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The truncated Wigner approximation for spin dynamics in systems of trapped ions, atoms & molecules JOHANNES SCHACHENMAYER, BIHUI ZHU, ALEXANDER PIKOVSKI, KADEN HAZZARD, MURRAY HOLLAND, ANA MARIA REY, JILA, CU Boulder & NIST — Trapped ions and systems of cold atoms or molecules in optical lattices offer controlled environments to experimentally study non-equilibrium dynamics of many-body quantum spin-models with interactions of varying range. Theoretically calculating dynamics of observables for these experiments is a major challenge both analytically and numerically. While in one dimension, time-dependent density matrix renormalization group techniques (t-DMRG) allow for an efficient simulation of the dynamics as long as the time-dependent bi-partite entanglement growth remains moderate, a simulation for systems in two or three dimensions is more demanding. Here we present a numerical technique, which employs the truncated Wigner approximation (TWA) and which can be used to simulate Ramsey-dynamics for current experiments with trapped ions, alkaline earth atoms, polar molecules in optical lattices, or for systems with Rydberg atoms.

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