Propagating relativistic jets into the ISM/ICM

V. Antonuccio-Delogu - INAF/OA Catania - ITALY

S. Cielo - IAP, Paris - FRANCE

Bologna, November 30th, 2017

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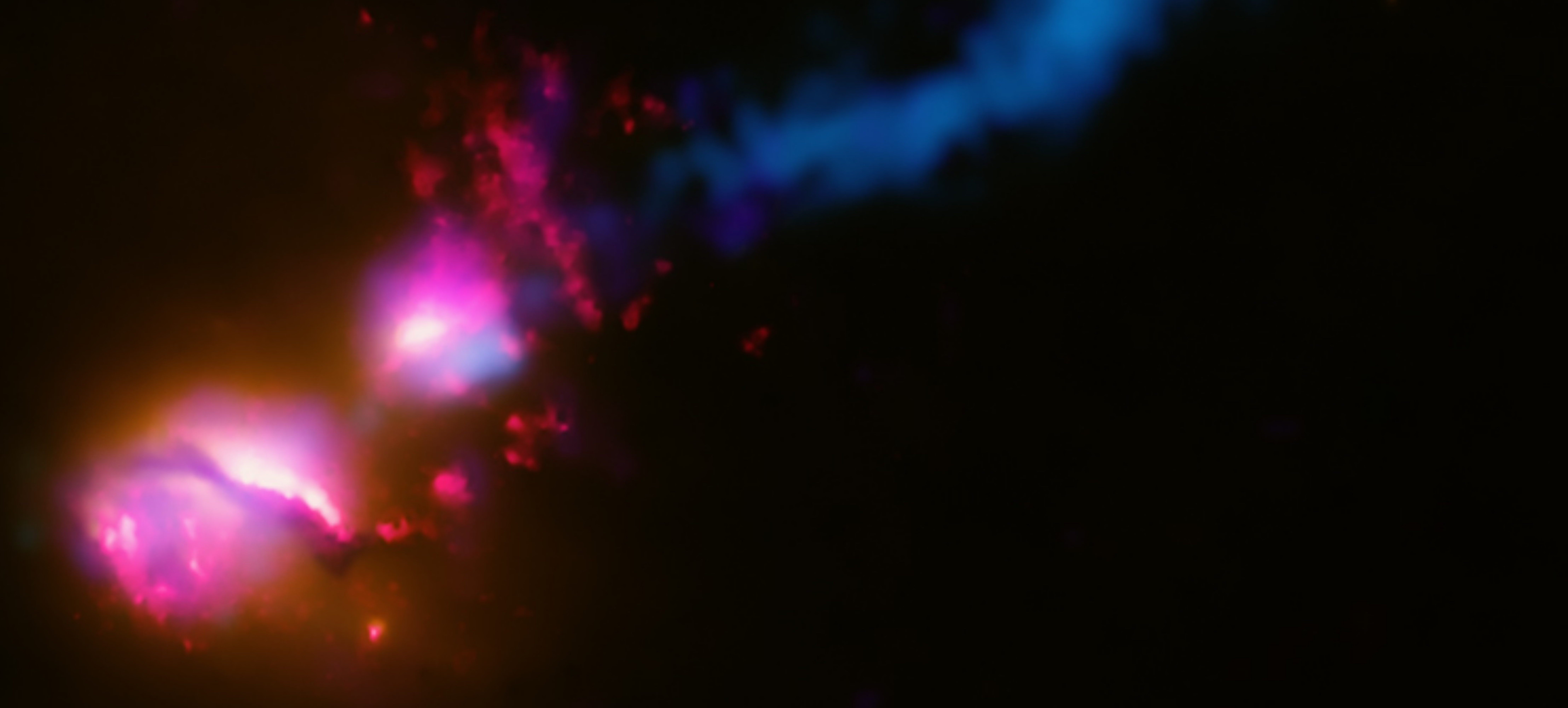

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- Science: *Study of the physical mechanisms underlying jet-star forming clouds interactions.*

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- Title: *Mechanical feedback and backflows in early-type galaxies.*

- Science: *Study of the physical mechanisms underlying jet-star forming clouds interactions*

- Code: *FLASH:*
  Adaptive Mesh Refinement, xyz-blocks, N_c^3 cells/block
  Physics: Rad. cooling, Self-gravity, Star formation and feedback (SN), DM halo, Central BH

Scalings

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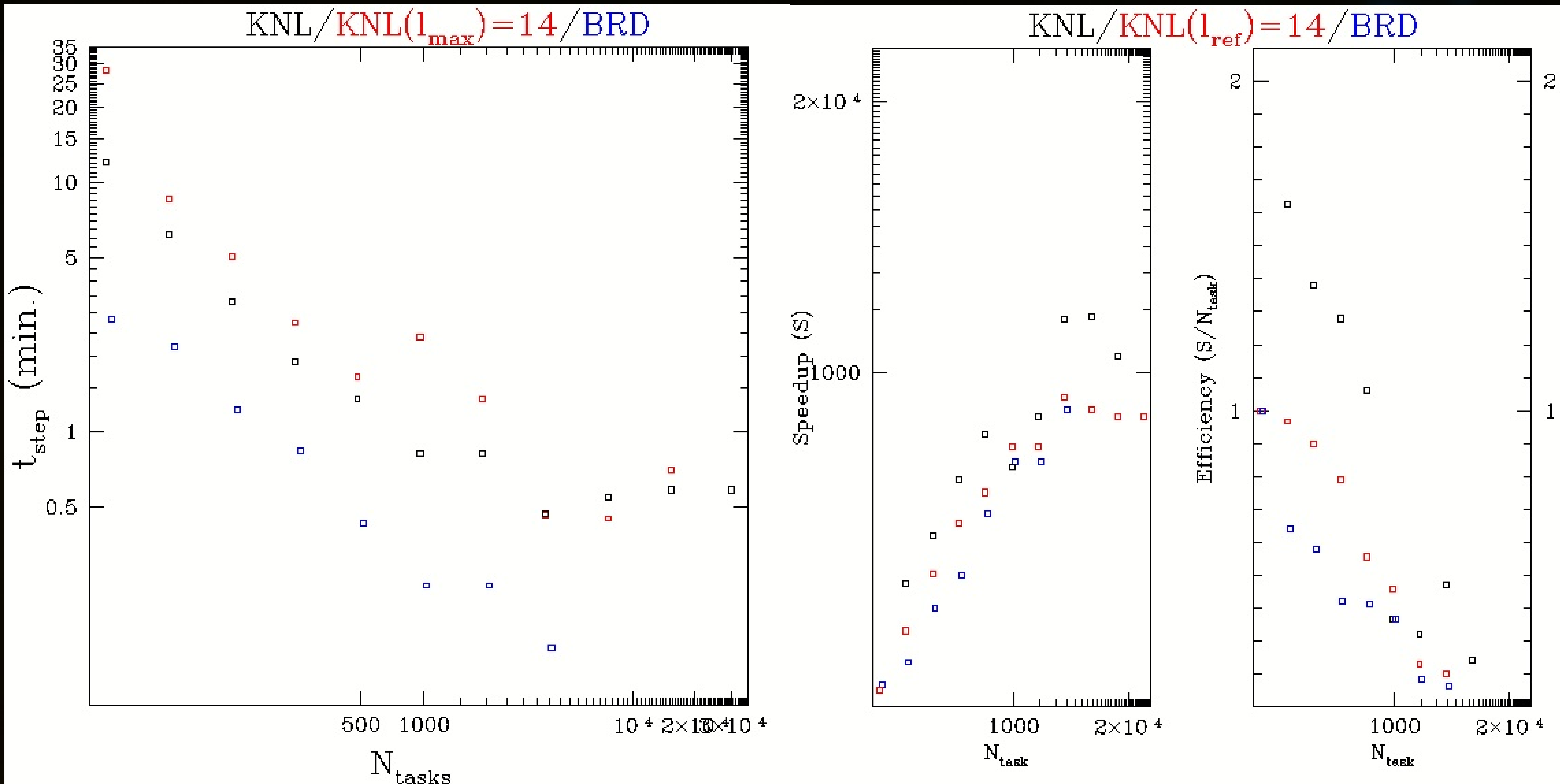

