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DESIGNING THE MOST ACCURATE QUANTUM SENSORS IN THE NISQ ERA: OPTIMIZATION METHODS AND IMPLEMENTATION

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ABSTRACT

Quantum sensing is featured as one of the near-term applications of quantum technologies. Quantum sensors utilizing entanglement and coherence can have boosted precision beyond any classical counterpart in a wide range of tasks including gravitational wave detection, clock synchronization, and navigation. Nevertheless, conventional theory of quantum sensing, aka quantum metrology, often focuses on the asymptotic regime of long interaction time with the sensed process, which requires techniques beyond reach in the NISQ era. In this talk, I will show a framework of non-asymptotic quantum metrology. I will introduce theoretical tools for optimizing quantum sensors and evaluating their optimal performance. I will also explore their application in sensing physical processes with memory and discuss the possibility of implementing optimal sensing using a classical-quantum hybrid structure.