HYDRODYNAMIC SIMULATIONS AT THE GLOBULAR CLUSTER SCALE

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Theoretical Framework: Globular cluster formation

- Non-cosmological scenario (no dark matter within Globular Clusters!)

- Many Evidences for multiple stellar populations (or generations) within GCs

- Not easy to explain and interpret, several scenarios proposed so far

- MAIN QUESTION: can First Generation Supernovae clear out all the gas they have polluted? Under which conditions?

Theoretical Framework: Globular cluster formation

- We run 3D Adaptive Mesh Refinement (AMR) simulations to study the feedback from Massive stars in a proto-GC of mass ~ 10^7 Msun

- Code used: RAMSES (Teyssier 2002)

The RAMSES hydrocode

- Eulerian (better for resolving shocks)
- Highly portable, very easy to install and run on multiple platforms
- (In principle) high scalability on parallel HPC systems
- Includes Adaptive Mesh Refinement

Teyssier, R., 2002, A&A, 385, 337

Previous projects at CINECA

- Couple class C projects submitted back in 2014/15 on EURORA (bad experience, then terminated) and GALILEO (overall OK), total ~100 kh

First Results
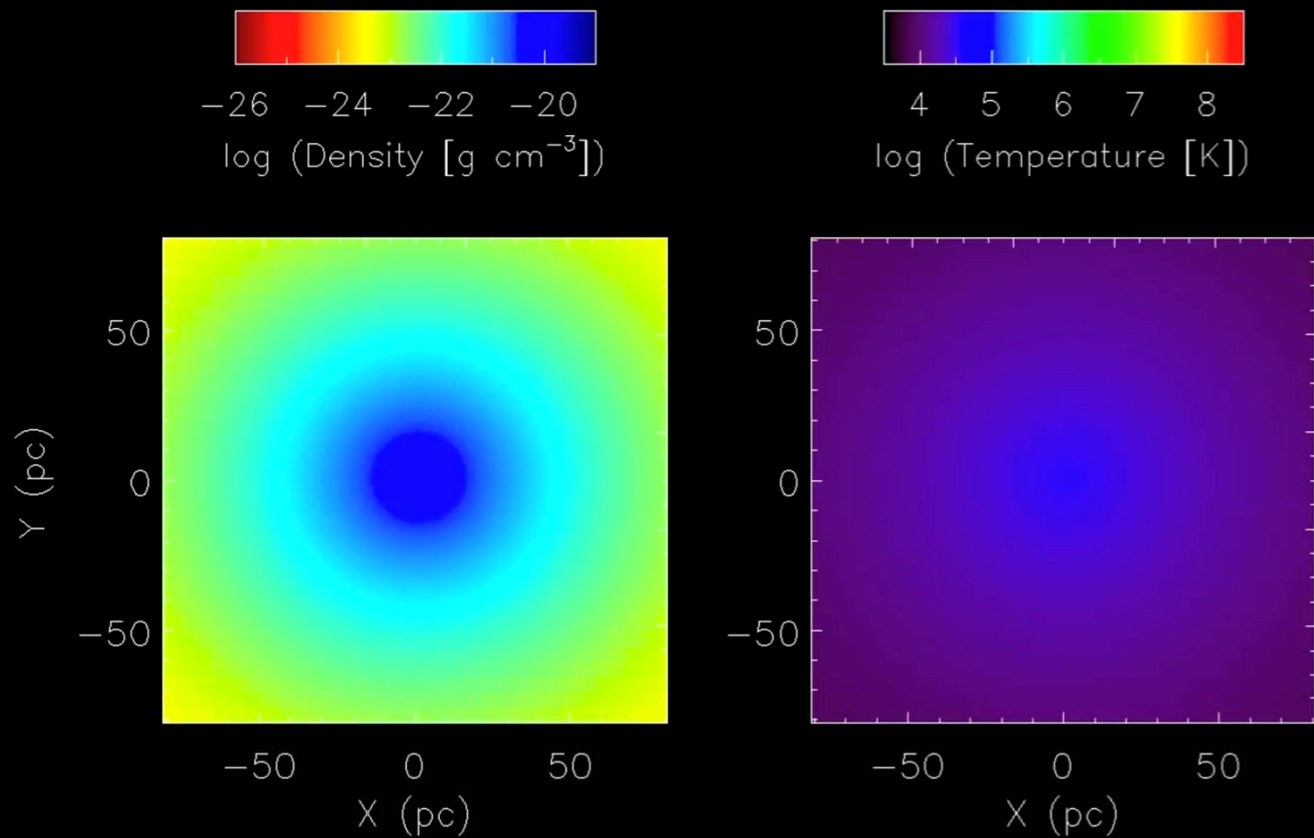
Calura, F.; Few, C. G.; Romano, D.; D'Ercole, A., 2015, ApJ, 814, L14

