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Testing the accuracy of likelihoods for cluster abundance cosmology

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The abundance of galaxy clusters is a sensitive probe to the amplitude of matter density fluctuations, the total amount of matter in the Universe as well as its expansion history. Inferring correct values and accurate uncertainties of cosmological parameters requires accurate knowledge of cluster abundance statistics, encoded in the likelihood function. We present a framework to test the accuracy of cluster abundance likelihoods used in the literature, namely the Poisson and Gaussian likelihoods as well as the more complete description of the Gauss-Poisson Compound likelihood. To do so, we use a suite of 1000 large cosmological simulations of dark matter halo catalogs obtained by the PINOCCHIO algorithm, and we evaluate the accuracy of a given likelihood by comparing individual posterior covariances to the covariance of estimators over the 1000 dark matter halo catalogs, for a variety of binning choices and analysis setups.

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