

Missions

During the 3-year doctoral position, the successful candidate will work on the very high-precision measurement of photon polarization in $b \rightarrow s$ gamma transitions. More precisely, she/he will work on angular analyses using recent Run3 data registered with the new LHCb Upgrade-I detector. Indeed in 2024, LHCb has recorded more data than during the period 2011-2018 and the amount of data which should be recorded in 2025 is expected to be even higher. She/he will also monitor the performances of the calorimeter and more generally of the electron reconstruction in the context of the LHCb Upgrade-I. She/he will work in collaboration with LHCb-IJCLab members and with our collaborators in LHCb. On top of the PhD thesis writing, the successful candidate will publish her/his results on data analyses and will present them in conferences.

Activities

The measurement of the photon polarization in $b \rightarrow s$ gamma transitions can be very precisely performed via the study of the angular distributions of the $B \rightarrow K^* e^+ e^-$ and $B_s \rightarrow \Phi e^+ e^-$ decays. The analyses will concentrate on the very low di-electrons invariant mass kinematical region where the $e^+ e^-$ pair comes predominantly from a virtual photon. With this measurement one can access the rate of right-handed photons in $b \rightarrow s$ gamma transitions and search for BSM signs since, in the Standard Model, the photon is left-handed in those decays.

The main activities will be :

- to revisit the selections for the $B \rightarrow K^* e^+ e^-$ and $B_s \rightarrow \Phi e^+ e^-$ decay modes given the upgraded LHCb detector, the larger size of the data sample and the more challenging environment due to higher pile-up.
- To characterise the backgrounds and to design the optimal way to extract the physical parameters of interest in order to confront them to the SM predictions.
- To monitor of the performances for the electron reconstruction in Run3 with the increased pile-up and potential ageing of the detector.
- An activity on the upgrade of the electromagnetic calorimeter can also be envisaged.

Skills

Education: master in experimental particle physics.

- Physics: some knowledge in flavour physics is preferred though not mandatory.
- Programming: knowledge in python or C++, and ROOT.
- Language: Fluency in spoken and written English. Some level of French could be useful.
- Good communication skills and ability to work in a team.

Work context

IJCLab is a CNRS/IN2P3, Université Paris-Saclay and Université de Paris, laboratory located at the campus of the University Paris- Sud at Orsay. The campus is conveniently located 20 km south of Paris and is easily reachable by regional train (40 mins) . IJCLab is the largest CNRS laboratory in fundamental research whose main field is the "physics of the two infinities". It gathers around 740 people with research topics spanning from the study of the elementary particles to cosmology. The largest department is the High Energy Physics one where 100 researchers (including about 30 doctoral students) are working.

The doctoral position is funded by the [Chiaroscuro](#) project corresponding to an ERC grant on the study of $b \rightarrow q$ ll transitions during Upgrade-I. It has been extended up to the end of 2028. The successful candidate will be part of the LHCb IJCLab team (~a dozen of researchers) which is included in the High

Energy physics Department of IJCLab. The doctoral student will also have the opportunity to interact with the active Flavour physics phenomenology group of IJCLab.

Additional information

The application consists of a cover letter and a CV including the names and e-mail addresses of two references. The application or inquiries for further information should be sent to Marie-Hélène Schune (marie-helene.schune@ijclab.in2p3.fr). All qualified applicants will receive equal consideration without regard to appearance, beliefs, sex, sexual orientation, gender identity, national origin, or disability.