

**Laboratory/research team**

Laboratoire Leprince-Ringuet, École polytechnique/collisionneurs leptonique

**Title:**

## **New method for a major improvement on the precision on the Higgs couplings at e+e- colliders**

**Overview of the research:**

The discovery of the Higgs boson at LHC in 2012, opens the possibility of a clean production of this boson in e+e- collisions at a center-of-mass energy of 250 GeV/c<sup>2</sup>. Several projects at CERN (FCCee), in China (CEPC) or in Japan (ILC) are under studied or close to a construction decision. More precisely, decision for these project will be taken within the next few months for Japan, and few years for China. One of the key questions concerns the precision which could be reached on such a machine on the Higgs couplings. The measurements on these e+e- collider is of course related to the fundamental question: "What is the real nature of the Higgs boson discovered at LHC: standard model or a sign of new physics?"

The collaboration ILD has designed a detector for e+e- collider at 250 GeV/c<sup>2</sup> center of mass. The team at LLR is member of this collaboration. The team has the responsibility of the more difficult and more expensive piece of the detector, namely the electromagnetic calorimeter. It is therefore of extreme importance to optimize the detector for better performances for the physics program. With the new method proposed, it will be essential to see the impact on the calorimeter and to compare the expected precision with other machine, like the HL-LHC.

## Thesis project

This thesis offers the unique opportunity to participate to an outstanding project in the field of high energy at the energy frontier for elementary particle physics.

The future PhD student will first use Monte-Carlo data produced at DESY or KEK, to study the feasibility of the new method. He/She will establish the performance and precision expected on the Higgs couplings.

The team collaborates with a lot of foreign laboratories, and more specifically with the Kyushu university and KEK in Japan and the IHEP Beijing laboratory.

The student is expected to spend some fraction of his time in Japan or in China, depending on the evolution of the projects in the coming months. Most of the time, he/she will be accompanied during his stay by members of the e+e- collider team.

In parallel to these activities, he/she will have to participate to the commissioning and test of a prototype of electromagnetic calorimeter, detector for which the LLR group is the world reference. It is expected that the PhD student plays a leading role in this commissioning and performance studies of this detector and envisaged beam test at DESY (Hamburg) and SLAC or FermiLab. The thesis will have a major impact on the design of detector for this leptonic collider, since the detector will have to be finalized for the mid-2022.

## Master and doctoral school

- Master 2 in particle physics

- PHENIICS doctoral school – Université Paris-Saclay

## Local team -LLR

[Equipe e+e- collider](#)

## Contact

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