Ph.D. Position in Neutron Physics

Search for New Physics Beyond the Standard Model through Momentum Spectroscopy

Primary supervisor: Hartmut Abele (TU Wien)
Research supervisor: Gertrud Konrad (TU Wien)
Application deadline: January 6, 2015
Expected start date: March 1, 2015
Duration: This is a three-year Ph.D. position.

Precision measurements of the parameters describing the beta decay of free neutrons address important questions in nuclear and particle physics, astrophysics, and cosmology.[1] The main emphasis is on the search for evidence of possible extensions of the Standard Model and on searches for new symmetry concepts.[2] The new user facility PERC delivers neutron decay products under well-defined and precisely variable conditions.[3]

For the first time, it is now possible to perform precision momentum spectroscopy of the decay electrons and protons. To this end, we will develop a novel detection system for electron and proton momentum spectroscopy, based on the RxB drift effect, in which the charged decay particles are dispersed in a uniformly curved magnetic field.[4]

The goal is neutron decay spectroscopy on a spectacular 10^{-4} level in order to, e.g., find the so far not observed and in the Standard Model forbidden Fierz interference term *b*, or to present new limits. A non-zero value for *b* would be an indication of the existence of scalar or tensor interactions which would occur if yet unknown charged bosons or leptoquarks were exchanged instead of a *W* boson.

We are seeking an outstanding student to join our international (Austria, France, Germany) research project. The Ph.D. student will work on the design, construction, and testing of the RxB spectrometer, participate in the investigation and characterization of spatial resolution electron/ proton detectors, and prepare and conduct the first measurement at PERC. For this reason, the student will spend part of his/her time working abroad, e.g., at FRM-II, Garching, Germany.

The Ph.D. position requires a completed Master (or equivalent) degree in experimental physics, preferably in neutron, nuclear, particle, or detector physics. The Ph.D. student is expected to

- have a strong background in experimental and numerical methods (e.g., Monte Carlo, FEM),
- have proven programming and simulation skills (e.g., C, C++, MATLAB, COMSOL, Geant),
- have a driven, professional, and self-dependent work attitude,
- have excellent English language skills, helpful are also French language skills.

For more information, please contact: Gertrud Konrad (project leader), e-mail gkonrad@ati.ac.at, phone +43 1 58801 141430.

Application: Applicants pass through the selection procedure of the *Vienna Doctoral Program (Doktoratskolleg) Particles and Interactions (DK-PI)*. To apply, please visit www.dkpi.at/ and submit your application through the electronic application form www.dkpi.at/application-form/.

The DK-PI doctoral program provides a high-profile international and interdisciplinary research environment coupled with a broad and thorough educational system. Its aim is that the students acquire the knowledge needed for becoming competitive participants in the international particle and nuclear physics research community and are able to start their own successful career.

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[1] H. Abele, Prog. Part. Nucl. Phys. **60**, 1 (2008).
[2] G. Konrad et al., World Sci. ISBN 9789814340854, 660, 2011; see also: arXiv:1007.3027.
[3] G. Konrad et al. [PERC Collaboration], J. Phys.: Conf. Ser. **340**, 012048 (2012).
[4] X. Wang, G. Konrad, H. Abele, Nucl. Instr. and Meth. A **701**, 254 (2013).