



New Opportunities for Quantum Computing Research Amid Rapid Hardware Advances



Dr. Dawei Ding

📍 Host: 袁晓 助理教授

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📍 静园五院204室



Abstract

The field of quantum computing is at a pivotal stage where there is rapid progress in hardware and hitherto purely theoretical constructs are now experimentally accessible in the lab. However, this union of theory and experiment is still in its early stages: currently, theorists provide protocols or schemes and experimentalists implement them on hardware verbatim, leading to an interface between theory and experiment that can be suboptimal and even somewhat unnatural. In this talk, I showcase the exciting opportunities for quantum computing research that combines both theoretical and experimental concepts to create a smoother and more efficient interface. I will demonstrate that this approach yields very useful tools for hardware development, focusing in particular on the boosting of quantum processor performance via novel quantum gate sets. Conversely, the richness of quantum device physics and the demands of hardware development motivate new, fascinating theoretical questions, including compilation with two-qubit gates beyond CNOT and new decompositions of $SU(2)$.

Biography

Dawei Ding completed his Ph.D. in theoretical physics at Stanford University and subsequently worked as a quantum scientist at Alibaba Quantum Laboratory. His research involves combining theoretical quantum information science and quantum hardware device physics to explore new avenues for quantum computing research. Specific research directions include novel quantum gate sets and scalable benchmarking for modern-day processors.