The Abdus Salam International Centre for Theoretical Physics

International Conference on Multi-Condensate Superconductivity and Superfluidity in Solids and Ultra-Cold Gases
14 - 18 May 2018 (Trieste, Italy)

One-dimensional Mixtures of Bose Gases: Spin Dynamics, Andreev-Bashkin Effect and Quantum Droplets

L. Parisi[1], G. E. Astrakharchik[2] and S. GIORGINI[1]
[1]Dipartimento di Fisica, Universita' di Trento and CNR-INO BEC Center, Povo, Trento, Italy
[2]Departament de Física i Enginyeria Nuclear, Univ. Politècnica de Catalunya, Barcelona, Spain

I will present some recent results obtained using quantum Monte-Carlo methods in one dimensional (1D) mixtures of Bose gases interacting via repulsive intra-species and both repulsive and attractive inter-species forces. The peculiarity of the 1D geometry is the possibility of reaching regimes of strong interactions in long-lived samples. In the case of repulsive inter-species interactions, the strength of the coupling constants determines whether the mixture is stable or prone to phase separation. In the regime of miscible mixtures we investigate spin transport phenomena and, in particular, the velocity of propagation of spin waves and the superfluid drag between the two components known as Andreev-Bashkin effect. When inter-species interactions are attractive, instead, the mixture can collapse into high-density cluster states. However, before reaching this point, a liquid phase with self-bound droplets becomes thermodynamically stable. We investigate the equilibrium properties of such exotic state and compare them with the predictions of extended mean-field approaches.