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Density of states techniques for fermion worldlines

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Worldline representations were established as a powerful tool for studying bosonic lattice field theories at finite density. For fermions, however, the worldlines still may carry signs that originate from the Dirac algebra and from the Grassmann nature of the fermion fields. We show that a density of states approach can be set up to deal with this remaining sign problem, where finite density is implemented by working with a fixed winding number of the fermion worldlines. We discuss the approach in detail and show first results of a numerical implementation in 2 dimensions.

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