# HK 47: Hadron Structure and Spectroscopy VII

Zeit: Donnerstag 14:00–16:00 Raum: HS 13

**Gruppenbericht** HK 47.1 Do 14:00 HS 13

**Baryons as relativistic three-quark bound states** — •Reinhard Alkofer — Institut für Physik, Universität Graz

The spectrum and electromagnetic properties of baryons described as relativistic three-quark bound states within QCD are described. The composite nature of baryons results in a rich excitation spectrum, whilst leading to highly non-trivial structural properties explored by the coupling to external (electromagnetic and other) currents. Both present many unsolved problems despite decades of experimental and theoretical research. In this talk I will discuss the progress in these fields from a theoretical perspective, focusing on non-perturbative QCD as encoded in the functional approach via Dyson-Schwinger and Bethe-Salpeter equations. Recent results on the spectrum of non-strange and strange baryons, their elastic and transition form factors as well as the issues of two-photon processes and Compton scattering determined in the Dyson-Schwinger framework are confronted with those of lattice QCD and the available experimental data. The general aim is to identify the underlying physical mechanisms behind the plethora of observable phenomena in terms of the underlying quark and gluon degrees of freedom.

HK 47.2 Do 14:30 HS 13

**Cascading decays of nucleon resonances via meson-pair emission** — •Mariana Nanova and Volker Metag for the CBELSA/TAPS-Collaboration — II. Physikalisches Institut, Justus-Liebig-Universität Giessen, Giessen, Germany

Photoproduction of mesons provides important information about the excitation spectrum of the nucleon that is still not sufficiently understood despite various long-lasting experimental and theoretical efforts [1]. Reactions with multiple-meson final states are important, in particular $\pi^0\eta$ since the $\eta$ acts as an isospin filter and provides information on the nature of the intermediate resonances. Particular attention has been paid to the recently claimed narrow structure observed at 1685 MeV in the $N\pi\eta$ channel [2]. We have studied the two-meson photoproduction with the CB/TAPS detector system at the ELSA accelerator in Bonn in the reaction $\gamma$p$\rightarrow p\pi^0\eta$. High statistics have been obtained in irradiating a liquid hydrogen target with photon beams in the incident energy range from 0.9 to 3.0 GeV. A kinematic fit has been used in the reconstruction and identification of the exit channels. Preliminary results on the search for the narrow structure at 1685 MeV will be presented.

[1] V. Crede and W. Roberts, *Rep. Prog. Phys.* **76** (2013) 076301
[2] V. Kuznetsov *et al.*, *JETP Letters* **106** (2017) 693

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HK 47.3 Do 14:45 HS 13

**$\eta'$ beam asymmetry at threshold using the BGO-OD experiment** — •Stefan Alef for the BGO-OD-Collaboration — Physikalisches Institut Universität Bonn

The unexpected nodal structure of the beam asymmetry recently reported by the GRAAL collaboration in $\eta'$ photoproduction very close to threshold could be explained by a previously unobserved very narrow resonance. Therefor, the measurement is important to be independently confirmed.
This possibility is offered by the BGO-OD experiment. It is well suited for the detection of forward going charged particles which in the threshold region of interest allows the identification of the reaction $\gamma p \rightarrow \eta' p$ solely based on the proton going in forward direction. This yields unprecedented statistics if in the missing mass analysis of the $\eta'$ meson the background can be sufficiently well controlled. A linearly polarized photon beam produced via coherent bremsstrahlung off a diamond radiator makes it possible to measure the $\eta'$ beam asymmetry.
In this talk I will present preliminary results on the determination of the $\eta'$ beam asymmetry in several energy and angular bins close to threshold.
Supported by DFG (PN 50165297).

