T 89: DM, Neutrino Theory

Time: Wednesday 17:30–19:00 Location: POT/0251

T 89.1 Wed 17:30 POT/0251

A mobile neutron spectrometer for the LNGS underground laboratory — •Melih Solmaz[1], Klaus Eitel[2], Kathrin Valerius[2], and Uwe Oberlack[3] — [1]Karlsruhe Institute of Technology, Institute of Experimental Particle Physics — [2]Karlsruhe Institute of Technology, Institute for Astroparticle Physics — [3]Johannes Gutenberg University Mainz, Institute for Physics

Environmental neutrons are a source of background for various rare event searches (e.g., dark matter direct detection and neutrinoless double beta decay experiments) taking place in deep underground laboratories. Both the neutron flux and spectrum depend on location. Precise knowledge of this background is necessary to devise shielding and veto mechanisms, improving the sensitivity of the neutron-susceptible underground experiments.

Ambient neutrons have been measured previously at different locations of the underground laboratory LNGS in Italy. However, flux numbers vary considerably across the measurements and direct comparison between them is difficult owing to the use of different detector technologies and setups, each of which possesses characteristic systematics and energy windows. A project was launched to solve these issues and enhance the scientific infrastructure of LNGS.

In this talk, we present the design and the expected performance of a portable neutron detector based on capture-gated spectroscopy as well as first test measurements and give an outlook towards the deployment at LNGS. This project is funded by the German Federal Ministry of Education and Research (BMBF) under the grant number 05A21VK1.

T 89.2 Wed 17:45 POT/0251

Background characterisation of GeMPI detectors and shield design for improved GeMPI-neo detectors — •Nicola Ackermann[1], Matthias sLaubenstein[2], Jochen Schreiner[1], Christian Buck[1], Manfred Lindner[1], Gerd Heusser[1], Herbert Strecker[1], Werner Maneschg[1], Janina Hakenmüller[1], and Hannes Bonet[1] — [1]Max-Planck-Institut für Kernphysik, Heidelberg, Germany — [2]Laboratori Nazionali del Gran Sasso, L'Aquila, Italy

This talk presents Monte Carlo simulations of the background spectra of the 4 screening detectors GeMPI 1 - 4 at the Gran Sasso Underground Laboratory (LNGS) using the Geant4 based framework MaGe. The GeMPI detectors are low background Ge spectrometers located at a depth of 3500 m.w.e. and achieve extremely high sensitivites in material screening at a level of muBq/kg. They are used to test material samples on their suitability to use in rare event experiments.

In the simulations muons, neutrons and tiny radioactive contaminations of the detector and shielding materials are investigated as possible sources of background radiation. It was found that the Pb210 contaminations in the detector shield and the neutrons coming from radioactive decays in the surrounding rock have the highest impact on the background spectra. With this new found understanding, a possible shield design for a next generation GeMPI-like detector is proposed.

T 89.3 Wed 18:00 POT/0251

Towards a low-background SDD for IAXO — Joanna Bilicki, Frank Edzards, Susanne Mertens, Lucinda Schönfeld, Juan Pablo Ulloa Beteta, •Christoph Wiesinger, and Michael Willers — Physik-Department, Technische Universität München, Garching

The International Axion Observatory (IAXO) aims to detect solar axions as they are back-converted into X-rays along a strong magnet pointed towards the sun Excellent spectroscopic performance, high X-ray absorption efficiency at and below 10 keV and great potential for ultra-low background operations are features of silicon drift detectors (SSDs) that could facilitate this endeavour. Dedicated low-background detector designs, following a consequent passive shielding strategy and a novel all-semiconductor active shield approach, are under development. A background demonstrator has been installed at the Canfranc underground laboratory in Spain. In this talk, we will report on the latest achievement towards a low-background SDD for IAXO. This work has been supported by the DFG through the Excellence Cluster ORIGINS.

T 89.4 Wed 18:15 POT/0251

Some Cosmological Constraints on Many Species Theories — •Alan Zander[1], Philipp Eller[1], and Manuel Ettengruber[2] — [1]TUM, Garching, Deutschland — [2]Max-Planck-Institut für Physik, München, Deutschland

We consider the so-called Many Species Model introduced by Dvali and Redi, which postulates the existence of $N \sim 10^{32}$ particle species yielding a new mechanism to solve the well-known hierarchy problem. We study some possible extensions of the model allowing the electroweak vacuum expectation values of the Higgs bosons of the different Standard Model (SM) copies to break the permutation symmetry in the species space and we show how this renders the theory testable in the context of neutrino physics. These scenarios make also possible to address some of the other biggest questions in modern physics that remain open like the smallness of the active neutrino masses and the nature of dark matter, yielding a viable explanation for these two mysteries. That being said, we also analyze some of the cosmological implications of these extensions, obtaining the first constraints available in the literature for this sort of theories on the number of species that interact to some extent with the SM.

T 89.5 Wed 18:30 POT/0251

Phenomenological implications of neutrinos and axions in Many Species Theories — •Manuel Ettengruber[1], Philipp Eller[2], Emmanouil Koutsangelas[1], and Alan Zander[2] — [1]Max-Planck-Institut für Physik, München, Deutschland — [2]TUM, Garching, Deutschland

The framework of TeV scale gravity theories was originally invented to solve the hierarchy problem. One specific BSM model is the Many Species Theory in which the scale of quantum gravity gets lowered by the existence of many additional light states. In this talk we want to present how small neutrino masses can be generated in this infrared approach and how this modifies the oscillation pattern. Then we present how current neutrino data can be used to give a lower bound on the number of additional species. Moreover, we show how to get an upper bound from axion physics. These results give the first time a theoretically restricted parameter space which can be tested by current and future experiments.

T 89.6 Wed 18:45 POT/0251

Influence of a gravitationally induced phase on neutrino oscillation and Baryogenesis — •Sara Krieg — TU Dortmund, 44227 Dortmund, Germany

In view of the fact that there is still no uncontroversial theory of quantum gravity nor an experimental evidence for its existence it is well motivated to look for the latter in neutrino oscillations.

For this a general transition probability is derived for a neutrino interacting gravitationally with background neutrinos. Entanglement of the neutrinos and a garvitational quantum field induces a phase modifying the oscillation behavior which may be experimentally detectable. Therefore this could be a direct evidence for the quantum character of gravity.

Since there are theories that explain baryon asymmetry via neutrino oscillations the effect of the phase shift may also have an impact on the predictions of these models.

Extra dimensions are introduced to consider even larger effects.