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Maximum likelihood decoding threshold for oscillator quantum error correcting codes[1] LEONID P. PRYADKO, HAMED ASASI, MICHAEL MULLIGAN, University of California, Riverside, ALEXEY A. KOVALEV, University of Nebraska—Lincoln — We consider syndrome-based decoding of continuous-variable (CV) codes encoding qubits in oscillators [1], assuming independent Gaussian error model. In the channel setting, given the measured syndrome, the conditional distribution of errors is described by an integer-variable Gaussian, with the coupling matrix determined by the syndrome and the code structure. For the encoded qubits, only the parity of these variables is relevant. As a result, maximum-likelihood (ML) decoding corresponds to an analog of the Nishimori line in a random-bond Ising model, where each bond coupling depends continuously on the measured syndrome. The ML decoding threshold corresponds to the multicritical point of this model. In the presence of phenomenological measurement errors, decoding is mapped to a Villain version of compact electrodynamics with Z_2 symmetry breaking.

[1] D. Gottesman, A. Kitaev, and J. Preskill, Phys. Rev. A 64, 012310 (2001).

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Leonid P. Pryadko
University of California, Riverside

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