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Crossover to a quasi-condensate in a weakly interacting trapped 1D Bose gas KAREN KHERUNTSYAN, University of Queensland, ISABELLE BOUCHOULE, Laboratoire Charles Fabry, UMR 8501 du CNRS, GORA SHLYAPNIKOV, Universite Paris-Sud XI — One-dimensional (1D) Bose gases are remarkably rich physical systems exhibiting properties not encountered in 2D or 3D. Here we study the exactly solvable 1D model of bosons interacting via a repulsive delta-function potential. Specifically, we discuss the system in the context of a harmonically trapped, weakly interacting 1D Bose gas at ultra-low temperatures and analyze the transition from a fully decoherent regime to a coherent, quasi-condensate regime. By finding the characteristic critical temperature and atom number that depend explicitly on the interaction strength and the trap frequency, we specify the conditions for identifying this transition as an interaction-induced crossover. We contrast this to the finite-size Bose-Einstein condensation (BEC) phenomenon studied previously in the context of an ideal trapped 1D Bose gas. We predict that for sufficiently weak confinement one expects to observe the interaction-induced crossover scenario, rather than the finite-size BEC. The situation is reversed for strong confinement. We identify typical experimental parameters that enable the realization of either of these two competing scenarios.

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