

**Fermi National Accelerator Laboratory  
LDRD Project Data Sheet - FY18**

**Project ID:** FNAL-LDRD-2018-003

**Project title:** A scintillating liquid argon bubble chamber for Weakly-interacting Massive Particle (WIMP) and Coherent Elastic Neutrino Nucleus Scattering (CEvNS)

**Principal investigator:** Eric Dahl

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

We propose to design, construct, commission, and calibrate a 5-liter liquid argon bubble chamber as the first ever scalable demonstration of a scintillating bubble chamber for nuclear recoil detection. We will (1) demonstrate a scalable technical design for larger scale scintillating bubble chambers and (2) test the hypothesis that liquid nobles can be superheated to near the thermodynamic limit without encountering bubble nucleation by electron recoils.

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

With a target argon recoil detection threshold of 100 eV, this device will have cutting-edge sensitivity to GeV-scale WIMP dark matter and coherent elastic neutrino nucleus scattering (CEvNS) from reactor neutrinos. The background discrimination and scalability of the scintillating bubble chamber technique also enable a rich experimental program for future ton-scale detectors. Such detectors might have promise in the post-generation 2 experiments.

**Previous year's accomplishments:** (as applicable)

N/A

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

The initial work will be move from the conceptual design of the 5-liter chamber to a fully engineered version from which appropriate procurements can begin. In particular, initial work will be on the pressure vessel contained in a vacuum cryostat. Similarly, fully specifying the inner vessel assembly will begin.

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

<b>Prior year(s) costs</b>	<b>FY18 ½</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21 ½</b>	<b>Total</b>
N/A	150,000	300,000	241,490		691,490

Project Start Data: 3/15/2018

Total Approved Project funds: \$ 691,490