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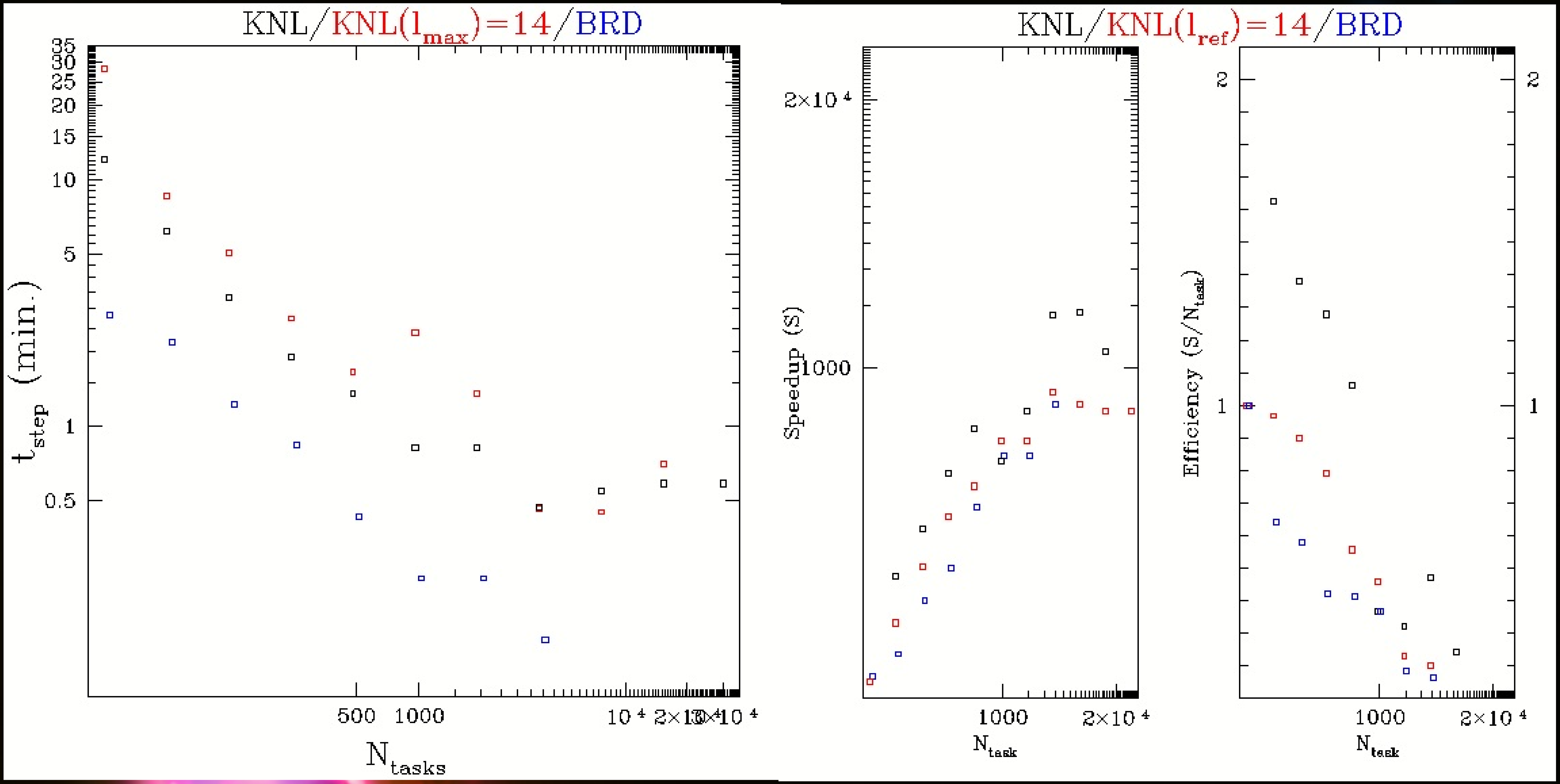

- Red/Black: KNL with $l_{r,max}$=14 and 11. Blue: BRD

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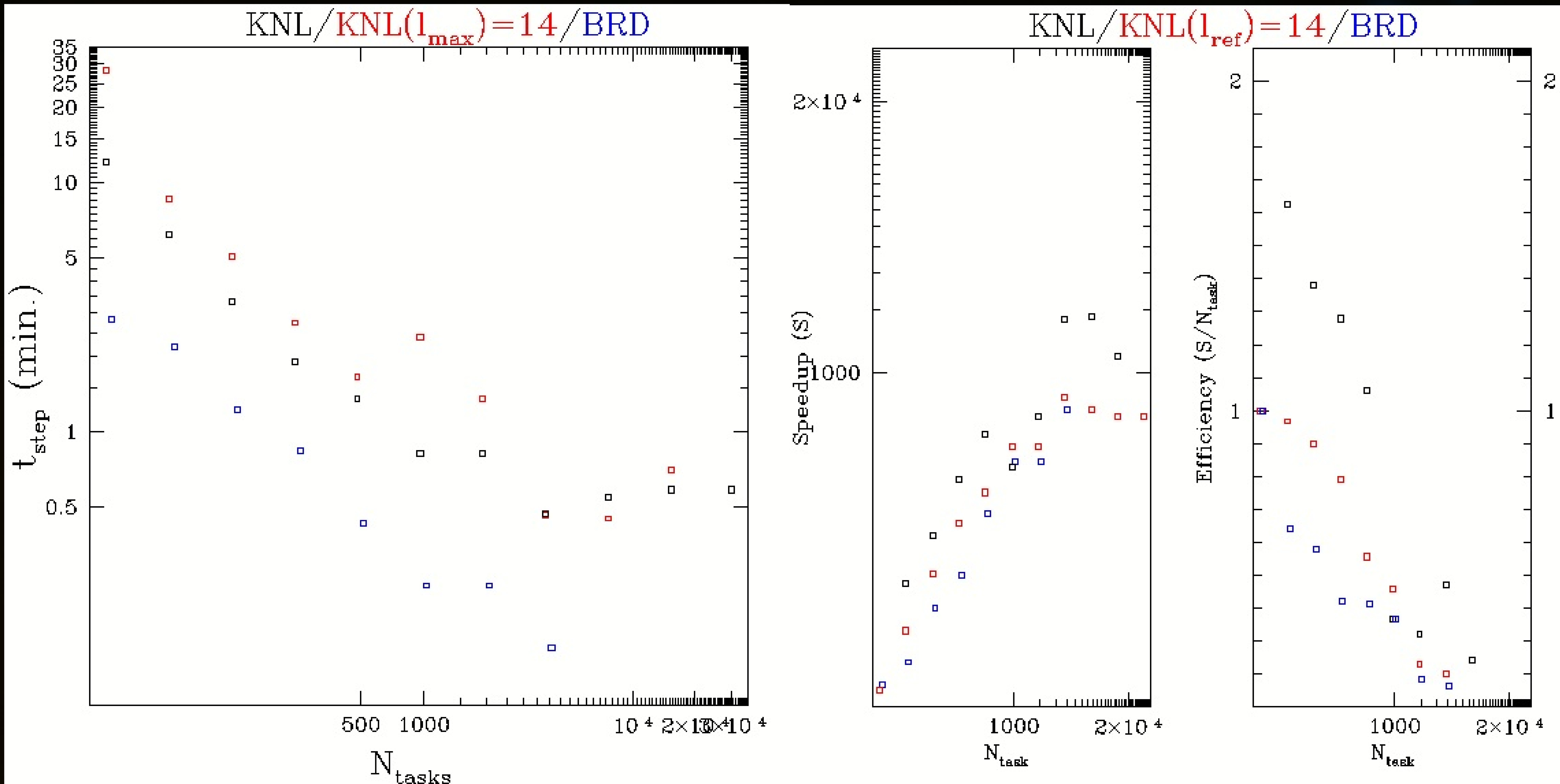

