Galactic clustering with GUP modified Newtonian potential

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We have studied the clustering of galaxies in generalized uncertainty principle(GUP) modified Newtonian potential. We have compute the corrected N-particle partition function which then leads to modified equations of state. We made a comparison to visualize the effect of this correction on the clustering parameter. An investigation of the distribution function for the system of galaxies was also made. Moreover,the effect of GUP correction on the two-point correlation function was also studied.

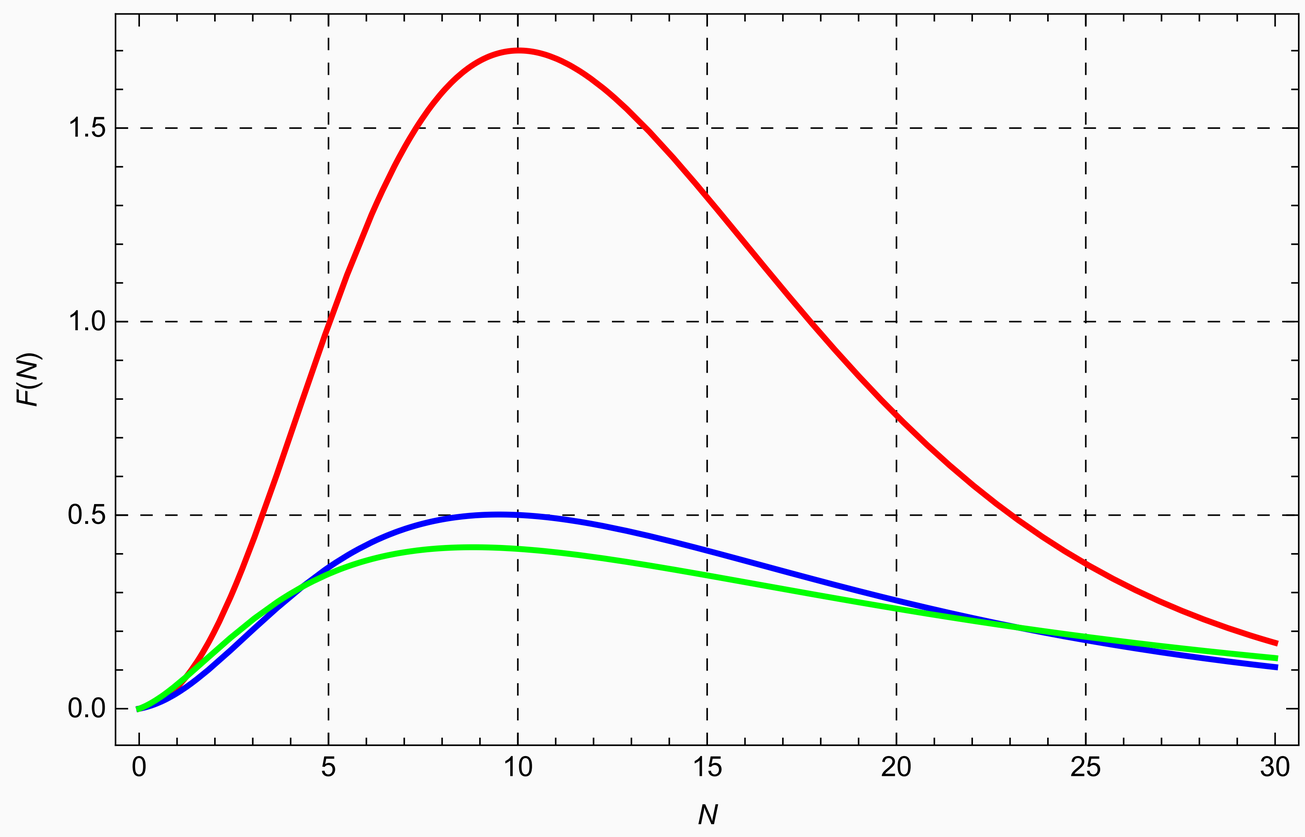
Recently Verlinde proposed entropic origin of gravity [1] . The author argued that in deriving gravity the central notion is the information associated with matter and its location measured via entropy. The displacement of matter leads to a change in entropy that in turn leads to a reaction force which then, under certain reasonable assumptions, takes the form of gravity. This work attempted to established thermodynamics as a basic principle.In his paper , Verlinde successfully obtained Gravitational law, Einstein's equations, and poisons equation utilizing the holographic principle and the Equipartition law of energy.

The standard commutation relations of quantum mechanics get modified at very small distances (plank scale). Michele Maggiore, in his approach to quantum gravity, for the measurement of the apparent horizon area of the black hole via a gedanken experiment arrived at generalized uncertainty (GUP) principle [2]. The effect of GUP in cosmological and non-relativistic contexts has been studied as it introduces a minimum length scale (plank scale).

Motivated by Generalized uncertainty principle (GUP) the entropic origin of the force law proposed by Verlinde can be corrected (Plank scale corrections). Recently this correction to the force law appeared in the literature which include correction to Newton's law [4], Friedmann Equations [5] among others.

Under GUP modification the correct formula for the Hawking temperature takes the form [3], $\mathrm{T}' = T\left(1 + \alpha\gamma T^2 + \alpha^4\right)$. This modified temperature leads to modified entropy which thens modifies the Newton's law considerably.

General distribution function



Description of the figure

Behavior of the distribution function $F(N)$ as a function of particle number, N. Red, blue , and green curves represent three different values for the correction parameter α_2. Red curve is for α_2=0 i,e. no correction, blue for α_2=0.5, and green for α_2=1. From the plot we confer that the correction parameter shifts the peak downwards without changing the basic structure of the curve.

The most important effect of the above correction was seen on the clustering parameter, $\mathrm{b}_g = \frac{(\alpha_1/F' + \alpha_2/F')x}{1+(\alpha_1/F' + \alpha_2/F')x}$. This parameter gives the extent of clustering.
If we let $b_g = 0$, it indicates no clustering.

References:

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