HK 10: Precision Tests of the Standard Model 1

Time: Monday 17:00–19:00 Location: K/HS1

Group Report HK 10.1 Mon 17:00 K/HS1

Development and status of the MAGIX experiment — •Sabato Stefano Caiazza — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Germany

One of the most relevant energy scales to solve several scientific puzzles in modern nuclear and particle physics is that between 10 and 100 MeV. For example, in this energy range, we might find a solution of the g-2 discrepancy and we can perform more precise measurements to address the proton radius puzzle.

To perform competitive research in any of those fields it is very important to have a dedicated machine with an high performance experiment, optimized for its environment. We will , therefore, present the status and the development plans of the MAGIX (MesA Gas Internal target eXperiment) experiment, currently under design, to be installed on the Mainz energy recovery superconductive accelerator (MESA) recirculating beam. This experiment features a high resolution, twin-arm magnetic spectrometer, interfaced without windows with an internal gas target and will be completed in the upcoming years.

Group Report HK 10.2 Mon 17:30 K/HS1

The Ultra-Cold Neutron Laboratory at the FRM II — •Stephan Wlokka[1], Andreas Frei[1], Peter Fierlinger[2], and Stephan Paul[2] — [1]Forschungs-Neutronenquelle Heinz Maier-Leibnitz (FRM II), Technische Universität München, Lichtenbergstraße 1, D-85748 Garching — [2]Physik-Department E18, Technische Universität München, James-Franck-Straße 1, D-85748 Garching

Ultra-cold neutrons (UCN) are neutrons which are totally reflected from a given material surface. Typical energies of UCN are below 300 neV and velocities below 8 $\frac{m}{s}$. Thus they can be stored in material or magnetic bottles for several hundreds of seconds. As such, UCN are excellent laboratories to study fundamental parameters, e.g. the free neutron lifetime or the electric dipole moment of the neutron.

At the Forschungs-Neutronenquelle Heinz Maier-Leibnitz (FRM II) a new source for UCN is currently being built. This talk will give an overview over the experimental facilities foreseen for this new source, aswell as the current efforts for a complete test setup at the Maier-Leibnitz-Labor (MLL).

The talk will also highlight a current experiment designed to study the irradiation effects on solid Deuterium during the operation of the UCN source.

This work was funded by the DFG Excellenz-Cluster EXC153 "Origin and Structure of the Universe" and the Maier-Leibnitz-Laboratorium (MLL) of the TU and LMU Munich.

HK 10.3 Mon 18:00 K/HS1

Detector studies for a high precision determination of the weak mixing angle at the future P2-experiment in Mainz — •Kathrin Gerz[1], Sebastian Baunack[1], Dominik Becker[1], Jürgen Diefenbach[1], Boris Gläser[1], Yoshio Imai[1], Thomas Jennewein[1], Frank Maas[1,2,3], and David Rodriguez[2] for the A4-Collaboration — [1]Institut für Kernphysik, Johannes-Gutenberg-Universität Mainz — [2]Helmholz-Institut Mainz — [3]PRISMA Cluster of Excellence, Johannes Gutenberg-Universität, 55099 Mainz

The P2 experiment at the upcoming MESA accelerator in Mainz aims for a high precision determination of the electroweak mixing angle:

The 2% measurement of the parity violating asymmetry in elastic electron-proton scattering will allow for a determination of $sin^2(\theta_W)$ of 0.15%. The experimental setup is currently being designed and will employ the use of an integrating, large solid angle magnetic solenoid spectrometer with quartz bars for the detection of elastically scattered electrons.

The low-energy and high-statistics experiment places high demands on detector performance and radiation hardness of all materials used in the setup.

We are going to present the current status of the development of the experiment, feasibility calculations and simulations. We will put an emphasis on technology and design of a Cherenkov detector.

HK 10.4 Mon 18:15 K/HS1

The neutron lifetime experiment PENeLOPE — •Wolfgang Schreyer for the PENeLOPE-Collaboration — Technische Universität München

The neutron lifetime $\tau_\text{n} = 880.3 \pm 1.1$ s is an important parameter in the Standard Model of particle physics and in Big Bang cosmology. Several systematic corrections of previously published results reduced the PDG world average by several σ in the last years and call for a new experiment with complementary systematics.