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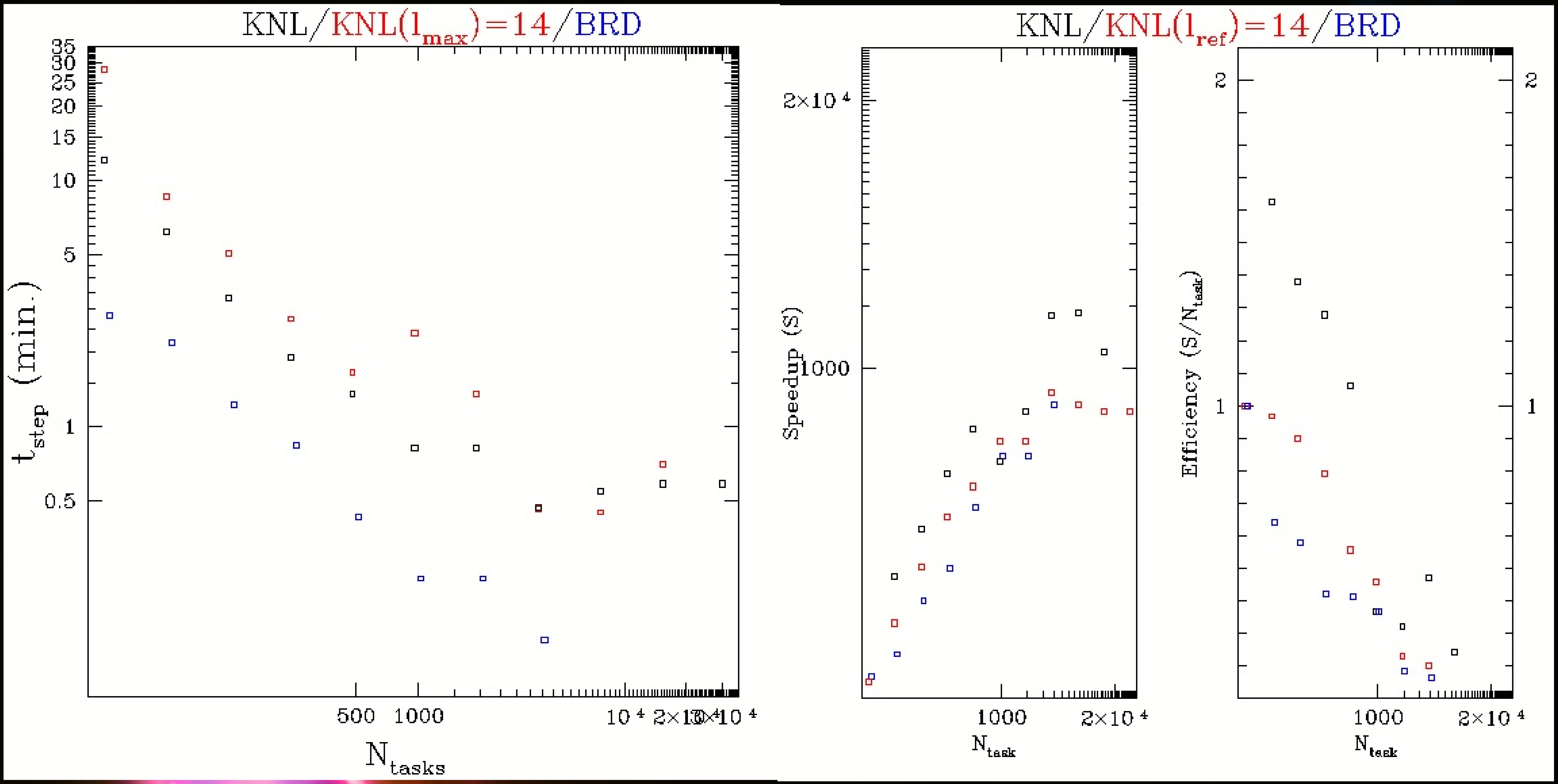

- Red/Black: KNL with $l_{r,max}$=14 and 11. Blue: BRD
- Linear scaling up to N_{task} ~ 12000
- We usually run with N_{task} ~ 2500 - 4500

Just **ONE** scientific result: X-ray cavities

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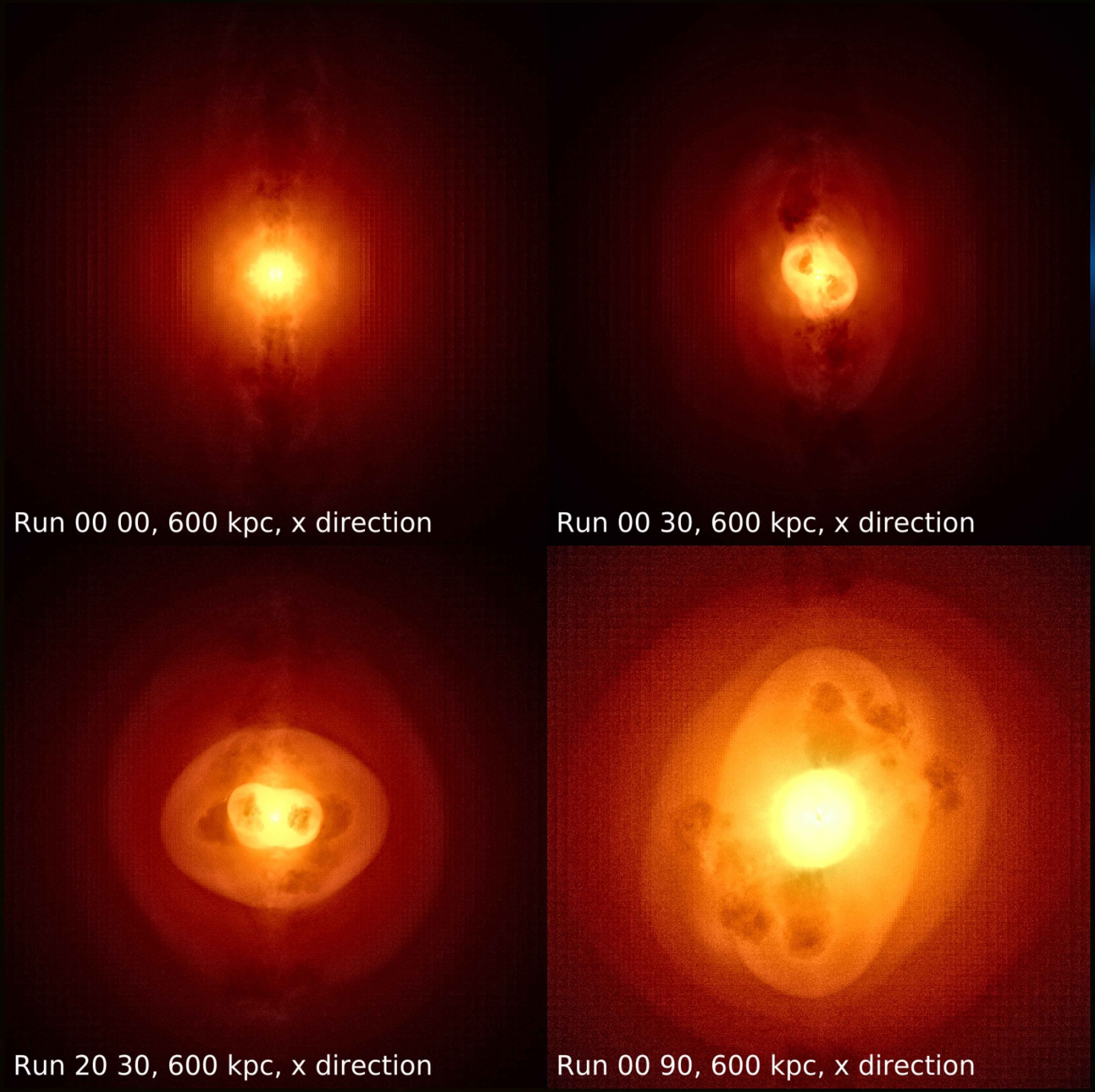
Re-orienting jets: multiple jets launched at different angles e.g. because of tidally-induced disc re-orientation due to minor mergers



