

Formation of nuclear clusters: a bumpy road

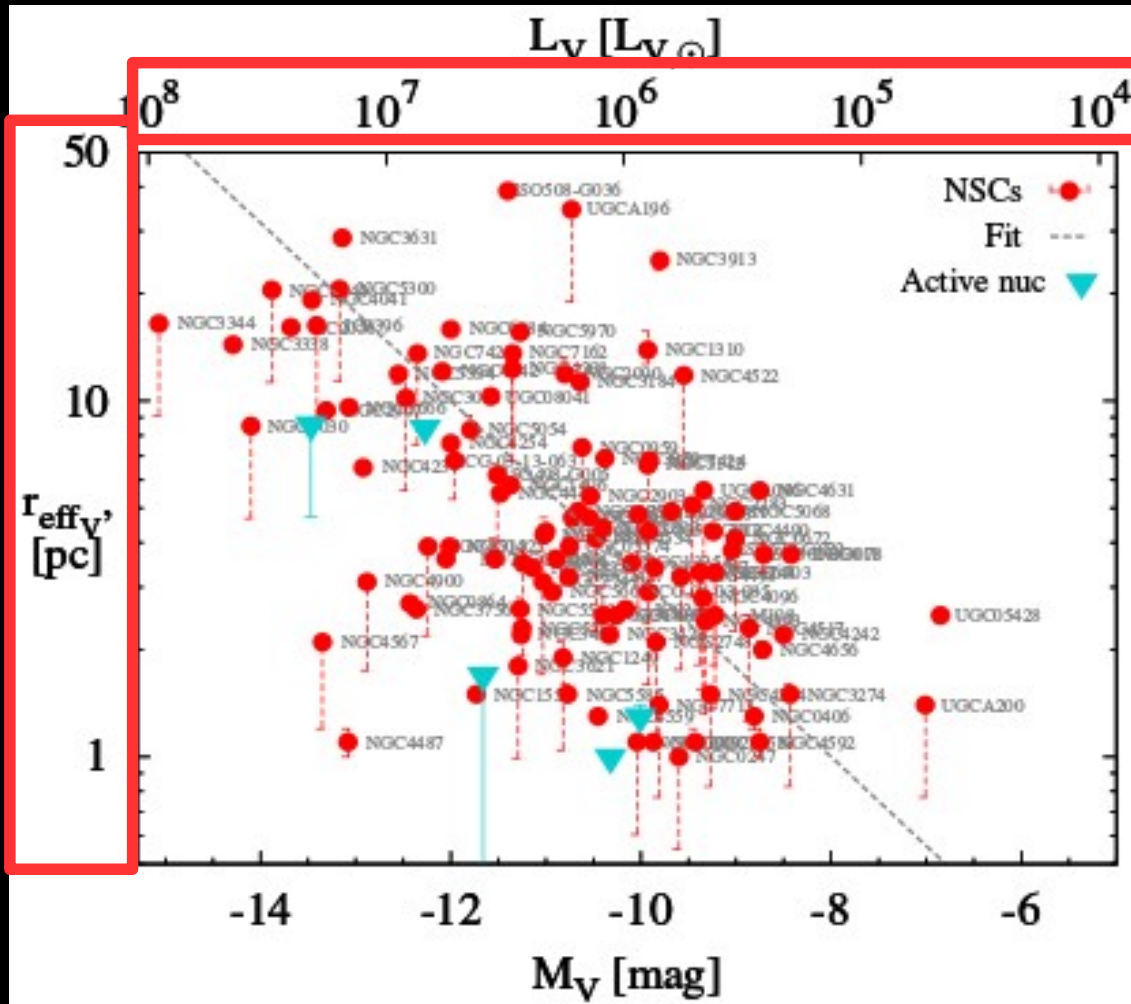


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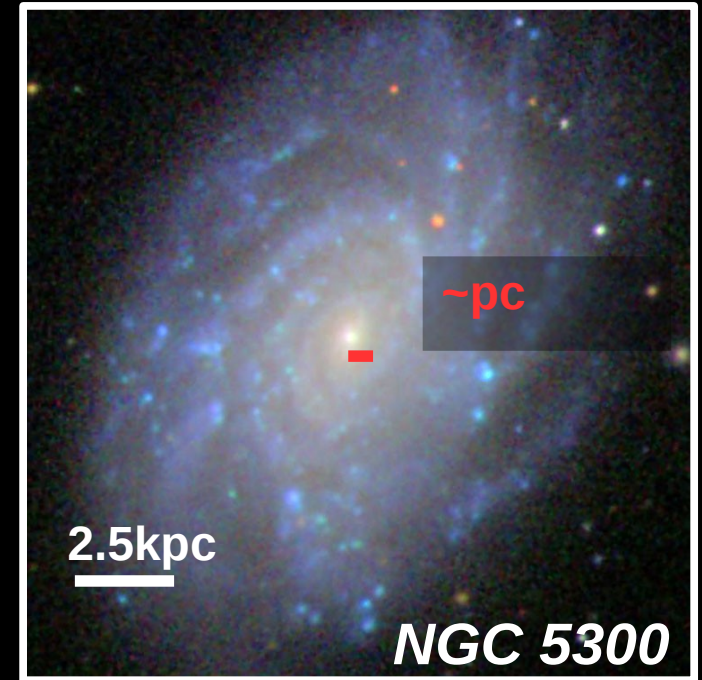
Eric Emsellem (ESO, Observatoire de Lyon)
Florent Renaud (University of Surrey)



