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Dynamics of fermionization for strongly interacting photons in 1D DOMINIK MUTH, BERND SCHMIDT, MICHAEL FLEISCHHAUER, Department of Physics and Research Center OPTIMAS, TU Kaiserslautern, Germany — When slow-light photons are confined to one spatial dimension with strong repulsive two-photon scattering they will fermionize, i.e. they will form the analog of a Lieb-Liniger gas in the Tonks limit [1]. We here analyze the dynamics of this process both for repulsive and attractive elastic two-photon scattering using exact numerical methods. We observe that the local two-body correlation attains a steady-state value after a short time, which is however substantially above the ground-state value of the Lieb-Liniger gas but is very close to the value in a high temperature state. This can be explained as a local thermalization to a temperature corresponding to the energy input by the sudden onset of interactions. Non-local two-particle correlations approach the steady-state on a longer time scale. In the case of attractive interactions, the non local correlations indicate a relaxation to a metastable steady-state, the super Tonks-Girardeau gas, recently seen for bosons in the experiment by Haller et al. [2].
[1] D. E. Chang, V. Gritsev, G. Morigi, V. Vuletic, M. D. Lukin, and E. A. Demler, Nature Physics 4, 884 (2008)
[2] E. Haller, M. Gustavsson, M. J. Mark, J. G. Danzl, R. Hart, G. Pupillo, and H. C. Naegerl, Science 325, 1224 (2009)

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