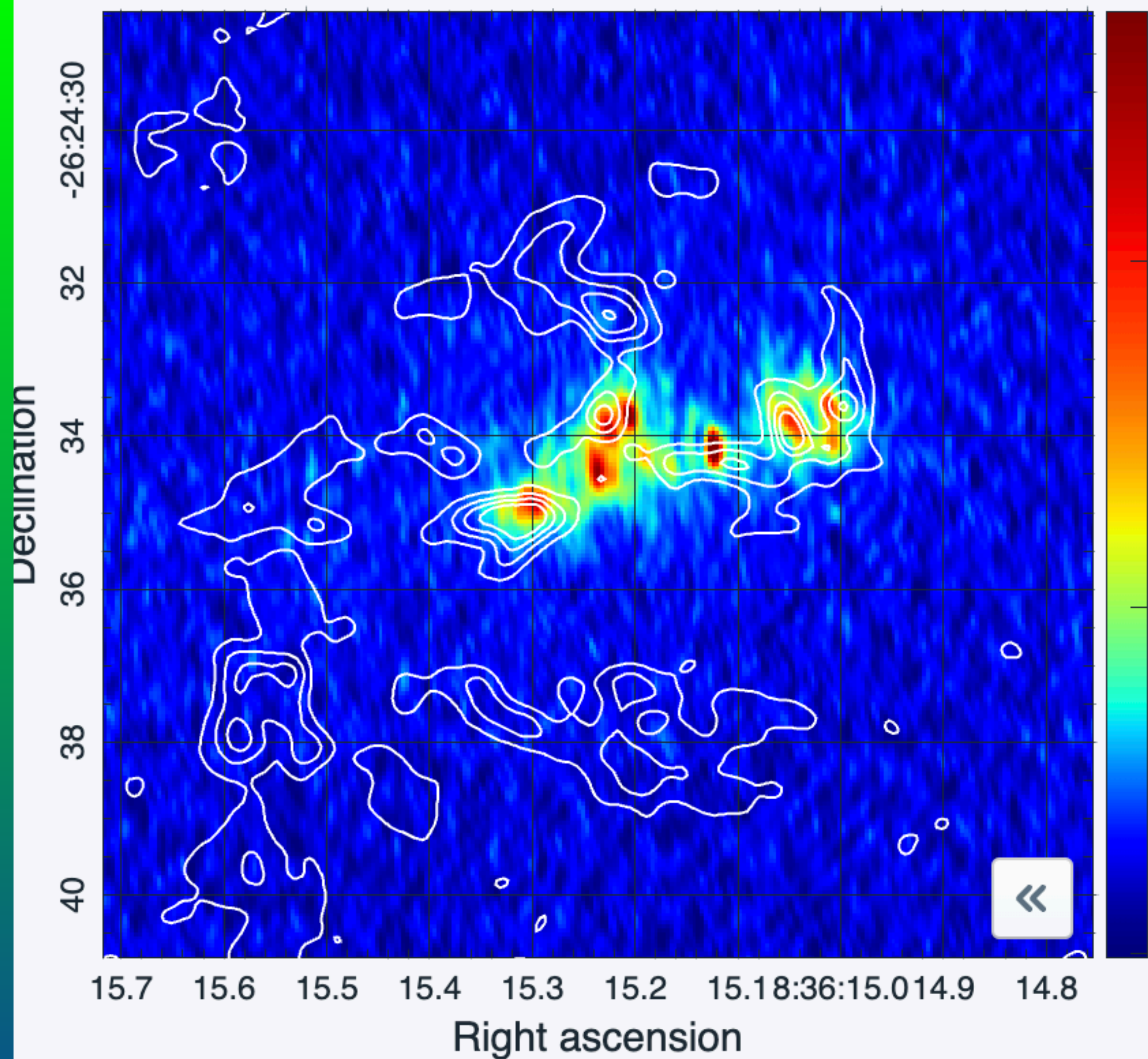
*Two giant clouds, each $\sim 10 \times W_{49}$
mass, 100x W49 stellar content*

