Equipment Upgrades at University of Massachusetts Lowell Research Reactor (UMLRR) to enable neutron-induced reaction research

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Collaborators: N/A

Program: University Research, Reactor Upgrade

ABSTRACT:

The University of Massachusetts Lowell Research Reactor (UMLRR) supports four growing Nuclear Science and Engineering (NS&E) programs that currently serve more than 100 undergraduate and graduate students. In 2015, UMLRR submitted an application to the NRC for renewal of its operating license, it is anticipated that renewal will occur in 2020. This infrastructure grant seeks funding for equipment that will ensure the safe and efficient operation, as well as upgrades to the experimental infrastructure of the facility, during the next 20 or more years of operations.

Leveraging the investments of both U.S. DOE and internal funding, upgrades to the UMLRR facilities have enabled advances in distance education initiatives, as well as research in support of the four NS&E programs. Students and researchers from these programs have actively utilized the UMLRR facilities for a wide range of fundamental research as well as research in applied radiation science. The proposed safety systems spare/repair parts will ensure that we can continue to enhance our ongoing educational development pathway (primarily distance education and data analytics) by having long-lead time (lead times can be in excess of 26 weeks) replacement parts on-hand rather than waiting for newly manufactured spare parts. Parts included in this proposal are to repair safety systems upgrades that are required for the license renewal. The nuclear instrumentation upgrade proposed within this project will enable studies of neutron-induced reactions, mainly neutron capture and neutron-induced fission. The high-resolution spectroscopic systems that would enable Neutron Activation Analysis, measurements of nuclear structure and gamma-ray production cross sections. The array of scintillator detectors using BaF_2 and NaI(Tl) crystals will enable calorimetric studies relevant to energy release in neutron reactions. Methods of gamma ray calorimetry are successful tool for cross section measurements as well as fundamental studies of structure of nuclei near neutron separation energy. The detector systems will be driven by the proposed high-resolution (14-bit) high-speed (500 MHz) digital data acquisition with ample room for future expansion and with flexibility to accommodate a variety of radiation detectors. This approach will also simplify and streamline future external collaborations. As such, the proposed upgrades will allow our experimental facilities to carry out measurements of advanced nuclear data needed for future reactor designs, reactor fuels, safeguards, nuclear forensics, nuclear safety and non-proliferation of nuclear material, all relevant to NE mission.