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Diagrammatic approach to quantum spin systems

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Frustrated quantum spin systems remain challenging to treat with state-of-the-art numerical methods. We review our recent fRG approach based on a pseudo-Majorana representation. We then turn to a rarely-applied diagrammatic formulation in terms of spin operators dating back to the 1960s. We pair this approach with modern computational capabilities and consider applications from the quantum optical community. We show that the resulting predictions for magnetic phase boundaries are surprisingly accurate. We also shed new light on a puzzling correspondence between spatial spin correlation patterns of quantum and classical spins where the latter are evaluated at a slightly elevated temperature.

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