HK 3: Fundamentale Wechselwirkungen

Zeit: Montag 14:00–16:00 Raum: 2B

Gruppenbericht HK 3.1 Mo 14:00 2B

Auf dem Weg zu Antiwasserstoff in Ruhe — •Walter Oelert für die ATRAP-Kollaboration — IKP, Forschungszentrum Jülich GmbH, 52425 Jülich, Germany

Experimente zum Vergleich physikalischer Observablen von Antiwasserstoff und Wasserstoff durch Präzisionsspektroskopie sind die Chance, einen sehr genauen, modellunabhängigen Test der CPT – Invarianz durchzuführen. Die ATRAP–Kollaboration hat sich zum Ziel gesetzt, Antiwasserstoff in Ruhe zu produzieren und die Spektroskopie an diesem mit der von Wasserstoffatomen zu vergleichen. Langfristiger sind Untersuchungen zur Gravitationswechselwirkung zwischen Materie und Antimaterie geplant.

Mit ATRAP-II steht der Kollaboration nun ein umfangreiches und kompaktes Experimentiergerät zur Verfügung, das vorgestellt werden wird.

Die erzeugten Antiwasserstoff–Atome sollen in einer magnetischen Falle gespeichert werden, wodurch eine lange Wechselwirkungszeit mit Laserstrahlen erreicht wird und nur so die Spektroskopie mit der vergleichsweise äußerst geringen Anzahl von Atomen überhaupt ermöglicht wird.

Der Status des ATRAP Experimentes zur Erzeugung von Antiwasserstoff–Atomen in der Umgebung der nicht homogenen Magnetfelder einer magnetischen Falle wird dargestellt und die neuesten Ergebniss werden diskutiert werden.

HK 3.2 Mo 14:30 2B

Collimation of ultra-cold neutrons with diffuse channels — •Philipp Schmidt-Wellenburg[1,2], Peter Geltenbort[1], Jan Jakubek[3], Valery Neshvizevsky[1], Michal Platkevic[3], Christian Plonka[1], Torsten Soldner[1], and Oliver Zimmer[1,2] — [1]Institut Laue Langevin, BP 156, 38042 Grenoble, France — [2]Physik Department E18, Technische Universität München, 85748 Garching, Germany — [3]Czech Technical University in Prague, Institute of Experimental and Applied Physics, CZ-12800 Prague 2 - Albertov, Horska 3a/22, Czech Republic

Semidiffuse and diffuse channels have been tested in the framework of the development of a dedicated ultra-cold neutron (UCN) source for the new gravitational spectormeter GRANIT at the ILL. In this talk we present first results of this method to extract a collimated beam of (UCN) from a storage vessel. Neutrons with too large divergence are not removed from the beam by an absorbing collimation, but a diffuse or semidiffuse channel with high Fermi potential reflects them back into the vessel. This avoids unnecessary losses and keeps the storage time high, which may be beneficial when the vessel is part of a UCN source with long buildup time of a high UCN density. A UCN detector with high spatial resolution was used for detection of the beam divergence.

HK 3.3 Mo 14:45 2B

Production and extraction of ultra-cold neutrons from a superfluid helium converter — Philipp Schmidt-Wellenburg[1,2], Martin Assmann[2], Kristian Baumann[2], Martin Fertl[2], Beatrice Franke[2], Jens Klenke[5], Sergei Mironov[1,2,3], Christian Plonka[1], •Dennis Rich[5], Ben van den Brandt[4], Hans-Friedrich Wirth[2], and Oliver Zimmer[1,2] — [1]Institut Laue Langevin, BP 156, 38042 Grenoble, France — [2]Physik Department E18, Technische Universität München, 85748 Garching, Germany — [3]Laboratory of Nuclear Problems, JINR, Dubna, Moscow Region 141980, Russia — [4]Paul Scherrer Insitut, CH-5232 Villingen PSI, Switzerland — [5]Forschungsreaktor München FRM II, Lichtenbergstrasse 1, 85747 Garching, Germany

We have successfully extracted ultra-cold neutrons (UCN) from a converter volume filled with superfluid helium. This window free extraction permits high precision experiments with UCN at room temperature and in vacuum. This talk will present recent results obtained at the Munich research reactor and give an overview of the source development project at the Institut Laue Langevin.

HK 3.4 Mo 15:00 2B

Structural and dynamical properties of solid deuterium as UCN converter material — •Markus Urban[1], Erwin Gutsmiedl[1], Axel Müller[1], Andreas Frei[1], Stephan Paul[1], Christoph Morkel[1], Helmut Schober[2], Stephane Rols[2], and Tobias Unruh[3] — [1]TU München — [2]ILL, Grenoble — [3]FRM-II, München

Ultracold neutrons (UCN) are the most promising candidates to determine the neutrons lifetime and electric dipole moment. With less than 300neV they have such little energy, that they can be confined in material containers and kept there for several hundred seconds for experiments. UCN can be produced from thermal or cold neutrons via downscattering in a solid deuterium converter.

