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Physical properties of cosmic filaments

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Under the action of gravity, matter in the largest scales is assembled to form a gigantic network composed of nodes, filaments, walls and voids, that is called the cosmic web. According to numerical simulations, around 50% of the total mass of the Universe might reside in the cosmic filaments, thus tying our understanding of matter to that of filaments. However, since these large-scale structures are very challenging to observe, a large fraction of baryons in the late Universe are still 'missing'.
In this talk, will present a study of galaxies and gas around cosmic filaments, detected in the IllustrisTNG300-1 hydro-dynamical simulation at redshift z=0. I will show that filaments can be separated into two different populations: the short and puffy filaments (L<9 Mpc) that might act as bridges of matter in the over-dense regions of the cosmic web, and the long filaments (L>20 Mpc) that are thinner and live in less-dense environments.
I will show that filaments are essentially dominated by gas in the warm-hot intergalactic medium (WHIM), which accounts for more than 86% of the baryon budget at 1 Mpc from the spine. Apart from WHIM gas, cores of filaments also host large contributions of other hotter and denser gas phases, whose fractions depend on the filament population. By building temperature and pressure profiles, I will show that gas in filaments is isothermal up to distances of ~ 1.5 Mpc, with average temperatures of $T_{core} = 4 - 13 \times 10^5$ K, depending on the large scale environment. Pressure at cores of filaments is on average $P_{core} = 4 - 12 \times 10^{-7}$ keV.cm^{-3} , which is ~ 1000 times lower than pressure measured in observed clusters. Finally, I will present an estimation of the observed Sunyaev-Zel'dovich signal from cores of filaments, and these results will be compared with recent observations.

Field

Cosmology

Day constaints

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