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Confinement transition of Z_2 gauge theory coupled to fermions. A sign problem free quantum Monte Carlo study. SNIR GAZIT, University of California, Berkeley, MOHIT RANDERIA, The Ohio State University, ASHVIN VISHWANATH, University of California, Berkeley — In two space dimensions, the Z_2 lattice gauge theory is known to undergo a zero temperature confinement to deconfinment quantum phase transition . In this work, we study how this transition is modified in the presence of lattice fermions which are minimally coupled to the Z_2 gauge field. This may be viewed as an extreme version of the BEC-BCS transition where fermions are confined in the strong coupling phase. We investigate both a square lattice model with a large fermi surface and Dirac fermions realized on a π flux and honeycomb lattices. The models are found to be free of the numerical sign problem for all fermion density. In addition, we introduce a numerical method to stochastically incorporate the Gauss law constraint in a quantum Monte Carlo (QMC) simulation. The phase diagram as a function of the model parameters, chemical potential and temperature is determined by means of a large scale determinant QMC.

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