**but very different activity
and evolutionary stages**



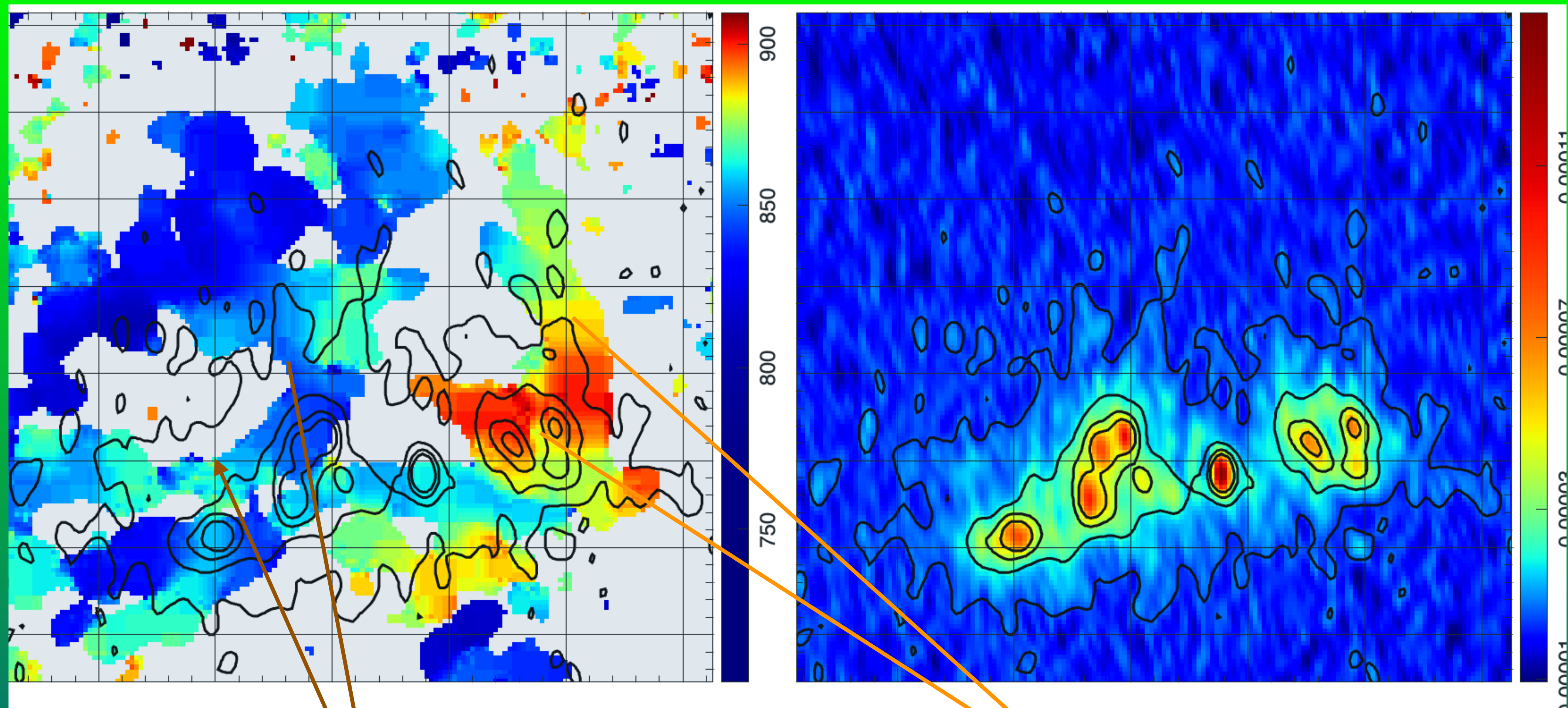
thermal radio right, optical-NIR left

E: clusters partially or completely emerged, W: clusters deeply embedded



*W cloud: HII regions, clusters
immersed in molecular gas;
gas on dark lanes
E cloud-partly or
entirely emerged,
2-3 still embedded, gas
patchy*

