

# Physics & Astronomy Colloquium

## Presents



He/him/his

## Shengwang Du

Professor, University of Texas at Dallas

Thursday, March 22, 2024  
12:10 pm, Webster Room 11

*Please meet our guest speaker and share in refreshments 11:45 a.m. -12:10 p.m. in the foyer on floor G above the lecture hall*

## “Distributed Quantum Computing with Shared Quantum Gate Processing Unit”

Due to many physical constraints, it is extremely challenging to build a monolithic fully connected quantum computer with a very large number ( $N$ ) of qubits, in which a direct control gate operation can be performed between two arbitrary qubits. The cost of such a fully connected quantum computer increases exponentially as the number of qubits increases. There is a growing interest in exploring distributed quantum computing (DQC) systems that can interconnect many small-sized, cost-effective local quantum computers. In most conventional DQC architectures, each local quantum computer is equipped with additional communication qubits dedicated to establishing remote entanglement links. The presence of these communication qubits not only substantially increases the cost of individual local quantum computer nodes, but also renders the entanglement-communication-based scheme inherently non-deterministic. We propose a DQC architecture in which individual small-sized quantum computers are connected through a shared quantum gate processing unit (S-QGPU) [1]. , S-QGPU effectively pools the resources together for remote gate operations, and thus significantly reduces the cost of not only the local quantum computers but also the overall distributed system. Moreover, S-QGPU's shared resources for remote gate operations enable efficient resource utilization. S-QGPU-based DQC architecture demands fewer resources, further decreasing the overall cost.

*Host: Dr. Yefeng Mei*

*ZOOM Information: Meeting ID: 965 8240 9398 • Passcode: physastro*