Subject matter for diploma work

Name of diploma work:
The systematic measurements at the neutrino mass experiment KATRIN

Working place:
Electron Spectroscopy Group at Nuclear Physics Institute of ASCR, Rez near Prague, Czech Republic

Period: 2014 -

Work specification:

Neutrinos, the most abundant fermions in the Universe, are the only elementary particles with unknown rest mass. Currently, the upper limit of this fundamental parameter 2 eV, based on tritium beta decay study, is established. The KATRIN (KArlsruhe TRItium Neutrino experiment) collaboration, founded in 2001 with our participation, builds a unique β-ray spectrometer and gaseous tritium source in order to achieve an unprecedented sensitivity to the effective neutrino mass of 200 meV after 1000 measuring days. This experiment, in which a shape of the beta spectrum around its endpoint is inspected, belongs to the category of direct measurements which do not need additional theoretical information for the neutrino mass determination. The KATRIN represents interdisciplinary project at the edge border of current technologies. A huge amount of research and developments works are in progress during the design and construction of the KATRIN components. The first test measurements are planned at the end of 2015.

Beside the own beta spectrum shape several auxiliary and systematic measurements will be accomplished in order to achieve the designed mass sensitivity. Our group is developing a source of monoenergetic electrons with energy stability at level of several ppm. Such sources will be used for the monitoring of the KATRIN energy scale. Further a development of the ^{83m}Kr gaseous source for tests of the KATRIN windowless gaseous tritium source is in progress. In 2015 we will start with monitoring the energy scale and the measurement of the tritium source characteristics using the ^{83m}Kr source.

For info about the KATRIN project see http://www.katrin.kit.edu and http://hp.ujf.cas.cz/~rysavy/katr1.htm.

The diploma work, having experimental character, will be oriented on work in frame of our group at Rez or Karlsruhe site. The applicant should have knowledge in experimental nuclear physics and in the field related to nuclear instrumentation on bachelor level. Appropriate mathematical and computer skills are necessary. Reasonable knowledge of English is expected.

Within the diploma work the student will obtain knowledge and skills in the field of electron and gamma radiation spectroscopy, ultra high vacuum technique, precise measurement of electric quantities and partially cryogenic. Moreover, the student will gain knowledge about the direct methods for neutrino mass determinations and some overview about the reminding neutrino physics fields.

Questions regarding the diploma work study can be directed to Dr. Drahoslav Vénos, Head of Electron Spectroscopy Group, venos@ujf.cas.cz, telephone number: +420 212 241 677

Rez near Prague, July 28, 2014