CO moment 0 contours, thermal radio



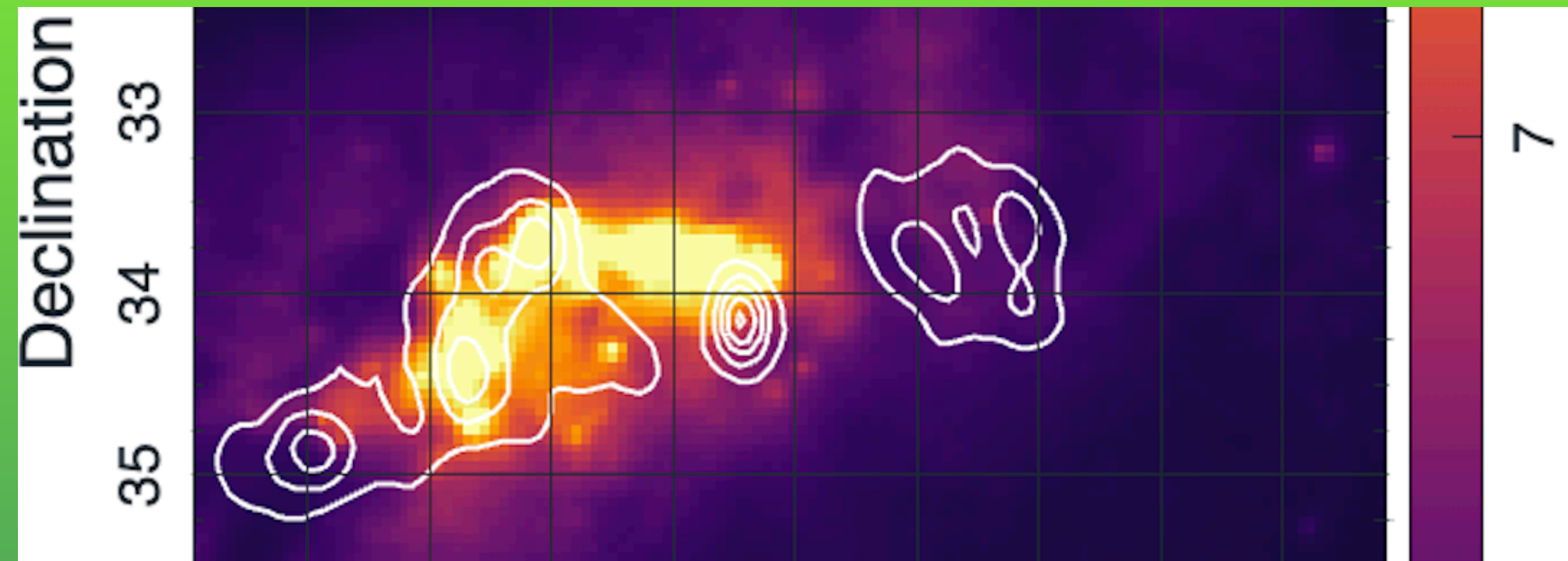
CO Moment 1 left, radio thermal right

*E: disorganized velocity, colliding patches?
Emergence is well underway*

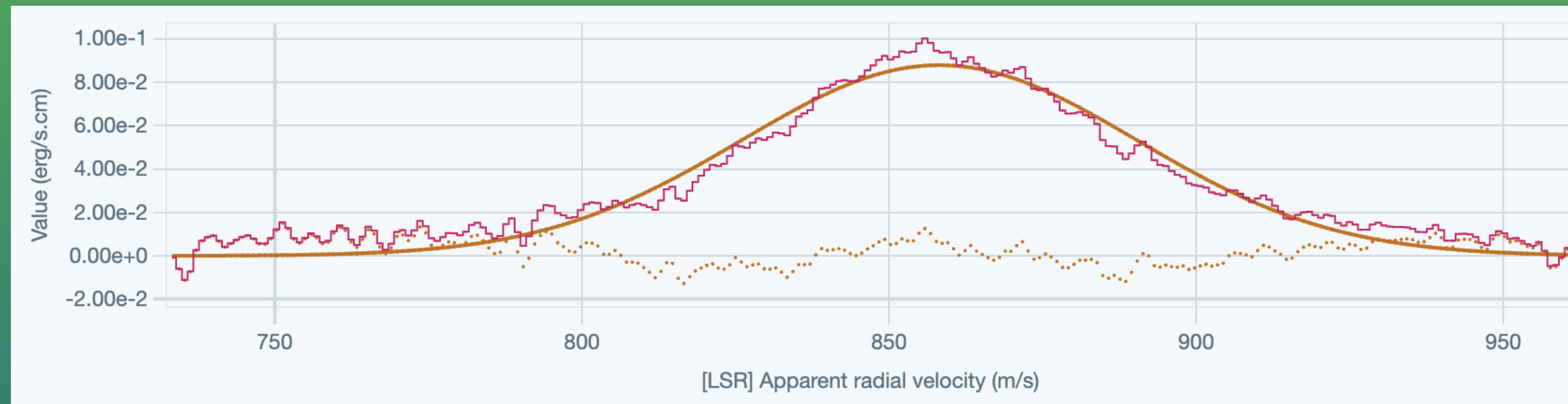
*W: elongated clouds accreting onto clusters-cluster
assembly still in process*

