

SEMINAR: Quantum simulation of lattice gauge theories - exploring fundamental physics in the era of quantum information

TORSTEN V. ZACHE

April 19, 2024

10:00 to 11:00

Seminar Room and online (Zoom)

Gauge theories are ubiquitous in fundamental physics with applications ranging from high-energy particle physics over emergent phenomena in condensed matter to quantum information science and technology. Since several regimes of interest have remained inaccessible to classical simulations, they constitute an ideal target for quantum simulations. In this talk, I will present recent progress towards the quantum simulation of non-abelian lattice gauge theories (LGTs) and discuss how to tackle outstanding open problems. After reviewing the current state-of-the-art, I will highlight key challenges that are unique to LGTs. Our proposed solutions require both hardware and software to be tailored to the requirements of LGTs. This includes the theoretical development of qudit and fermion architectures, as well as digital algorithms based on a q-deformed formulation of LGTs.

Based on:

- [1] Gonzalez-Cuadra et al., PRL 129, 160501 (2022)
- [2] Gonzalez-Cuadra et al., PNAS 120, e2304294120 (2023)
- [3] Zache et al., Quantum 7, 1140 (2023)
- [4] Zache et al., PRL 131, 171902 (2023)

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Hosted by: Prof. Dr. Maciej Lewenstein