Abstract Submitted
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Vlasov Evoluton of a Gravitational System via a Spectral Method[1] JOSH ALVORD, BRUCE MILLER, Texas Christian University — There are open questions concerning the distribution of clusters in the expanding universe. The coupled Vlasov-Poisson equations govern the evolution of density in mu(position-velocity) space. In the comoving frame, the evolution of the μ-space density f for a one-dimensional gravitational system is governed by the Vlasov-Poisson continuity equation where a is the local acceleration:

$$\frac{\partial f}{\partial t} + v\frac{\partial f}{\partial x} + \frac{\partial af}{\partial v} = 0$$

Here we introduce a spectral method to obtain a coupled set of ordinary differential equations governing the time dependence of the coefficients. For the bounded position space we utilize a Fourier expansion, whereas for the infinite velocity space we utilize a Hermite expansion. The resulting equations are bilinear and govern the coefficients $\psi_{m,n}(t)$, where m represents the Fourier index and n the Hermite index. By truncating the doubly infinite series they can be integrated numerically to model and simulate the system evolution of f, in our case using a traditional fourth-order Runge-Kutta method. We will present the important derivations and preliminary results of the numerical integration.

[1]TCU Physics REU Program

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