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Critical quantum thermometry and its feasibility in spin systems

Monday, 11 September 2023 22:00 (20 minutes)

I will present the results of our study on temperature sensing with finite-sized strongly correlated systems exhibiting quantum phase transitions. We use the quantum Fisher information (QFI) approach to quantify the sensitivity in the temperature estimation and apply a finite-size scaling framework to link this sensitivity to critical exponents of the system around critical points. We numerically calculate the QFI around the critical points for two experimentally-realizable systems: the spin-1 Bose-Einstein condensate and the spin-chain Heisenberg XX model in the presence of an external magnetic field. Our results confirm the finite-size scaling properties of the QFI. Furthermore, we discuss experimentally-accessible observables that (nearly) saturate the QFI at the critical points for these two systems.

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