Molecular Gas Kinematics

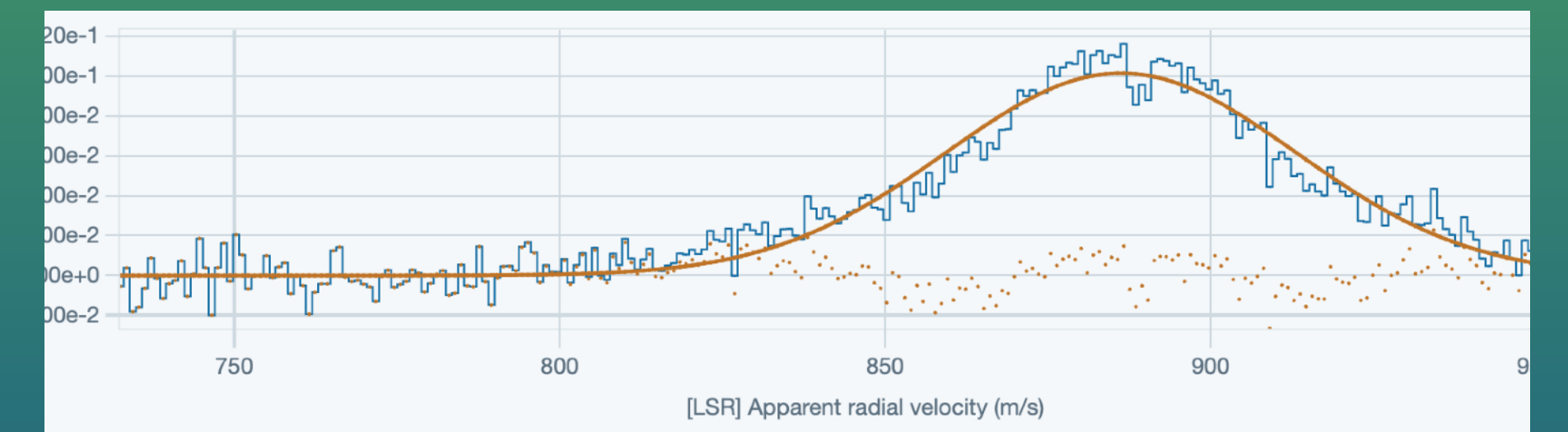
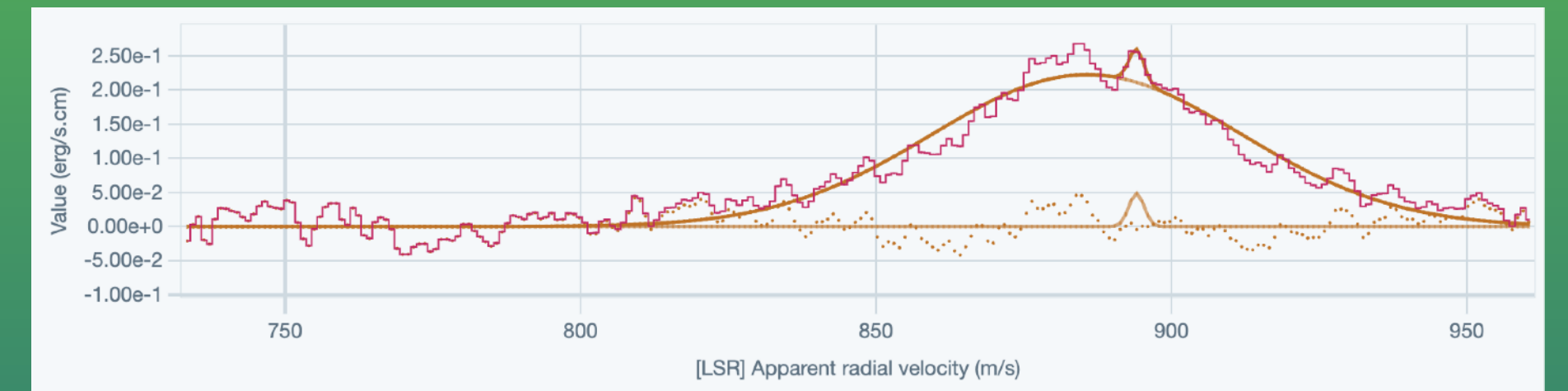
Ionized Gas Kinematics



