HK 24: Fundamental Symmetries I

Zeit: Dienstag 14:00–16:15 Raum: F 073

Gruppenbericht HK 24.1 Di 14:00 F 073

Precision Measurement of the Beta Asymmetry in Neutron Beta Decay with Perkeo III — •Heiko Saul[1,2], Hartmut Abele[2], Dirk Dubbers[3], Bastian Märkisch[1], Alexandr Pethukov[4], Christoph Roick[1], Ulrich Schmidt[3], Torsten Soldner[4], Xiangzun Wang[2], and Dominik Werder[3] — [1]Physik Department, TU München — [2]Atominstitut, TU Wien — [3]Physikalisches Institut, Universität Heidelberg — [4]Institut Laue-Langevin, Grenoble

Neutron beta decay is described accurately within the standard model of particle physics using the first CKM-matrix element, V_{ud}, and the ratio of vector and axial vector couplings, λ, as parameters. Angular correlations, spectra and the neutron lifetime are accessible experimentally, providing an excellent toolkit for investigating the structure of weak interaction.

Measuring the Beta Asymmetry, A, is the most precise way of determining λ, which is an important standard model parameter and necessary for the determination of V_{ud} from Neutron Decay. Moreover it allows to derive limits on non-standard model couplings by combining with measurements of other correlation coefficients.

In this talk we present the most precise measurement of the Beta Asymmetry performed with the decay spectrometer Perkeo III carried out at the PF1B cold neutron beam facility at the Institut Laue-Langevin. We discuss the result and its implications.

Gruppenbericht HK 24.2 Di 14:30 F 073

Parity violation in the 2s-1s muonic X-ray transition — •Frederik Wauters — Johannes Gutenberg University of Mainz, Germany

Negative muons at rest get captured by nearby atoms in highly exited atomic states. These muonic atoms subsequently de-exite via radiative and Auger transitions until the muon ends up in the 1s orbital. Due to the substantial overlap between the muon wave function and the nucleus, muonic X-rays are extremely sensitive to short range interactions. For example, weak neutral currents will mix the opposite parity 2p and 2s atomic states, leading to parity violation in the 2s-1s transition. Recent anomalies in precision muon data suggest new physics which may amplify this effect. A ongoing effort at the Paul Scherrer Institute (Switzerland) aims at measuring atomic parity violating in muonic X-rays for the first time for nuclei around Z=30. As a first step, we will make use of coincidences in the muonic X-ray cascade to suppress the background for the 2s-1s transition, utilizing high granularity, large solid angle germanium detectors. Once a clear 2s-1s signal above background is achieved, our goal for 2017, a full atomic parity violation experiment can be developed.

Gruppenbericht HK 24.3 Di 15:00 F 073

Recent Progress of the JEDI Collaboration — •Martin Gaisser on behalf of the JEDI collaboration — III. Physikalisches Institut B, RWTH Aachen University

The CP violation known from the Standard Model is not sufficient to describe the observed matter over anti-matter dominance in our universe. Electric Dipole Moments (EDMs) of elementary particles, including hadrons, are one of the most powerful tools to search for additional CP violation. Up to now experiments concentrated on neutral systems, namely neutron, atoms and molecules. Storage rings offer the possibility to measure EDMs of charged particles. The Jülich Electric Dipole Moment Investigation (JEDI) collaboration intends to measure the electric dipole moment of charged hadrons. The talk describes the experimental challenges and recent progress made at the COoler SYnchrotron (COSY) in Jülich.

HK 24.4 Di 15:30 F 073

Status of the PERC Instrument — •Bastian Märkisch for the PERC-Collaboration — Physik-Department, Technische Universität München

Neutron beta decay is an excellent system to study the charged weak interaction experimentally. The decay is precisely described by theory and unencumbered by nuclear structure effects. Observables are numerous correlation coefficients which e.g. relate the spin of the neutron and the momenta of the particles, spectra and the neutron lifetime. Most importantly, precision measurements in neutron beta decay are used to investigate the structure of the weak interaction and to derive the element Vud of the Cabibbio-Kobayashi-Maskawa matrix.

The Proton Electron Radiation Channel instrument, which is currently under construction at the FRM, Garching, is designed to improve measurements of several correlation coefficients by an order of magnitude. In this talk, we will briefly present the concept of the instrument as well as its current status.

HK 24.5 Di 15:45 F 073

Studien zum Energiespektrum von Betazerfällen mit PIPS Detektoren — Kai Zuber, Alexander Robert Domula und •Jan Thurn — IKTP TU Dresden

Die Übergangsmatrixelemente für verbotene Betazerfälle sind maßgeblich von dem benutzten Modell zur Beschreibung des Übergangs abhängig. Die aktuellen Kernmodelle sind jedoch vom gewählten (A,Z)-Bereich abhängig. Weitere experimentelle Ansätze und Messungen können somit zur Verbesserung der vorliegenden Modelle beitragen. Des weiteren kann die Verbesserung der Kenntnis der Energiespektren zu präziseren Aussagen in der Neutrino und Astroteilchenphysik führen.

Zu diesem Zweck wurde ein Setup basierend auf PIPS-Detektoren für die Messung von Betazerfallsspektren mit Quellen niedriger Aktivität entwickelt. Mit diesem wurden erste Messungen der Zerfallsspektren von Si-31 und Bi-210, welches eine wesentliche Rolle als Nuklid in den Untergrundmodellen von Experimenten mit solaren Neutrinos einnimmt, durchgeführt. Erste Ergebnisse zu den durchgeführten Messungen und dem Aufbau der Kammer werden präsentiert.

HK 24.6 Di 16:00 F 073

Studies of cosmogenic neutron activation of natural Tellurium — •Steffen Turkat, Alexander Domula, Valentina Lozza, and Kai Zuber — TU Dresden, Institut für Kern- und Teilchenphysik, Germany

Due to its relative natural abundance of 34.08 % and its high Q-Value of 2.53 MeV, the radionuclide ^{130}Te is a perfect candidate for studying the neutrinoless double beta decay ($0\nu2\beta$). This isotope is currently selected by two experiments: CUORE and SNO^{+}. Important backgrounds for the $0\nu2\beta$ searches are the long-lived, high Q-value isotopes which can be produced by the activation of the target material by high-energetic cosmic neutrons during the period it spends on surface (like during transport). An example is ^{124}Sb. Due to its high Q-value this radionuclide would create a background signal in the expected region of the neutrinoless double beta decay of ^{130}Te.

An experiment at iThemba LABS in South Africa was performed irradiating Tellurium probes by a neutron beam. The emitted gamma spectra of the activated probes were measured using high purity Germanium Detectors.

This talk will describe the analysis of the collected gamma spectra with the extraction of both short- and long-lived radionuclides. The Germanium detectors are fully characterized comparing data to Monte-Carlo Simulations. Additionally, correction factors for summation and for the geometry are obtained. Average cross section values have been extracted and compared to theoretical predictions.