
GR 19: Cosmology

Time: Wednesday 18:10–18:30

Location: SPA SR220

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Beyond single stream with the Schrödinger method - Closing the Vlasov hierarchy — ●CORA UHLEMANN, MICHAEL KOPP, and THOMAS HAUGG — Arnold Sommerfeld Center for Theoretical Physics, Ludwig-Maximilians-University, Theresienstr. 37, D-80333 Munich

We investigate large scale structure formation of dark matter in the phase-space description based on the Vlasov equation whose nonlinearity is induced by gravitational interaction according to the Poisson equation. Determining the time-evolution of density and peculiar velocity demands solving the full Vlasov hierarchy for the moments of the phase-space distribution function. In the presence of long-range interaction no consistent truncation of the hierarchy is known apart from the pressureless fluid (dust) model which is incapable of describ-

ing virialization due to the occurrence of shell-crossing singularities and the inability to generate higher cumulants like vorticity and velocity dispersion. Our goal is to find a phase-space distribution function that is able to describe regions of multi-streaming and therefore can serve as theoretical N-body double. We use the coarse-grained Wigner probability distribution obtained from a wavefunction fulfilling the Schrödinger equation and show that its evolution equation bears strong resemblance to the Vlasov equation but cures the shell-crossing singularities. This feature was already employed in cosmological simulations of large-scale structure formation by Widrow & Kaiser '93. We are able to show that the coarse-grained Wigner ansatz automatically closes the corresponding hierarchy while incorporating nonzero higher cumulants which are determined self-consistently from density and velocity.