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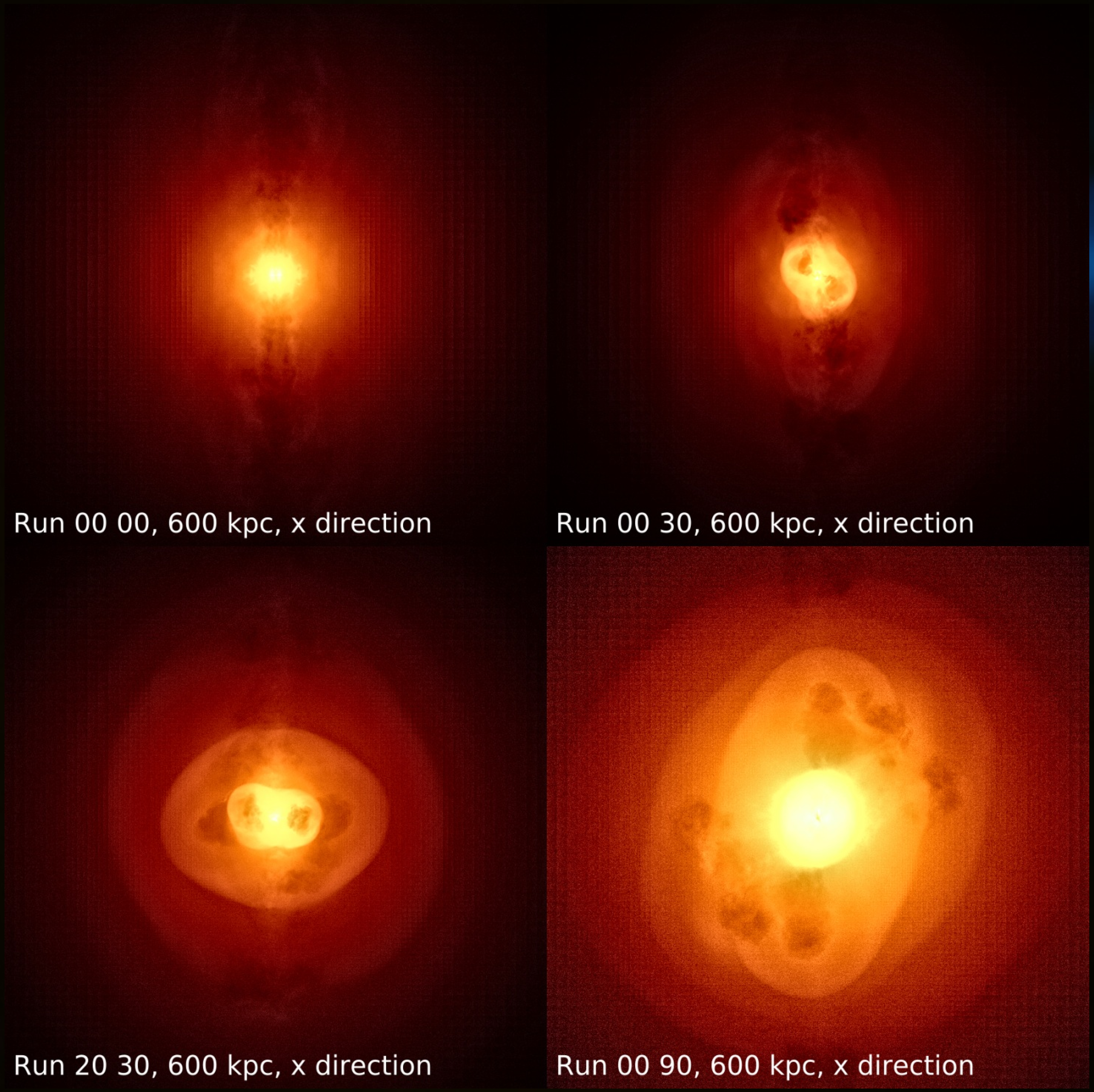
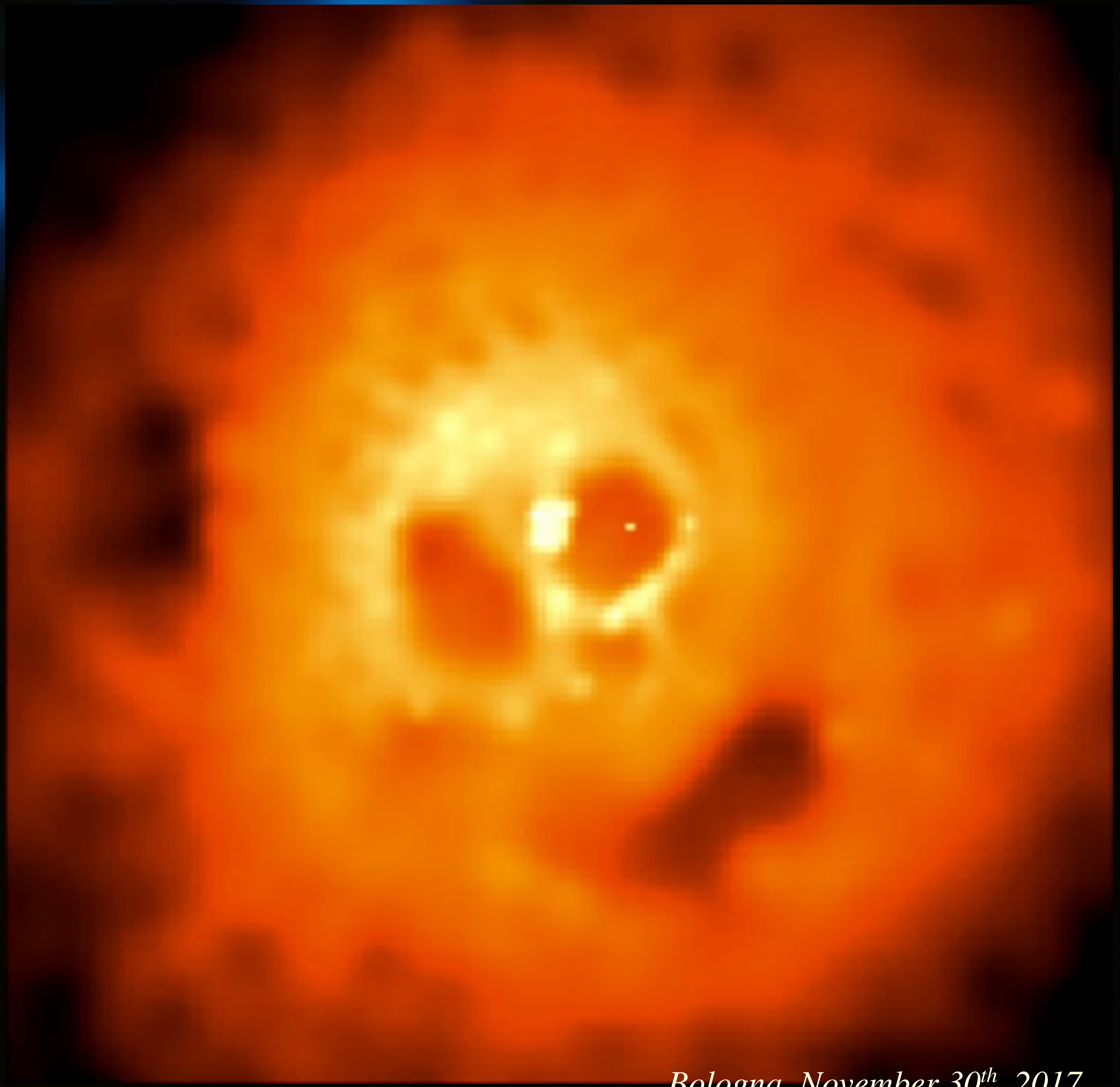


