



Contribution ID: 252

Type: **Oral Presentation**

Density profiles and correlations of harmonically trapped ultracold fermions

Wednesday, August 10, 2022 3:20 PM (20 minutes)

Standard lattice formulations of non-relativistic Fermi gases with two spin components suffer from a sign problem in the cases of repulsive contact interactions and attractive contact interactions with spin imbalance. We discuss the nature of this sign problem and the applicability of the complex Langevin method in both cases. For repulsive interactions, we find the results to converge well using adaptive step size scaling and a Gaussian regulator to modify the lattice action. Finally, we present results on density profiles and correlations of a harmonically trapped, one dimensional system in both position and momentum space, which are also directly accessible via cold atoms experiments.

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Session Classification: Theoretical Developments

Track Classification: Theoretical Developments and Applications beyond Particle Physics