Two years of Ramses School for New Users

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RAMSES SNO Days 2025 – Université Paris Cité

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Why organising a *Ramses School for New Users*?

- Widely shared feeling is that RAMSES is feature-rich… meaning it's hard to grasp

  *For example, new users and developers have pointed to a **lack of training in how to handle the code in order to get off to a good start with RAMSES**, as well as a lack of visibility of the expertise of the members of the RAMSES community who could help them. Indeed, the diversity of the methods and physics covered is such that isolated or novice users cannot acquire these basic skills on their own. **Training initiatives […] are essential here**.*

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Community training

RAMSES quick-start-classes : 2-days training event hosted by one of the partners (Lyon in 2024). Practical crash-course to using RAMSES and analysing its outputs. Every year !

RAMSES master-classes : for more advanced users and for developers, with practical introductions to e.g. sub-grid models. Every year, starting in 2025.

Scope of the school

- The role is **onboarding**. We aim at putting (potential) new users on the right track to get started with RAMSES simulations :
  - No in-depth review of the code
  - No training for “developing your own model”
  - Only a broad overview of *what the code can do* and *what are the limitations*
- Initial intent:

  we want them to be able to get the code, compile it with relevant options, set up a simulation (including generating initial conditions), read the results and make a few plots
- Target audience :
  - Starting PhD students
  - People starting with simulations (postdocs, staff, ...)
  - People with experience with other codes, but who want to start using RAMSES specifically

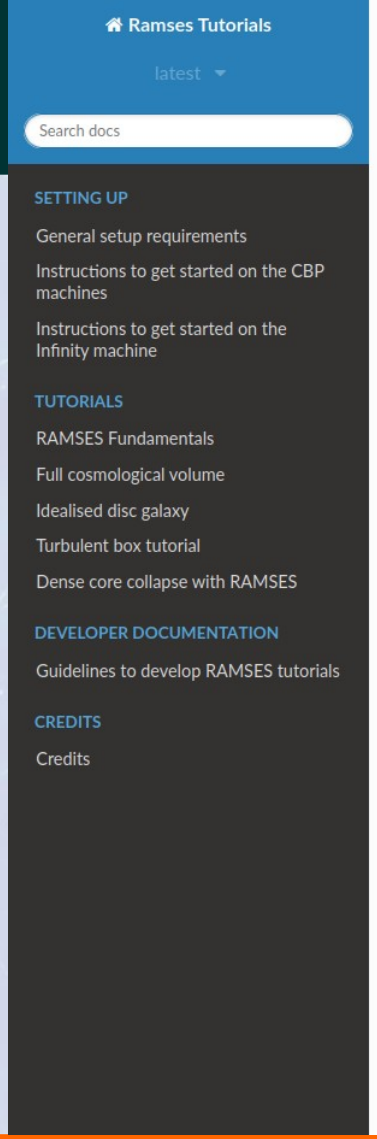
Backbone of the school: RAMSES Tutorials