Perseus cluster, Chandra/ACIS-I 0.5 - 2 keV, 7hrs (Fabian et al 2001)



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Run 0030, central 200 kpc, 52 Myrs, 4 jets episodes (Cielo et al., MNRAS subm., 12/2017)

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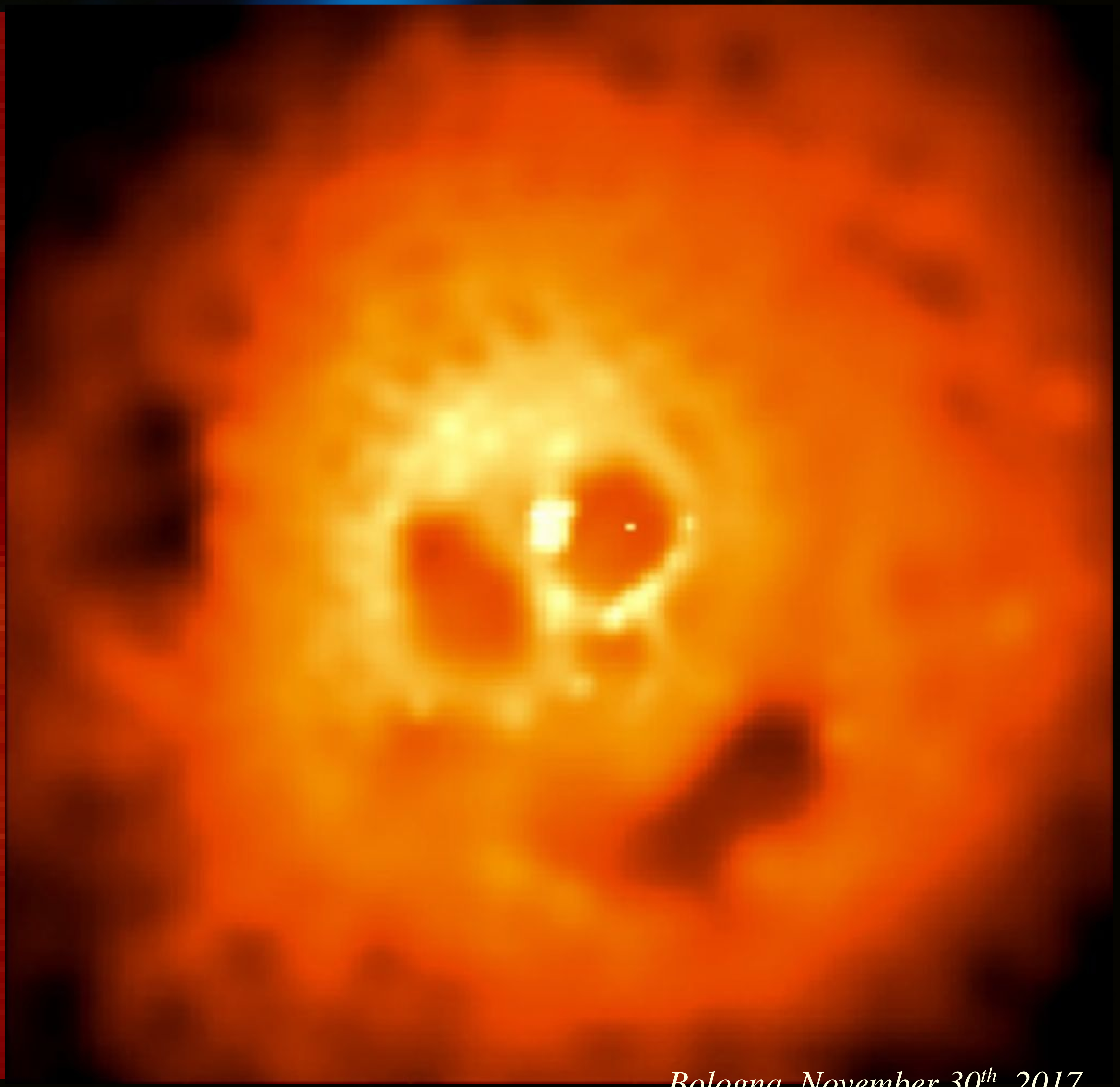

