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Likelihoods for Cluster Count Cosmology

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Cosmological analyses with galaxy cluster abundance will be significantly improved with Rubin, moving from the order of thousands of clusters to potentially hundreds of thousands clusters. A standard choice for cosmological cluster analyses is to use Poissonian likelihoods; however such a likelihood neglects the effects of sample variance whereby the anticipated number of clusters at a given mass and redshift is a random realisation of some theoretical underlying number. To date this assumption has been justified but to make the most of the Rubin data, improvements to the cluster likelihood must be considered. The simplest way to deal with the effects of sample variance is by using a gaussian approximation, however with such an approximation we lose valuable cosmological information. In this talk we present a new unbinned cluster likelihood which incorporates the effects of sample variance. We then present a framework, using 1000 cosmological simulations of a Rubin volume universe, in which we can consistently determine the precision of each of the proposed cluster likelihoods: the unbinned Poissonian, the binned Gaussian and a Poissonian/Gaussian mixture likelihood.

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