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Simulating galaxy formation with the Illustris-TNG model in f(R) modified gravity

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The question on the nature of gravity and dark energy is one of the fundamental problems in modern cosmology. f(R) gravity is a viable alternative to general relativity (GR) with a cosmological constant and can therefore be used to test GR over a large range of scales. Simulations of cosmic structure formation in this model thus deliver crucial information on how possible deviations from GR might be observable in upcoming surveys such as Euclid, DESI or LSST. The simulations I will present in this talk are dedicated to study the interplay between baryonic feedback and modified gravity, two processes which both have a significant effect on the matter clustering and the matter power spectrum. They for the first time include both a full physics hydrodynamical model and modified gravity in one simulation at a time. The simulations were carried out with the AREPO cosmological simulation code and its new modified gravity solver which allows to solve the f(R) gravity equations in full non-linearity and to fully capture the effects of the chameleon screening mechanism. The baryonic physics are simulated employing the Illustris-TNG hydrodynamical model in the code which incorporates magnetohydrodynamics, star- and black hole formation, supernova- and AGN feedback, metal advection and galactic winds. In this talk I will present detailed study of the degeneracy between AGN-feedback and f(R) gravity in the matter power spectrum, results on the impact of f(R) gravity on the stellar and gaseous components of galaxies and on the effects of modified gravity on star formation.

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