Properties of NCs



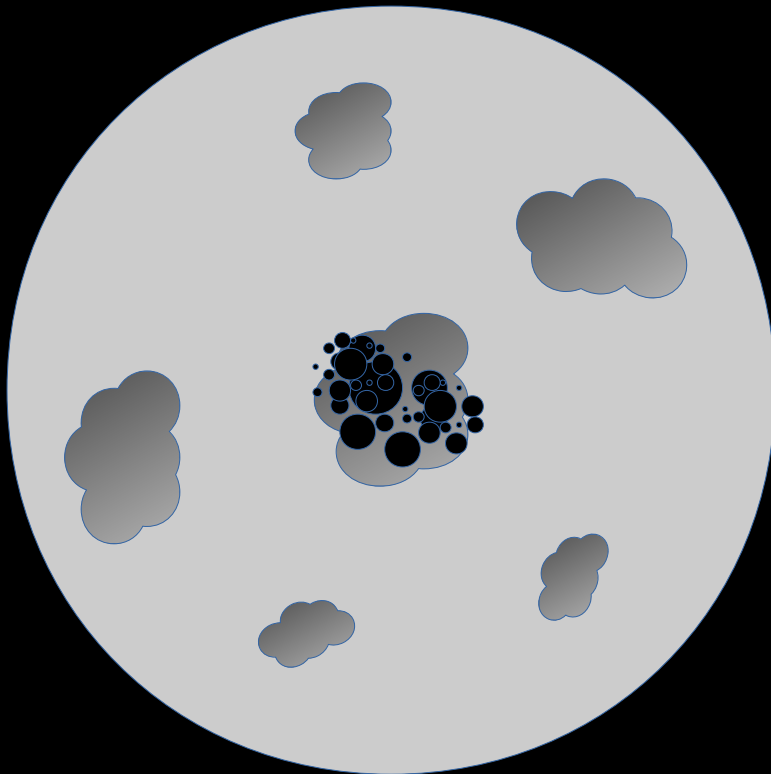
Georgiev & Böker, 2014



Size ~ 3pc
Mass ~ $10^5 - 10^8 M_{\odot}$

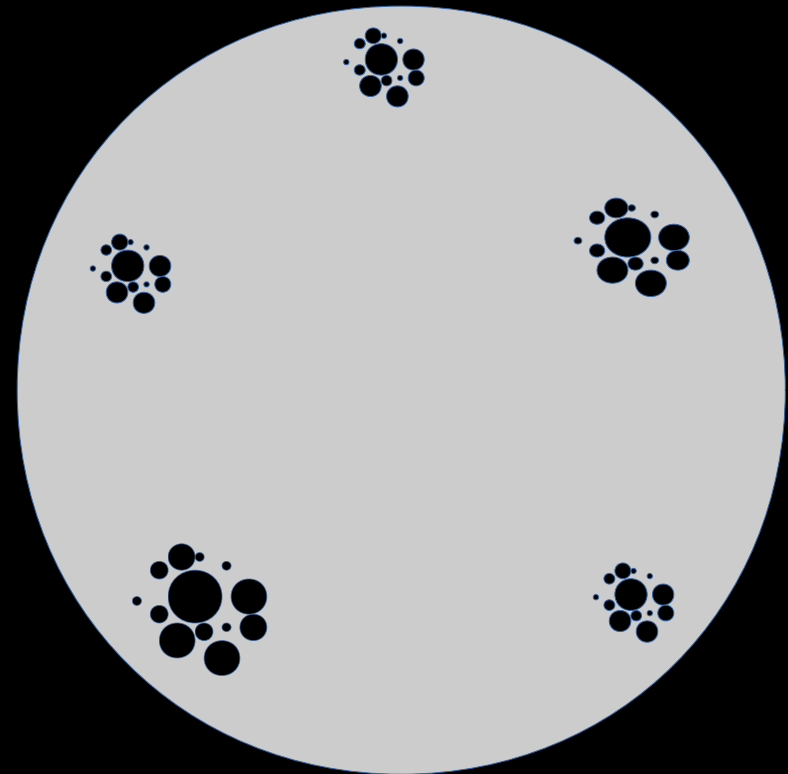
The formation of NCs: paradigm

In-situ



Milosavljevic, 2004