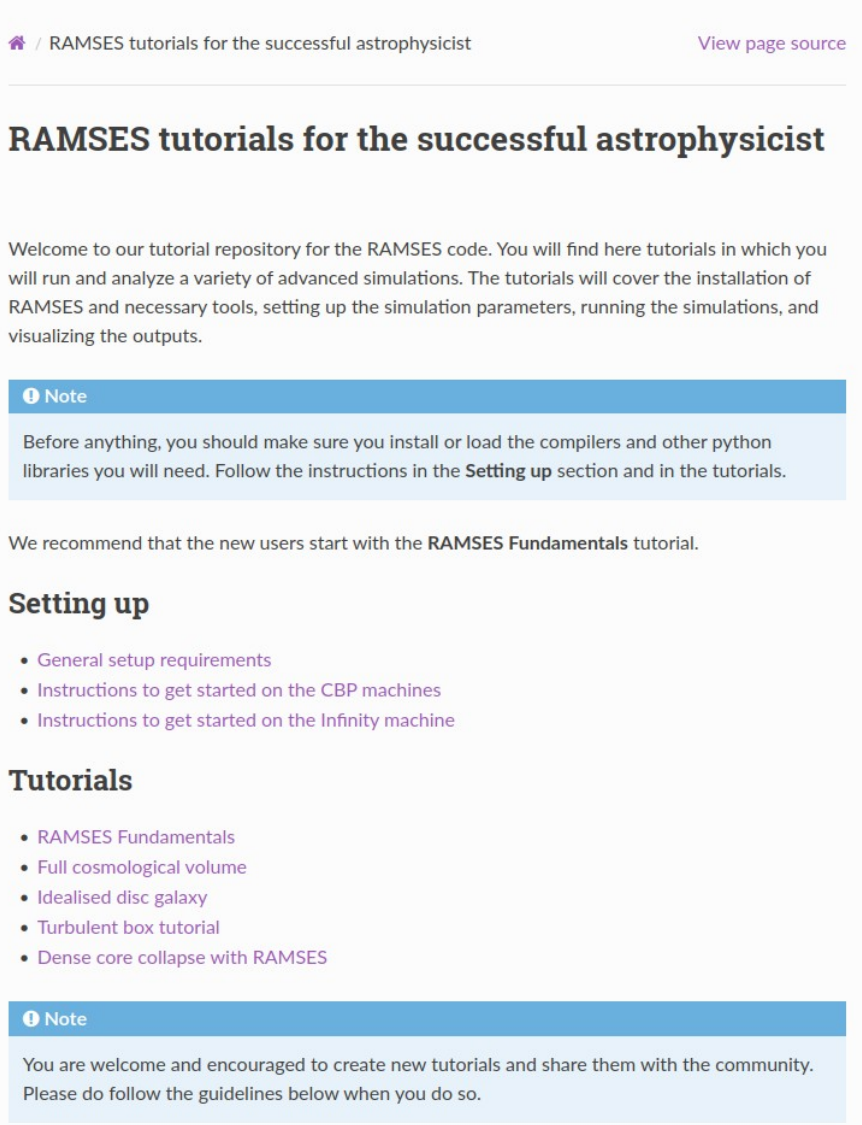
What will you find in there?

"Read The Docs" with all the content required (we think) to get started:

- General set-up instructions
- One introductory tutorial
- Four applications:
  - Cosmological volume
  - Idealised disc galaxy
  - Turbulent box
  - Dense core collapse

