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Status of the SuperNEMO Experiment and First Simulation-Based Sensitivity Estimates

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The SuperNEMO Experiment has entered its physics data-taking phase as of April 2025, becoming the only operational double beta decay detector capable of full topological event reconstruction via the tracker-calorimeter design. This topology-driven approach provides powerful discrimination of signal and background, and is uniquely suited to explore a wide range of BSM scenarios. The detector, located at the Laboratoire Souterrain de Modane (LSM) in France, uses 6.11 kg of enriched ^{82}Se as its double beta decay source.

We present the first simulation-based sensitivity estimates using the newly developed tracking algorithm and an updated analysis framework, targeting both the neutrinoless double beta decay mode and other exotic decays such as Majoron-emitting decays and the right-handed currents. The extended analysis takes advantage of SuperNEMO's capability to measure not only the total electron energy but also single-electron energies and angular correlations. These results represent an important step toward quantifying SuperNEMO's sensitivity to a broad range of double beta decay processes.

Primary authors: PETRO, Maros (IEAP CTU in Prague); SUPERNEMO COLLABORATION, on behalf of the

Presenter: PETRO, Maros (IEAP CTU in Prague)

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