# DISORDERED BOSE EINSTEIN CONDENSATES WITH INTERACTION IN ONE DIMENSION

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We study the effects of random scatterers on the ground state of the one-dimensional Lieb-Liniger model of interacting bosons in the Gross-Pitaevskii regime. Our main findings are as follows:

1. Bose-Einstein condensation (BEC) in the ground state of the interacting gas in the Gross-Pitaevskii regime can survive even in a strong random potential. As far as BEC is concerned, the interacting gas in this regime thus behaves in a similar way as an ideal gas at zero temperature. The character of the wave function of the condensate, however, is strongly affected by an interplay between the interaction and the density of the scatterers.

2. A random potential may lead to localization of the wave function of the condensate, even though the density of scatterers is much less than the particle density. The interparticle interaction counteracts this effect and can lead to complete delocalization if the interaction is strong enough.

3. In terms of the interaction strength, $\gamma$, and density of scatterers, $\nu$, the transition between localization and delocalization occurs in the model considered when $\gamma \sim \nu^2$. For $\gamma \lesssim \nu/(\ln \nu)$ the condensate is localized in a small number of random intervals and the energy is no longer deterministic.

In the course of the proof of Bose-Einstein condensation in the model we generalize a result of Kirsch and Simon on spectral gaps in one-dimensional Schrödinger operators.