# HK 25: Hadron Structure and Spectroscopy IV

Time: Tuesday 17:30–19:00 Location: HBR 14: HS 1

**Group Report** HK 25.1 Tue 17:30 HBR 14: HS 1

**Chiral symmetry breaking: experimental tests at COMPASS and future prospects*** — •Dominik Ecker for the COMPASS-Collaboration — Technische Universität München

When we are dealing with the lightest quarks at low energies, the properties of Quantum Chromodynamics are encoded by chiral symmetry and the manifestation of its breaking. We can exploit this symmetry to build an effective field theory, which can be expanded as a perturbation theory. Chiral Perturbation Theory allows to describe a variety of phenomena observed for light mesons at low-energies, including their decays and their couplings to photons or other matter fields. Among the light hadrons, the pion plays a special role, as it is the lightest meson and emerges as a Goldstone boson from the breaking of the Chiral Symmetry. Its properties are directly related to the underlying symmetry.

In this talk, we will focus on the experimental verification of pion properties, in particular so-called anomalous couplings, which arise as a consequence of the chiral anomaly. We will review the state of the art, explain previous measurements and point out experimental challenges. We will then highlight the recent measurement of the anomalous value for $F_{3\pi}$ by the COMPASS collaboration at CERN. A proposed measurement at the AMBER experiment will allow us to extent the studies to the next heaviest quark generation in interactions with kaons.

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HK 25.2 Tue 18:00 HBR 14: HS 1

**Measuring Dipole Moments of Charmed Baryons in a new Fixed Target Experiment at the LHC with Bent Crystals** — •Jascha Grabowski and Sebastian Neubert — University of Bonn, Bonn, Germany

Values for the magnetic dipole moments of the charmed baryons have been predicted, but could never be observed experimentally, due to their short lifetimes. Their measurement would probe the internal structure of the baryons, making them a valuable anchor point for low-energy QCD models. It would also allow the search for the electric dipole moments of these states, which are suppressed in the standard model and sensitive to new physics contributions.

A sufficient spin precession for a measurement of the dipole moments of the short-lived charmed baryons can be achieved by exploiting the channeling effect of relativistic charged particles in bent crystals. A proof-of-principle setup and first simulation studies for a fixed target experiment at the LHC developed by an international group of researchers inside the CERN Physics Beyond Colliders program will be presented.

HK 25.3 Tue 18:15 HBR 14: HS 1

**Spacelike electromagnetic form factors of Lambda- and Sigma-baryons** — •Langtian Liu and Christian S. Fischer — Institut für Theoretische Physik, Justus-Liebig-Universität Gießen, 35392 Gießen, Germany

An important goal of ongoing and future experiments is to explore spectra and transition form factors of baryons with non-zero strangeness. Of particular interest is the transition form factor $\gamma^{(*)}\Sigma^0 \to \Lambda$ and $\gamma^{(*)}\Sigma^0(1382) \to \Lambda$ in the time-like momentum region that can be extracted from Dalitz decays. On the road towards a theoretical description of these form factors we extend a covariant dynamical quark-diquark model for the baryon Faddeev equation to the strange-quark sector. Based on an excellent description of the mass spectrum of selected baryon octet and decuplet states and reasonable results for the nucleon form factors we determine the elastic electromagnetic form factors of $\Lambda$ and $\Sigma^+, \Sigma^0, \Sigma^-, \Sigma^0(1382)$ hyperons in the space-like region as well as the ones for the octet transition $\gamma^{(*)}\Sigma^0 \to \Lambda$. We discuss qualitative and quantitative features of the diquark-quark picture and compare systematically with previous results from a three-body Faddeev approach and lattice data where available.

HK 25.4 Tue 18:30 HBR 14: HS 1

**Accessing transverse momentum dependent distribution functions with semi-inclusive deep inelastic single pion production** — •Stefan Diehl for the CLAS-Collaboration — Justus Liebig Universität Gießen and University of Connecticut

Semi-inclusive deep inelastic scattering is a well-established tool to study TMDs and fragmentation functions. With the CLAS12 detector at Jefferson Laboratory (JLab), precise, multidimensional measurements of cross sections and asymmetry observables become possible in the valence quark regime for the first time. The structure-function ratio $F_{LU}^{\sin\phi}/F_{UU}$ was studied based on beam single-spin asymmetries from pion SIDIS. The talk will present a comprehensive multidimensional study for all three pions over a large range of $Q^2$, $x_B$, $z$ and $P_T$, discuss the connection of the observable to TMDs and the impact of the new data on our understanding of the involved TMDs based on a comparison to TMD based reaction models. A special focus will be given to the impact of exclusive vector meson production on the SIDIS observables.

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HK 25.5 Tue 18:45 HBR 14: HS 1

**The Chiral Anomaly in $\pi\gamma \to \pi\eta$ Scattering at COMPASS*** — •Andrii Maltsev for the COMPASS-Collaboration — Technische Universität München

Quantum chromodynamics (QCD) has been extremely successful in desribing hadron interactions at high energies. However, at low energies it is no longer possible to apply the standard perturbative series in the strong coupling constant $\alpha_s$. Using the chiral symmetry, a fundamental property of QCD, phenomenological models, such as the chiral perturbation theory ($\chi$PT), have been developed that are able to describe low-energy processes. Testing the predictions of such models, such as the $\pi\gamma \to \pi\pi$, $\pi\gamma \to \eta\pi$ couplings, is important for understanding the low-energy interactions of hadrons.

In this talk, the status of the measurement of the $F_{\eta\pi\pi\gamma}$ constant, which is predicted by $\chi$PT and describes the anomalous vertex $\pi\gamma \to \eta\pi$, in the COMPASS experiment will be presented, as well as the comparison with the previous measurement.

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