Title: Logarithmic nonlinear Schroedinger equation in theory of quantum Bose liquids

Abstract:
The Gross-Pitaevskii (GP) equation is a long-wavelength approach widely used to describe the dilute Bose-Einstein condensates (BEC). However, in many physical situations, such as higher densities, this approximation unlikely suffices hence one might need models which would account for long-range correlations and multi-body interactions. We show that the Bose liquid described by the logarithmic Schroedinger equation (which can be introduced on grounds of the open quantum system theory) has a number of drastic differences from the GP one which are more suitable for description of realistic quantum liquids. As an example, we apply the logarithmic model to the superfluidity of helium-4. It turns out that one arrives at a unified description of the phonon, maxon and roton excitations, and has a noteworthy agreement with experiment: with one essential parameter to fit we reproduce at high accuracy not only the famous Landau roton spectrum but also the the sound velocity and structure factor of superfluid helium.