HK 12: Invited Talks I

Time: Tuesday 11:00–12:30 Location: HBR 14: HS 1

Invited Talk HK 12.1 Tue 11:00 HBR 14: HS 1

How to understand the hadron spectrum — •Meike Küssner — Ruhr-Universität Bochum

The spectroscopic observation of hadrons played a key role in the development of the quark model and the strong interaction. QCD predicts a zoo of "exotic" hadrons with more complex internal structures than the quark-antiquark mesons and three-quark baryons of the original quark model. Nowadays, there are experimentally observed states that are often assigned to the light meson or charmonium sector, indicating an exotic nature. Such exotic particles include glueballs, hybrids, and tetraquarks. Not only do these states pose a theoretical challenge, but experimentally it is often difficult to distinguish and characterize exotic and non-exotic matter. Here it helps to compare different production mechanisms and decay patterns. This provides additional constraints and allows a coupled channel partial wave analyses. Therefore, gluon-poor two-photon fusion events and gluon-rich hadronic reactions are used to disentangle the highly populated light meson spectrum. Sophisticated dynamical models and analysis tools need to be applied, respecting unitarity and analyticity. The talk will discuss recent experimental results and techniques and analyses methods in order to identify and characterize exotic and non-exotic QCD states.

Invited Talk HK 12.2 Tue 11:30 HBR 14: HS 1

3-body problem from phenomenology and lattice QCD — •Maxim Mai — HISKP, Uni Bonn

The quest of unraveling the nature of excited hadrons necessarily involves determination of universal (reaction independent) parameters of these states. Such determinations require input, either from experiment or theory. The challenge in answering these questions from theory arises from the very structure of the theory of strong interaction, the QCD.

Lattice gauge theory is the only tool available to us to tackle the non-perturbative dynamics of QCD encoded in the determined finite-volume interaction spectra. Many insights have been gained on resonant two-body systems in the past by studying such spectra. Now – with the advent of the three-body finite-volume methods – advances are being made towards more complex systems. This progress will be discussed in the talk, including theoretical developments and applications to phenomenologically interesting systems.

Invited Talk HK 12.3 Tue 12:00 HBR 14: HS 1

Measurement of Antiproton-Production Cross Sections at AMBER — •Thomas Pöschl for the AMBER-Collaboration — European Organization for Nuclear Research (CERN), Geneva, Switzerland

To the best of our knowledge, cosmic-ray antiprotons are exclusively produced by interactions of cosmic rays with interstellar material. By comparing their measured flux with our expectations, we can test for the presence of exotic sources of antimatter, such as dark matter annihilations. This method requires a precise knowledge of antiproton production over a wide range of collision energies and for different collision systems as they occur in the Galaxy. For collisions of protons with light ions such as helium, experimental data are sparse, limiting the interpretation of the measured cosmic antiproton flux.

The AMBER collaboration aims to measure antiproton production in collisions of protons with hydrogen, deuterium, and helium at different collisions energies using the M2 beam line at CERN's SPS. First measurements of proton-helium collisions were recorded in 2023, and measurements with hydrogen and deuterium targets are planned for 2024. These data sets will be of particular interest for the investigation of a possible isospin-asymmetric production.

I will review our current knowledge of collisional antiproton production, the uncertainty of the production cross sections on the modeling of the cosmic antiproton flux, and the impact of the upcoming experimental data from AMBER.