Abstract Submitted
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Quantum measurement-based feedback simulation of complex dynamics of mean-field p-spin models.[1] MANUEL MUNOZ-ARIAS, PABLO POGGI, University of New Mexico, POUL JESSEN, University of Arizona, IVAN DEUTSCH, University of New Mexico — We study a method for simulating the nonlinear dynamics of many-body spin systems based on measurement-based feedback. We focus on p-spin models describing an Ising-like model on a completely connected graph with p-body interactions. These models exhibit diverse critical phenomena. For $p = 2$ this recovers the Lipkin-Meshkov-Glick (LMG) model, exhibiting a continuous second-order phase transition between paramagnetic and ferromagnetic phases. For $p > 2$, the phase transition is a first order and discontinuous. Our protocol considers the collective spin of an ensemble on N qubits, and approximates the dynamics by weakly measuring one projection of the collective spin, followed by unitary evolution conditioned on the measurement outcome [2] [3]. We use our scheme to simulate dynamical quantum phase transitions of p-spin models, and explore a possible experimental implementation of these dynamical quantum simulations on an atom-light interface.

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[2]Munoz-Arias, et. al, PRL 124, 110503 (2020)
[3]Munoz-Arias, et. al, PRA 102, 022610 (2020)

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