

## **Ramses with cosmic rays : anisotropic diffusion, streaming instability and shock-acceleration**

*Wednesday, 2 October 2019 10:50 (20 minutes)*

I will detail the implementation of cosmic rays (CR) in Ramses. This numerical method of CRs is based on a fluid description of CRs. The anisotropic diffusion of CRs along magnetic field lines is modeled with an implicit solver. CR streaming instability (CRs streaming down their own gradient at the Alfvén velocity) can be solved within the implicit diffusion solver. The so-called diffuse shock acceleration mechanism is captured with a shock finder algorithm performed on-the-fly that injects CR pressure at shocks with acceleration efficiencies depending on the Mach number, the pre-shock fraction of CRs, and the magnetic obliquity. A few applications of the diverse elements of the CRMHD description will be touched: structure of the interstellar medium, supernova remnants and the formation of large-scale galactic winds.

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**Session Classification:** Star Formation