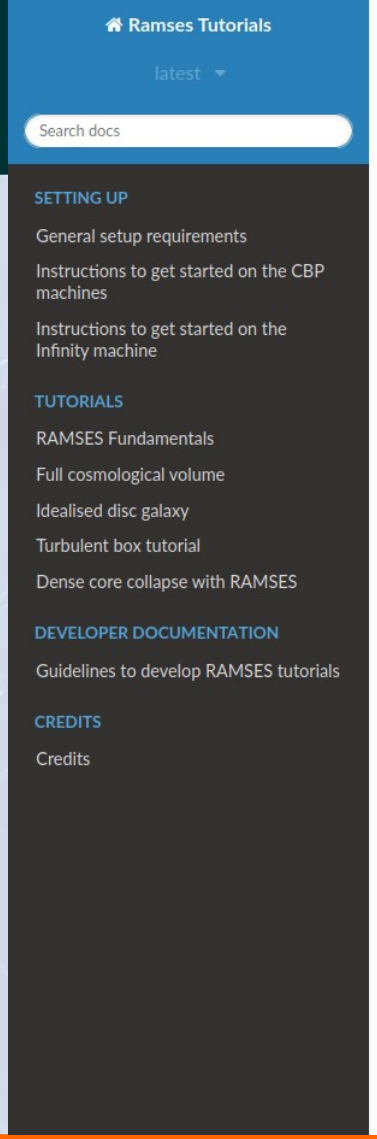
https://ramses-tutorials.readthedocs.io

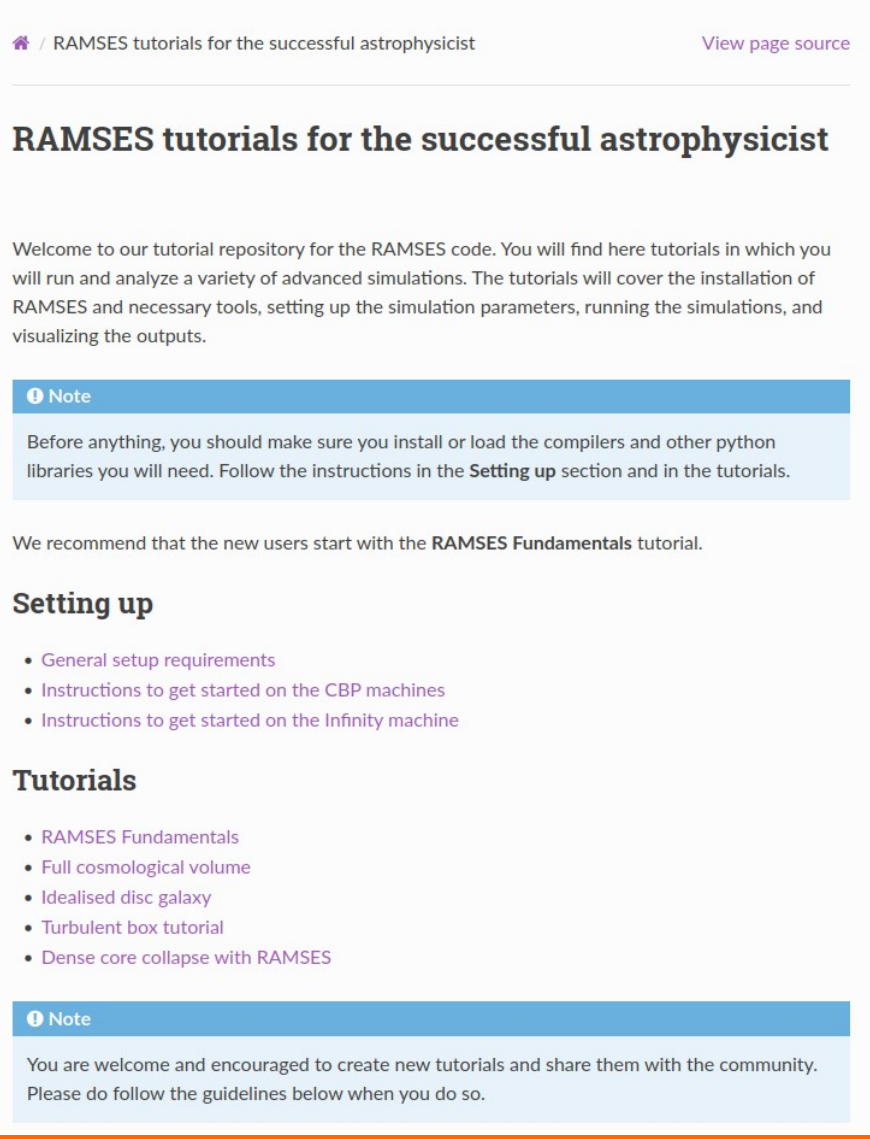




Credits

- Developed by a fairly large group :
  - *RAMSES Fundamentals*: J. Rosdahl & B. Commerçon
  - *Dense Core Collapse*: U. Lebreuilly
  - *Forced Turbulence*: B. Commerçon, N. Brucy
  - *Idealized Disk Galaxy*: J. Rosdahl, M. Rey, M. Farcy
  - *Full Cosmological Volume*: J. Blaizot & C. Stahl
- Reviewers and maintainers include
  - J. Blaizot, N. Brucy, M. Farcy, M. Rey, M. Trebitsch for the 1st edition
  - M. González, C. Cadiou, N. Brucy, M. Trebitsch for the 2nd edition



