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DMRG simulations of a trapped one-dimensional Bose gas
MICHAEL FLEISCHHAUER, BERND SCHMIDT, Technical University Kaiserslautern, Germany — We present numerical simulations of a one-dimensional Bose gas in a harmonic trap for different interaction strength ranging from the Bogoliubov to the Tonks-Girardeau regime using the density matrix renormalization group (DMRG). Local properties such as single-particle density, density fluctuations and g_3 are calculated and compared to theoretical predictions from the Lieb-Liniger model within the local density approximation. Also first-order correlations are calculated for different (low) temperatures and interaction strength. The transition from a temperature-dominated regime with exponentially decaying correlations to a quantum regime with a power-law decay of correlations is demonstrated. The long-range correlations are shown to be identical to those of a homogeous Luttinger liquid with an interaction parameter (Tonks parameter) corresponding to the center of the trap.

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