

# Physics of Spin Systems using Quantum Computing

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Quantum hardware has advanced to the point where it is now possible to perform simulations of physical systems and elucidate their ground states and excitation spectra. In this talk, I will overview some of our recent results on this topic, focusing mainly on systems of interacting spins and their properties as seen through a quantum computing lens. First, I will discuss our recent results on measuring magnons in the Heisenberg chain based on circuit that constructs the Lehmann representation of an operator. Although this approach is straightforward mathematically, the noise characteristics of the current generation of hardware causes rapid deterioration of the signal to noise ratio as a function of system size. Nevertheless, we are able to show that relatively modest noise mitigation together with Fourier transform filtering enables one to extract the magnon spectra. Second, I will overview our results on the quantum calculation of the topological phase transitions in the Kitaev model based on an adaptation of tensor network approaches. Finally, time permitting, I will overview our recent work on measuring the thermodynamic partition function on quantum computers based on time evolution of a thermal density matrix.