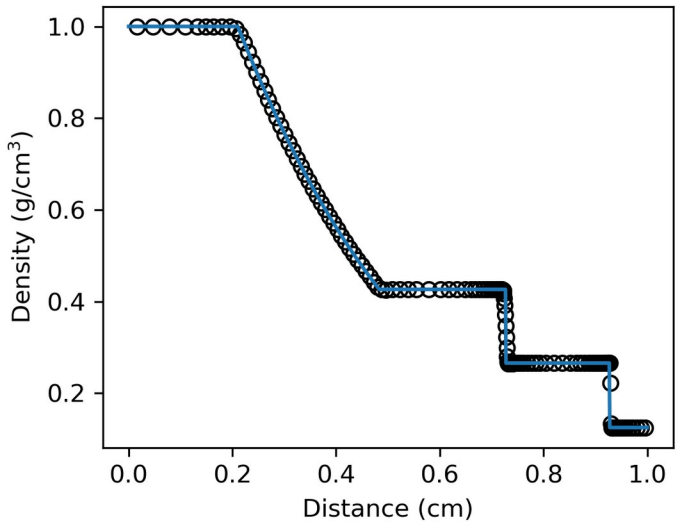


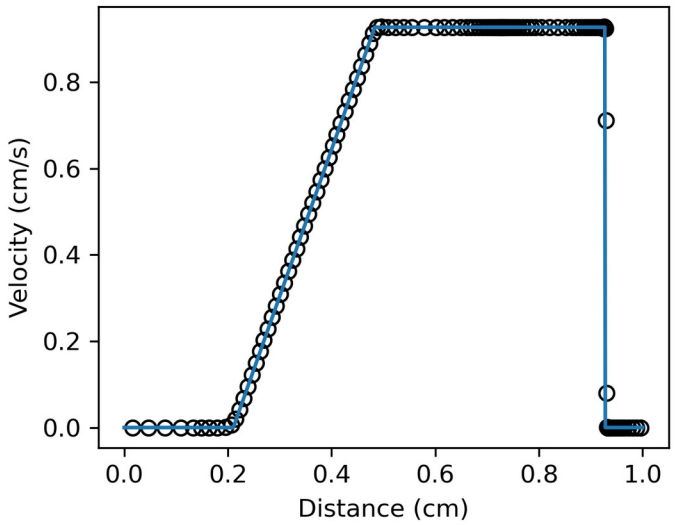
General setup: installing RAMSES and the computing environment

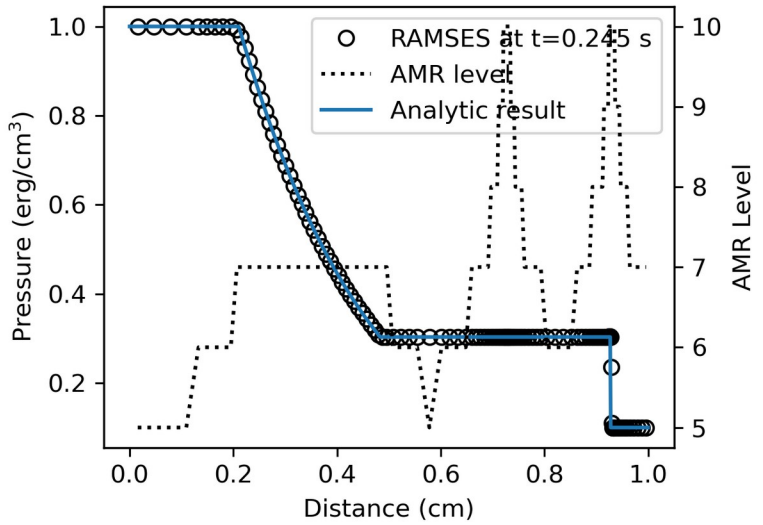
- Covers (mostly) :
  - How to get RAMSES (*git clone* etc)
  - How to install the right environment: Python tools, libraries, etc
  - How to install the “third-party” libraries for IC generation (MUSIC, DICE, mainly)
- This is one of the **HARDEST part** (see later)
- Choice for now:
  - One catch-all page for “non-experts”
  - One page per school (CBP@CRAL, Infinity@IAP, …)
- My feeling: this is not super satisfactory

Fundamentals: basic setups (Sod shock, Sedov blast, Strömgren sphere)

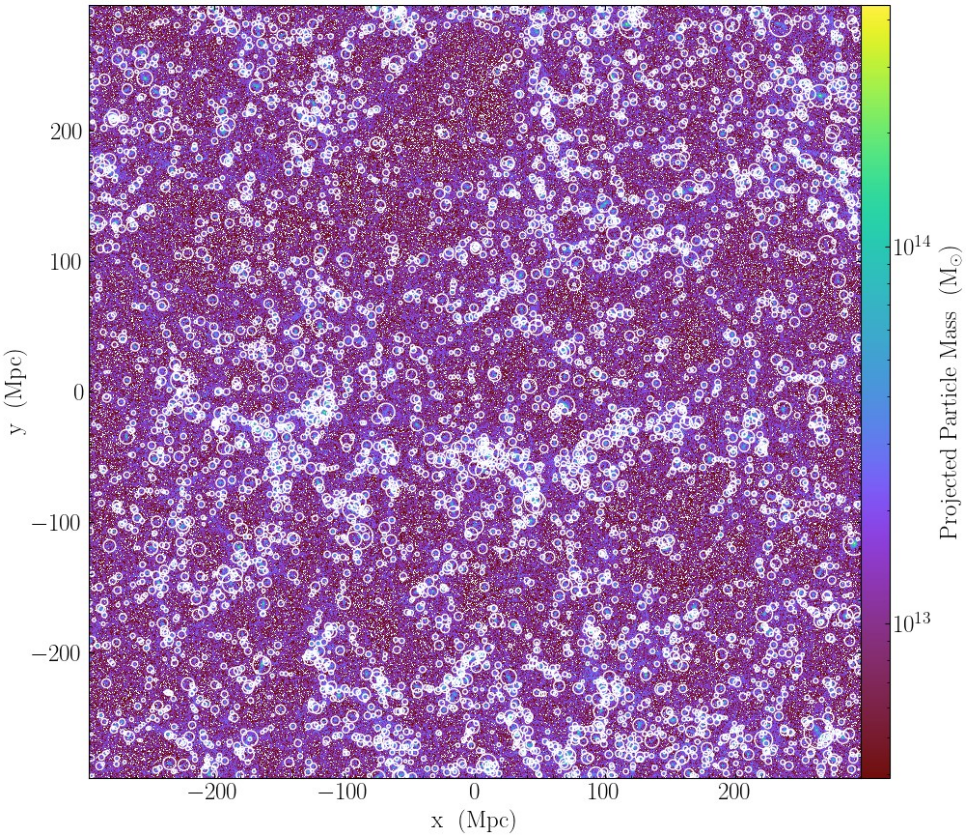
- Introduces the **namelist**, the **makefile** and its options, etc
- Very basic setup: can definitely run on a laptop
- During the school: ensures everyone can run RAMSES smoothly







