Weakly interacting Bose gas in a random environment

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The localization-disorder paradigm is analyzed for a speciýc system of weakly repulsive Bose gas at zero temperature placed into a quenched random potential. We show that, at low average density or weak enough interaction the particles ýll deep potential wells of the random potential whose radius and depth depend on the characteristics of the random potential and the interacting gas. The localized state is the random singlet with no long-range phase correlation. At a critical density the quantum phase transition to the coherent superþuid state proceeds. We calculate the critical density in terms of the geometrical characteristics of the noise and the gas. In a ýnite system the ground state becomes non ergodic at very low density. For atoms in traps four different regimes are found, only one of it is superþuid. The theory is extended to lower (1 and 2) dimensions.
Its quantitative predictions can be checked in experiments with ultracold atomic gases and other Bose-systems.

References