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# Effect of slow losses in quantum gases with short range interactions: UV divergence in higher dimensions and breakdown of Tan's relation in 1D gases

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We investigate the effect of losses on interacting quantum gases with contact interaction. We show that, for gases in dimension higher than one, assuming a vanishing correlation time of the reservoir where dissipation occurs leads to a divergence of the energy increase rate. This divergence orginiates from the ghost singularity of the wavefunction immediately after a loss event. We show how the divergence is regularized when taking into account the finite energy width of the reservoir. We will for this consider the specific case of a weakly interacting Bose Einstein condensate, that we describe using the Bogoliubov theory. Assuming slow losses so that the gas is at any time described by a thermal equilibrium, we compute the time evolution of the temperature of the gas.

We then focus on the 1D case where the above divergence is absent. We show however that the ghost singularity produced by losses induce a breakdown of the Tan's relation, which relates the large momentum tails of the momentum distribution and the adiabatic derivative of the energy with respect to the gas'coupling constant or scattering length. Such a breakdown is possible in 1D for a peculiar class of stationary states, which exist thanks to the infinite number of conserved quantities in the system. This phenomenon is discussed for arbitrary interaction strengths, and it is supported by exact calculations in the two asymptotic regimes of infinite and weak repulsion.

We conclude by experimental considerations.

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