Cosmological volume

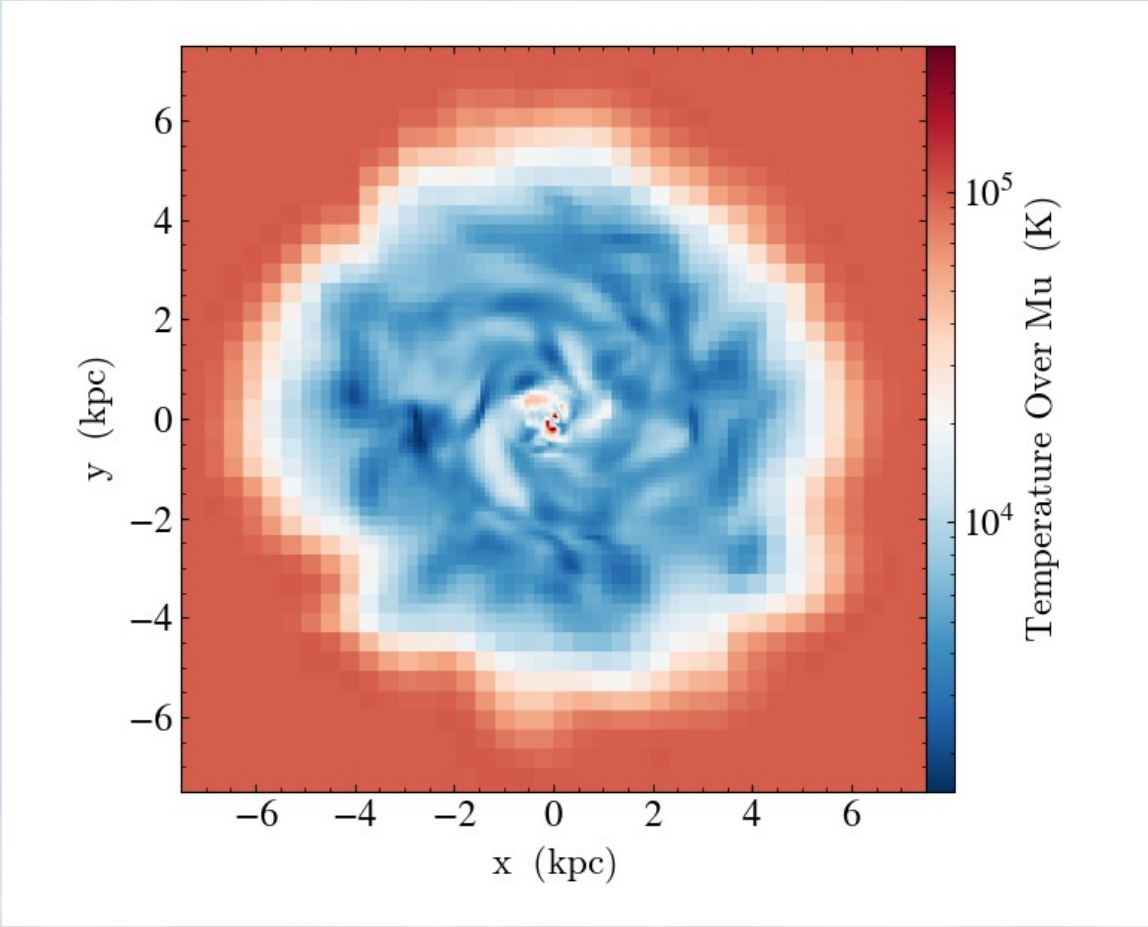


- Creating cosmological ICs with MUSIC
- Running RAMSES in DM-only mode
  - Particles
  - Gravity
  - AMR
  - Mostly that
- We run the simulation, identify haloes, make basic maps and showcase some more advanced analysis
- Could be significantly expanded

