# T 101: Neutrino physics without accelerators VII

Time: Friday 11:00–12:45 Location: H-ÜR 1

T 101.1 Fri 11:00 H-ÜR 1

**Indirect dark matter search with JUNO** — •David Blum, Marc Breisch, Jessica Eck, Tobias Heinz, Tobias Lachenmaier, Neha Lad, Axel Müller, Tobias Sterr, and Alexander Tietzsch — Eberhard Karls Universität Tübingen, Physikalisches Institut

The Jiangmen Underground Neutrino Observatory (JUNO) is a multi-purpose 20 kt liquid scintillator neutrino detector currently under construction in southern China. Its main goal is the determination of the neutrino mass ordering by measuring reactor antineutrinos at 53 km baseline. Due to the size and the excellent energy resolution (3% @ 1 MeV) of the detector, JUNO is sensitive to a potential neutrino flux produced by dark matter self-annihilation. The expected neutrino signals from dark matter self-annihilation and the relevant backgrounds in the energy range from 10 MeV to 100 MeV are investigated. Results of a sensitivity study on the dark matter self-annihilation cross section based on a Bayesian analysis are presented in this talk. This work is supported by the Deutsche Forschungsgemeinschaft.

T 101.2 Fri 11:15 H-ÜR 1

**CONUS - COherent Neutrino nucleUs Scattering with reactor neutrinos** — •Thomas Hugle for the CONUS-Collaboration — Max-Planck-Institut für Kernphysik

The measurement of coherent elastic neutrino nucleus scattering (CE$\nu$NS) by the COHERENT collaboration served as a first step into this kind of new measurements of the standard model neutrino sector. However, accessing the fully coherent regime at low neutrino energies provided by, e.g., nuclear power plants, is still a challenge due to the strong requirements in terms of a low detection threshold and a reduction of backgrounds. The CONUS experiment at the powerful commercial nuclear power plant in Brokdorf, Germany, with a distance of 17.1 m to the reactor core, employs the latest generation of ultra-low threshold and high-purity Germanium detectors with noise thresholds around 300 eV as well as an advanced shield design to tackle those challenges. Data collection started in April 2018 and is ongoing, while a first rate-only analysis has been done and further analyses are currently studied. The talk will give an overview of the CONUS experiment together with the latest results and developments, like an investigation of reactor-correlated backgrounds.

T 101.3 Fri 11:30 H-ÜR 1

**The Design and Status of the DAQ-software for OSIRIS** — •Kai Loo[1], Christoph Genster[2], Runxuan Liu[2,3], and Michael Wurm[1] — [1]Johannes Gutenberg-Universität Mainz, Institute for Physics, Staudingerweg 7, 55128 Mainz — [2]Institut für Kernphysik, Forschungszentrum Jülich, 52428 Jülich — [3]III. Physikalisches Institut B, RWTH Aachen University

The Jiangmen Underground Neutrino Observatory (JUNO), under construction in southern China, will determine the neutrino mass hierarchy (MH) by observing neutrinos from nuclear reactors at the distance of 53 km. To reach the desired sensitivity ($> 3\sigma$) for MH, the radiopurity of the different detector components plays a crucial role. To ensure the purity of the 20 kt liquid scintillator (LS) target of JUNO, the Online Scintillator Internal Radioactivity Investigation System (OSIRIS) will be constructed. It will monitor the radiopurity of the LS during its production and the filling phase of the central detector of JUNO. The OSIRIS will utilize the novel concept of intelligent-PMT i.e. the necessary DAQ electronics will be mounted at the back of the PMT. Each iPMT will then act as an individual self-triggering digitizer. Due to the asynchronous data flow from the iPMT system and of the order of 15 kHz dark count rate per PMT, this chosen approach requires a triggering and physical event building in software level. This talk will report the design, progress and status of the DAQ software for OSIRIS. This work is supported by the DFG Research Unit "JUNO"

T 101.4 Fri 11:45 H-ÜR 1

**Measurement of the attenuation length and the group velocity of liquid scintillators with the CELLPALS technique** — David Blum, Marc Breisch, •Jessica Eck, Tobias Heinz, Tobias Lachenmaier, Neha Lad, Axel Müller, Tobias Sterr, and Alexander Tietzsch — Physikalisches Institut Eberhard Karls Universität Tübingen

To quantify the transparency of liquid scintillators for next-generation neutrino experiments (e.g. JUNO), a measurement of the attenuation length is crucial to ensure that a sufficient number of scintillation photons reach the surrounding photomultipliers. However, this becomes difficult for attenuation lengths of several tens of meters due to the necessity of a sufficient long light path through the sample.

