Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Spin glass reflection of quantum error correcting codes[1] ALEXEY KOVALEV, University of Nebraska-Lincoln, LEONID PRYADKO, University of California, Riverside — We study the decoding transition for quantum error correcting codes with the help of a mapping to random-bond Wegner spin models. Known families of quantum low density parity check (LDPC) codes lead to unexplored earlier generally non-local Wegner models with rich phase diagrams that include ordered, disordered, and spin glass phases. The decoding transition corresponds to a transition from the ordered phase by proliferation of extended defects which generalize the notion of domain walls to non-local spin models. In recently discovered quantum LDPC code families with finite rates the number of distinct classes of such extended defects is exponentially large, corresponding to extensive ground state entropy of these codes. Here, the transition can be driven by the entropy of the extended defects, a mechanism distinct from that in the local spin models where the number of defect types (domain walls) is always finite. We construct numerically phase diagrams for models corresponding to several families of quantum LDPC codes. We formulate similar mapping to random bond Wegner models for the case of errors in syndrome measurements, and find several examples of code families with highest fault-tolerant thresholds.

[1]U.S. Army Research Office under Grant No. W911NF-11-1-0027, NSF under Grant No. 1018935

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Date submitted: 15 Nov 2013 Electronic form version 1.4