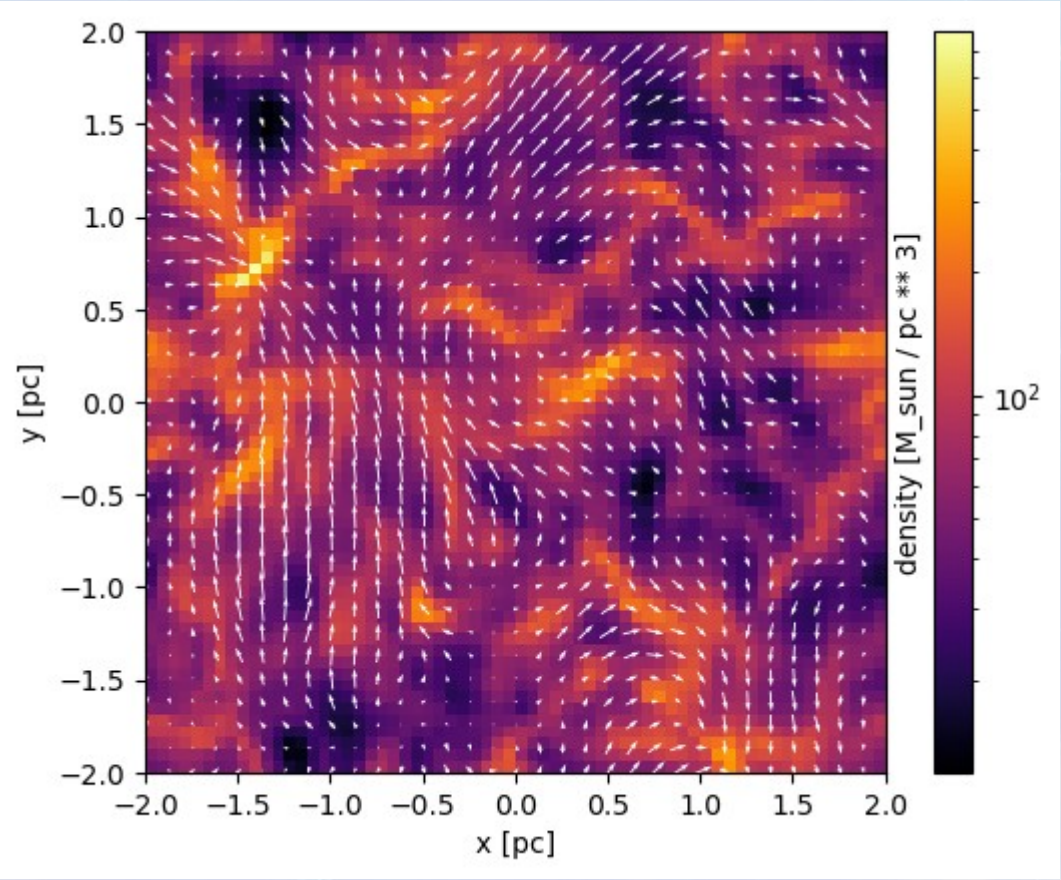
Idealised galaxy

- Creating isolated ICs with DICE
- Running basic “hydro” setup
- Simple analysis: maps, SFR, movies
- Explore variations:
  - Radiation Hydrodynamics
  - Subgrid models for star formation
  - Including metals
  - Stellar feedback
  - (some) AGN

