

## **A LEGENDary Program:**

### **Searching for Neutrinoless Double-Beta Decay in Ge-76**

Dr. Vincente Guiseppe

Oak Ridge National Lab

Neutrinoless double-beta decay searches have the potential to discover the existence of a lepton-number violating process and the particle-antiparticle nature of neutrinos, which form the basis of theories explaining the matter-antimatter asymmetry in the universe. The MAJORANA Collaboration operated its DEMONSTRATOR array of high-purity Ge detectors at the Sanford Underground Research Facility in South Dakota to search for neutrinoless double-beta decay in Ge-76. Along with the GERDA experiment in Italy, Ge-based experiments have achieved the lowest backgrounds and a superior energy resolution at the neutrinoless double-beta decay region of interest, which illustrates that Ge-76 is an ideal isotope for a large, next-generation experiment. Building on the successes of these experiments, the LEGEND collaboration was formed to develop a phased, next-generation Ge-based double-beta decay program. The LEGEND-1000 experiment represents the ton-scale phase of the LEGEND program's search for neutrinoless double-beta decay of Ge-76, following the current intermediate-stage LEGEND-200 experiment at LNGS in Italy. The LEGEND-1000 experiment's technical design, energy resolution, material selection, and background suppression techniques combine to project a quasi-background-free search for neutrinoless double-beta decay in Ge-76 at a half-life beyond  $10^{28}$  yr and a discovery sensitivity spanning the inverted-ordering neutrino mass scale. This talk will present the latest results from the MAJORANA DEMONSTRATOR and LEGEND-200 experiments, as well as the supporting innovations and discovery potential of the next-generation LEGEND-1000 experiment.