[NII] 12.8μm, 4 km/s , 0.3'' res (TeXes on Gemini)



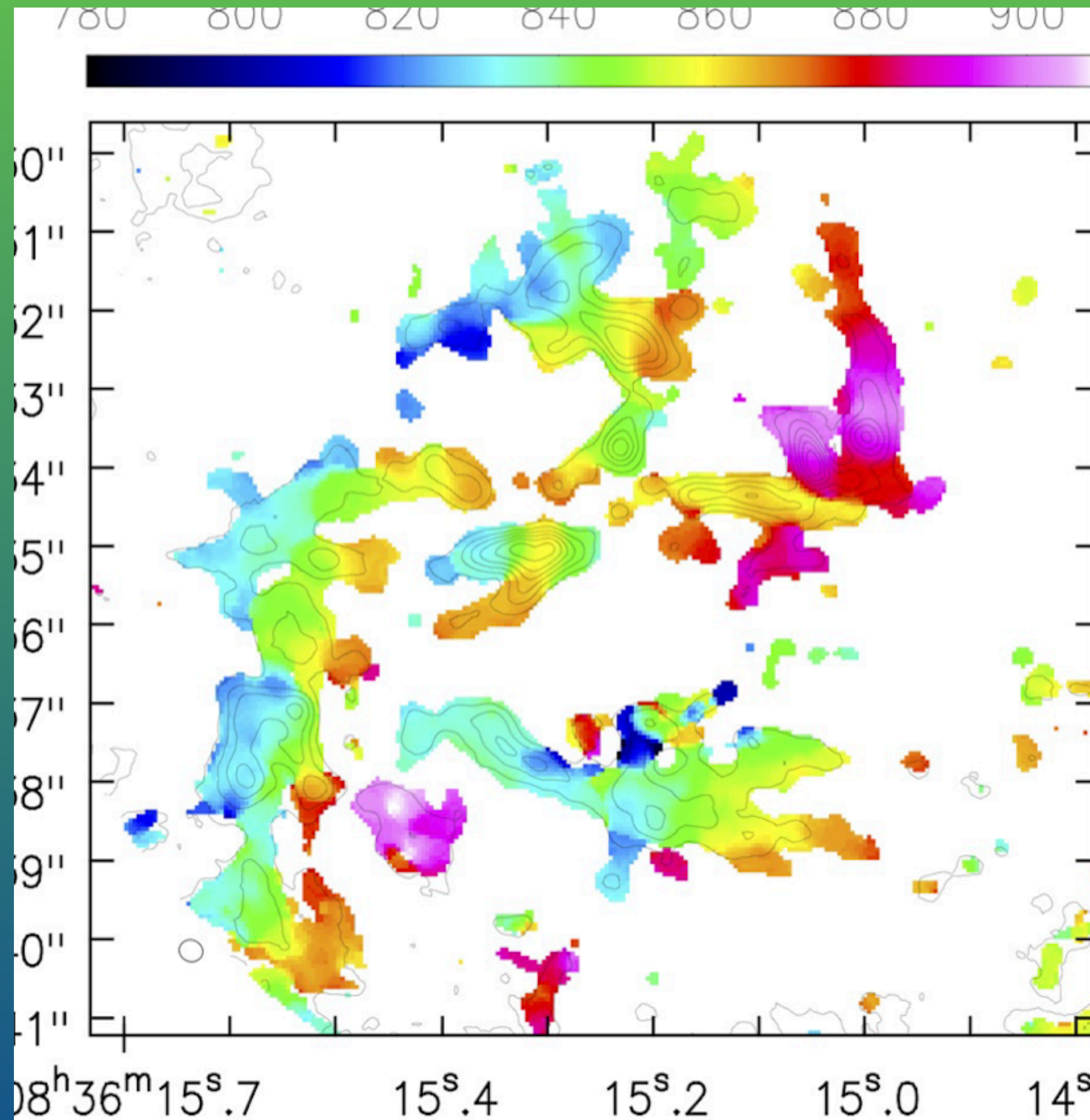
E cloud—uniform velocity field, much at $>V_{\text{escape}}$, wings



