HK 51: Instrumentation XVI

Zeit: Donnerstag 14:00–15:15 Raum: HZO 90

Gruppenbericht HK 51.1 Do 14:00 HZO 90

The neutron lifetime experiment PENeLOPE — •Dominic Gaisbauer — TU München Physik E18, 85748 Garching, Deutschland

The neutron lifetime 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 Sigma 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 51.2 Do 14:30 HZO 90

Compensation of a magnetic octupole field for the lifetime experiment τSPECT — •Kim Ulrike Ross[1], Peter Blümler[2], Werner Heil[2], Jan Kahlenberg[2], Jan Karch[2], and Dieter Ries[1] — [1]Institute of Nuclear Chemistry, Johannes-Gutenberg-University Mainz — [2]Institute of Physics, Johannes-Gutenberg-University Mainz

The neutron lifetime experiment τSPECT at TRIGA Mainz uses full magnetic storage of ultracold neutrons (UCN) to avoid neutron losses on material walls due to upscattering or absorption. Therein the neutrons are radially stored by a Halbach octupole and in longitudinal direction between two high field bumps produced by superconducting coils. The latter also serve to polarise the neutrons as they enter the τSPECT cryostate. Only *high field seekers* (HFS) are accelerated into the cryostate, the *low field seekers* (LFS) are being reflected at the magnetic potential wall of the first bump. For the storage of the neutrons in the low field region of the magnetic trap, the HFS need to be transformed into LFS. This is done by an RF coil (birdcage resonator), which irradiates a transverse magnetic field. In their rest-frame, the neutrons experience a rotating field, which adiabatically rotates their spin by 180°. However this resonator does not work efficiently enough in the high radial gradient field of the magnetic octupole. Therefore a second octupole is built which fits into the first one and ideally compensates the radial magnetic field in the spin-flipping region.
In this talk field compensation simulations are shown, the realisation of the inner octupole together with field measurements on the quality of the field compensation.

HK 51.3 Do 14:45 HZO 90

High Resolution Neutron Detection by the yTPC method — •Markus Köhli[1,2], Markus Gruber[1], Fabian Schmidt[1], Jochen Kaminski[1], and Klaus Desch[1] — [1]Physikalisches Institut, Universität Bonn, Bonn, Germany — [2]Physikalisches Institut, Universität Heidelberg, Heidelberg, Germany

The world of detectors used in thermal neutron scattering instrumentation has changed. By alerts on the future Helium-3 supply, critical to perspectives of the large-scale research infrastructures, the run on substitutional technologies started. Most of the solutions could be adapted from developments of particle physics and are comprised of one or more layers of Boron-10. The Time Projection Method achieves a very high resolution by projecting ionization tracks onto a readout with dense spatial and time information. The University of Bonn is developing a novel system employing the TimePix technology - CMOS based chips with 55 μm sized pixels operated at clock speeds up to 80 MHz. In a first prototype with 8 TimePix chips, which are arranged in parallel to a boron layer, the track topology with this unrivaled high resolution has been studied. By reconstructing the origin of the conversion ions a time resolution below 50 ns and a spatial resolution of 100 μm has been achieved.

HK 51.4 Do 15:00 HZO 90

Ultracold neutron sources and applications at the research reactor TRIGA Mainz — •Christian Gorges[1], Christopher Geppert[1], Werner Heil[2], Jan Kahlenberg[2], Jan Karch[2], Sergei Karpuk[1], Tobias Reich[1], Dieter Ries[1], Kim Ulrike Ross[1], Yury Sobolev[1], and Norbert Trautmann[1] — [1]Institut für Kernchemie, Johannes Gutenberg-Universität Mainz — [2]Institut für Physik, Johannes Gutenberg-Universität Mainz

The inherent safe research reactor TRIGA Mainz is able to produce short neutron pulses with an energy of 10 MWs for a short time of 30 ms. This makes it a perfect tool for the investigation of the free neutron's lifetime and for fundamental neutron research in general.

A source for Ultracold Neutrons (UCN) (neutrons with kinetic energies below 335 neV) has been built and is in operation at the research reactor TRIGA Mainz. A UCN density of up to 8.5 UCN per cm^3 per neutron pulse was established [1]. At the TRIGA Mainz, a second UCN source can be used in the continuous reactor operation mode with 100 kW thermal reactor power, e.g., to test and improve the properties of experimental components like detectors etc.

The research reactor itself is also a powerful tool to simulate accelerated aging and to test radiation hardness of electronic components in radiative areas. After a short introduction of the facility and a few applications, the talk will concentrate on the UCN production mechanism and the infrastructure of the UCN source.

[1] J. Kahlenberg et al., Eur. Phys. J. A (2017) 53: 226