

Marcello Dalmonte (ICTP-Trieste, Italy): Quantum Simulation of Lattice Gauge Theories

The main aim of this lecture series is to present the state-of-the-art on the following problem: the study of particle physics phenomena - and of gauge theories broadly defined - utilizing quantum computers and quantum simulators.

During the first lecture, we will (1) motivate this research line, discussing the computational success as well as challenges that gauge theories represent, and (2) introduce the main theoretical framework we will utilise - lattice gauge theories - via two illustrative examples (one taken from particle, one from condensed matter physics): the Schwinger model and quantum dimers.

During the second lecture, we will introduce the concepts of quantum simulation and quantum computing, and briefly review applications in the context of traditional condensed matter and statistical physics models. A quick overview of experimental platforms will also be presented.

During the third lecture, we will combine these elements and discuss implementation strategies for lattice gauge theories on quantum simulators, as well as the experimental state of the art.

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Suggested reading:

Some introductory references to the topic written by HEP experts are:

J. Preskill, arXiv.1811.10085 (2018). U. J. Wiese, Ann. Phys. 525, 777 (2013) and a pedagogical review article:

MD and S. Montangero, Contemporary Physics 57, 388 (2016)