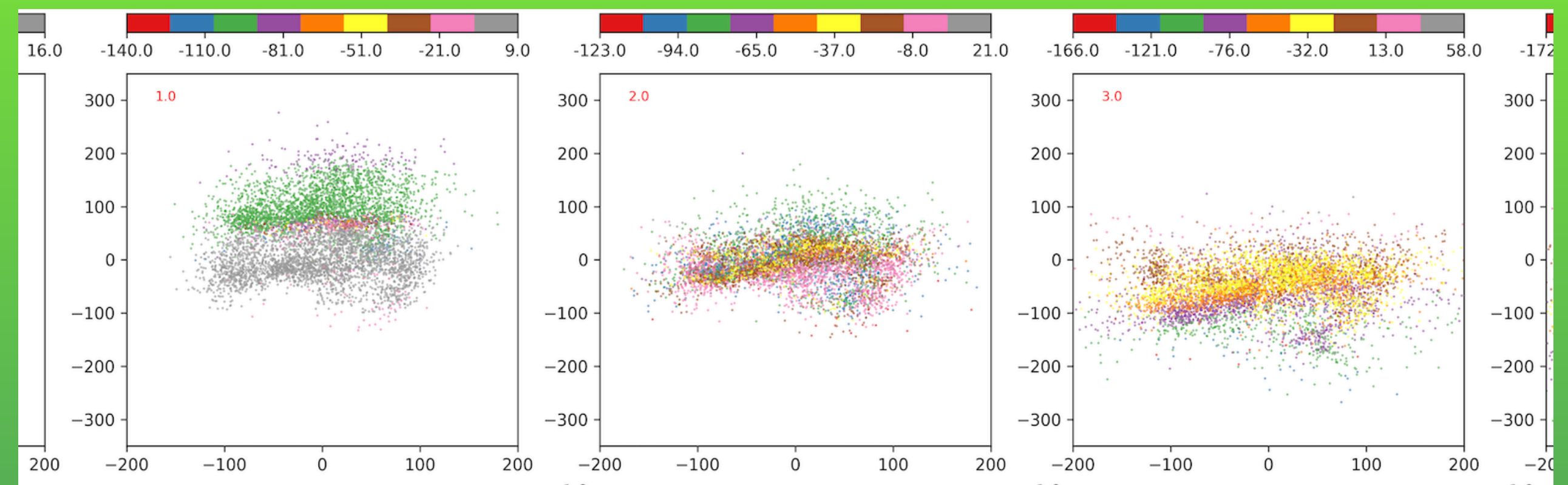
W cloud: discrete velocity features associated with accreting gas, $< V_{\text{escape}}$, no wings-Quenching Candidate!!

Unique Data !!- TeXes, who else?? Need $R \sim 10^5$!!

