Isolated disk simulations

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Rationale

Isolated disk with MW-like conditions are easier to model at high resolution and with a faster turn-over time.

We need to cross-calibrate our different stellar and AGN feedback models: several runs are required to explore the parameter space of each code.

Goal: compute macroscopic quantities as a function of time such as:

- SFR

- mass outflow and inflow rate

- velocity dispersion

- cold/warm/hot gas fraction

For each code, we need to determine the set of subgrid parameters that give rise to a similar set of macroscopic properties (SFR, wind, fountain).

Then we can go cosmological !

Initial condition generation with MakeDisk

MakeDisk is a code developed by Volker Springel that can generate initial conditions with 4 components:

- dark halo with NFW profile (no gaseous halo)

- exponential stellar disk

- stellar bulge with Hernquist profile

- exponential gas disk

References: Hernquist (1990), Springel (2000, 2005)

Suggested set of parameters:

$M_{200}=10^{12}$ M_{sol}, c=10. More masses ?

$M_D=4x10^{10}$ M_{sol}, $R_D=3.6$ kpc, $h=0.1R_D$

$f_G=0.2$, B/D=0.1

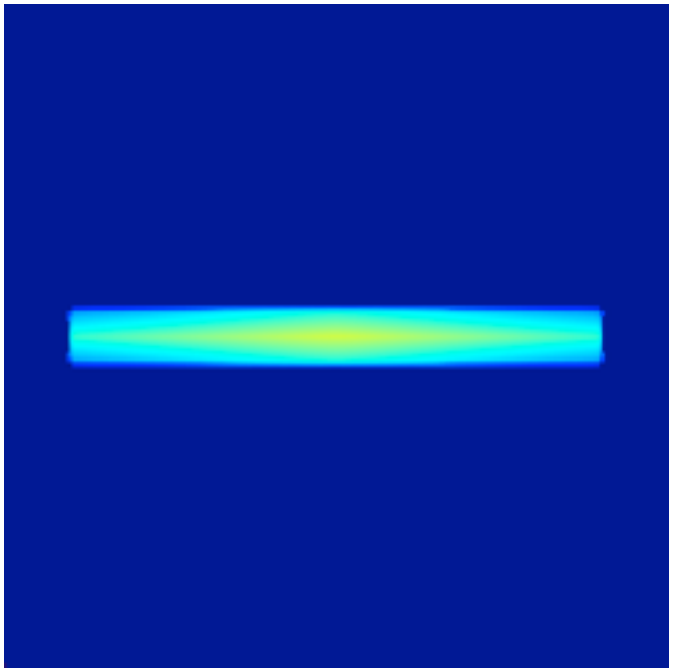
For SPH/AREPO codes, use the gas particles

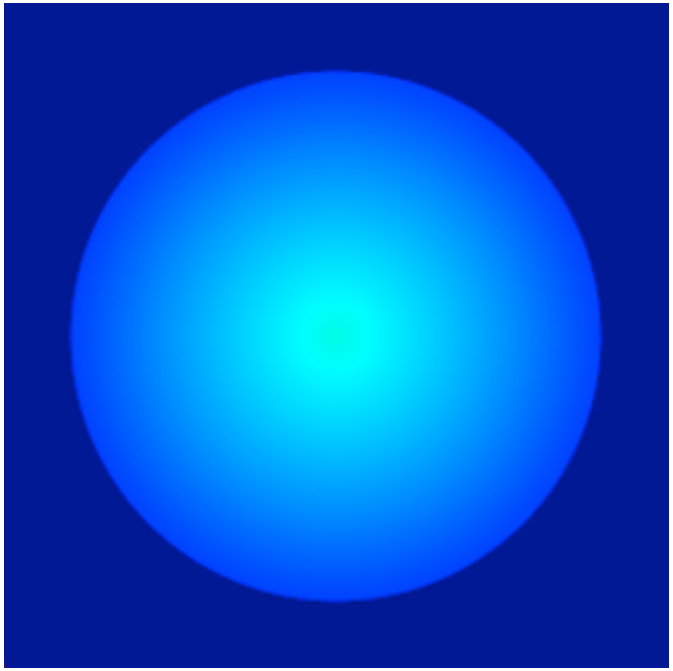
For AMR codes, use the analytical gas density and velocity profile.

Comparison runs: a proposition

- Isothermal equation of state + pressure floor (no SF, no cooling)
- Cooling only (solar metallicity) + pressure floor
- Cooling + SF (no feedback)
- Cooling + SF + stellar feedback

Resolution should vary:100 pc, 50 pc, 25 pc. More ? SPH vs AMR ?





RAMSES

Δx=25 pc

Potential problems

Unresolved disk scale height: results might depend too much on truncation errors.

Solution: use a fixed physical pressure floor (not resolution dependent) ?

Start-up errors. Different codes might give different results.

Solution: focus on the final stationary solution (if any). Use imposed perturbations ?

Different star formation recipe and cooling physics.

Solution: agree on a single set of (simplified?) physical inputs

Different feedback recipe.

Solution: cross-calibration of subgrid parameters.

Feedback and SF recipe depend on cosmological epoch and environment.

Solution: run several types of isolated disks (MW, LMC, M82, HiZ)

Conclusion

- Who's in charge ?
- Generate ICs. What ICs ?
- Collect snapshots and compute diagnostics. What diagnostics ?