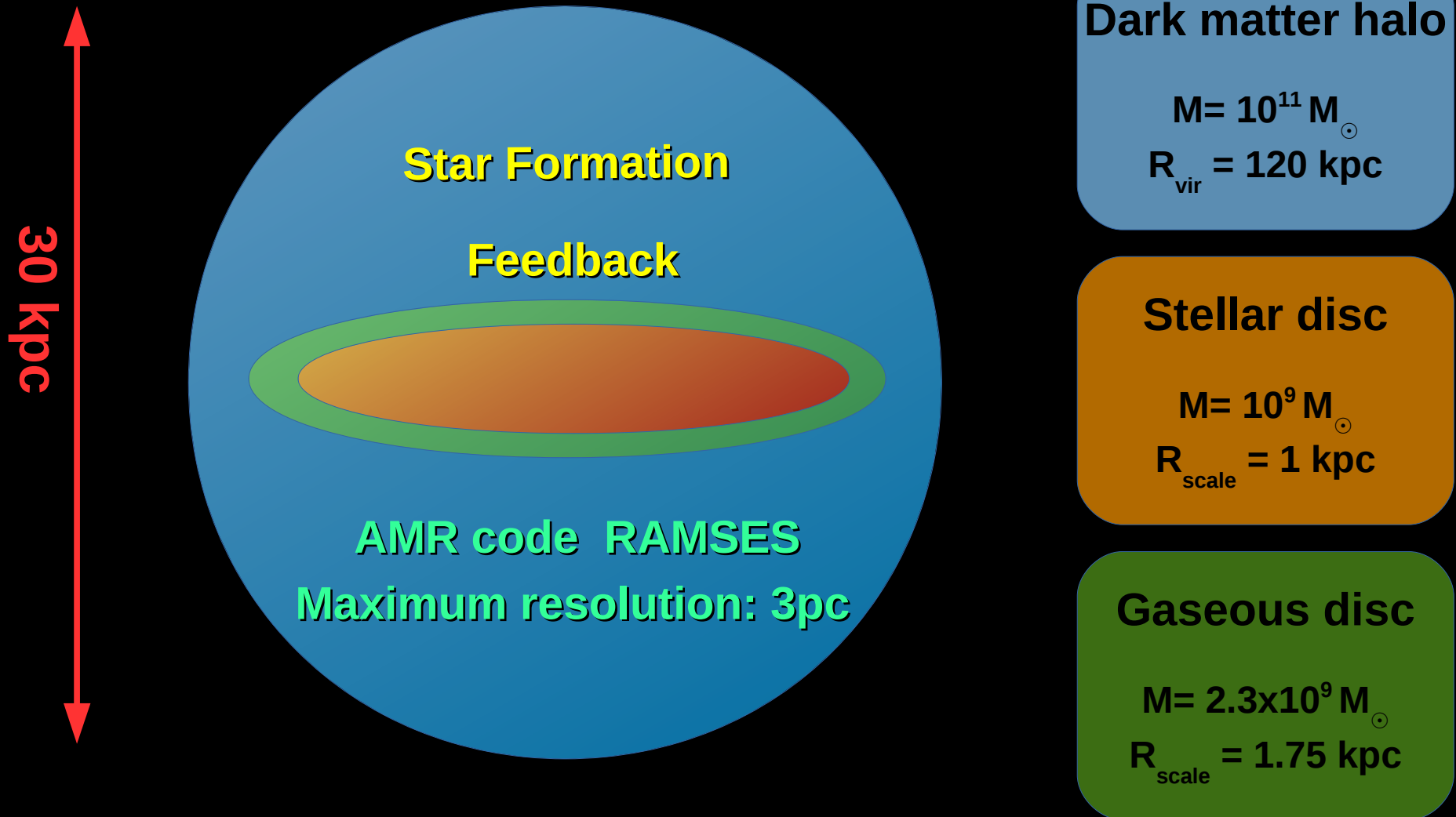
Migration



Tremaine et al., 1975

Our work: study of the NC progenitor(s?) with hydrodynamical simulations

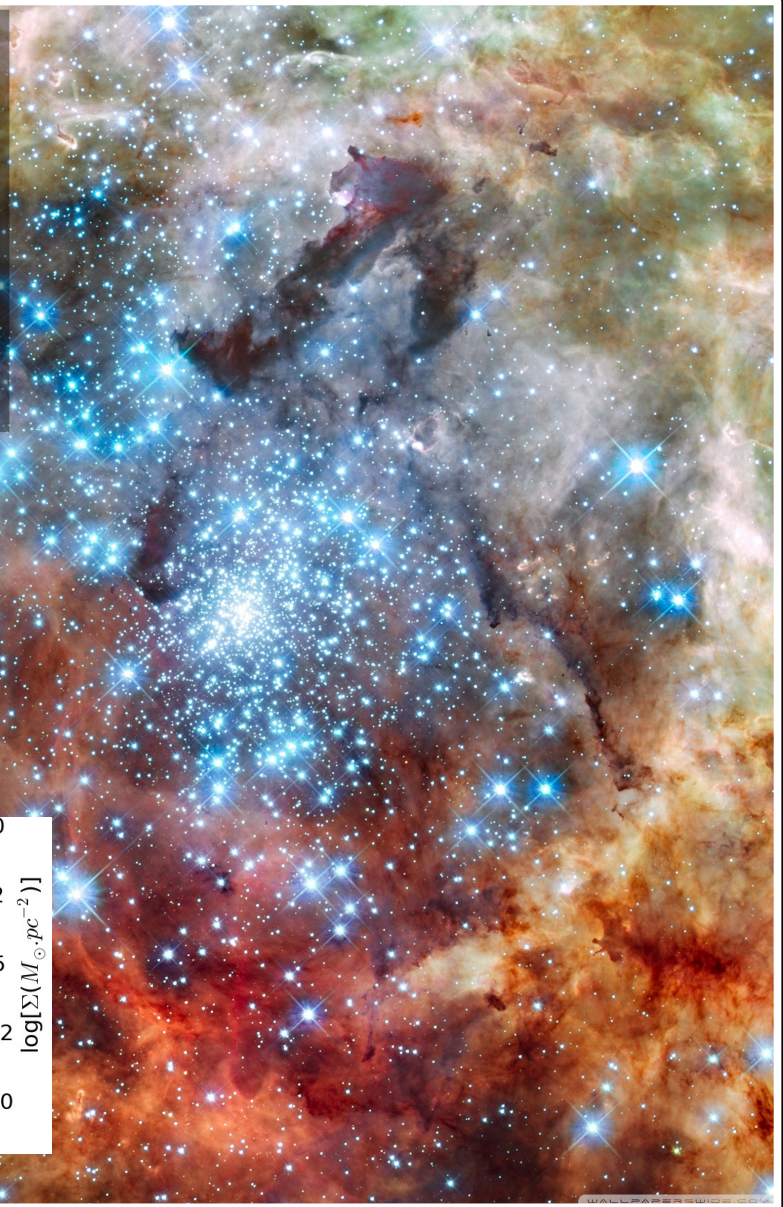
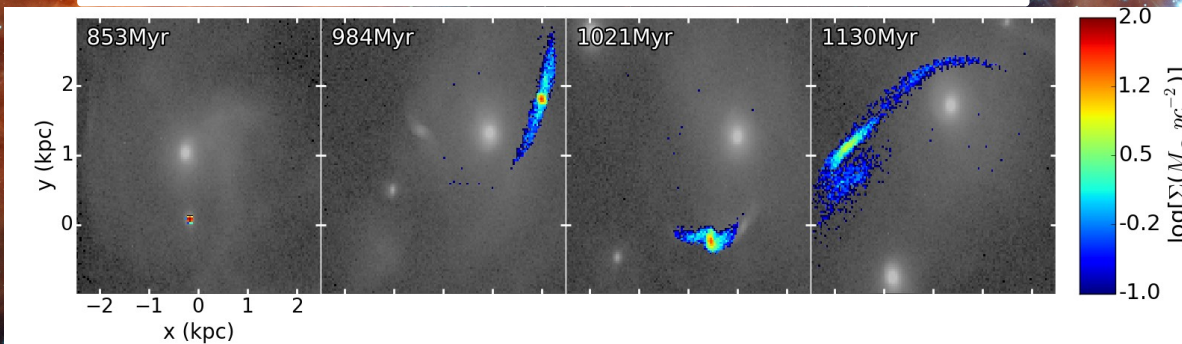
Model of a dwarf galaxy



Teyssier 2002, Renaud et al, 2013

Formation of NCs: conditions

- Formation of a **population of star clusters**
- Cluster becomes **dense**
- Cluster **migrates** to the center (?)
- Do not be destroyed!



