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Statistical Mechanics of Self-Gravitating Systems

Guest Editor:

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Deadline for manuscript submissions:
closed (15 March 2024)

Message from the Guest Editor

Even though the gravitational force is very weak, observational astronomy provides us with numerous examples of assembled systems where it is the central unifying element. Going down in scale, galactic clusters, galaxies, globular clusters and solar systems come to mind, but there are other examples as well. At first glance, it would be natural to suppose that statistical mechanics should provide a unifying set of principles for understanding the main properties of these systems. However, the infinite range and short-range singularity of the Newtonian gravitational force introduces challenges for the standard theories that have yet to be fully resolved. Since they lack the short-range singularity, one-dimensional gravitational models are more susceptible to standard treatments and have had some success in providing insights into their 3D cousins. However, challenges remain even in that domain. Researchers have employed non-standard statistical mechanics to approach these issues for 3D, but a clear systematic theory has yet to be achieved. We are now in a good position to address them, or at the least take stock of what can be achieved and where further progress can be made.

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Message from the Editor-in-Chief

The concept of entropy is traditionally a quantity in physics that has to do with temperature. However, it is now clear that entropy is deeply related to information theory and the process of inference. As such, entropic techniques have found broad application in the sciences.

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