Laboratoire de Physique de Clermont

4, Avenue Blaise Pascal - Campus Universitaire des Cézeaux
63178 Aubière Cedex - France
Tel:+33 (0)473407272 - Fax: +33 (0)473264598
http://clrwww.in2p3.fr

Post-doctoral offer

SEARCH FOR NEW PHYSICS IN RADIATIVE B MESON DECAYS AT LHCB

Program

The French National Agency for Research is funding two post-doc positions to work for a period of three years on radiative *B* meson decays in the LHCb groups of LAPP (Annecy-le-Vieux) and LPC (Clermont-Ferrand).

The so-called RadiCal project aims at precision measurements in radiative decays at the LHCb heavy flavour experiment to test the Cabibbo-Kobayashi-Maskawa (CKM) paradigm of the Standard Model (SM) and search for the footprint of New Physics (NP). Branching fractions and CP violation studies are foreseen using the existing dataset and the one to be recorded during the Run 3 of the LHC. Each scientific goal includes a technical component to maintain or improve key physics performance towards Run 3.

Branching fraction measurements of the Cabibbo-suppressed decays $B_d \to \pi\pi\gamma$ and $B_s \to K\pi\gamma$ can be used to constrain the ratio of CKM elements $|V_{td}/V_{ts}|^2$ using favoured $B_d \to K\pi\gamma$ decays as a normalisation and the ratios of the corresponding hadronic form-factors. An observation by LHCb of the first decay should improve the current constraints and motivate refined calculations of the ρ/K* form-factor ratio which otherwise would become the dominating source of uncertainty. On the other hand, this QCD contribution is negligible in the case of B_d and B_s decays to the same final-state, making the $B_s \to K\pi\gamma$ mode a very interesting complementary probe of the CKM ratio. The main challenge in observing the $B_d \to \pi\pi\gamma$ mode is an excellent control of the cross-feed from mis-identified backgrounds. For $B_s \to K\pi\gamma$, the crucial point is the detector performance to reconstruct photons converting in an e^+e^- pair which allow to distinguish the B_d and B_s signals in the $K\pi\gamma$ final-state.

The envisioned CP analyses will determine the time-dependent asymmetries in the rate of *B* decays to $hh\gamma$ final states (where *h* is either a kaon or a pion). In the SM, those asymmetries are negligibly small due to the polarization of the emitted photon which forbids interference effects between direct decay and decay after mixing: any deviation from zero would then be an unambiguous sign of NP. Given the spin-dependence of the asymmetries, amplitude analyses of the decays are also foreseen allowing for a gain in statistics and an improved sensitivity to the contribution of non-dipole operators in $b \to q\gamma$ quark transitions as these could induce a variation of the CP parameters across the Dalitz plot. The key of this analysis is the implementation of the time-dependent amplitude CP fit. While disjoint amplitude and CP analyses are currently on-going at LPC and LAPP respectively, it is foreseen to merge the current fitters or develop a new one to better match the necessities coming along the analyses of ever-larger sample sizes (weighted unbinned multi-dimensional fits, pseudo-experiments...).

UNIVERSITÉ Clermont Auvergne

Position and main responsibilities

The post-doc candidate to be recruited at LPC will focus on the analysis of the suppressed $b \to d\gamma$ transitions, targeting the first observation of the $B_d \to \pi\pi\gamma$ mode and the measurement of its branching fraction. An amplitude analysis will be conducted to extract the $B_d \to \rho^0\gamma$ contribution.

In parallel the search for the $B_s \to K\pi\gamma$ decay with converted photons will be deployed to exploit the expected large Run 3 dataset. Technical developments on the reconstruction of photon conversions and on the fit tools are foreseen.

This three-year research program will be realized in a close collaboration with the related activities performed at LAPP.

Required qualifications

The successful applicant must have completed the requirement for a PhD in Particle Physics at most two years prior the start of the appointment.

Physics: acquaintance with flavour physics is preferred though not mandatory.
Programming: skills in C++, ROOT and python, acquaintance with the LHCb software is preferred though not mandatory.
Language: fluency in spoken and written English.
Good communication skills and ability to work in a team.

Information

Type of contract:	*temporary contract*
Appointment period:	the appointment is initially *36 months*
Scheduled Hire date:	*01 April 2023*
Working Quota:	*full time*
Remuneration:	between *2400 and 2500 euros monthly net*
Workplace:	*LPC, Clermont-Ferrand (63118), France*
Attachment:	*LHCb collaboration*
Trips:	*some short trips in France and abroad are foreseen*
Desired level of education:	*PhD in Particle Physics*
Experience required:	*< 2 years after the PhD*

How to apply

The applicants should submit a detailed Curriculum Vitae (including a description of their research with a list of publications highlighting their personal contributions) and a cover letter explaining the interest in the position. Application should be made through CNRS recruitment website:
https://emploi.cnrs.fr/Offres/CDD/UMR6533-OLIDES-001/Default.aspx?lang=EN.

For any additional information, please contact Olivier Deschamps at the following address:
Olivier.Deschamps@clermont.in2p3.fr.
At least two letters of recommendation to be send directly by the referees to this address.

The deadline for the submission is March 01, 2023. We reserve the right not to make an appointment and continue searching after the closing date. Only shortlisted candidates will be contacted.

cnrs UNIVERSITÉ Clermont Auvergne