PerPPS 2025

INFN PERUGIA

Giovedì 8 maggio

ore 15:00 - aula A

A.D. 1308 unipg

DIPARTIMENTO DI FISICA E GEOLOGIA

Quantum computing the Schwinger model: 1st order phase transitions and open quantum system

Karl Jansen

We will introduce the 1+1-dimensional Schwinger model on the lattice in the Hamiltonian formulation. The model is analyzed both with tensor network (TN) and also quantum computing (QC) techniques. In particular we will focus on the continuum limit employing two different fermion formulations within the TN approach. By adding a topological term, the CP violating first order phase transition can be studied using QC when the theta-parameter, which multiplies the topological term, is varied. To this end, real quantum computer hardware is employed.
In the talk we will also investigate the Schwinger model as an open quantum system. Finally the center of quantum technology and applications is introduced and its main activities described.

Analysis of the confinement string in (2+1)-dimensional Quantum Electrodynamics with quantum computing

Arianna Crippa

In this presentation I will focus on a (2+1)-dimensional lattice discretization of Quantum Electrodynamics with the inclusion of dynamical fermionic matter. By defining a suitable quantum algorithm to measure the static potential as a function of the distance between two static charges on the lattice, we use a variational quantum calculation to explore the Coulomb, confinement and string breaking regimes.
A symmetry-preserving and resource-efficient variational quantum circuit is employed to prepare the ground state of the theory at various values of the coupling constant, corresponding to different physical distances. This allows the accurate extraction of the static potential from a quantum computer.
We demonstrate that results from quantum experiments on the Quantinuum H1-1 trapped-ion device and emulator, with full connectivity between qubits, agree with classical noiseless simulations using circuits with 10 and 24 qubits.
We also test the performance of an IBM superconducting device in a direct calculation of the relevant state probabilities.
Moreover, we visualize the electric field flux configurations that mostly contribute in the wave-function of the quantum ground state in the different regimes of the potential, thus giving insights into the mechanisms of confinement and string breaking.