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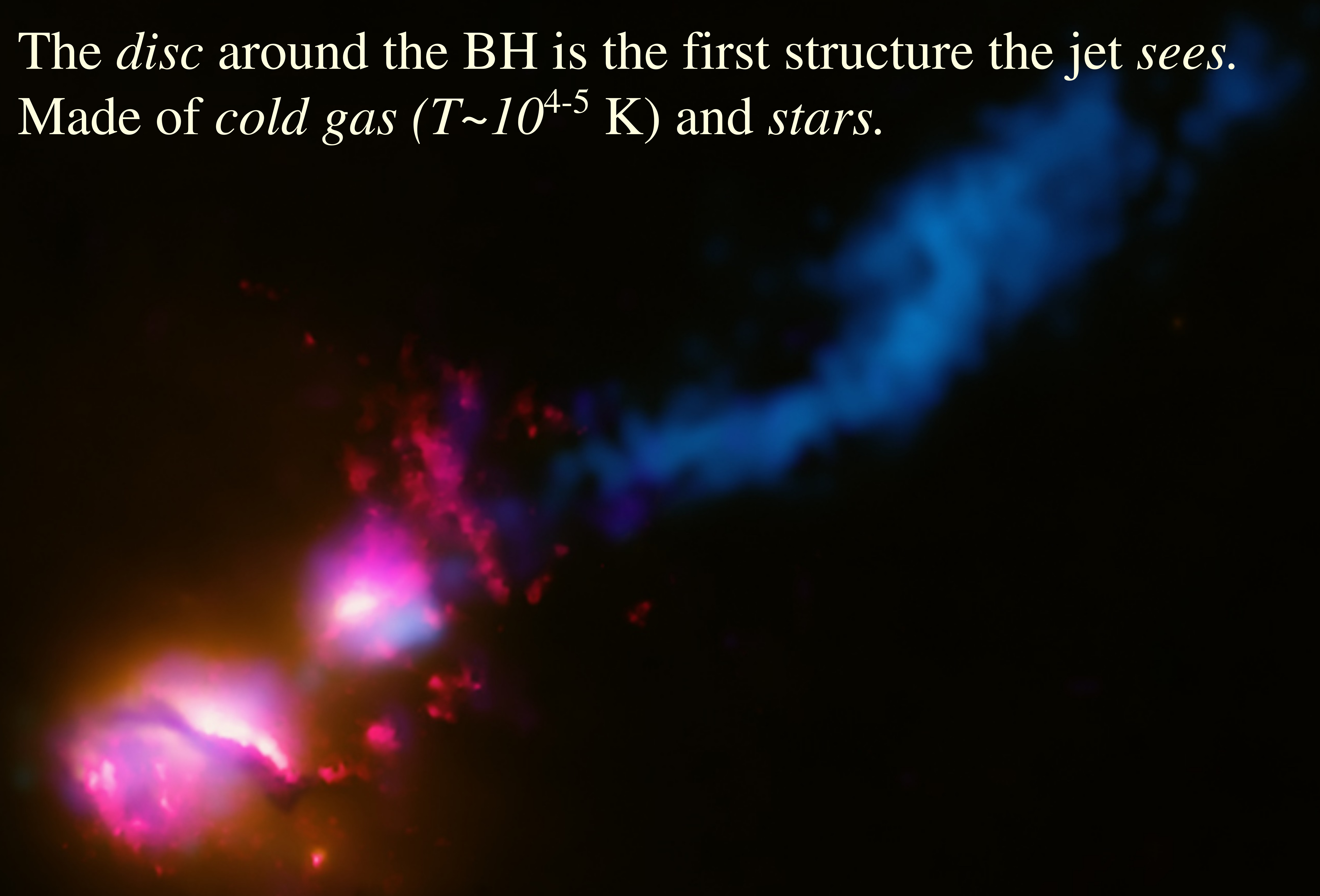
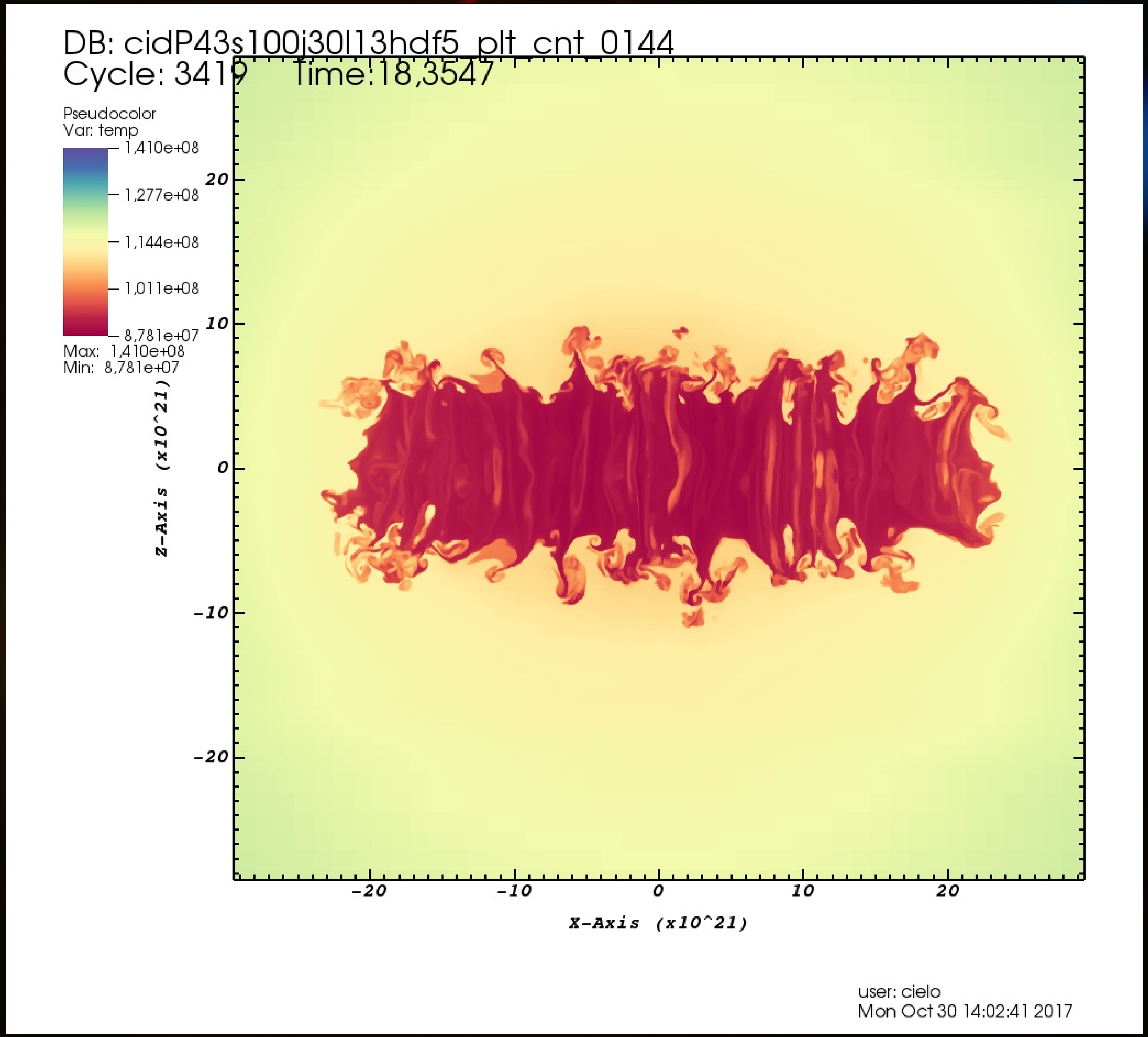


Numerical problem: Setting the disc

- The *disc* around the BH is the first structure the jet *sees*.
- Made of *cold gas* (T~10^{4-5} K) and *stars*.
- Very unstable numerically: initial gas-stellar systems heavily subject to RT and heating instabilities:



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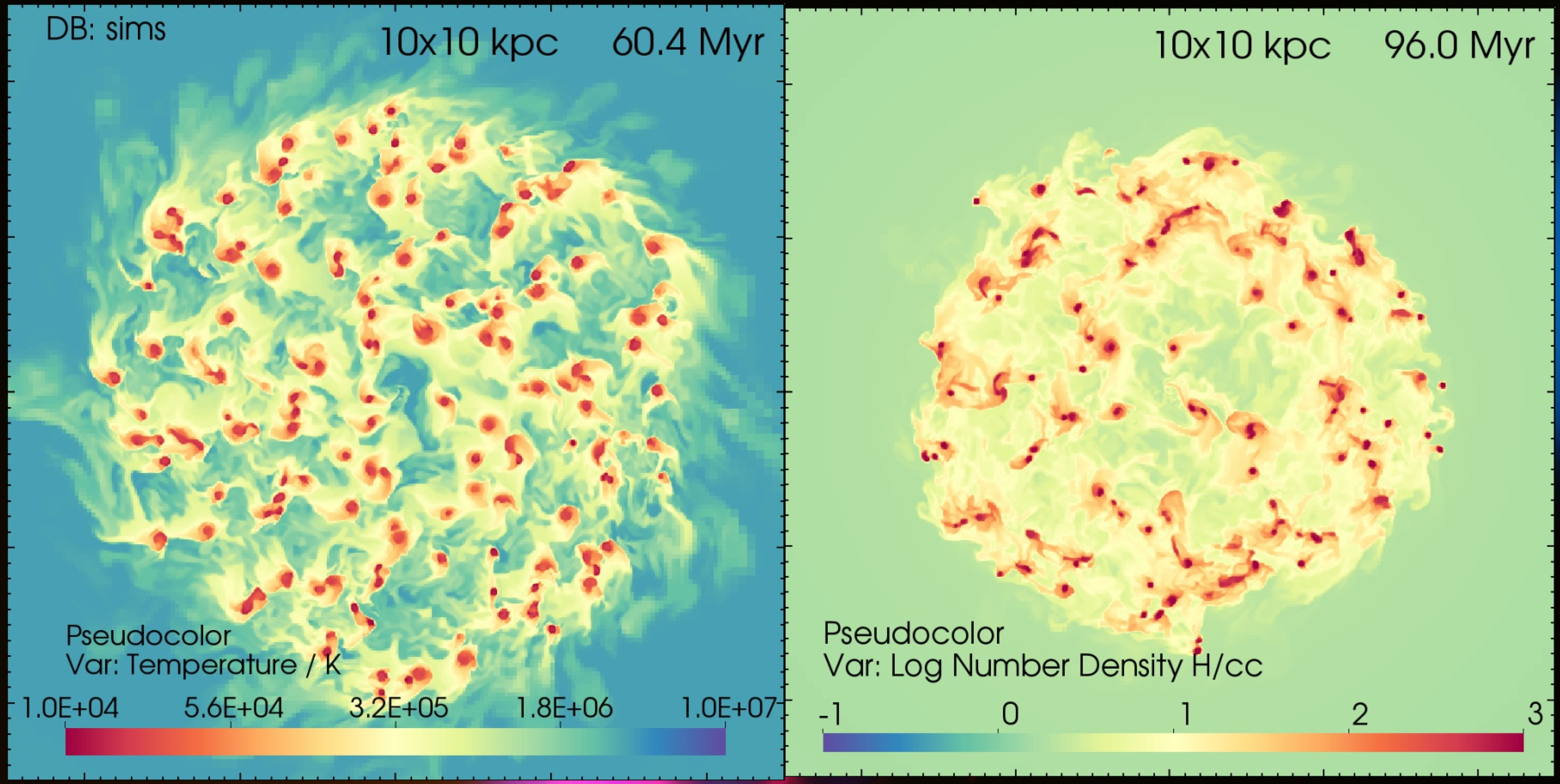

