HK 20: Hadron Structure and Spectroscopy IV

Time: Monday 16:00–17:30 Location: HK-H9

Group Report HK 20.1 Mon 16:00 HK-H9

Polarisation observables Σ, T, P, and H in π^0 and η photoproduction off quasifree nucleons — •Nicolas Jermann for the CBELSA/TAPS-Collaboration — University of Basel, Switzerland

The excitation spectrum of the nucleon is an important testing ground for quantum chromodynamics in the regime where it cannot be treated perturbatively. During the last two decades much progress has been made on the theory side, e.g. lattice gauge methods, and in experiments, particularly using energy tagged photon beams at electron accelerators, which has now reached a state where not only differential cross sections but also asymmetries measured with polarised photons and polarised targets allow for detailed partial wave analyses. This provides much more stringent information about the involved reaction multipoles and thus the contributing nucleon resonances.

The present experiment was done at the ELSA accelerator in Bonn with the CBELSA/TAPS detector setup. The incident electron beam of 3.2 GeV impinged on a diamond radiator where it produced coherent bremsstrahlung photons with linear polarisation, which again impinged on a transversely polarised, deuterated butanol target. This allows the simultaneous measurement of the polarisation observables Σ, T, P, and H. Analysed were the final states $N\pi^0$ and $N\eta$ with the almost 4π covering electromagnetic calorimeter CBELSA/TAPS.

One of the main motivations of this experiment was a more detailed investigation of the not yet understood narrow structure in the excitation function of the $\gamma n \to n\eta$ reaction at approximately 1 GeV. Preliminary results will be discussed.

HK 20.2 Mon 16:30 HK-H9

Helicity dependent cross sections for the photoproduction of $\pi^0\pi^\pm$ pairs from quasi-free nucleons — •Debdeep Ghosal for the CBELSA/TAPS-Collaboration — University of Basel, Basel, CH

Photon induced $\pi^0\pi^\pm$-pairs production from quasi-free nucleons bound in the deuteron has been investigated in view of the helicity dependence of those two reactions. Measurements with a liquid deuterium target were used to extract the unpolarized cross sections for protons and neutrons. A deuterated, longitudinally polarized butanol target together with a circularly polarized photon beam was used to measure the double polarization observable E. Antiparallel and parallel spin configurations of the beam photon and target nucleon correspond to the spin-dependent cross sections $\sigma_{1/2}$ and $\sigma_{3/2}$ respectively, which have been derived from E. The measurements were done at the Mainz MAMI accelerator with tagged photon beams produced via bremsstrahlung from longitudinally polarized electron beams. The reaction products from the two target types were detected with an almost 4π solid-angle covering calorimeter composed of the Crystal Ball, TAPS detectors and particle identification detectors. The results are sensitive to sequential decays of nucleon resonances via intermediate states and also by emission of charged ρ mesons. Furthermore, the results have been compared to the recent available model calculation.

HK 20.3 Mon 16:45 HK-H9

Measuring the 2s-1s transition in Muonic atoms — •Nilesh Deokar — Johannes Gutenberg University of Mainz, Johann Joachim-Becher-Weg 45, 55128 Mainz, Germany

Muonic X-rays are produced when negative muons are stopped inside matter and cascade down the different energy levels of an atom. The 2s-1s muonic X-rays are a potential observable to study the Atomic Parity Violation (APV) in muonic atoms. For a Krypton (2018) and a Zinc (2019) target, Muonic X-ray measurements were carried out at the Paul Scherrer Institute using muon beam from the piE1 beamline facility to detect these 2s-1s X-rays. High Purity Germanium (HPGe) detectors surrounded the targets to detect the outgoing Muonic X-rays. The X-rays of interest in Krypton and Zinc are in the 1-2 MeV energy range. The signal though, is buried under background arising from delayed Michel electrons, nuclear capture background from muons, Bremsstrahlung etc. A scan of various time and energy cuts along with X-ray-Xray coincidences is implemented to reduce this background and optimize the signal to background ratio. A clear observation of the 2s-1s transition opens up to the possibility for an APV experiment with muonic atoms.

HK 20.4 Mon 17:00 HK-H9

Accessing the coupled-channel dynamics with two-particle correlations at ALICE — •Valentina Mantovani Sarti for the ALICE-Collaboration — TUM, Garching, Germany

The strong interaction between hadrons can be characterised by the so-called coupled-channel dynamics, responsible for inelastic processes such as absorption and annihilation. The strength of the coupling to the inelastic channels can lead to the formation of molecular states, such as the $\Lambda(1405)$ in the $\overline{\mathrm{K}}\mathrm{N}$–$\Sigma\pi$ system and it also plays a crucial role in the possible existence of new bound states, as it might occurs in baryon-antibaryon interaction.

Measurements of two-particle correlations in the relative momentum space performed in different colliding systems and probing different inter-particle distances opens the possibility to partially isolate the elastic interaction and to provide experimental constraints for the coupling to the inelastic channels. In this talk we will present results on the coupled-channel dynamics of $\overline{\mathrm{K}}\mathrm{N}$ interaction, and on the annihilation processes in p-$\overline{\mathrm{p}}$, p-$\overline{\Lambda}$ and p-$\overline{\Lambda}$ interactions obtained in pp, p–Pb and Pb–Pb collisions. The effect of inelastic contributions in these systems has been investigated within the C^{3}ATS framework.

HK 20.5 Mon 17:15 HK-H9

New experimental limits on the effective strong interaction between multi-strange hadrons by ALICE — •Georgios Mantzaridis[1] and Otón Vazquez Doce[2] for the ALICE-Collaboration — [1]Technische Universität München, Fakultät für Physik, James-Franck-Str. 1, 85748 Garching — [2]Laboratori Nazionali di Frascati, Via Enrico Fermi 40, 00044 Frascati (Roma)

Understanding from first principles the strong interaction between hadrons with $S < -1$ is one of the key challenges for nuclear physics today. Traditional experimental techniques such as scattering or hypernuclei experiments are not able to access these strangeness sectors because of the small lifetimes of the involved hadrons. On the other hand calculations using lattice QCD are particularly stable in this regime because of the larger quark masses.

In an attempt to close this gap we present the direct measurement of two interactions of the $S = -3$ sector: the p-Ω^- and the Λ-Ξ^- interaction. For both systems the correlation function was measured in high-multiplicity pp collisions at $\sqrt{s} = 13$ TeV with ALICE at the LHC.

We have compared the p-Ω^- interaction to first principle lattice QCD calculations and found that they agree with the measured data if the inelastic channels are neglected. The Λ-Ξ^- correlation function is compared to predictions from leading order chiral effective field theory, meson exchange models as well as lattice QCD calculations. The data supports a shallow Λ-Ξ^- interaction which is more compatible with small scattering parameters.