

# Effect of dark energy on the thermodynamics and statistical mechanics of Galaxy clustering

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## Abstract

In this paper, we consider a cluster of galaxy as many body systems and study the effect of dark energy with varying energy density on the thermodynamics and statistical mechanics of the mentioned system. Some thermodynamics quantities calculated in the canonical ensemble such as Helmholtz free energy, entropy, and specific heat of the system, and also the second law of thermodynamics were verified. Moreover, we obtain the probability and distribution function in the grand canonical ensemble and study time evolution of galaxy clustering by graphical analysis. We compare our results with observations and many body simulations and show that our model agrees with Peebles power law for the correlation function.

**Keywords:** Thermodynamics; Statistics; Dark Energy; Clustering of Galaxy

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