HK 33: Astroparticle Physics 1

Time: Tuesday 17:00–19:00 Location: P/H2

Group Report HK 33.1 Tue 17:00 P/H2

Sterile neutrino search with SOX/Borexino — •Birgit Neumair — for the SOX/Borexino Collaboration. Physik-Department E15, Technische Universität München, Germany

In the last years, several neutrino oscillation experiments reported results not compatible within the 3-neutrino model, which hint to the existence of light sterile neutrinos. To test this hypothesis, the SOX (Short distance neutrino Oscillations in BoreXino) experiment will search for oscillations from active to sterile neutrinos by placing radioactive electron (anti-)neutrino sources underneath the Borexino detector. Oscillations will be observed via a reduction of the detected interaction rate of the electron(anti-)neutrinos and an oscillatory pattern as a function of the neutrino energy and travelled distance. The talk will give an overview of the project and of the expected discovery potential for a 10MCi ^{51}Cr neutrino and a 100kCi ^{144}Ce antineutrino source.

This work is supported by the DFG cluster of excellence "Origin and Structure of the Universe".

Group Report HK 33.2 Tue 17:30 P/H2

Latest results from the Borexino experiment and future CNO-cycle analysis — •Jan Thurn[1] and the Borexino collaboration[2,3] — [1]Technische Universität Dresden — [2]INFN, Italy — [3]Laboratori Nazionali del Gran Sasso, Assergi, Italy

The sun is producing energy through a sequence of nuclear processes. The majority of the energy comes from the so called pp-chain where protons are merged into helium. Neutrinos named by their originating reactions are produced in several steps of this sequence. Besides the pp-chain, the CNO-cycle is considered responsible of ~1% of the total energy produced in the Sun. According to the standard astrophysics this cycle should be dominant in heavy stars. It is still unclear whether this cycle is present in our sun and how large is its contribution is, especially related to the so called 'metalliticity' problem. Differently from photons that travel about 100 000 years from the core of the sun to outside being scattered all the way, neutrinos (thanks to their weakly interacting nature) are giving a clearer signal for studying these reactions. The Borexino experiment, a low background sub-MeV neutrinos detector - by measuring the pp, pep, 7Be and 8B neutrino spectra and giving the only current limit on the CNO-neutrino flux - is one of the leading experiments in the solar neutrino physics. In this talk the latest results are presented, together with a roadmap for the next steps of solar neutrino analysis concerning the improvement of the CNO-cycle detection techniques

HK 33.3 Tue 18:00 P/H2

First Penning-trap mass measurement of the electron capture nuclide ^{163}Ho and its daughter ^{163}Dy for the ECHO project — •Fabian Schneider and the TRIGA-SPEC Collaboration for the ECHo-Collaboration — Institut für Kernchemie und Institut für Physik, Johannes Gutenberg-Universität Mainz

The ECHo (**E**lectron **C**apture of ^{163}**Ho**) project aims to determine the mass of the electron neutrino by measuring the calorimetric spectrum of ^{163}Ho. To be able to extract the neutrino mass from the spectrum near the endpoint a precise knowledge of the decay Q-value is necessary. The ideal way to measure this in a model independent way is by high-precision Penning-trap mass spectrometry.

The ECHo collaboration has ^{163}Ho samples available, which were produced by reactor neutron irradiation. Such samples are typically highly contaminated with radioactive and stable species. These were efficiently removed by chemical purification. Ionization by laser ablation allows high-precision Penning-trap mass measurements with sample sizes of 10^{16} atoms. From the measured cyclotron frequency ratio of ^{163}Ho^{16}O$^+$ to ^{163}Dy^{16}O$^+$ we determined the Q-value to be 2.5(7) keV. In addition absolute mass measurements using carbon cluster ions as reference were performed with an uncertainty two times lower than literature values.

Future measurements at SHIPTRAP (GSI, Darmstadt) and PENTATRAP (MPIK, Heidelberg) are planned with the aim to drastically improve the uncertainty of the Q-value down to a few eV and thus providing the required input for the ECHo project.