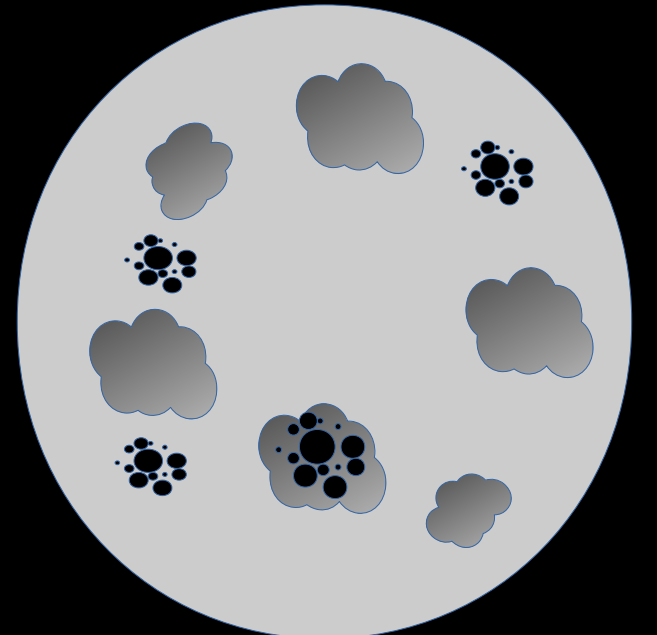
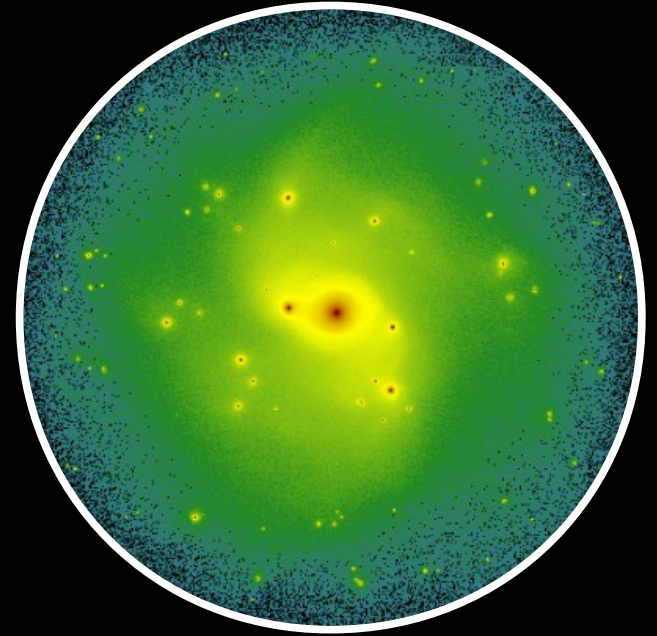
Simple case: no feedback

~500 Myr

- Population of star clusters forms
- Cluster + gas reservoir
→ star formation
- Cluster **migrates** to the center

~300 Myr

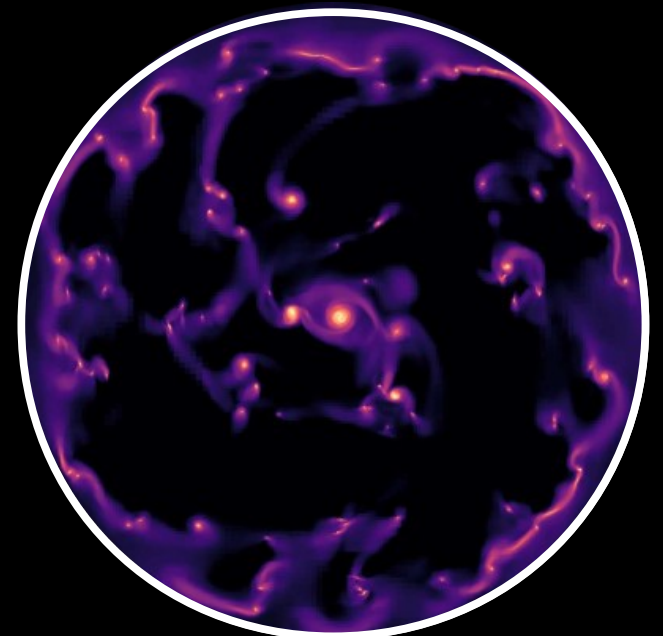
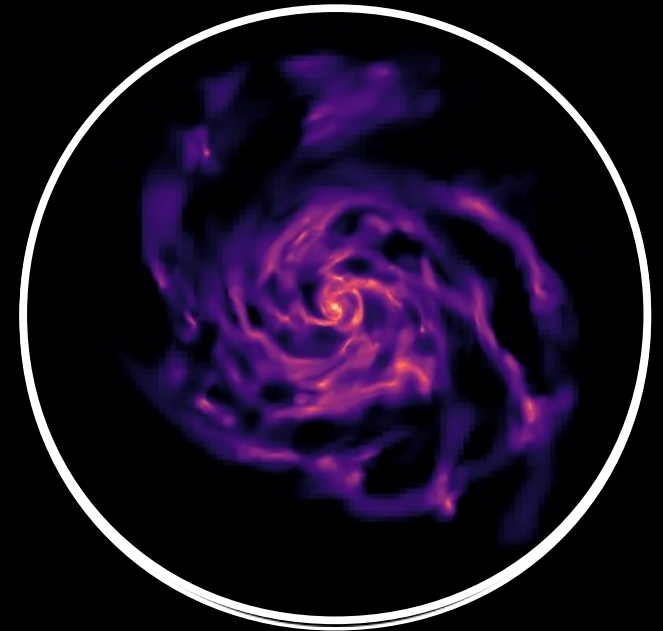
- Eventually **mergers** with other cluster
- Gas consumption



