T 40: Niederenergie-Neutrinophysik 2

Zeit: Montag 16:45–19:00 Raum: P106

Gruppenbericht T 40.1 Mo 16:45 P106

Results from Borexino phase I and future plans of the experiment — •Daniel Bick, Caren Hagner, Markus Kaiser, and Mikko Meyer for the Borexino-Collaboration — Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg

The Borexino experiment is a 300 t liquid scintillator detector designed for the realtime detection of solar neutrinos in the sub-MeV energy range located at the LNGS underground laboratory in Italy. This talk will give an overview of the results from the first phase of the experimental program including the measurement of ^{7}Be, ^{8}B and pep solar neutrinos as well as geoneutrinos.

An update will be given on phase II of Borexino, which has now begun, covering a rich variety of physics. This includes the challenging goal of measuring the CNO and pp solar neutrino flux.

T 40.2 Mo 17:05 P106

Update on the ^{8}B neutrino analysis in Borexino — •Simon Appel for the Borexino-Collaboration — TU München

Borexino is a liquid scintillator based real-time neutrino detector with a target mass of 278t, located at the Laboratori Nationali del Gran Sasso. Due to its low energy threshold of 100 keV, Borexino was able to perform the first real-time measurement of ^{7}Be neutrinos. Furthermore it is also sensitive to ^{8}B neutrinos, which is main topic of this talk. The ^{8}B analysis is limited to a lower energy threshold of 3 MeV by external gamma background. As the expected event rate is in the order of only 0.2-0.3 counts per day, it is crucial to have a profound knowledge of the different background sources. Especially radio-isotopes produced by muons are a major source of background for this analysis. To veto these events one has to identify cosmic muons crossing Borexino, which is realized with a water cherenkov veto in the outer detector and a pulse shape analysis in the inner detector. A time cut after each muon reduces background induced by comsogenically produced radio-isotopes. In the presented analysis it was possible to suppress all the backgrounds to a negligible value. This allows to detect solar ^{8}B neutrinos in Borexino and thus makes it possible to confirm the MSW-LMA solution. This talk will give an update on this analysis within the Borexino detector framework.

Gruppenbericht T 40.3 Mo 17:20 P106

The LENA neutrino observatory — •Björn Wonsak — Universität Hamburg — for the LENA working group

LENA (Low Energy Neutrino Astronomy) is a proposed 50 kt liquid scintillator detector, planed for the detection of low energetic neutrinos. Due to its low energy threshold, high energy resolution and its good background discrimination capabilities it features a very rich physics program. This includes the detection of solar and geoneutrinos, which will be recorded with unprecedented statistics thanks to the large target mass. Furthermore, LENA will provide a time, energy and flavour resolved analysis of the neutrinos from a possible galactic supernova and it is also sensitive to the diffuse supernova neutrino background.

In addition LENA is suited for studies of neutrino oscillations using atmospheric neutrinos or a long baseline beam. The latter case is part of the LAGUNA-LBNO design study. A Daedalus-like approach using several pion-decay-at-rest neutrino sources is also under investigation.

T 40.4 Mo 17:40 P106

Application of the Backtracking-Algorithm to muons in Borexino — •Dominikus Hellgartner, German Beischler, Timo Lewke, Randolph Möllenberg, Lothar Oberauer, Patrick Pfahler, Tobias Stempfle, Marc Tippmann, Jürgen Winter, and Vincenz Zimmer — for the LAGUNA-LENA working group — Technische Universität München, Physik Department E15, James Franck Straße, 85748 Garching

The backtracking algorithm was originally developed to reconstruct contained high energy neutrino events in the planned next-generation liquid-scintillator neutrino detector LENA. Simulations showed promising results for this detector.

To ensure that the algorithm also works on real data, it was applied to through-going cosmic muons in the Borexino detector. The angular resolution of the algorithm was found to be $(1.62 \pm 0.8)^\circ$, which is superior to the established tracking algorithms in Borexino. The lateral resolution is about 40 cm and therefore comparable with the existing tracking algorithms.

Furthermore, the backtracking algorithm can be extended to cover more complicated event types, which cannot be handled by the existing tracking algorithms. Examples for these events include muons which are stopped in the detector or two simultaneous muons.

This work was supported by the Maier-Leibniz-Laboratorium and by the DFG cluster of excellence 'Origin and Structure of the Universe'.

T 40.5 Mo 17:55 P106

Neue Experimente zur Klärung der Reaktorneutrinoanomalie — •Christian Buck, Antoine Collin und Manfred Lindner — MPIK Heidelberg

In den Reaktorneutrinoexperimenten der letzten Jahrzehnte wurde ein Neutrinofluss gemessen, der nur etwa 94% des theoretisch vorhergesagten Flusses entspricht. Die Ursache für diese als "Reaktoranomalie" bezeichnete Diskrepanz könnten Umwandlungen der Elektronantineutrinos in sterile Neutrinos sein, was weitreichende Konsequenzen für theoretische Modelle der Teilchenphysik und die Kosmologie hätte.

