

**Fermi National Accelerator Laboratory
LDRD Project Data Sheet – FY20**

Project ID: FNAL-LDRD-2020-53

Project title: Q-NetARCH: Software defined network architecture for quantum networks

Principal investigator: Wenji Wu.

Project description:

Quantum networks enable the transmission of information in the form of quantum bits (qubits) between physically separate quantum nodes. Like the Internet, quantum networks are expected to undergo different stages of research and development until they reach maturity; we are still at the beginning of this process. Quantum network architecture is at the core of quantum network research and development and to date very little work has been done on quantum network architectures.

To explore this gap, we propose to research and develop “*Q-NetARCH: an SDN (Software Defined Networking) -based network architecture for quantum networks*”. The goal of the project is to investigate and explore designs of scalable, flexible, reliable, and platform-independent quantum network architectures that supports essential quantum network functionalities and capabilities. Due to technology immaturity in quantum memory and quantum computation, we will not consider entanglement swapping and entanglement purification in *Q-NetARCH* at this initial stage.

Tie to Mission:

This proposal explores and advances the Fermi Quantum Institute thrust: “Quantum communication: Advancing the capabilities of computer networks” and builds on recently completed quantum network Lab Directed R&D “Quantum Networks Using Time-bin Photonic Qubits” (FNAL-LDRD-2018-041 ; P.I. Cristián Peña). The Fermi Quantum Institute is an important partner in the greater Quantum Sciences mission in the DOE Office of Science.

Work proposed for current fiscal year and anticipated / desired results:

Acquire and deploy a tunable state-of-the-art mode-locked laser (note that this is planned at the end of FY20, which marks the start of our project.

Project funding profile:

Prior year(s) costs	FY21	FY22	FY23	FY24 ½	Total
N/A	\$400,000	\$382,000	\$308,000	\$18,000	1,108,000

Project Start Data: 8/17/2020

Total Approved Project funds: \$1,108,000