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Variational Quantum Eigensolver for SU(N) Fermions

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Variational quantum algorithms aim at harnessing the power of noisy intermediate-scale quantum computers, by using a classical optimizer to train a parameterized quantum circuit to solve tractable quantum problems. The variational quantum eigensolver is one of the aforementioned algorithms designed to determine the ground-state of many-body Hamiltonians. Here, we apply the variational quantum eigensolver to study the ground-state properties of N-component fermions. With such knowledge, we study the persistent current of interacting SU(N) fermions, which is employed to reliably map out the different quantum phases of the system. Our approach lays out the basis for a current-based quantum simulator of many-body systems that can be implemented on noisy intermediate-scale quantum computers.

Primary author(s) : Mr. CONSIGLIO, Mirko (Department of Physics, University of Malta); Dr. APOLLARO, Tony John George (Department of Physics, University of Malta); Prof. LATORRE, Jose Ignacio (Technology Innovation Institute, Abu Dhabi); Prof. AMICO, Luigi (Technology Innovation Institute, Abu Dhabi); Prof. MINGUZZI, Anna (Laboratoire de Physique et Modélisation des Milieux Condensés, CNRS); Mr. RAMOS, Sergi (Technology Innovation Institute, Abu Dhabi); Mr. BRAVO-PRIETO, Carlos (Technology Innovation Institute, Abu Dhabi); Mr. CHETCUTI, Wayne (Technology Innovation Institute, Abu Dhabi)

Presenter(s) : Mr. CONSIGLIO, Mirko (Department of Physics, University of Malta)

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