From prototype UCN sources we know that the solid deuterium converter's efficiency strongly depends on the specific way of crystal-preparation. Especially the freezeout process and temperature cycling (annealing) can improve the UCN output significantly. This is more or less phenomenologically observerd, but not really understood if the physical effect behind is of structural or dynamical nature.

Therefore we systematically measured the scattering function $S(\mathbf{Q},\omega)$ of solid deuterium with the TOFTOF time-of-flight spectrometer at the FRM-II and with the IN4-spectrometer at the ILL for different D_2 samples, frozen in different manners, at different para-/ortho ratios and temperatures and before and after annealing.

In this talk some preliminary results are presented. Supported by DFG, BMBF, MLL and Cluster of Excellence Exc153.

HK 3.5 Mo 15:15 2B

Characterization of a solid deuterium ultracold neutron source by the time of flight method — •Thorsten Lauer[1], Igor Altarev[3], Andreas Frei[3], Erwin Gutsmiedl[3], Gabriele Hampel[1], Werner Heil[2], Jens Volker Kratz[1], Stephan Paul[3], Youri Sobolev[1], and Norbert Wiehl[1] — [1]Institut für Kernchemie, Universität Mainz — [2]Institut für Physik, Universität Mainz — [3]Physik Department E18, TU München

Recently, a prototype of an ultra cold neutron (UCN) source with a solid deuterium converter has been taken into operation at the tangential beamtube C at the reactor TRIGA Mainz. To characterize the solid deuterium converter performance, the time of flight method with a three disc chopper was succesfully used at a constant reactor power of 100kW . Results of these measurements will be presented. Based on these experiences, an upgraded UCN source will be in operation from 2008 on at the radial beamtune D.

HK 3.6 Mo 15:30 2B

Results and present status of the spectrometer *a*SPECT — •Fidel Ayala Guardia[1], Heinz Angerer[2], Stefan Baessler[3], Michael Borg[1], Klaus Eberhardt[4], Ferenc Glück[1], Werner Heil[1], Igor Konorov[2], Gertrud Konrad[1], Raquel Munoz Horta[1], Gerd Petzoldt[2], Martin Simson[2], Yury Sobolev[1], Hans-Friedrich Wirth[2], and Oliver Zimmer[2] — [1]Institut für Physik, Universität Mainz — [2]Physik Department, Technische Universität München — [3]Department of Physics, University of Virginia, Charlottesville, USA — [4]Institut für Kernchemie, Universität Mainz

The aim of the *a*SPECT spectrometer is a precise measurement of the proton recoil spectrum in free neutron decay. For kinematic reasons, the shape of the proton spectrum depends on the angular correlation coefficient between the momenta of the electron antineutrino and the electron, a. An accurate measurement of the angular correlation coefficient a is of great interest in order to test the unitarity of the Cabibbo Kobayashi Maskawa Matrix (CKM-Matrix).

A first test beam time was performed during 2005/06 at the beam line MEPHISTO at the neutron research reactor FRM-II in Garching. Results of the data analysis as well as the present status of the *a*SPECT spectrometer will be presented in this talk.

HK 3.7 Mo 15:45 2B

Experiment PERKEO III and weak magnetism form factor in polarized neutron decay — •Bastian Märkisch[1], Hartmut Abele[1], Dirk Dubbers[1], Felix Friedl[1], Alexander Kaplan[1], Alexandre Petoukhov[2], Marc Schumann[3], Torsten Soldner[2], and Daniel Wilkin[1] — [1]Universität Heidelberg — [2]Institut Laue-Langevin, Grenoble, Frankreich — [3]Rice University, Houston, USA

The decay of free neutrons offers unique insight into the weak interaction at low energies and allows high precision tests of the Standard Model. In the past two years we have measured improved values for the beta-asymmetry A and the neutrino-asymmetry B, and, for the first time, have measured the proton-asymmetry C in neutron decay. The new spectrometer Perkeo III now offers increased statistics by two orders of magnitude compared to its predecessor Perkeo II. With this precision it is now possible to directly measure the underlying structure of the weak interaction of semileptonic decays.

In a first run 2007 at the Institute Laue-Langevin we aimed to measure the weak magnetism prediction of electroweak theory, which results in an energy dependent correction on the beta asymmetry A coefficient. Weak magnetism mirrors the fact that in the Standard Model the electric and weak currents are united in one isotriplet. Therefore weak magnetism is a strong pillar of electroweak unification and weak magnetism form factor is directly related to the difference of the magnetic moments of the proton μ_p and the neutron μ_n.

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