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Error mitigation with post-selection in symmetry-constrained Quantum Simulations: an application to lattice gauge theories

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In physics, symmetries are ubiquitous. Quantum simulation of symmetry-constrained systems represent an outstanding challenge in the rapidly evolving field of quantum technology and information. A key prerequisite is the protection of the symmetry sector we want to study against errors that, if unchecked, would lead to unwanted symmetry-breaking results. In this framework, post-selection is one of the simplest yet effective methods for mitigating errors in simulations of symmetry-constrained theories.
However, applying it to systems affected by non-Abelian symmetries becomes non-trivial, as the symmetry generators typically do not commute with each other.
In this seminar, I will review the fundamental post-selection techniques for error mitigation of symmetry-breaking errors in quantum simulations of symmetry-constrained systems. In particular, I will show possible post-selection applications to lattice gauge theories (LGTs), that underlie our understanding of fundamental forces of modern physics, and that are characterized by multiple local symmetries. I will discuss differences in the application of those post-selection methods between Abelian and non-Abelian LGTs.

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