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The Fluctuation theory and Gravitational Galaxy Clustering

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Abstract: The description of gravitational galaxy clustering evolving through quasi-equilibrium thermodynamics is examined on the basis of thermodynamic fluctuations and statistical mechanical ensemble techniques. Second order fluctuation moments lead to an ordinary differential equation for $b(nT^{-3})$, ratio of gravitational correlation energy to (twice) the kinetic energy of peculiar velocities. The general solution of the differential equation gives a functional form of b in terms of a scale invariant function nT^{-3}, in conformity with the earlier results. A method for finding analytic expression for probability distribution function f(N) of gravitational clustering in a expanding universe is also developed on the basis of ensemble theory. The results can provide a deeper understanding of gravitational clustering on the basis of statistical mechanics.

Key Words: Cosmology - gravitation - galaxies: Clustering - method: Analytical.