HK 47.4 Do 15:00 HS 13

**Truncated partial wave analysis (TPWA) of the reactions $\gamma p \rightarrow \pi^0 p$ and $\gamma p \rightarrow \eta p$** — •Philipp Krönert[1], Yannick Wunderlich[1], Farah Afzal[1], Annika Thiel[2], and Reinhard Beck[1] for the CBELSA/TAPS-Collaboration — [1]Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn — [2]School of Physics & Astronomy, University of Glasgow

According to the current scientific knowledge, quarks are the fundamental components of the nucleon. Their interaction is described theoretically by quantum chromodynamics. The study of the excitation spectrum of the nucleon can validate and improve the understanding of the underlying theory.
A possible mechanism for the excitation of nucleon resonances is the photoproduction of mesons. The reaction of pseudoscalar meson photoproduction $\gamma N \rightarrow \varphi N$ in particular allows for the extraction of 16 polarization observables.
An introduction to a model-independent analysis scheme will be given in the talk, namely the technique of truncated partial wave analysis. This permits the study of different contributions from partial waves to the full reaction amplitude via so-called moment analysis. Furthermore, attempts can be made to extract partial waves, up to one overall phase, from polarisation data at single energies.

Preliminary results for the photoproduction reactions $\gamma p \rightarrow \pi^0 p$ and $\gamma p \rightarrow \eta p$ will be shown.

HK 47.5 Do 15:15 HS 13

**Studying the p$-\Sigma^0$ interaction employing femtoscopy in ALICE** — •Andreas Mathis, Max Korwieser, and Laura Fabbietti for the ALICE-Collaboration — Technische Universität München, Physik Department E62, Excellence Cluster 'Universe'

Pioneering studies by the ALICE Collaboration demonstrated the potential of employing femtoscopy to investigate and constrain baryon−baryon interactions with unprecedented precision. In particular, the small size of the particle-emitting source in pp and p−Pb collision systems at ultrarelativistic energies is well suited to study short-ranged strong potentials. Newly developed analysis tools allow comparing the measured correlation function between the particle pairs of interest to theory predictions using either potentials or wave functions as input.

In this contribution, we present measurements of p$-\Sigma^0$ correlations by the ALICE Collaboration in high multiplicity triggered pp collisions at $\sqrt{s} = 13$ TeV. The p$-\Sigma^0$ interaction is investigated and constrained by comparing the measured correlation function to model predictions and determining the compatibility with a wide range of scattering parameters.

This research was supported by the DFG cluster of excellence 'Origin and Structure of the Universe' and the SFB 1258.

HK 47.6 Do 15:30 HS 13

**Studying the Λ–Λ interaction and the existence of a H-dibaryon using femtoscopy** — •Dimitar Mihaylov for the ALICE-Collaboration — Technische Universität München, James-Franck-Straße, 85748, Garching, Germany

The femtoscopy method can be used to investigate both the emission source and the interaction potential between particle pairs by measuring their correlation function. The small emission source in pp and p–Pb collision systems at TeV energies results in an enhanced sensitivity to the strong interaction potential. Thus femtoscopy studies performed at the LHC can provide deep insights into the interaction between different baryon pairs.

In this study the ALICE collaboration performed a combined analysis of three different data sets, namely pp at $\sqrt{s}$ =7,13 TeV and p–Pb $\sqrt{s_{\rm NN}}$ = 5.02 TeV, to investigate the Λ–Λ interaction potential. The emission source is obtained by using the p–p correlation as a reference, while the Λ–Λ interaction is studied within the effective range expansion, obtaining an exclusion plot for the scattering length and the effective range of the potential. The results allow to test the compatibility of different theoretical models to the ALICE data, as well as obtain tighter constraints on the allowed binding energy of the H-dibaryon, a hypothetical Λ–Λ bound state.

This work is supported by SFB1258.

HK 47.7 Do 15:45 HS 13

**Femtoscotpic studies on proton-Ω correlations with ALICE** — •Oton Vazquez Doce for the ALICE-Collaboration — TU - Munich

It has been recently demonstrated that for particle emitting sources of small size (of about 1fm), like those created after proton-proton collisions, the femtoscopic technique applied to baryon-baryon pairs allows to study the short range strong interaction between them. In this contribution the the study of correlations between proton-Ω produced in high-multiplicity proton-proton collisions at 13TeV measured by the ALICE collaboration will be presented. The experimentally obtained correlation in function of the relative momentum of the pair can be compared with predictions from local potentials. This research was supported by the DFG cluster of excellence *Origin and Structure of the Universe* and the SFB 1258.