Contribution ID: **90** Type: **not specified**

Off-equilibrium infrared structure of self-interacting scalar fields

Summary

We map the infrared dynamics of a relativistic single-component (N = 1) interacting scalar field theory to that of nonrelativistic complex scalar fields. The Gross-Pitaevskii (GP) equation, describing the real-time dynamics of single-component ultracold Bose gases, is obtained at first nontrivial order in an expansion proportional to the powers of λφˆ2/mˆ2 where λ, φ, and m are the coupling constant, the scalar field, and the particle mass respectively. Our analytical studies are corroborated by numerical simulations of the spatial and momentum structure of overoccupied scalar fields in (2+1)-dimensions.Universal scaling of infrared modes, vortex-antivortex superfluid dynamics, and the off-equilibrium formation of a Bose-Einstein condensate are observed. Our results for the universal scaling exponents are in agreement with those extracted in the numerical simulations of the
GP equation. As in these simulations, we observe coarsening phase kinetics in the Bose superfluid with strongly anomalous scaling exponents relative to that of vertex resummed kinetic theory. Our relativistic field theory framework further allows one to study more closely the coupling between superfluid and normal fluid modes, specifically the turbulent momentum and spatial structure of the coupling between a quasiparticle cascade to
the infrared and an energy cascade to the ultraviolet. We outline possible applications of the formalism to the dynamics of vortex-antivortex formation and to the off-equilibrium dynamics of the strongly interacting matter formed in heavy-ion collisions.

Primary author: Dr DENG, Jian (Shandong University)

Presenter: Dr DENG, Jian (Shandong University)