

Laboratory : Laboratoire de Physique Corpusculaire in Caen

Title: *Measurement of the electric dipole moment of the neutron at the Paul Scherrer Institute*

Director: Ban Gilles ; **Co-advisor:** Lefort Thomas

Subject:

The search for electric dipole moment (EDM) of elementary particles or composite system (electron, neutron, Hg and so on ...) probes the origins of the baryogenesis. In particular, it has a high discovery potential of new mechanisms of CP violation, which is one of the elements required to account for the appearance of matter in our Universe.

The LPC Caen is involved in an experiment at Paul Scherrer Institute (PSI) in Switzerland aiming at measuring the neutron EDM. The experiment is carried out with the ultra-cold neutrons (UCN) source from PSI. The project has two phases. The first phase is over. It led to the publication of the best worldwide limit on the neutron EDM in 2020. The phase II has started and a new highly sensitive spectrometer is under construction (n2EDM). An improvement of one order of magnitude is expected on the statistical and the systematic errors. The experiment commissioning is planned for 2022-23. The LPC laboratory is involved in the collaboration since 2003. It is in charge of the neutron detection, the measurement of the neutron polarisation, the manufacturing of the non-magnetic vacuum tank and the design and the manufacturing of the coils system.

The PhD student will be involved in studies about UCN detection and analysis of neutron polarisation. The current detector is gaseous (filled with a gas mixture of CF_4 and ^3He). The neutron is captured on ^3He nuclei. Then, the energy released induces the CF_4 scintillation which signs the neutron detection. The improvement of the detector efficiency is one of the goal of the PhD. The tests of other gases than CF_4 is foreseen. The purpose is to find a scintillating gas with a lower neutron scattering cross section. Studies about the light collection optimisation will be also pursued. Finally, it is necessary to qualify the analyser of the neutron polarisation and the detectors on site at PSI. Systematic effects related to neutron polarisation and neutron counting will be also studied and their possible influence on the nEDM measurement will be quantified.

The candidate must have a Master in experimental physics (nuclear, particles etc ...). For further information, please call Thomas Lefort at 00.33.2.31.45.24.12 or write an email to lefort@lpccaen.in2p3.fr.