Density

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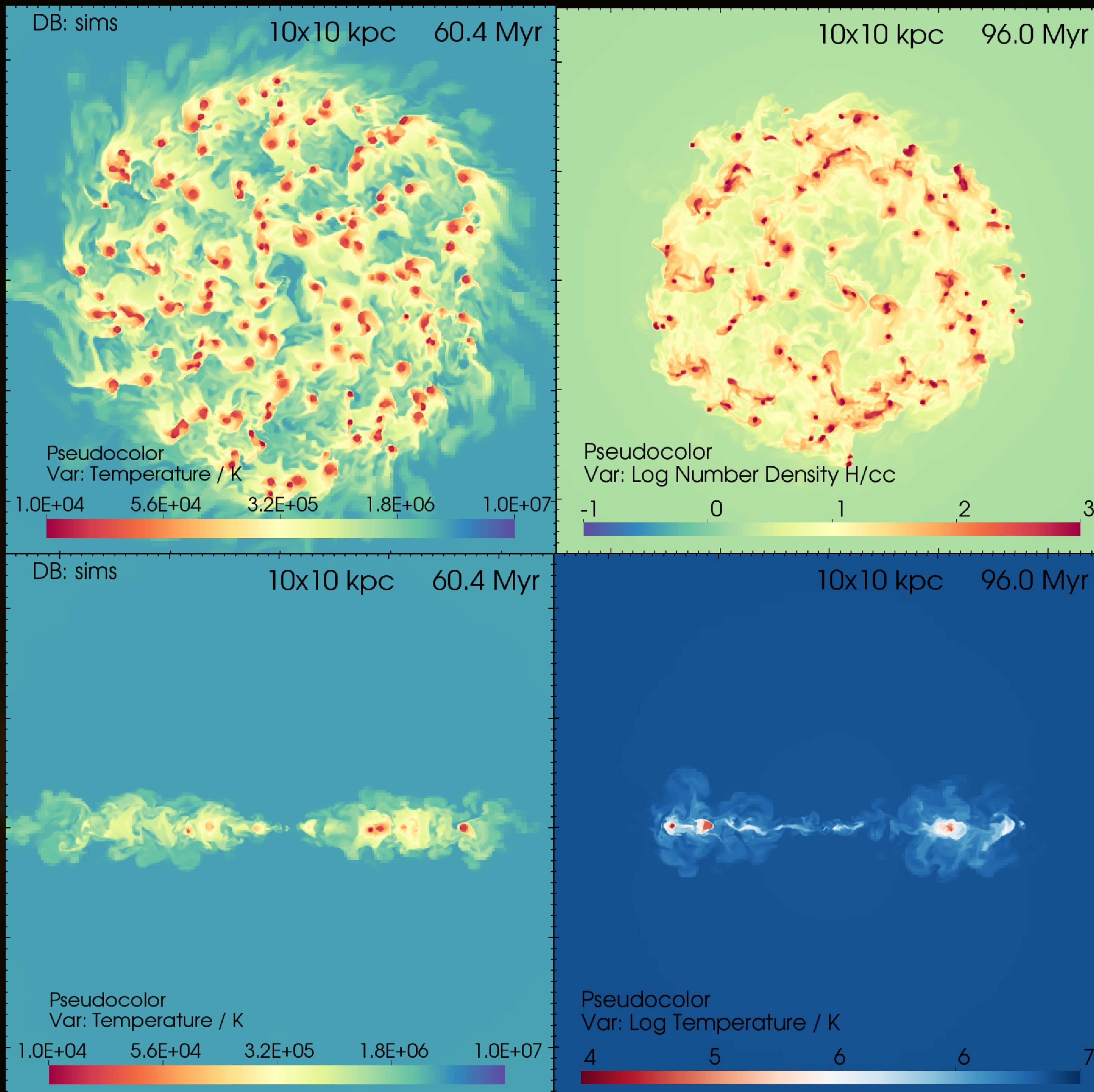

Density

Temperature

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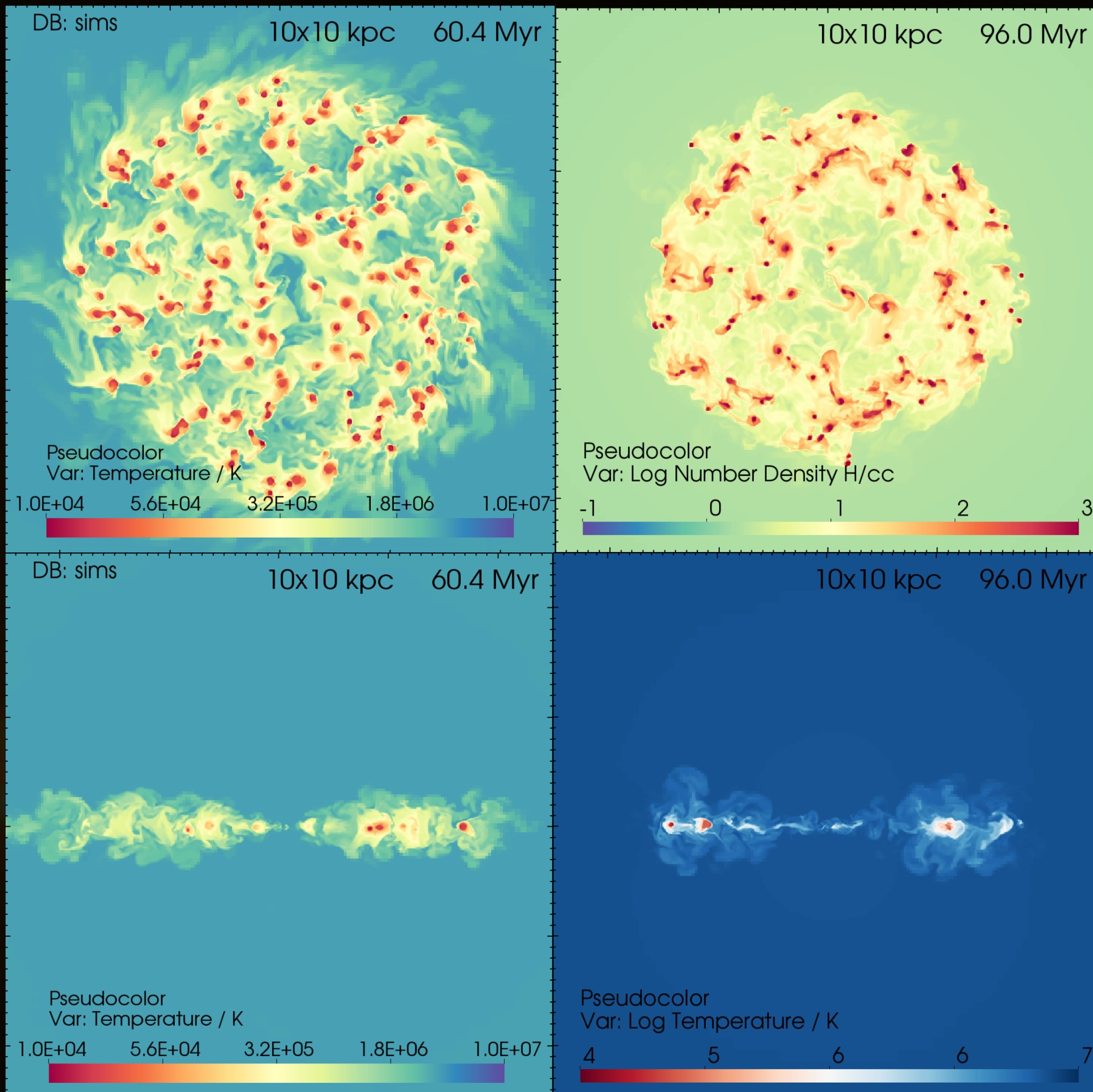

Density

Temperature

- Both gas and stars are <u>stable</u>.

