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Computing theta-dependent mass spectrum of the 2-flavor Schwinger model in the Hamiltonian formalism

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We compute the θ-dependent mass spectrum of the 2-flavor Schwingr model using the tensor network (DMRG) in the Hamiltonian formalism. The pion and the sigma meson are identified as stable particles of the model for nonzero θ whereas the eta meson becomes unstable. The meson masses are obtained from the one-point functions, using the meson operators defined by diagonalizing the correlation matrix to deal with the operator mixing. We also compute the dispersion relation directly by measuring the energy and momentum of the excited states, where the mesons are distinguished by the isospin quantum number. We confirmed that the meson masses computed by these methods agree with each other and are consistent with the calculation by the bosonized model. Furthermore, at the critical point $\theta = \pi$, the mesons become almost massless, and the one-point functions reproduce the expected CFT-like behavior.

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