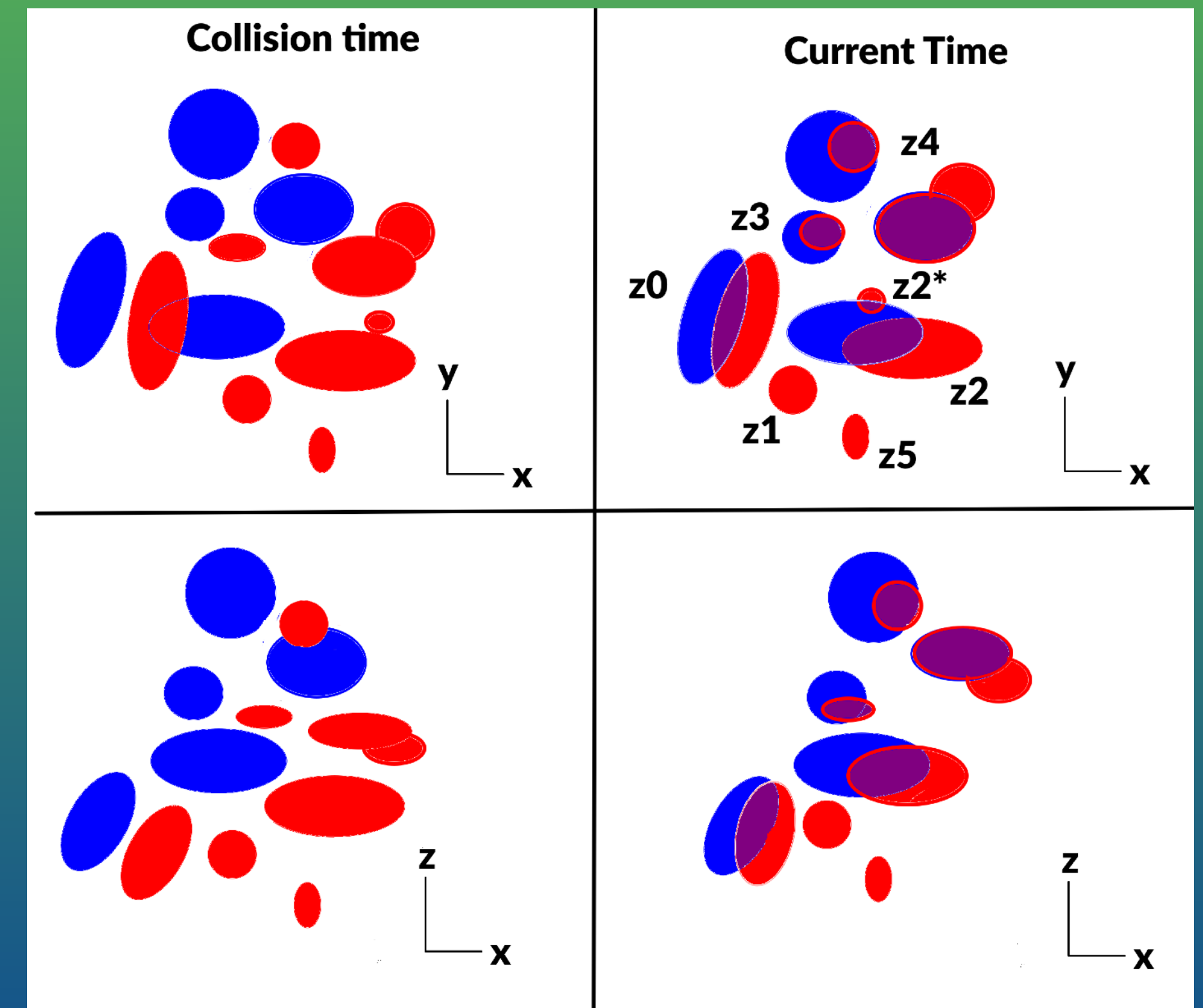
Backstory: Cloud Collisions, Filament Creation and Star Formation



streamers?filaments?spiral arms?



Simulations of Colliding cloudlets



*Cloudlets collide, **create filaments**, trigger star formation?*

*Summary? –No Summary (yet)–all ongoing work-
observations must continue!!*

HIGH RESOLUTION IS CRUCIAL!!!!

“Check the answers in the back of the book FIRST”