Abstract Submitted
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Thermometry of ultracold atoms based on momentum-distribution noise[1] TOMMASO ROSCILDE, Ecole Normale Superieure de Lyon — Ultracold atoms have the puzzling feature of representing, within a good approximation, a microcanonical system, whose temperature cannot be controlled in a direct manner. Yet thermometry is essential for the use of cold atoms as quantum simulators reconstructing, e.g., equilibrium phase diagrams of strongly correlated models. Here I propose a very general thermometry scheme based on the fluctuations of the momentum distribution - a primary observable of cold-atom experiments. Relying on model-independent fluctuation-dissipation relations, the temperature can be estimated from a combined measurement of 1) the gradient of the momentum distribution, or its response to the application of a gauge field; 2) the fluctuations of the momentum distribution. This estimator provides the exact temperature in a translationally invariant system, or in a lattice system without interactions and further confining potentials - in these cases the fluctuations of the (quasi-)momentum distribution are purely thermal. When quantum fluctuations are also present, their effect does not jeopardize the thermometry down to temperatures well below the onset of quantum degeneracy; in the case of bosons, the proposed thermometry becomes exact in the thermodynamic limit in the presence of Bose condensation.

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