T 44: Invited Topical Talks II

Time: Wednesday 13:45–15:45 Location: MED 00.915

Invited Topical Talk T 44.1 Wed 13:45 MED 00.915
Probing Heavy New Physics at the Precision Frontier with Effective Field Theory — •Peter Stangl — Johannes Gutenberg-Universität Mainz

The Standard Model of particle physics successfully describes all known elementary particles, yet it leaves fundamental questions unanswered, from the origin of neutrino masses and the Higgs hierarchy problem to the puzzling patterns in particle masses and mixings. With direct searches at the LHC having reached their energy limit without discovering particles beyond the Standard Model, precision measurements offer a powerful complementary approach: heavy new particles, even if beyond direct reach, modify the interactions of known particles in measurable ways. I will discuss how Effective Field Theory methods combined with precision data from flavour physics, electroweak measurements, and collider observables can be used to systematically search for these subtle signatures of physics beyond the Standard Model.

Invited Topical Talk T 44.2 Wed 14:15 MED 00.915
Hadron Spectroscopy at Belle (II) — •Stefan Wallner — Max Planck Institute for Physics, Garching, Germany

The Belle and Belle II experiments recorded the world's largest dataset of e^+e^- collisions at center-of-mass energies at and around the $\Upsilon(nS)$ resonances. This dataset provides diverse opportunities to study the excitation spectrum of mesons and baryons with unparalleled precision. We present measurements of hadrons composed of heavy quarks, searches for exotic states beyond the quark model, and studies of the light-meson spectrum.

Invited Topical Talk T 44.3 Wed 14:45 MED 00.915
Rare B meson decays at Belle II: indirect searches for new physics at the luminosity frontier — •Ana Luisa Moreira de Carvalho — DESY, Hamburg, Germany

There is a lot we still do not understand about the Universe and its evolution. A striking example is the observed asymmetry in the quantity of matter and antimatter, which, together with other experimental evidence, points to physical processes and/or particles not contemplated in our current theoretical framework (the Standard Model).

Despite extensive searches at the LHC, the highest energy particle collider available, no evidence of physics beyond the Standard Model has been observed, indicating that new physical phenomena may lie beyond the energy reach of current experiments.

In this context, indirect searches - based on precision measurements and the study of rare Standard Model processes - provide a powerful and complementary approach. These studies require very large data samples, such as those produced in high-luminosity electron-positron collisions at the SuperKEKB accelerator, where the Belle II detector operates. At Belle II, rare electroweak transitions of a b-quark into an s-quark can be studied as sensitive probes of physics beyond the Standard Model. Additionally, precise measurement of the differences in the transition properties of a b-quark and an anti-b-quark may shed light on the mechanisms responsible for the matter-antimatter asymmetry in the present Universe.

Invited Topical Talk T 44.4 Wed 15:15 MED 00.915
Search for CP violation in $D^0 \to K^0_S K^0_S$ decays at the LHCb experiment — •Giulia Tuci — Heidelberg University

The study of CP violation in charm mesons provides a complementary probe of possible physics beyond the Standard Model with respect to beauty mesons, and allows the exploration of very high energy scales. The LHCb experiment has collected the largest sample of charm hadrons ever and in 2019 reported the first observation of CP violation analysing $D^0 \to K^+K^-$ and $D^0 \to \pi^+\pi^-$ decays, marking a milestone in flavour physics. However, the interpretation of this observation within the Standard Model is still under debate, making complementary experimental results essential to clarify the picture. In this presentation, a new measurement of the time-integrated CP asymmetry in the $D^0 \to K^0_S K^0_S$ decay will be presented. The analysis uses data collected by LHCb in 2024, inaugurating a new era enabled by the upgraded detector, which provides improved tracking, vertex resolution, and a fully software-based trigger, allowing unprecedented precision in charm physics.