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Simulated galaxy catalogues for astronomical surveys

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Multimessenger astronomy is an emerging field that combines observations from different sources of cosmic events, such as gravitational waves, photons and neutrinos. This approach provides a new framework for investigating the origin and underlying mechanisms of energetic astrophysical events. By integrating complementary observational perspectives, it becomes possible to explore different timescales and processes, leading to a more complete understanding of complex astrophysical phenomena. Moreover, multimessenger observations not only deepen our knowledge of the Universe but also offer valuable insights into fundamental physics, including particle interactions and the nature of gravity. In this context, synthetic galaxy catalogues serve as powerful tools for analyzing these events by constraining their possible origins, estimating probability distances, and quantifying systematic uncertainties in the analysis. In this work, we introduce the SciPIC pipeline, which efficiently produces realistic galaxy mock catalogues based on dark-matter halo catalogues. The pipeline relies on HOD and AM techniques to link the halo properties to the galaxies produced. We present the development of tools designed to enhance the realism and accuracy of the mocks generated. In particular, we focus on the development of calibration pipelines that allows to improve the methodology adopted by SciPIC in assigning the galaxy properties and ensures that the produced catalog remain up to date by incorporating constraints from upcoming observational data in the calibration procedure.

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