- Gives a broad overview of “galaxy formation” physics available



Turbulent box

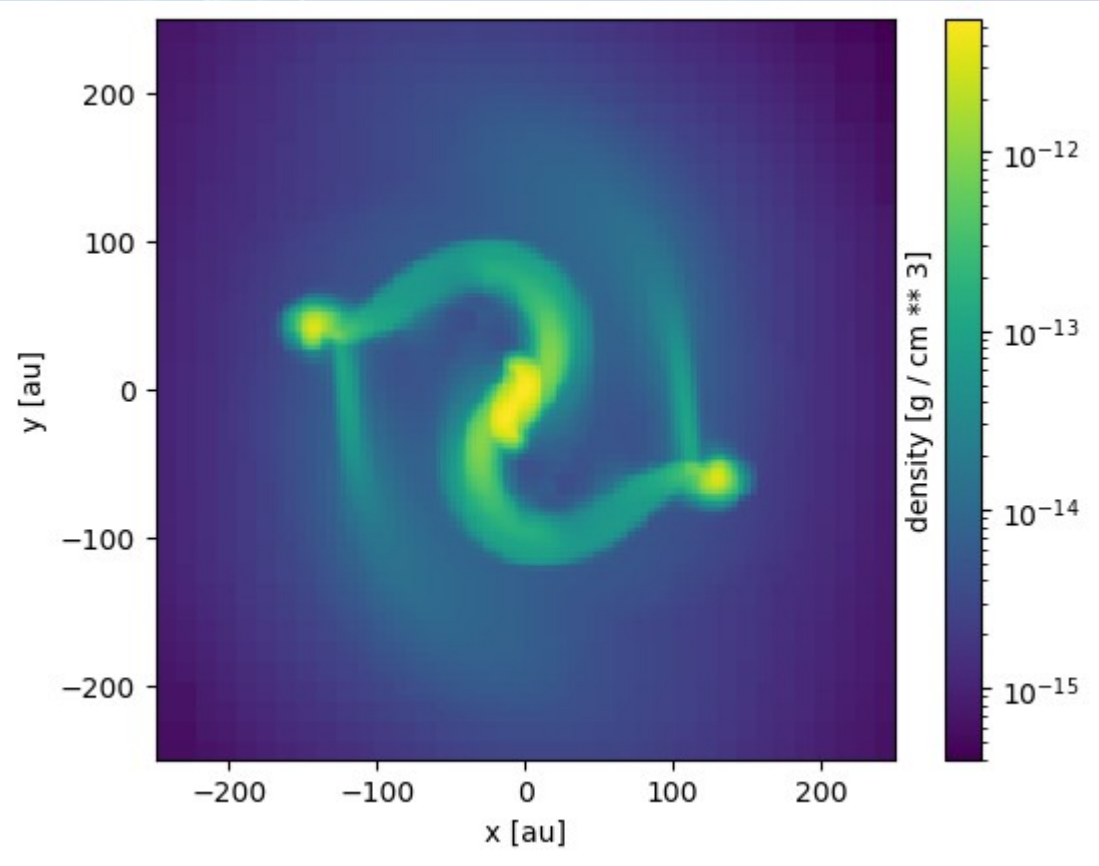


- Based on the test suite
- Showcases the “turbulence driving” module of RAMSES
- Basics of Osyris analysis
- Introduces the test suite

- Could also be expanded

Dense core collapse

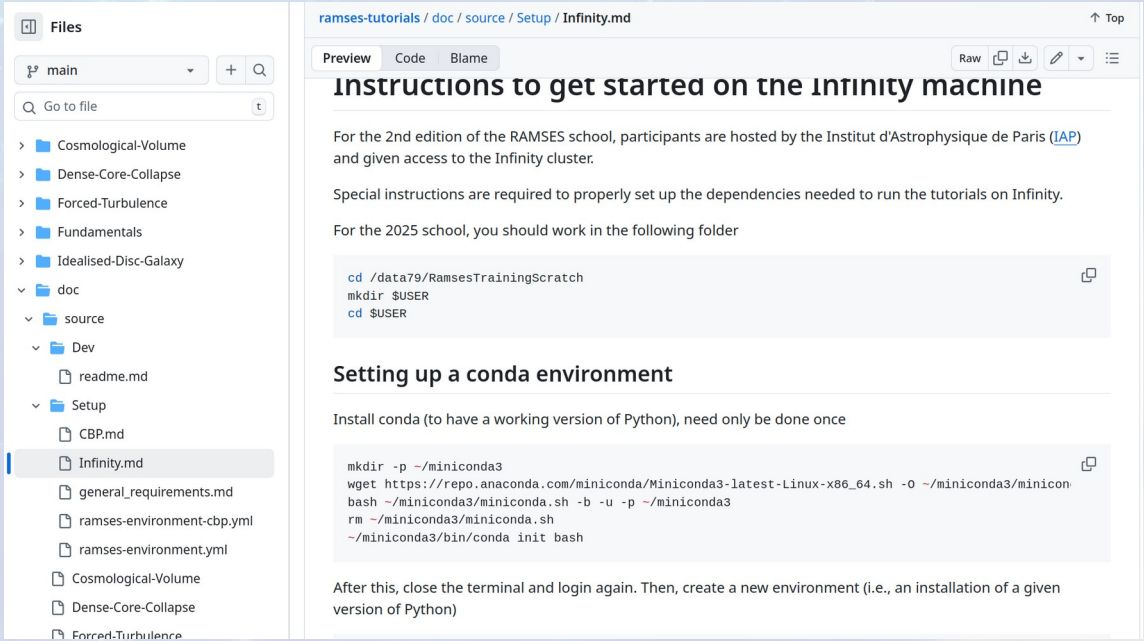
- Collapse setup for star formation
- Only tutorial with MHD
- Details on the namelist parameters:
  - Non-periodic boundaries
  - Specific ICs
  - Equation of State
  - ...
- Exploration on MHD, rotation, etc



