ENTENTE

Monday, September 29, 2025 - Tuesday, September 30, 2025

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Extreme Nuclear Half-Life Efforts: New Theories and Experiments

Book of Abstracts

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Exploring Double Beta Plus Decays with NuDoubt++

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Double beta plus decay is a rare nuclear disintegration process. Difficulties in its measurement arise from suppressed decay probabilities, experimentally challenging decay signatures and low natural abundances of suitable candidate nuclei. Studying these decays can offer valuable insights into nuclear structure and fundamental symmetries. The decay rate is influenced by nuclear matrix elements (NMEs) and phase space factors (PSFs) - both essential for interpreting results and refining theoretical models.

In this context, we present NuDoubt++, a new detector concept to overcome the experimental challenges. It is based on the first-time combination of hybrid and opaque scintillation detector technology paired with novel light read-out techniques. This approach is particularly suitable detecting positron (beta plus) signatures. We expect to measure two-neutrino double beta plus decay modes in less than two years of operation. Moreover, we are able to probe neutrinoless double beta plus decays at several orders of magnitude improved significance compared to current experimental limits.

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Techniques to reach the Normal Hierarchy of Double Beta Decay using liquid Xenon

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The scientific priority of searching for neutrinoless double beta decay with sensitivity to the Normal Hierarchy is well known. In this talk I will point out how a liquid xenon detector might be designed to reach the required sensitivity by implementing a number of techniques to control the backgrounds. The concept would allow almost all of the xenon to be fiducial, leading to a modular approach to the detector, allowing several laboratories to share the project.

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The Quest for No Neutrinos: Advancing the Search with LEGEND-1000

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The LEGEND collaboration aims to unambiguously discover neutrinoless double-beta decay ($0\nu\beta\beta$) using high-purity germanium (HPGe) detectors enriched in the double-beta-decaying isotope ^{76}Ge (Q = 2039 keV). The HPGe detectors operate in liquid argon, which serves as a coolant and an active

shield, enabling a quasi background-free search for $0\nu\beta\beta$ decay. The first phase, LEGEND-200, utilizes up to 200 kg of enriched HPGe detectors and is currently operational in Hall A of the Laboratori Nazionali del Gran Sasso (LNGS), Italy. The subsequent phase, LEGEND-1000, is scheduled to begin construction in Hall C of the LNGS in 2026 and aims to scale up to 1000 kg of detectors.
Achieving a discovery sensitivity of 3σ for $0\nu\beta\beta$ decay at a half-life of 10^{28} years requires maintaining a background contribution at Q of less than 10^{-5} counts/(keV kg yr). Strategies to meet this requirement include selecting radiopure materials and using underground liquid argon. Alternatives are being explored, such as optically active enclosures and specialized pulse shape discrimination. Furthermore, novel background suppression techniques have been developed for the in-situ produced isotope $^{77(m)}$Ge based on delayed coincidences. This presentation will provide insights into the LEGEND-1000 baseline design and discuss various background reduction techniques, focusing on the suppression of the decays of in-situ produced isotopes.
This work is supported by the U.S. DOE and the NSF; the LANL, ORNL, and LBNL LDRD programs; the European ERC and Horizon programs; the German DFG, BMBF, and MPG; the Italian INFN; the Polish NCN and MNiSW; the Czech MEYS; the Slovak RDA; the Swiss SNF; the UK STFC; the Canadian NSERC and CFI; the LNGS and SURF facilities.

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Determination of the quenched weak axial-vector coupling through measurements of highly forbidden nuclear decays

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Nuclear-structure effects play an important role in the decay rate of very rare processes. These effects are summarized in the nuclear matrix elements which holds information about the initial and final states and are dependent on the weak axial-vector coupling. One commonly overlooked suppression, quenching of the weak axial-vector coupling, can significantly increase calculated $0\nu\beta\beta$ half-lives. Experimental measurements of highly forbidden transitions can lead to insight into this quenching. The RAMPS (RadioActive isotope Measurement Program at SNOLAB) aims to take advantage of the existing SNOLAB experimental infrastructure to perform these measurements. This talk will discuss the pilot project of RAMPS which aims to measure the excited-state electron capture of ^{176}Lu, as well as giving an overview into other experimental efforts both past and present.

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0vbb into the normal ordering with Theia

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$0\nu\beta\beta$ into the normal ordering with Theia

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Challenges and Opportunities with Xenon

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Opportunities with Te

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TBD

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Close Out

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No-Host Dinner