Adding feedback

- Population of star clusters forms
not surprisingly, no feedback → more clusters
- Cluster + gas reservoir
→ star formation
- Cluster migrates to the center
- Eventually mergers with other cluster
- Gas consumption

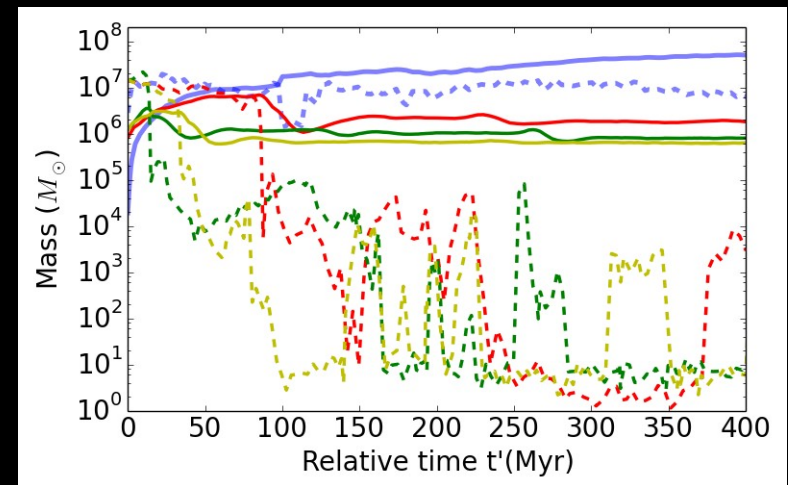
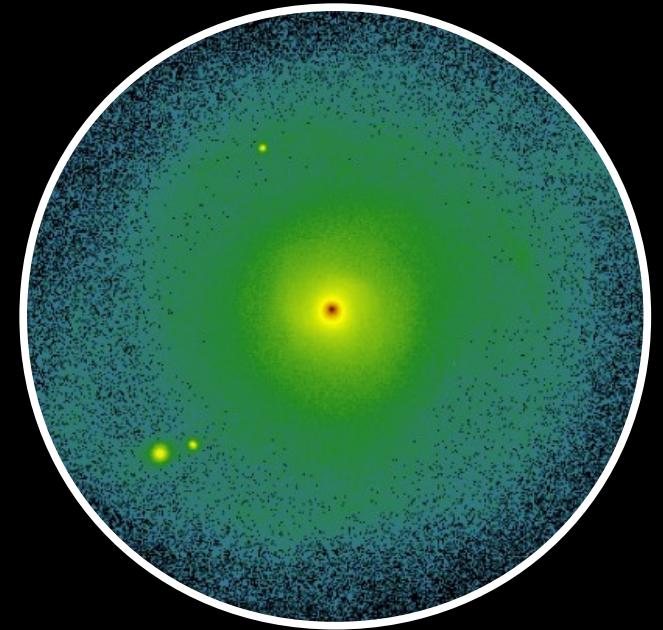
Guillard et al, 2016



Fueling of the cluster

- Population of star clusters forms
- Cluster + gas reservoir
→ star formation
cluster density is crucial
- Cluster migrates to the center
- Eventually mergers with other cluster
- Gas consumption

