Chemistry-aware noise mitigation on molecular simulations for NISQ hardware

Quantum computers promise to enable the simulation of complex chemical systems is one of the main applications expected to yield quantum advantage. However, the current generation of quantum hardware is difficult to use for molecular simulations due to the high levels of noise during device operation. Improvements on hardware promise to make these simulations possible, either by improvements in fidelities and coherence time, or by making quantum error correction possible. In parallel, research in algorithms to combat noise is actively being developed.

In this talk, I'll present work performed by our team on a novel noise mitigation technique, called Partition Measurement Symmetry Verification (PMSV), which exploits the symmetries present in molecular systems to reduce noise in NISQ experiments. I will show how PMSV, alone or in combination with other noise mitigation methods, greatly helps in improving results from hardware experiments and pushes us closer to making quantum computers useful for the simulation of chemical systems. I will illustrate the performance of this technique with examples run on superconducting and ion trap hardware.