Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Floquet approach to Z_2 lattice gauge theories with ultracold atoms in optical lattices CHRISTIAN SCHWEIZER, LMU München; MPI für Quantenoptik; MCQST, FABIAN GRUSDT, Technical University of Munich; MCQST, MORITZ BERNGRUBER, LMU München; MCQST, LUCA BARBIERO, Université Libre de Bruxelles, EUGENE DEMLER, Harvard University, NATHAN GOLDMAN, Université Libre de Bruxelles, IMMANUEL BLOCH, MONIKA AIDELSBURGER, LMU München; MPI für Quantenoptik; MCQST — Z_2 lattice gauge theories (LGTs) are of high interest in condensed matter physics and topological quantum computation. The investigation of strongly-interacting regimes, however, is especially challenging and in general difficult to access with conventional numerical methods. Here, we take a first step using analog quantum simulations and present an approach to realize Z_2 LGTs. We use a two-component mixture of ultracold bosonic atoms with strong on-site interactions in an optical two-site potential together with resonant periodic driving. For particular driving parameters, the effective Floquet Hamiltonian exhibits Z_2 symmetry. We study the dynamics of the system for different initial states and find that it is well described by a full time-dependent description. Moreover, it is non-trivial due to the imposed gauge constraints and in agreement with predictions from the ideal Z_2 LGT. We reveal challenges that arise due to symmetry-breaking terms, which may be relevant for any experimental implementation, and outline potential pathways to overcome them. The results provide important insights for studies of LGTs based on Floquet techniques and the two-site model constitutes a minimal instance for extended LGTs coupled to matter.

Christian Schweizer
Ludwig Maximilian University of Munich

Date submitted: 31 Jan 2019 Electronic form version 1.4