

HK 20: Focus Session: QCD@FAIR

Time: Wednesday 13:45–15:45

Location: AM 00.014

Group Report

HK 20.1 Wed 13:45 AM 00.014

"QCD at FAIR" – A hadron physics driven campaign towards FAIR completion — •FRANK NERLING — GSI Helmholtz Centre for Heavy Ion research, Darmstadt, Germany, Helmholtz Research Academy Hesse for FAIR, Campus Frankfurt — Goethe University Frankfurt

A newly established initiative has successfully been launched to strengthen the First Science(+) programme of the upcoming FAIR accelerator facility, also in view of anti-protons delivered by the High Energy Storage Ring in the future. While investigating fundamental questions related to the strong interaction in the non-perturbative regime, the overarching goal is to keep the expertise and interest of the community in hadron physics at FAIR. In this Focus Session, the hadron physics opportunities at the existing and upcoming experiments at SIS18/SIS100 of GSI/FAIR as summarised in the corresponding White Paper are discussed.

Group Report

HK 20.2 Wed 14:05 AM 00.014

Physics opportunities for hadron physics at FAIR — •CHRISTOPH HANHART — IAS-4, Forschungszentrum Jülich, 52428 Jülich

In this talk I will discuss the physics program planned for proton and pion induced reactions at FAIR. In particular I will highlight two cases: The perspectives to measure hyperon-nucleon and hyperon-hyperon scattering lengths and to study the hidden charm pentaquarks, so far seen only at LHCb.

Group Report

HK 20.3 Wed 14:25 AM 00.014

Hadron physics studies at the pion beams facility with HADES — •MANUEL LORENZ for the HADES-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI) — Goethe University Frankfurt

We present the physics program of π -N and π -A reactions up to $\sqrt{s} \approx 2.35$ GeV at the GSI pion-beam facility in combination with the HADES spectrometer. On proton targets, the program enables systematic studies of baryon resonances and their electromagnetic structure up to the third resonance region. Differential cross sections and polarization observables are used in Partial-Wave Analyses to tightly constrain baryon-meson and baryon-virtual-photon couplings, in particular ρN and ωN . Moreover, e^+e^- measurements probe the electromagnetic transition form factors in the time-like region and clarify the role of vector mesons. On nuclear targets, pion beams provide excellent kinematic conditions, with small relative momenta in the final state, enhancing sensitivity to medium effects. This allows us to explore vector-meson propagation in cold nuclear matter and to study the production of hidden- and open-strangeness particles. The same kinematics are ideally suited to investigate hypernuclei formation from low-relative-momentum strange baryons. In addition, these measurements provide a crucial connection to neutrino-nucleus interaction modeling by delivering high-precision hadronic baselines that constrain the reaction dynamics underlying long-baseline neutrino-oscillation ex-

periments.

Group Report

HK 20.4 Wed 14:45 AM 00.014

Spectroscopy of η' -mesic nuclei at GSI and FAIR — •KENTA ITAHASHI¹ and YOSHIKI TANAKA² for the Super-FRS Experiment-Collaboration — ¹Department of Physics, The University of Osaka, Japan — ²High Energy Nuclear Physics Laboratory, RIKEN, Saitama, Japan

We have conducted experimental search for η' -nuclei, a bound system of an η' -meson and a carbon 11 nucleus, using FRS at GSI as a high-resolution spectrometer. We measured the missing mass of the $^{12}\text{C}(p, d)$ reaction near the η' - emission threshold and selected formation events of the η' -mesic nuclei by tagging a high-momentum proton emitted in the two nucleon absorption channel, $\eta' NN \rightarrow NN$, where N denotes a nucleon. The measured excitation spectrum may indicate first experimental observation of the bound systems of an η' and a ^{11}C nucleus. We deduced the real part of the $\eta' - ^{11}\text{C}$ potential to be $-61 \pm 1 \pm 5$ MeV with the local and global statistical significance of 3.5σ and 2.1σ , respectively. We plan a new experiment to improve the statistical sensitivity and extend the excitation-energy region of the measurement. We make use of a new solenoidal magnet to be transferred from SPring-8, Japan, which has larger geometry and higher magnetic field to achieve better tagging efficiency. We also discuss possibilities to utilize secondary beams such as pions or antiprotons, using the combination of SIS100 and the SuperFRS.

Group Report

HK 20.5 Wed 15:05 AM 00.014

Hadron physics with proton and deuteron beams at the CBM experiment — •JAMES RITMAN for the CBM-Collaboration — GSI mbH, Darmstadt — Ruhr-Uni-Bochum

The high-intensity 30 GeV/c proton and deuteron beams soon available at FAIR will enable a rich program of hadron and QCD studies. These beams will be directed towards the large acceptance CBM detector, which provides an excellent basis for fully exclusive reconstruction of all final-state reaction products. These data will not only play a crucial role in contextualising the results from heavy-ion reactions, but will also provide great opportunities in the realm of hadron physics. The physics program includes investigations of hadron-hadron interactions and the composition of hadrons, as well as the mapping of baryon and meson spectra, including exotic states and quantifying hadron structure. This talk will present an overview of both, the detector set-up and expected performance for the related measurements.

Group Report

HK 20.6 Wed 15:25 AM 00.014

QCDA@FAIR Round Table Discussion — •FRANK NERLING^{1,2} and JOHAN MESSCHENDORP³ — ¹GSI Helmholtz Research Academy Hesse for FAIR, Campus Frankfurt — ²Goethe University Frankfurt — ³GSI Helmholtz Centre for Heavy Ion research, Darmstadt, Germany

We discuss the contributions of this Focus Session including the status and perspectives of the newly established initiative.