T 55: Neutrinophysik III

Zeit: Mittwoch 16:00–18:30 Raum: S06

Gruppenbericht T 55.1 Mi 16:00 S06
KM3NeT/ORCA: status and perspectives — •Jannik Hofestädt for the KM3NeT-ECAP-Collaboration — Friedrich-Alexander-Universität Erlangen-Nürnberg, ECAP

ORCA is the low-energy part of KM3NeT, the next-generation underwater Cherenkov neutrino detector currently under construction in the Mediterranean Sea. The ORCA detector features a dense configuration of optical modules, optimised for measuring the oscillation of atmospheric neutrinos with energies down to a few GeV. ORCA's primary goal is to resolve the neutrino mass hierarchy. With the same data, ORCA is also sensitive to the appearance of tau neutrinos and a variety of possible new physics phenomena.

In this talk, the status of the ORCA detector construction and the performance of the first detector elements in the deep sea will be reported. Different activities of the ORCA group at ECAP will be presented. An overview is given on the deep-learning-based event classification and regression developments for the analysis of ORCA data. Furthermore, the sensitivity of ORCA to possible quantum decoherence effects will be discussed.

Gruppenbericht T 55.2 Mi 16:20 S06
The Jiangmen Underground Neutrino Observatory — •Michaela Schever for the JUNO-Collaboration — IKP-2, Forschungszentrum Jülich — III. Physikalisches Institut, RWTH Aachen University

The Jiangmen Underground Neutrino Observatory (JUNO) is a next generation multi-purpose antineutrino detector currently under construction in Jiangmen, China. The central detector contains 20 kton of liquid scintillator and is equipped with 18,000 20 inch and 25,000 3 inch PMTs. The surrounding water pool serves as Cherenkov veto detector allowing muon track reconstruction for a partial volume veto of the central detector. Measuring reactor antineutrinos of two powerplants at a baseline of 53 km, the unprecedented design energy resolution is 3% at 1 MeV. The main physics goal is to determine the neutrino mass hierarchy within six years of run time with a significance of 3-4 sigma. Additional physics goals are the precise measurement of the solar neutrinos, geo-neutrinos, supernova burst neutrinos, the diffuse supernova neutrino background as well as the search for proton decays. Data taking is expected to start in 2021. This talk reviews the current status of the project and the physics goals. Furthermore, the contributions of the German collaboration groups are summarized.

Gruppenbericht T 55.3 Mi 16:40 S06
Borexino's guide into the solar core and neutrinos — •Zara Bagdasarian[1], Sale-Iti Kroon[1,2], Sindhujha Kumaran[1,2], Livia Ludhova[1,2], Ömer Penek[1,2], and Mariia Redchuk[1,2] for the Borexino-Collaboration — [1]IKP-2, Forschungszentrum Jülich — [2]III Physikalisches Institut, RWTH Aachen University

The Borexino experiment is located at the Laboratori Nazionali del Gran Sasso in Italy with the primary goal of detecting solar neutrinos, particularly those below 2 MeV, with unprecedentedly high sensitivity. The Borexino collaboration has recently published the comprehensive measurement of solar neutrinos produced along the pp-chain, a sequence of nuclear reactions responsible for about 99 percent of solar energy. The solar neutrinos produced in different fusion reactions are affected to a different extent (due to their different energies) by the so-called Mikheyev, Smirnov, and Wolfenstein effect. As neutrinos propagate from the core of Sun to the photosphere, the oscillation parameters acquire effective values in an energy-dependent fashion. As a result, by measuring the solar neutrinos at different energies, Borexino probes the neutrino flavor-transition phenomena simultaneously both in a vacuum and matter-dominated regimes. The neutrino fluxes also provide a direct determination of the relative intensity of the two primary terminations of the pp-chain (pp-I and pp-II) and an indication that the temperature profile in the Sun is more compatible with solar models that assume high surface metallicity. In short, we explore the solar neutrinos measurements in Borexino as a unique probe of both the Sun's internal working, as well as fundamental physics.

T 55.4 Mi 17:00 S06
Analysis of first KM3NeT/ORCA data — •Johannes Schumann for the KM3NeT-ECAP-Collaboration — Friedrich-Alexander-Universität Erlangen-Nürnberg, ECAP

The KM3NeT neutrino detectors are currently being built in the deep Mediterranean Sea. KM3NeT/ORCA is the low energy branch of KM3NeT and the ORCA detector is designed for the investigation of oscillations of atmospheric neutrinos. The first detection elements have been deployed and the corresponding data has been analysed. Even with the first detection elements of the detector, the reconstruction of muon tracks is already possible.

In this talk, the analysis of the track reconstruction data and the identification of first neutrino candidates is presented.

T 55.5 Mi 17:15 S06
Updated Geoneutrino Measurement with the Borexino Detector — •Sindhujha Kumaran[1,2], Zara Bagdasarian[1], Sale-Iti Kroon[1,2], Livia Ludhova[1,2], Ömer Penek[1,2], and Mariia Redchuk[1,2] for the Borexino-Collaboration — [1]IKP-2, Forschungszentrum Jülich — [2]III B Physikalisches Institut, RWTH Aachen University

Geoneutrinos are electron antineutrinos and neutrinos emitted in the radioactive decays of heat producing elements such as ^{238}U, ^{235}U, ^{232}Th and ^{40}K from the Earth's interior. The main goal of neutrino geophysics is to use the obtained geoneutrino signals in estimating the abundance and distribution of these elements. So far, only two detectors, namely KamLAND and Borexino, have measured geoneutrinos.

