Contribution ID: **31** Type: **not specified**

Constraining Cosmological Parameters from Galaxy Cluster Observables: an SBI Approach

Modeling the universe and determining its ultimate fate requires accurate and precise estimation of cosmological parameters such as baryonic density, Hubble's constant, spectral index, etc. Terabytes of galaxy data would soon be made available by current projects on powerful telescopes like the JWST or future ones like LSST. Analyzing these data requires efficient computational tools, which can accurately process bulk data in a reasonable amount of time. In this work we use Simulation-Based Inference (SBI) method to estimate the five fundamental cosmological parameters, and three astrophysical parameters which quantify the mass-richness relationship of galaxy clusters. SBI does not use an explicit form of the likelihood (unlike MCMC), which leads to loss of information due to simplifying assumptions (Gaussian likelihood). SBI's flexibility can help with modeling uncertainties due to systematic errors caused by complex phenomena like astrophysics of AGN feedback, blackhole accretion, etc. In this work, we train a neural network embedded in the SBI framework using simulated data of optical galaxy cluster abundance. We train our model using Fast-Forward models, based on simple analytical equations and test on Quijote simulations to examine if the models developed can capture the complexities of the Quijote Simulations. Our results show that SBI can successfully recover the true values of all eight parameters within the 2σ limit, which is comparable to the state-of-the-art MCMC-based inference method. In addition, the bias obtained for SBI is ~10% smaller for 3 parameters than MCMC.

Session Classification: Dark Sector Physics