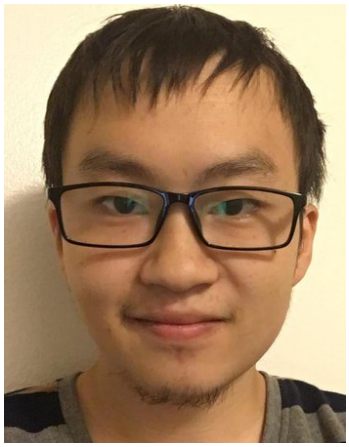
Quantum computation and "cyberpunkian" quantum field theory



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Quantum field theory is one of the greatest achievements by human beings in understanding the law of the universe. Almost all subjects in modern physics, from condensed-matter physics to string theory, are closely related to the developments of quantum field theory. However, Established in the infinite-dimensional Hilbert spaces, quantum field theory is very hard to study, especially when the theory is strongly coupled.

This talk is a summary of quantum opportunities for solving quantum field theory theoretically and numerically, based on a series of works by the speaker and collaborators. Specifically, we describe a digital quantum simulation algorithm for simulating domain wall scatterings in the 1+1 dimensional quantum field theory, which could be regarded as a toy version of cosmological false vacuum decay in the real universe, as an example. We will discuss some potential fundamental limitations of classical algorithms, how quantum computers will help us solve the problem, and how good quantum computers are (the quantum-extended Church-Turing Thesis).

The Chicago Quantum Exchange promotes academic collaboration and information exchange across the quantum information science community.

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