

Measuring Renyi entropies in finite-temperature QMC using Wang-Landau sampling

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Until the recent introduction of Renyi estimators based on the replica trick, it was difficult if not impossible to use standard quantum Monte Carlo (QMC) techniques to measure entanglement entropy in finite-temperature quantum systems. Even using the replica trick, finite-temperature partition functions must be estimated using importance sampling, requiring a delicate thermodynamic integration of data from many simulations, starting at infinite temperature. Here, we introduce an alternate QMC sampling method using quantum Wang-Landau sampling and an implementation of Sanvik's SSE technique which allows us to directly generate the entanglement over a large range of temperatures using one simulation. I will discuss the algorithmic details of this modified sampling technique, and it's benefits and drawbacks over standard importance sampling when used to measure Renyi entropy. Results will be shown for spin 1/2 XXZ models in two and three dimensions.

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