Practical details

About the Read The Docs tutorials

- As of the ~October, the tutorials are hosted under the umbrella of the Ramses Organisation
- Everything is on github: https://github.com/ramses-organisation/ramses-tutorials
- Content is a mix of Markdown files and Jupyter Notebooks
- **Easy to add new tutorials**



First edition in Lyon

- 12 people (6 PhD, 3 postdocs, 3 faculty)
- First lecture introducing RAMSES
- Then tutorials

- Technical choices :
  - Local install on laptops + cluster access
  - Tutorials run mostly through the Jupyter notebooks
- Hosted by Benoît Commerçon, Joki Rosdahl, Noé Brucy, Jérémy Blaizot

Second edition at IAP

- Mostly based on the tutorials from the first edition
- 11 attendees, mostly new PhD students (1 master, 2 postdocs, 8 PhD)
- Hosted by Yohan Dubois, Matthias González, Corentin Cadiou, Maxime Trebitsch

- Technical choices
  - Everything run on the IAP cluster *Infinity* → includes SLURM training
  - Still uses Jupyter notebooks... with SSH tunnels to run on the compute nodes

- I think it went pretty well, but with no photo, you will have to trust me on this
- The cluster worked really well, thanks to the very reactive system admin

Lessons learned and open questions

Good news

- The school seemed **pretty well received** both years
- The format seems to work:
  - 2 days is short, but probably enough (maybe 2.5 days **if we have more material**)
  - 10-12 attendees seems like a high but good number
  - ~4 lecturers works well
- So far, enough people are interested to keep it going
- The tutorials have strong legacy value:
  - Used to train newcomers even outside of the school setup (tried and tested at ObsParis)
  - Used e.g. by Ricarda Beckmann in the UK
  - **Useful complement to the user documentation**

Some things that required some work

- The **tutorials need to be maintained**
  - RAMSES evolves regularly
  - Third party tools can change (eg Osyris, YT, but also just Matplotlib or MUSIC)
- **Installing RAMSES and its setup is complex** (MPI, compilers, Python modules, etc) and requires dedicated effort:
  - Either supporting individual laptops (but not “production-ready”) → way too much work
  - Real cluster environment → complex with notebooks, requires system admin helping
  - Mix of both? Running on a dedicated node, but analysis on the login node? Desktop computers?
- Pace of the school can probably be improved (eg regular checkpoints, more discussions), but at the same time, this is hard to “force”
- We need **MORE NEW TUTORIALS** : feel free to help!

Open questions

- **How to maintain the tutorials? What should we do?**
  - Pinning the version of all python modules, compilers, etc
  - Freezing a version of RAMSES and the corresponding tutorials

    → **Yearly release of the tutorials**? This requires people time, so any help is welcome
- What is a good **install setup**?
  - One per system/school, one “catch-all” guide, etc?
  - Maybe this could connect to the “SLURM working group”?
- How to improve the **legacy value** of the tutorials?
  - Running “remote schools” seems difficult to me, but we can help “setting up schools”
  - Extra training initiative to organise broader/international schools?
- **New tutorials** need to be developed: this needs planning! We should start now!

  → Raises the question of “**what do people want from these schools?**”