New task:
Study Different feedback schemes

- Injection of momentum (without switching off cooling)

- Injection of energy (w/out switching off cooling)?

- Both?

- Switching off cooling according to some 'turbulence' criterion (but varying σ_{turb})

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- Present: ~ 2e6 h (knl-equivalent) assigned on GALILEO (EoP) and MARCONI, used so far ~1.3e6

- Aim: study different feedbacks schemes and compactness of the cluster

- Scalability: it seems an issue (>300-400 CPUs seem to saturate [also on other systems])
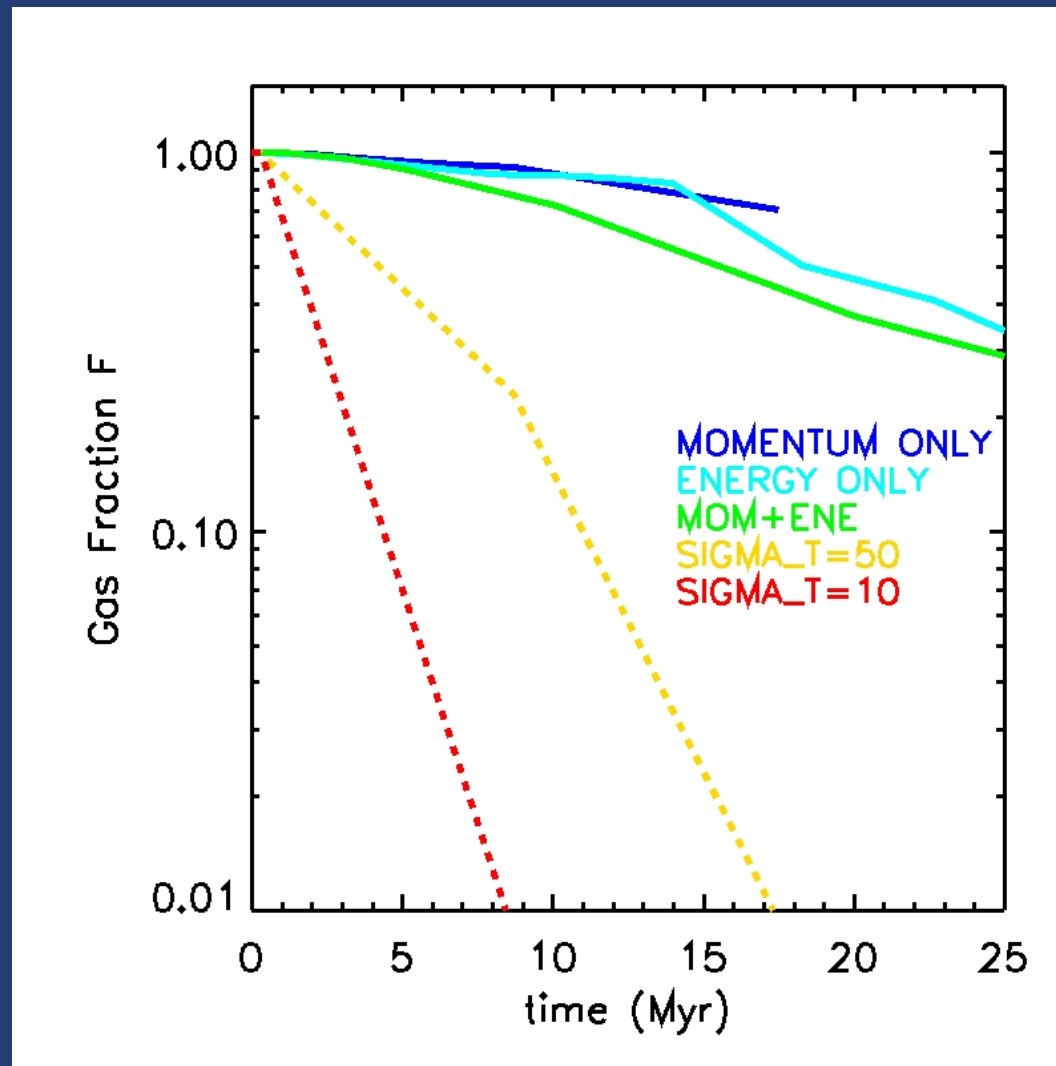
Different feedback schemes
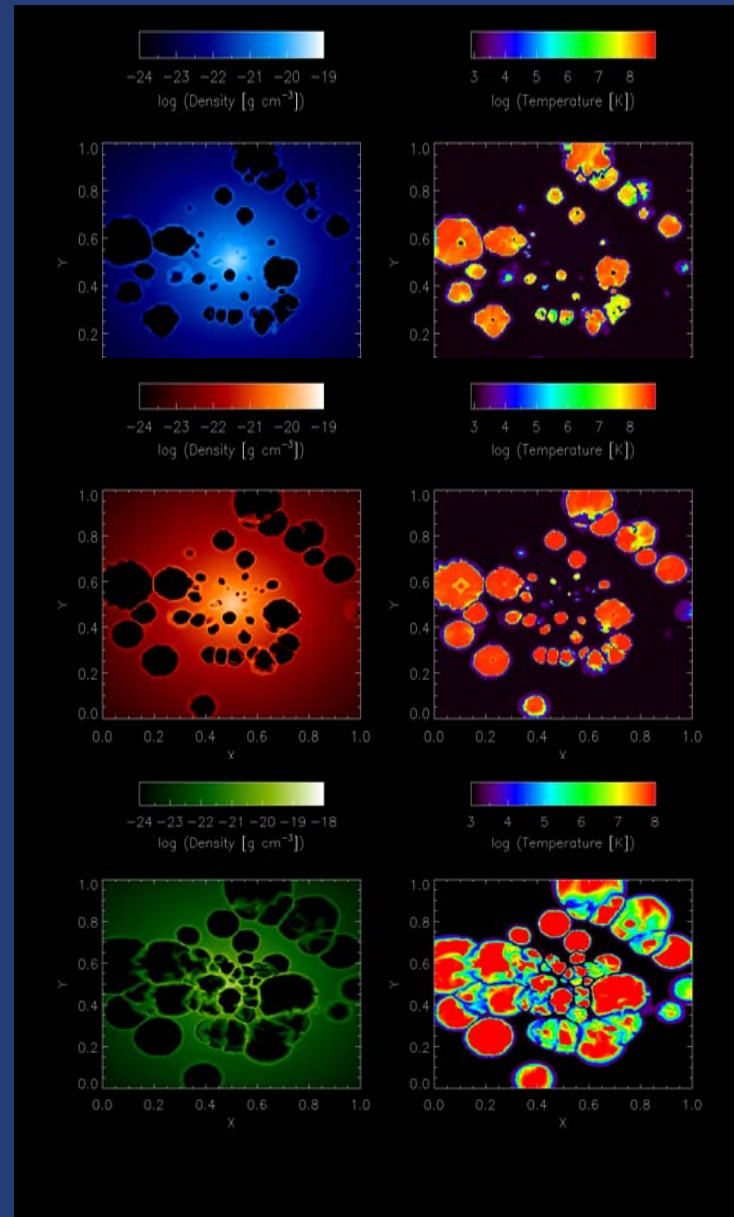
Momentum, Cooling

Energy, Cooling

Energy + switch off cooling for σ_{turb}>50 km/s

Different feedback schemes

FC et al., in prep.

On the Convenzione:

- Overall, it improved my (scientific) life

    -Less time spent on proposals (one was rejected back in the days)
    -Allows me more continuity in production
    -Excellent support offered (Maximum rank)

    -Perhaps storage is a bit limited (but I admit I need to spend some more time to organise my files)

- Difficulties so far seem all due to old version of RAMSES I'm using

    -Need to upgrade to new version (AUGURI), some work but hope to fix my issues and go on exploiting the Convenzione