HK 33.4 Tue 18:15 P/H2

Messungen mit einer winkelselektiven Elektronenquelle am KATRIN-Hauptspektrometer — •Jan David Behrens für die KATRIN-Kollaboration — Institut für Kernphysik, Wilhelm-Klemm-Str. 9, 48149 Münster

Durch das **KA**rlsruhe **TRI**tium **N**eutrino-Experiment soll die Masse des Elektron-Antineutrinos mit einer Sensitivität von 200 meV/c^2 (90% C.L.) vermessen werden. Die Vermessung der Form des Tritium-β-Spektrums im Endpunktbereich ermöglicht eine modellunabhängige Bestimmung dieses wichtigen Parameters.

Die Energieanalyse der Zerfallselektronen erfolgt beim KATRIN-Experiment in einem elektrostatischen Spektrometer, das nach dem Prinzip des MAC-E-Filters arbeitet. Zur Charakterisierung des Spektrometers wird eine monoenergetische und winkelselektive Elektronenquelle benötigt, um unter anderem die Transmissionseigenschaften zu untersuchen.

An der WWU Münster wurde eine solche Photoelektronenquelle entwickelt, in der Elektronen mit geringer Linienbreite und definiertem Winkel zu den magnetischen Feldlinien aus einer mit UV-Licht beleuchteten Silberkathode emittiert und beschleunigt werden. Der Vortrag stellt den Aufbau der Photoelektronenquelle sowie Resultate der Messungen am Monitor- und am Hauspektrometer des KATRIN-Experiments vor.

Dieses Projekt wird unter dem Kennzeichen 05A11PM2 durch das BMBF gefördert.

HK 33.5 Tue 18:30 P/H2

Commissioning and first measurements with the *post regulation* for the high voltage system of the KATRIN-experiment — •Oliver Wack for the KATRIN-Collaboration — IKP,KIT,Karlsruhe,Germany

The Karlsruhe Tritium Neutrino-Experiment KATRIN will measure the endpoint energy region of the tritium β -decay spectrum to determine the mass of the electron antineutrino with a sensitivity of about $200meV/c^2$. Therefore the principle of a MAC-E-filter spectrometer will be used. The retarding potential up to -35kV has to achieve a stability of at least 3ppm. For this two high precision voltage dividers in addition with high precision digital voltmeters will be monitoring the high voltage in parallel with another MAC-E-filter type spectrometer formerly used in the Mainz-Experiment.

This talk will give a brief introduction in the problem of electromagnetic disturbances coupling into the spectrometer resulting in AC noise in the retarding potential. It will also cover the hardware solution, the so called *post regulation* and the first measurements during the second main spectrometer commissioning phase.

HK 33.6 Tue 18:45 P/H2

Messungen der Transmissionseigenschaften des KATRIN Hauptspektrometers — •Moritz Erhard — Karlsruher Institut für Technologie (KIT), Institut für experimentelle Kernphysik (IEKP)

Ziel des Karlsruher Tritium Neutrino Experiments ist es, durch eine Endpunktsuntersuchung des β-Zerfallsspektrums von Tritium die effektive Masse des Elektronantineutrinos direkt und modellunabhängig mit einer Sensitivität von 200 meV/c^2 (90% CL) zu bestimmen. Um diese hohe Sensitivität zu erreichen wird das KATRIN Hauptspektrometer mit dem MAC-E-Filter (Magnetic Adiabatic Collimation followed by Electrostatic Filter) Prinzip betrieben.

Die Kenntnis der genauen Transmissionseigenschaften des Hauptspektrometers ist für die spätere Interpretation der Tritiumdaten und Extraktion der Neutrinomasse von großer Wichtigkeit.

In der aktuellen Messphase wurden Messungen mit einer Elektronenkanone durchgeführt die weitere Daten zur Bestimmung der Transmissionseigenschaften liefern die in diesem Vortrag präsentiert werden.

Gefördert durch das BMBF unter Kennzeichen 05A11VK3 und die Helmholtz-Gemeinschaft.