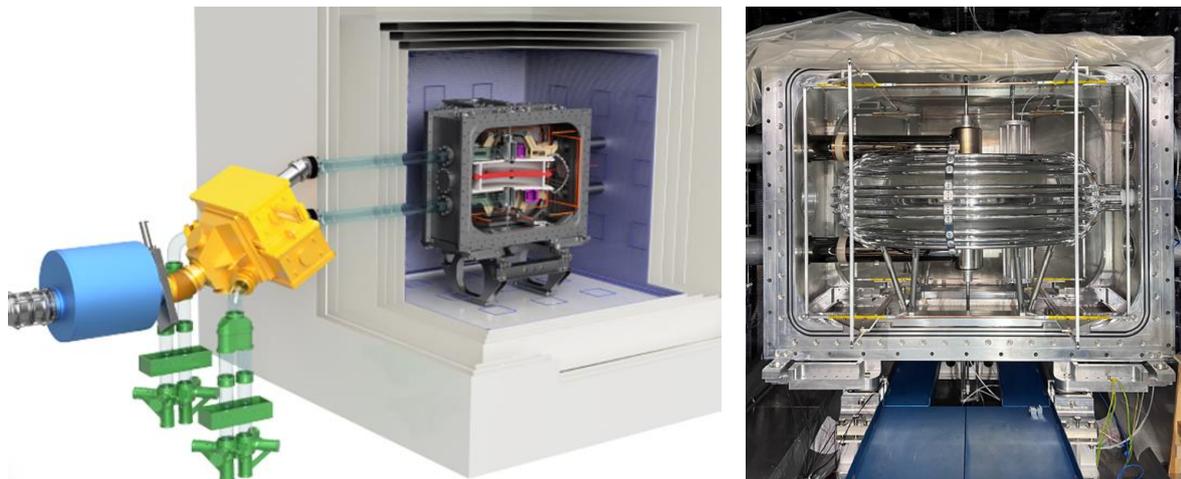


Title: *Measurement of the electric dipole moment of the neutron.*

Advisor: Lefort Thomas at the Laboratoire de Physique Corpusculaire (LPC).

Internship subject: The search for electric dipole moment (EDM) of elementary particles or composite system (electron, neutron, Hg and so on ...) probes physics beyond the standard model. It has also 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 [1]. The experiment is carried out with the ultra-cold neutrons (UCN) source from PSI. A new highly sensitive spectrometer was built and is nearly operational. An improvement of one order of magnitude is expected on the statistical and the systematic errors with respect to the best worldwide measurement performed so far [2]. The LPC laboratory is involved in the n2EDM project since 2014. 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 spectrometer commissioning is ongoing and the data taking is planned for two years starting in 2025.



Left: scheme of the n2EDM experiment, right: picture of the neutron precession chamber.

The internship is dedicated to the first data analysis. The nEDM measurement procedure is the following: neutrons are stored for 3 minutes in precession chambers (see the right picture above). There, they experience electric and magnetic fields. The magnetic field causes the precession of the neutron spin at a given frequency. The interaction of the electric field with the neutron EDM changes this frequency. Any measurement of a frequency shift is therefore a signature of the neutron EDM. The precession frequency is measured with the detection system built at LPC (green component in the design above). The internship goal is to assess the influence of the detection (especially the background discrimination) on the neutron precession frequency measurement. A PhD may follow during the 2025-2028 period.

For further information, contact T. Lefort: 00.33.2.31.45.24.12, lefort@lpccaen.in2p3.fr.

[1] The design of the n2EDM experiment, Eur. Phys. J. C. (2021).

[2] Measurement of the permanent EDM of the neutron, PRL 124 (2020).