The experiment PENeLOPE, currently under construction at the Physik-Department of Technische Universität München, aims to determine the neutron lifetime with a precision of 0.1 s. It will trap ultra-cold neutrons in a magneto-gravitational trap using a large superconducting magnet and will measure their lifetime by both neutron counting and online proton detection. This presentation will give an overview over the latest developments of the experiment.

The project is supported by the Maier-Leibnitz-Laboratorium (Garching), the Deutsche Forschungsgemeinschaft and the Excellence Cluster "Origin and Structure of the Universe".

HK 10.5 Mon 18:30 K/HS1

CsI-Silicon heavy-ion telescope for storage rings — •Mohammad Ali Najafi[1,4], Iris Dillmann[2,3,4], Fritz Bosch[2], Michael Böhmer[1], Thomas Faestermann[1], Bingshui Gao[2], Roman Gernhäuser[1], Christophor Kozhuharov[2], Sergey A Litvinov[2], Yuri A Litvinov[2], Ludwig Maier[1], Fritz Nolden[2], Ulrich Popp[2], Mohammad Shahab Sanjari[2], Uwe Spillmann[2], Markus Steck[2], Thomas Stöhlker[2], and Helmut Weick[2] — [1]TU München — [2]GSI Darmstadt — [3]TRIUMF Vancouver — [4]JLU Giessen

A multi-purpose particle detector was developed for heavy-ion experiments at the ESR in GSI Darmstadt, and also as a prototype for future ILIMA and EXL experiments at FAIR. The detector was designed and developed at the TU München, and was used successfully for the measurement of the decay rate of ^{142}Pm ions in October 2014. The detector has an active area of 60×40 mm^2 and includes a stack of six silicon pad detectors, a DSSD, and a CsI scintillator (24×24×10 mm^3) that stops the beam after a passive degrader. The excellent resolution of the detector allows an unambiguous identification of the incident particles. The relative resolution (FWHM) of the detector is 1% for the energy deposit (ΔE), and 0.9% for the residue energy (E_{csi}), and 0.8% for the total summed energy. We report on the design, development, and the preliminary results from the experiment.

This project was funded by the Helmholtz Association via the Young Investigators Grant VHNG 627 and the Germany BMBF via the project 05P12RGFNJ-06GI7118.

HK 10.6 Mon 18:45 K/HS1

Messung des Wirkungsquerschnittes für ^{x}Ge(n,jn)^{68}Ge Reaktionen mit quasi monoenergetischen Neutronen im Energiebereich 20..100 MeV — •Alexander R. Domula[1], Andy Buffler[2], Emmanael Musonza[3], Ralf Nolte[3], F.D. Smit[4], Peane Maleka[4], Anton Wallner[5] und Kai Zuber[1] — [1]TU-Dresden, Dresden, Germany — [2]UCT, Cape-Town, South Africa — [3]PTB, Braunschweig, Germany — [4]iThemba LABS, Somerset West, South Africa — [5]VERA Laboratory, Vienna, Austria

Die Suche nach dem neutrinolosen Doppelbetazerfall ist ein großes Ziel der modernen Physik. Großexperimente wie GERDA oder MAJORANA untersuchen diesen besonders seltenen Zerfall am Germaniumisotop ^{76}Ge. GERDA untersucht diesen Zerfall mit HP-Ge-Kristallen aus angereichertem Germanium, die in flüssigem Argon betrieben werden. Der Messuntergrund, insbesondere die Aktivierung von Detektorkomponenten durch kosmogene Neutronen, spielt bei solchen Experimenten eine zentrale Rolle. Für den Messuntergrund in GERDA ist ^{68}Ge ein problematisches Nuklid, das durch Reaktionen mit schnellen, kosmogenen Neutronen in den HP-Ge Kristallen selbst erzeugt wird.

Im Rahmen von Untergrundstudien werden die Wirkungsquerschnitte für die erzeugenden ^{x}Ge(n,jn)^{68}Ge Reaktionen im dafür interessanten Energiebereich En=20..100 MeV durch Nutzung der Aktivierungssondentechnik mit quasi-monoenergetischen Neutronen gemessen. Die Messung des Wirkungsquerschnittes ^{70}Ge(n,3n)^{68}Ge bei En=35,9 MeV im Beschleunigerlabor iThemba LABS (Südafrika) wird vorgestellt.