

**Fermi National Accelerator Laboratory
LDRD Project Data Sheet - FY17**

Project ID: FNAL-LDRD-2017-038

Project title: Quantum Computing using Superconducting Radio Frequency Technology

Principal investigator: Alexander Romanenko

Project description: (short description and explanation of cutting edge, high-risk, high-potential science or engineering)

We propose to design, manufacture, and study single and multiple unit quantum computing structures based upon a combination of ultra-high Q superconducting radio frequency, SRF, host cavities and embedded Josephson junction qubit(s). The goal is for this work to achieve within the next few years a working high coherence 50+ qubit quantum computer.

Tie to Mission: (explain the project's relevance or anticipated benefits to Fermilab's and DOE's missions)

Quantum computers propose to provide a new degree of computational power that potentially could revolutionize certain calculations that are relevant for High Energy Physics (HEP). Current limitations include lifetime and de-coherence issues with storing quantum information. This project will utilize existing expertise in High Energy Physics in SRF technology, cryogenics, and other technical abilities to help overcome the limitations and position HEP to be a contributor to this possible computing revolution.

Previous year's accomplishments: (as applicable)

N/A

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

For the first phase of the project, the objective is to specify, procure, and commission a dilution refrigerator for the purpose of providing the test bed for resonator measurements.

Project funding profile: (costs, budgets, projected budgets, and total)

Prior year(s) costs	FY17	FY18	FY19	Total
N/A	350,000	550,000	500,000	1,400,000

Project Start Date: 3/01/2017

Total Approved Project funds: \$ 1,400,000