The Borexino Detector is a liquid scintillator detector located at the Laboratori Nazionali del Gran Sasso (LNGS). The latest geoneutrino measurement included a 5.9σ evidence of geoneutrinos and the rejection of the null hypothesis of the mantle signal at a 98% C.L. The uncertainty in the latest published result is 26.2%. This work concentrates on the further improvement of the geoneutrino measurement. The increased statistics and the optimised selection cuts used for the analysis have made it possible to reduce the uncertainty to 20.6%. An uncertainty of less than 20% can be achieved by the further optimisation of the selection cuts and needs more investigation.

T 55.6 Mi 17:30 S06
Detection of the Diffuse Supernova Neutrino Background (DSNB) in JUNO: Challenges and Prospects — •Julia Sawatzki and Lothar Oberauer — Technical University of Munich, Chair for Experimental Astroparticle Physics E15, James- Franck-Str. 1, 85748 Garching b. München

The planned 20kt liquid scintillator detector JUNO (Jiangmen Underground Neutrino Observatory) will offer the possibility of a diffuse supernova neutrino background (DSNB) measurement. Although the cosmic background of neutrinos generated by core collapse supernova explosions throughout the universe is present in all flavors, the study will focus on the measurement of electron antineutrinos via the inverse beta decay, as this coincidence reaction provide powerful background suppression. This is of particular importance, as the relic neutrino signal rate in JUNO is, with few events per year, quite low. Therefore good background knowledge as well as powerful background suppression techniques are required. Neutrinos produced in nuclear reactors, the atmosphere, and cosmic muons, which can induce cosmogenic isotopes or fast neutrons, are the main background sources.

T 55.7 Mi 17:45 S06
Measuring the atmospheric neutrino to antineutrino flux ratio with IceCube DeepCore — •Lasse Halve, Marvin Beck, Christian Haack, Martin Leuermann, Saskia Philippen, Jöran Stettner, and Christopher Wiebusch for the IceCube-Collaboration — III. Physikalisches Institut B, RWTH Aachen

The IceCube Neutrino Observatory, located at the geographic South Pole, measures neutrinos and antineutrinos produced in cosmic-ray showers in the atmosphere. Neutrinos and antineutrinos cannot be distinguished on an event-to-event basis within IceCube, but follow different distributions of the inelasticity parameter y in deep inelastic scattering. We present first results from a novel analysis, based on a new reconstruction of y with machine-learning methods, which measures the energy dependent $\nu\bar{\nu}$ flux ratio between 50 GeV and 300 GeV.

T 55.8 Mi 18:00 S06
ORCA sensitivity to ν_τ appearance — •Lukas Maderer for

the KM3NeT-ECAP-Collaboration — ECAP / Universität Erlangen-Nürnberg

The deep-sea neutrino detector KM3NeT/ORCA is optimized to study oscillations of atmospheric neutrinos in the few-GeV energy range. Apart from the primary science goal of ORCA - to resolve the neutrino mass hierarchy - the detector will be sensitive to the ν_τ flux developing from oscillations from a purely ν_μ and ν_e atmospheric flux along its passage through the Earth. Precise measurements of the ν_τ flux normalization facilitate the investigation of deviations from the expected unitarity of the PMNS matrix.

The upcoming installation of its first detector strings (about 5% of full detector with 115 strings) will already provide considerable atmospheric neutrino statistics with about 450 detected ν_τ events per year. This talk will present performance studies of a 7-string ORCA array and its sensitivity to exclude ν_τ non-appearance within the first months of operation.

T 55.9 Mi 18:15 S06

Effect of different host material for implantation of ^{163}Ho in metallic magnetic calorimeters — •Martin Neidig, Benjamin Raach, Christian Enss, Andreas Fleischmann, Loredana Gastaldo, Sebastian Kempf, Federica Mantegazzini, and Clemens Velte for the ECHo-Collaboration — Kirchhoff Institute for Physics, Heidelberg University

The ECHo experiment has been designed for determining the value of the effective electron neutrino mass by the analysis of the endpoint region of the ^{163}Ho spectrum. The measurement of the ^{163}Ho spectrum is performed using low temperature metallic magnetic calorimeters (MMCs) with ^{163}Ho enclosed in the absorber. To achieve high sensitivity, detector performance as energy and time resolution are fundamental. In the process of optimizing MMCs for ECHo we have tested different materials for hosting ^{163}Ho: gold, silver and aluminum. For that, high purity ^{163}Ho has been implanted at Mainz University in three different MMC arrays having different implantation layers.
We discuss the signal shape obtained with the different detectors as function of temperature as well as the energy resolution at the operating temperature of about 20 mK. In addition, we have also investigated if different host material could influence the decay mode for the electron capture in ^{163}Ho. We present the comparison of ^{163}Ho spectra acquired with the different detectors and discuss the results at the light of available theories.