

Strong-weak dualities for spin systems

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The Jordan–Wigner (JW) transformation establishes a duality between $su(2)$ and fermionic algebras. This means that full CI is identical in both frames, but approximations are not. I will present qualitative arguments and numerical evidence showing that when mapping spins to fermions, the transformation makes strong correlation weaker [1]. The presence of many-body JW strings operators has been traditionally viewed as a fundamental obstacle for the implementation of many-body methods on the transformed fermionic Hamiltonian. However, strings are Thouless rotations, and can be dealt with at low computational cost. Our proof of principle results for the Heisenberg XXZ and J1-J2 Hamiltonians (in 1D and 2D) demonstrate that the fermionic frame provides a better starting point for addressing challenging spin problems.

[1] T. M. Henderson, G. P. Chen, G. E. Scuseria, *J. Chem. Phys.*, **157** (2022), 194114.