Current tensions and controversies in cosmology and extragalactic astrophysics

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Abstract

The current paradigm of cosmological structure formation has been extraordinarily successful at accounting for a wide range of observations, from the fluctuations of the cosmological background radiation to the large-scale distribution of galaxies through the properties of clusters of galaxies, among others. However, not only it relies on unknown components (inflation, cold dark matter and dark energy), but a number of internal tensions might point to the need for extensions to the standard model of particle physics. Likewise, the unprecedented discovery of hitherto unknown ultra diffuse galaxies and ultra-faint satellites point to vast volumes in observational parameter space that remain to be explored. Large- and small-scale instrumentation projects, both from the ground and from space, will be reviewed, along with the contributions that middle-income countries might provide.