Guillard et al, 2016



Gas



Stars

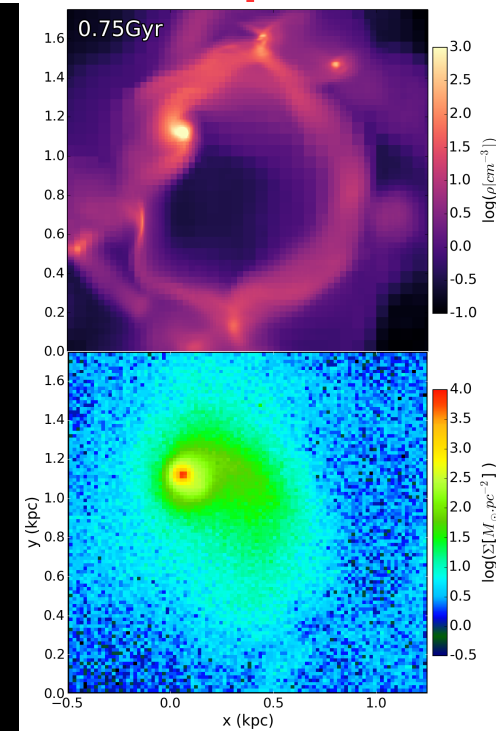
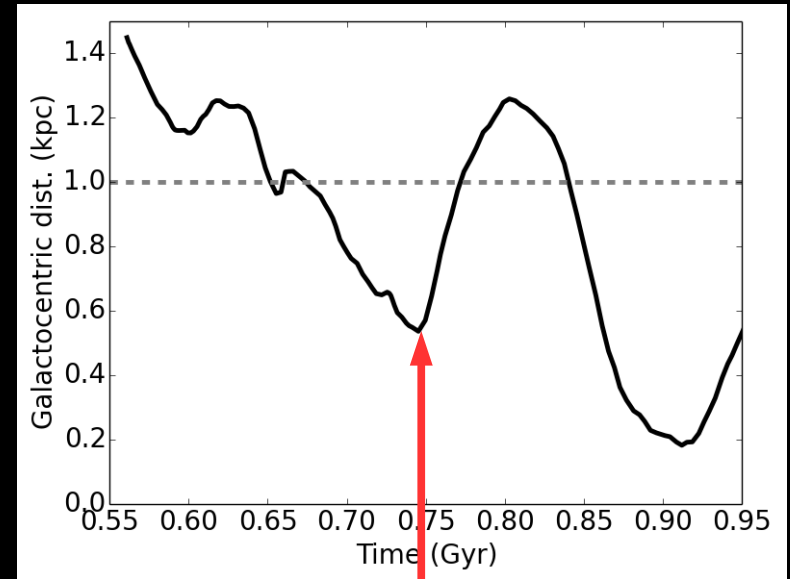


Migration: a bumpy road

- Population of star clusters forms
- Cluster + gas reservoir
→ star formation
- Cluster migrates to the center
SN blast amplifies disturbances in the potential
- Eventually mergers with other cluster
- Gas consumption

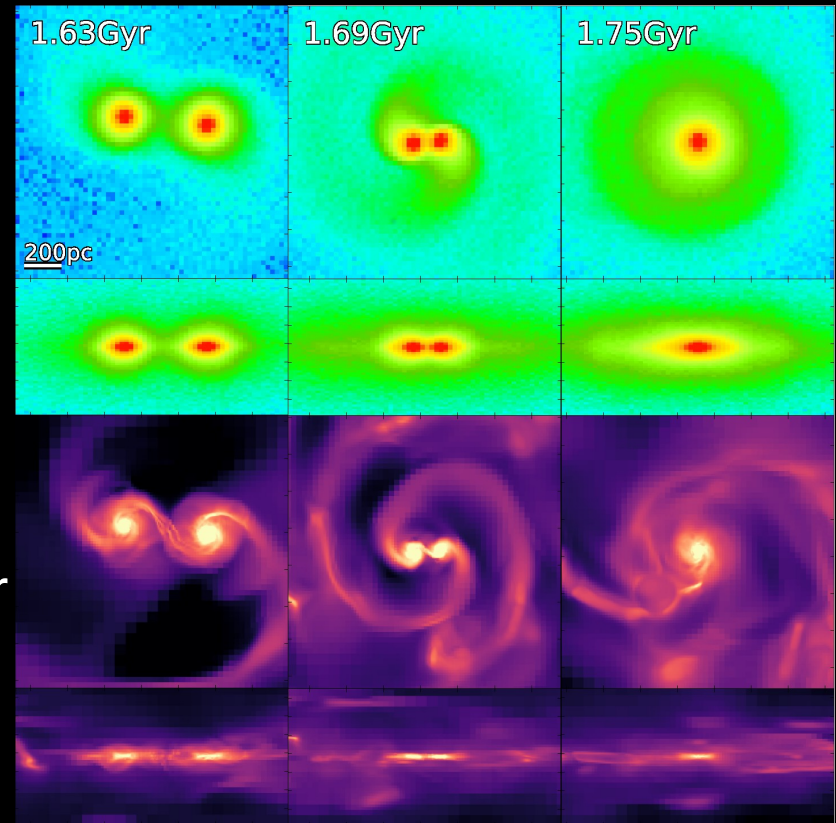
*Guillard et al, 2016, see also
e.g. Renaud et al, 2013*