Usage of ICT resources

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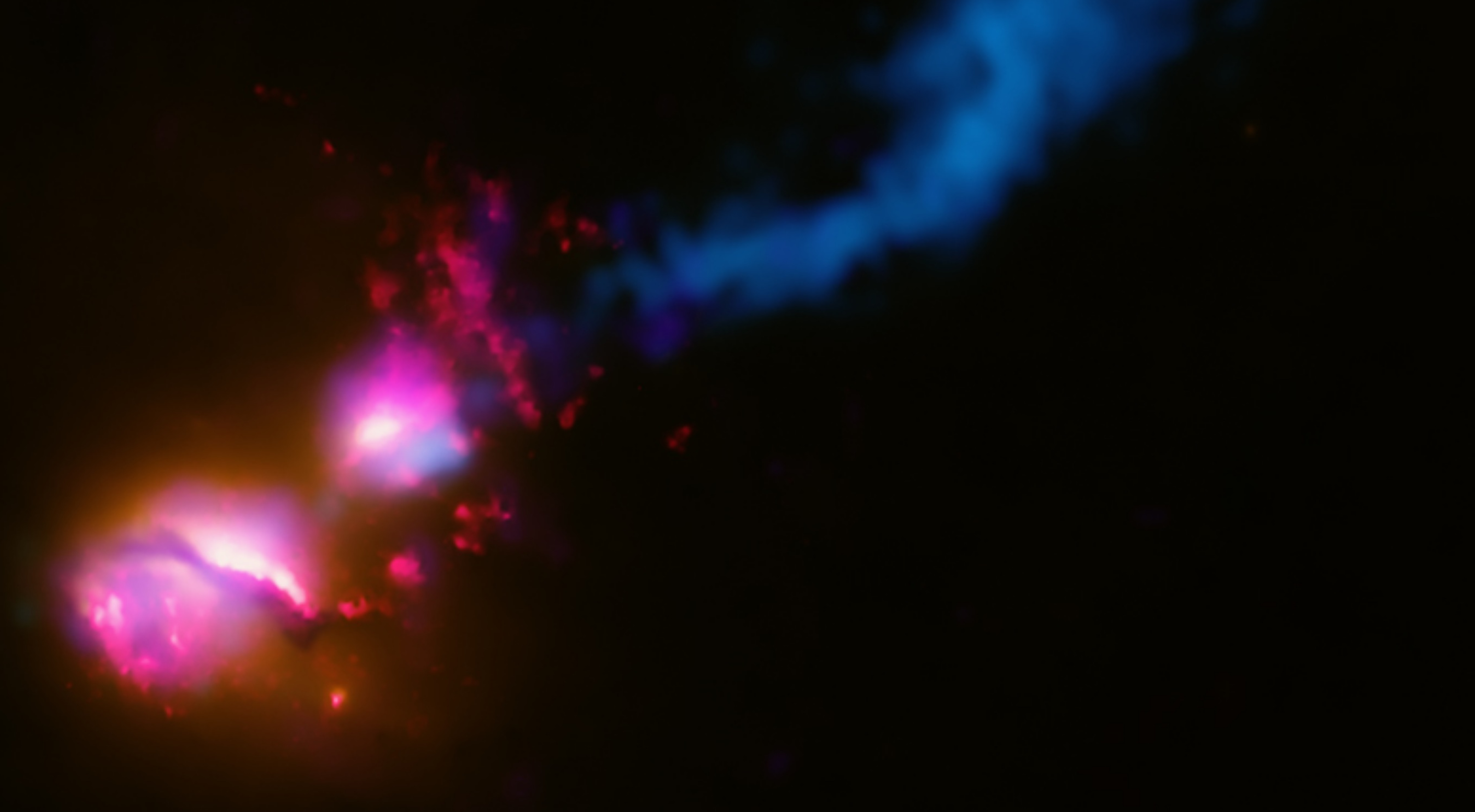
- These Numerical Experiments* have for the moment consumed 1103130/3000000 assigned hrs., i.e. 36.8% since 09/2017



* Simulations: Procedures aiming at reproducing natural phenomena in their full complexity

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2. File system crashes, too frequent....

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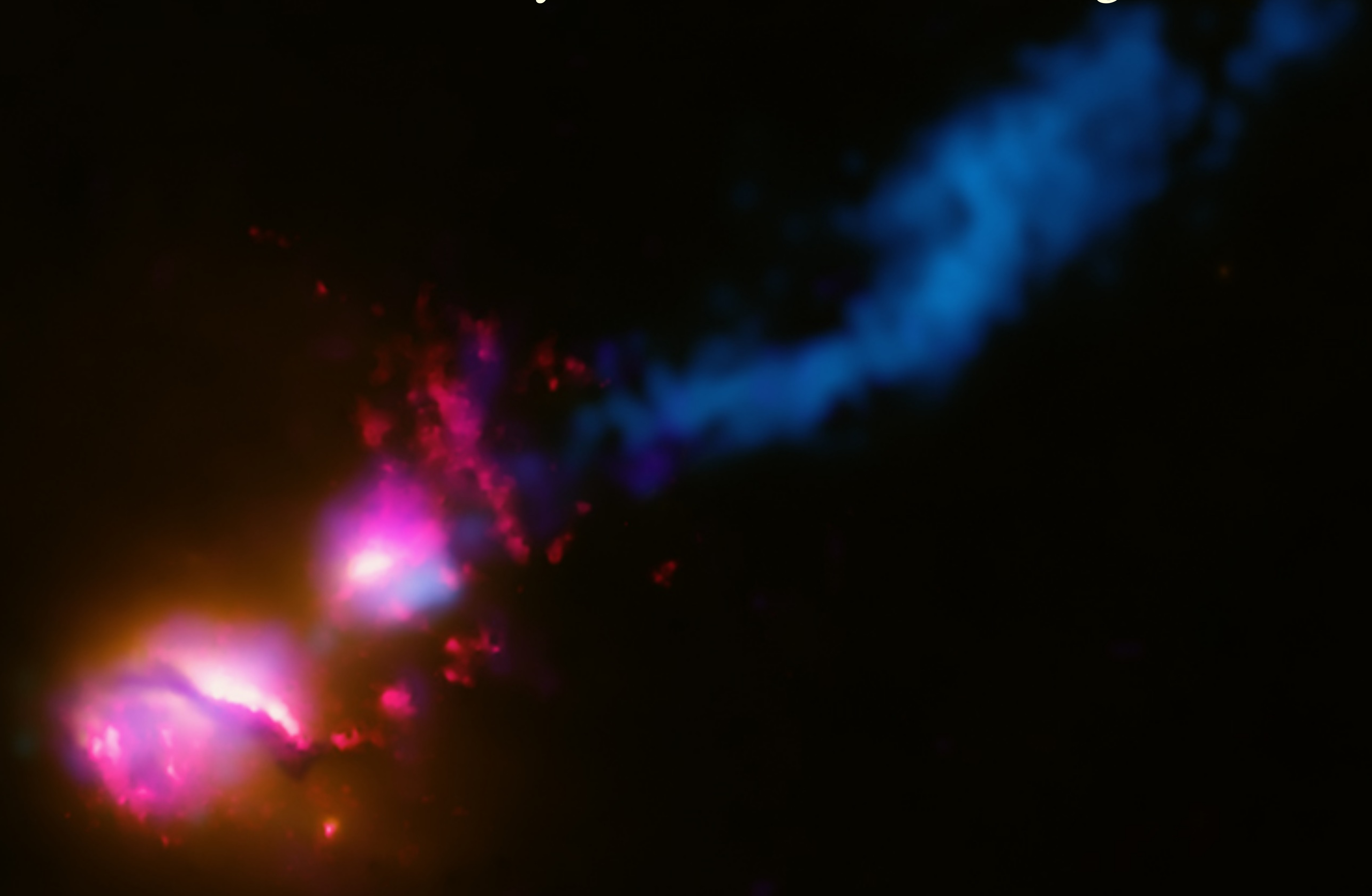

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- **Thus they are <u>complementary</u>** to Exascale efforts.