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Differential measurement of coherent-elastic neutrino-nucleus scattering using isotopically enriched Ge detectors

The Spallation Neutron Source (SNS) and the High Flux Isotope Reactor (HFIR) of ORNL are two very powerful neutrino sources. Coherent elastic neutrino-nucleus scattering (CEνNS) was first predicted in 1974 and recently observed by the COHERENT collaboration taking advantage of the extremely high-quality stopped-pion neutrino source available at the SNS. CEνNS is a process in which a neutrino scatters off an entire nucleus. The precise measurement of CEνNS has the potential to probe physics beyond the Standard Model and can also provide information about the nuclear form factors. We present a novel neutrino experiment that allows for precision measurements with a miniaturized detector size. It will demonstrate the N^2 dependence of the cross-section and significantly improve constraints on non-standard interactions of neutrinos with nuclei. The proposed project utilizes highly enriched $^{70-76}$Ge isotopes and has straightforward scalability to a large-scale experiment. The process of isotopically enriching germanium is a well-known technology used to fabricate ^{76}Ge search for neutrinoless double-beta decay. By making a simultaneous differential CEνNS measurement with Ge detectors of different Ge composition many systematic errors would cancel. We will present the experimental strategy for this proposal and an estimate of the sensitivity of the detection system to changes in the form factor.

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