

Joint Nuclear and Astrophysics Seminar

- When: Friday December 1st at 2:00 PM (US Central time)
- Where: Cyclotron Institute seminar room 228 and Zoom
<https://tamu.zoom.us/j/95700340712?pwd=dUxPbSswZG1yTlFyMC92eUdkS1RJdz09>
- Speakers: Beyhan Bastin and Iain Bisset

Probing the existence of a Dark Boson in the MeV range

Beyhan BASTIN (GANIL), Philip Adsley (TAMU) on the behalf of the New JEDI collaboration

Understanding the composition and functioning of our Universe are among the most fundamental and challenging questions in Physics. To date, the intrinsic nature of dark matter remains a mystery. This presentation is about the New JEDI project which aims to study through several nuclear physics experiments a fascinating alternative scenario, such as the existence of an indirect interaction between ordinary matter, well described by the Standard Model, and the Dark Sectors of the Universe via portals (so-called Dark Bosons). In other words, does a new fifth force of nature exist?

Our investigation is further motivated by the recent claim of an anomaly observed in the electron-positron pair decays of an excited state in ^8Be , during an experiment of the Hungarian ATOMKI group, which may be interpreted as the signature of a hypothetical dark boson (named X17). However, uncertainties linked to the structure of ^8Be and new hypotheses to explain the experimental results are currently debated. The ATOMKI group confirmed latter on the existence of this anomaly on other nuclei such as ^4He and ^{12}C . The quantum nature of this hypothetical boson is also unclear at the moment. Independent measurements are needed.

For three years now, the collaboration has worked on the construction of a new detection system, named New JEDI. The latter is designed to be versatile in order to make a proposal for a large-scale broadband experimental program. The project relies on pathfinder experiments conducted at the ARAMIS-SCALP facility (Orsay, France). The commissioning of the New JEDI setup has been completed successfully on June 2021 at a tandetron facility in (Rez, Czech Republic). The first experiment has taken place in June-July 2022 at the ANDROMEDE facility (Orsay, France). A complementary experiment, lead also by Texas A&M, was just completed at the iThemba LABS laboratory (Cape Town, South Africa). We plan to develop a long-term research program in the MeV terra incognita energy range at the new SPIRAL2 facility (Caen, France), that will deliver unique high-intensity beams of light, heavy-ions and neutrons in Europe.

In the presentation, we will present the overall New JEDI project and provide for a synthesis about the measurements and the analysis carried out up to now. Results from the iThemba LABS experiment will be reported later on by Philip Adsley.

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Testing Short Baseline Anomalies with CEvNS From Stopped Pion Decay Experiments

Iain Bisset

Stopped-pion experiments that measure coherent elastic neutrino-nucleus scattering (CEvNS) are sensitive to sterile neutrinos via disappearance. Using timing and energy spectra to perform flavor decomposition, we show that the delayed electron neutrino component provides an independent test of short-baseline anomalies that hint at \sim eV-mass sterile neutrinos. Dedicated experiments will be sensitive to nearly the entire sterile neutrino parameter space consistent with short-baseline data.

