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Diabatic spectroscopy with cold ion quantum simulation BRYCE YOSHIMURA, Georgetown University, WES CAMPBELL, UCLA, JAMES FREERICKS, Georgetown University — An experimental simulation that adiabatically prepares a nontrivial ground state of trapped ions becomes more and more difficult as the number of ions increase. The difficulty of the adiabatic preparation is due to the decoherence time and the minimum energy gap, that shrinks as the number of ions increase. We propose a spectroscopy protocol that takes advantage of the diabatic effect by intentionally populating the excited states and then performing Fourier analysis to extract the energies of the low-lying excited states. We explore the diabatic spectroscopy protocol by simulating the transverse-field Ising model, where one can perform analysis on large systems when the interactions do not decay with distance. To simulate experimental data, noise from counting statistics and decoherence error is added to the resulting signal from the simulations. By using a signal processing technique known as compressive sensing we can sharply reduce the amount of data needed to extract the energy spectrum.

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