Mehrere Projekte haben sich zum Ziel gesetzt das Rätsel der Reaktorneutrinoanomalie zu lösen. Im Vortrag werden zwei dieser Experimente vorgestellt: Nucifer und Stereo. Das ursprüngliche Ziel des Nucifer Experiments am CEA Saclay in Frankreich war zu prüfen, ob Antineutrinodetektoren zur Reaktorüberwachung und im Kampf gegen die Verbreitung von Nuklearwaffen eingesetzt werden können. Der Nucifer Detektor hat bereits erste Neutrinodaten genommen. Durch Verbesserungen in der Abschirmung wird versucht die Sensitivität auf die Suche nach sterilen Neutrinos zu erhöhen.

Das Targetvolumen des Stereo Detektors wird mit etwa 2000 l eines Gadolinium beladenen Flüssigszintillators etwa doppelt so groß sein als in Nucifer. Die Neutrinoquelle in Stereo, ein mit 235-U angereicherter Reaktorkern mit 58 MW Leistung, befindet sich in etwa 8 m Entfernung vom Detektor am ILL Grenoble, Frankreich. Umwandlungen in sterile Neutrinos würden sich in Deformationen im Energiespektrum zeigen, die in den sechs Detektorkammern unterschiedlich stark wären.

Gruppenbericht T 40.6 Mo 18:10 P106

The Double Chooz Experiment — •Stefan Schoppmann for the Double Chooz-Collaboration — III. Physikalisches Institut B, RWTH Aachen University

The Double Chooz experiment is a reactor neutrino disappearance experiment located in Chooz, France. It consists of two identical liquid scintillator detectors and measures the electron-antineutrino flux of two nuclear reactors located at the Chooz nuclear power plant. The 1 km distant far detector started operation in 2011. It was upgraded end of 2013 and is now recommissioned. The 400 m distant near detector is currently under construction and expected to start operation in mid 2014.

The aim of the Double Chooz experiment is the precise measurement of the neutrino mixing angle θ_{13}, a neutrino oscillation parameter. The reactor neutrinos are detected by the signature of an inverse beta decay (IBD). The IBD-produced neutrons can be captured by Gadolinium or Hydrogen, which provides two independent data samples. Both samples allow the utilisation of the neutrino rate and energy spectral shape information, as this information is extracted from the spectrum of the IBD-produced positrons.

This contribution provides an overview of the recently performed work done on both detectors. Furthermore, it reviews the latest results of the experiment.

T 40.7 Mo 18:30 P106

^{9}Li & ^{8}He Contamination in the Hydrogen Capture Neutrino Sample in Double Chooz — •Lee F F Stokes, Josef Jochum, Tobias Lachenmaier, Michael Wurm, and Markus Röhling for the Double Chooz-Collaboration — Physikalisches Institut, Universität Tübingen

Double Chooz is a reactor $\overline{\nu}_e$ disappearance experiment whose aim is to measure the neutrino mixing angle θ_{13}. Along with the two competing reactor experiments Daya Bay and RENO, Double Chooz searches for a prompt positron signal followed by a delayed neutron capture on gadolinium.

Whilst our competitors have at least a far and near detector, Double

Chooz is limited to data taking with the far detector only whilst the near detector is under construction. To compete, Double Chooz has increased the number of neutrino candidates at its disposal by using neutrinos whose delayed neutron capture is on hydrogen and has as a result published a θ_{13} measurement using the hydrogen capture analysis only.

In the framework of the hydrogen analysis, the second largest component of the background after the accidentals is the cosmogenic contribution from the decay of ^{9}Li and ^{8}He. I will show a preliminary look at the analysis dedicated to finding this component in the hydrogen capture neutrino sample.

T 40.8 Mo 18:45 P106

Bestimmung des optimalen Zeitfensters für das Double Chooz-Myonenveto — Josef Jochum, Tobias Lachenmaier, •Markus Röhling, Lee Stokes, Alexander Tietzsch und Michael Wurm für die Double Chooz-Kollaboration — Physikalisches Institut, Universität Tübingen

Ziel des Double Chooz-Experimentes, das seit April 2011 mit einem Detektor Daten nimmt, ist es den Neutrinomischungswinkel Θ_{13} zu messen. Für die hierzu notwendige Präzision ist eine genaue Kenntnis des myoninduzierten Untergrundes, speziell schneller Neutronen und Spallationsprodukte, unerlässlich. Aus diesem Grund werden beide Double Chooz-Detektoren ein aktives, auf Flüssigszintillator basierendes Veto besitzen.

In diesem Vortrag soll gezeigt werden, wie die Vetozeit nach Myondurchgang durch systematische Studien der myoninduzierten Ereignisse bestimmt wurde, ein Vergleich zwischen Myonsimulation und Daten vorgestellt, sowie der Aufbau des Vetos des nahen Detektors präsentiert werden.