

CESQ Colloquium

Tuesday December 17 @ 3 PM

**Seminar Room, Centre Européen de Sciences Quantiques,
Campus de Cronenbourg**

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Strongly interacting one-dimensional quantum gases : exact solutions

Understanding the effect of correlations in interacting many-body systems is one of the main challenges in quantum mechanics. While the general problem can only be addressed by approximate methods and numerical simulations, in some limiting cases, it is amenable to exact solutions. I will present a family of exact solutions for strongly interacting 1D quantum gases in arbitrary external potential, valid for bosons, multicomponent fermions and mixtures. It allows us to obtain experimental observables such as the density profiles and momentum distribution at all momentum scales, beyond the Luttinger liquid approach. It also predicts the exact quantum dynamics at all the times, including the small oscillation regime yielding the collective modes of the system and the large quench regime where the system parameters are changed considerably. The solution can be extended to describe finite-temperature conditions, spin, and magnetization effects. In particular I will present large-size calculations of the frequency- and momentum-resolved spectral function of strongly repulsive lattice bosons and a symmetry-breaking exact solution for a Bose-Bose mixture, which has allowed us to discover symmetry oscillations in the momentum distribution dynamics. Our approach directly describes the experiments with trapped ultracold atoms where the strongly correlated regime in one dimension has been achieved.

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