This talk will present the CELLPALS technique to measure the attenuation length of liquid scintillators using an optical cavity to extend the effective light path. In addition, the CELLPALS method also provides the determination of the group velocity of the sample. The experimental setup and the results for different samples will be presented. This work is supported by the Deutsche Forschungsgemeinschaft.

T 101.5 Fri 12:00 H-ÜR 1

**Development of an attenuation length monitor for JUNO** — •Heike Enzmann and Michael Wurm — Johannes Gutenberg-Universität, Mainz, Germany

The Jiangmen Underground Neutrino Observatory (JUNO) is currently under construction in China. With its 20 kt liquid scintillator (LS) detector is designed to determine the neutrino mass hierarchy via a precision measurement of the survival probabilities of electron antineutrinos in reactor neutrino oscillations. The filling of the detector with LS will commence in 2021. Excellent transparency of the LS is required to maximize the collection of scintillation light, in order to reach the required measurement precision. Thus, several purity monitors will be installed as part of the filling system to test each batch of LS prior to its insertion into the Central Detector. This talk covers the development and testing of an attenuation length monitor for LS quality control. The monitor will measure the attenuation length using a laser. The measurement will be done over two different lengths of LS to reduce systematic effects. This work is supported by DFG research unit "JUNO".

T 101.6 Fri 12:15 H-ÜR 1

**Waveform Reconstruction with Deep Learning method in JUNO** — •Yu Xu[1,2], Christoph Christoph Genster[1], Alexandre Göttel[1,2], Yuhang Guo[1,3], Philipp Kampmann[1,2], Runxuan Liu[1,2], Ludhova Livia[1,2], Giulio Settanta[1], and Cornelius Vollbrecht[1,2] — [1]Institut für Kernphysik, Forschungszentrum Jülich — [2]III. Physikalisches Institut B, RWTH Aachen University — [3]School of Nuclear Science and Technology, Xi'an Jiaotong University, Xi'an 710049, China

Jiangmen Underground Neutrino Experiment (JUNO) is a next generation liquid scintillator neutrino experiment. The main goal of JUNO is to measure the neutrino mass ordering, while its 20 kton target mass and excellent energy resolution of 3%@1MeV will allow to study the neutrinos from multiple sources, including solar, geo, supernova, and atmospheric neutrinos. Signal from about 18,000 20-inch photomultiplier tubes will be read by 1 GHz Flash ADCs. Ideally, the precise reconstruction of charge and hit times of incident photons from Flash ADC waveforms would allow us to push the resolutions of energy and spatial reconstructions to their physical limits: a feature helpful to multiple physics purposes. In this talk, we will present the current status of the waveform reconstruction in JUNO, including the new results obtained with dedicated neural network. The details and the possible ways of additional improvement in waveform reconstruction with deep learning methods will be also discussed.

T 101.7 Fri 12:30 H-ÜR 1

**Fluorescence Decay-Time Spectroscopy of the JUNO Liquid Scintillator using Gamma Radiation and a Pulsed Neutron Beam** — •Matthias Raphael Stock, Hans Theodor Josef Steiger, Lothar Oberauer, Andreas Steiger, Ulrike Fahrendholz, Katharina Bock, and Oliver Dötterl — Technische Universität München, Physik-Department, James-Franck-Straße 1, 85748 Garching bei München

Major science goals of the upcoming Jiangmen Underground Neutrino Observatory (JUNO) in China are the search for the proton decay and the detection of the diffuse supernova neutrino background. Both phenomena will show characteristic signals in the detector. Therefore, we evaluate the pulse shape discrimination performance of liquid scintillators (LSs) using excitation by gamma radiation inducing recoil electrons as well as a pulsed neutron beam inducing recoil protons. We developed an experimental setup to characterize the distribution of light emission in the fluorescence process for different LS mixtures for future neutrino experiments e.g. JUNO and THEIA. We present results such as the fluorescence decay-time constants of the JUNO LS, which we investigated during two beam times at the 14 MV Tandem Van de Graaff Accelerator of the Maier-Leibnitz-Laboratorium (MLL). This work is supported by the DFG Research Unit JUNO and by the Bundesministerium für Bildung und Forschung (BMBF) for THEIA (Verbundprojekt 05H2018: R&D Detectors and Scintillators).