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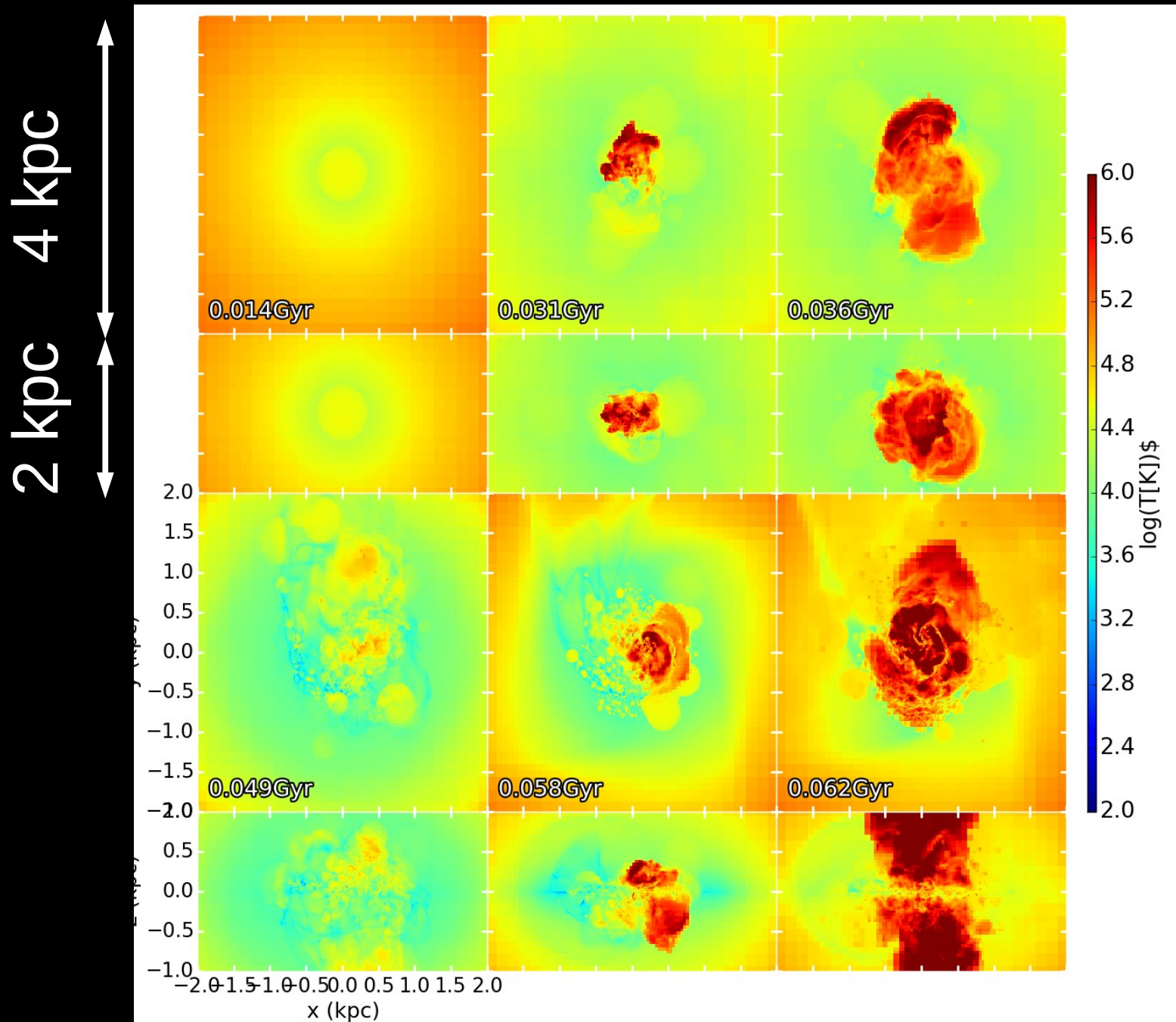
Mergers of clusters

- Population of star clusters forms
- Cluster + gas reservoir
→ star formation
- Cluster **migrates** to the center
- Eventually **mergers** with other cluster
change in the **morphology**
- Gas consumption



Guillard et al, 2016

With some 'cosmological' context



Conclusion

- Forming a NC without feedback: **easy**
- Forming a NC with feedback: **more complicated but doable**
- First 100 Myrs in the life of star clusters: **crucial!**
- Gas associated to the cluster: **key component!**
- Feedback **interferes** but does **not necessarily** change the scenario
- Next steps: probing impact of **feedback** and **initial conditions**