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ORIGINAL ARTICLE

Peculiar motions of galaxy clusters: correlation function approach

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Abstract The correlation function theory on the basis of prescribed boundary conditions provides a deeper understanding in studying the dynamical parameters of galaxy clusters. The approach approximates that the moderate dense systems discussed by a two point correlation function is helpful for describing the dynamical nature of galaxy clusters. The projected theory of two point correlation function for point mass and extended mass structures can be used an alternative tool in measuring the average peculiar motion and temperature profile of galaxy clusters.

Keywords Large scale structure of universe · Thermodynamics · Clustering · Correlation functions · Dynamical properties

1 Introduction

Galaxy clusters are important astrophysical laboratories providing us with a well characterized physical environment in which we can understand many interesting astrophysical phenomena's. They allow us to study the properties of galaxy clusters in context to their dynamical behavior. In recent years, most of the detailed knowledge on galaxy clusters have been obtained through X-ray spectroscopy but at the same time theoretical approaches are no more less important. Various theories like Percolation (Bhavasar and Splinter 1996), MST (Kreziwina and Saslaw 1996), Fractals (Martinez and Coles 1994), Voids (Arseth and Saslaw 1982), Distribution functions (Efstathiou 1991) and correlation functions (Peebles 1980; Collins et al. 2000; Lee and Park 2002; Bahcall et al. 2003; Estrada et al. 2009; Iqbal et al. 2012; Valogeas and Clerc 2008) have played an important role in understanding the phenomena. Developing the theory for galaxy clustering have been mainly constructed with all the galaxies as point mass approximations. Actually galaxies have real extended structures and a pure semi analytical approach for extended mass galaxy clusters has been developed which has yielded interesting results (Ahmad et al. 2002; Iqbal et al. 2006, 2012). By using equation of state along with the correlation functions of galaxy clusters provides a description of dynamical parameters related to average velocity dispersion and intra-cluster temperature of a system.

In this work, we calculate the magnitude of the average velocity dispersion and ICM temperature of galaxy clusters using an extended theory of correlation functions. The theoretical basis of the correlation function approach for the estimation of peculiar motions and temperature profile of galaxy clusters is the subject of this paper.

2 Correlation functions in the cosmological many body problem

Correlation functions are one of the standard ways of studying formation of structures in the universe. The visible structures mainly the galaxies arise from the large dark matter haloes, and tend to form hierarchically large structures of clusters and super-clusters. Thus the phenomena of clustering is important to understand the distribution of visible and

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