Avviso di Seminario Wednesday, April 26th, 16.00 Mercoledì, 26 Aprile, ore 16.00

Aula Marchetti, U1-07



IllustrisTNG: a Universe in a Box

Dylan Nelson Emmy Noether Research Group Leader, Institute for Theoretical Astrophysics, Heidelberg University, Germany.



Recently it has become possible to numerically simulate large, representative volumes of the Universe. These cosmological (magneto)hydrodynamical simulations solve for the coupled evolution of gas, dark matter, stars, and supermassive black holes interacting via the coupled equations of self-gravity and fluid dynamics, all within the context of an expanding spacetime. The IllustrisTNG simulations are the current stateof-the-art in this context. They simultaneously resolve tens of thousands, to millions, of individual galaxies - with properties and characteristics in broad agreement with observational data of real galaxy populations. This enables many theoretical studies on galaxy formation and evolution, as well as large-scale structure and cosmology. Our numerical backbone is the AREPO "moving-mesh" code, which adopts a finite-volume type approach to solve the equations of ideal MHD on an unstructured, spatially and temporally adaptive discretization of space provided by a Voronoi tessellation. I will give a tour of the IllustrisTNG simulations, touching on a few scientific applications and novel insights, and showcase the information content and breadth of a virtual Universe. I will describe the modeling required for these simulations, both numerical and physical, its development and calibration phases, and the key assumptions and approximations therein.