HK 1: Hadronenstruktur und -spektroskopie

Zeit: Montag 14:00–16:00 Raum: RW 1

Gruppenbericht HK 1.1 Mo 14:00 RW 1

Messung von elektromagnetischen Übergangsformfaktoren von pseudoskalaren Mesonen mit dem Crystal Ball am MAMI und mit BES-III am BEPC-II — •Marc Unverzagt, Achim Denig, Alexander Hahn, Benedikt Kloss und Sascha Wagner — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

Das Studium elektromagnetischer Übergangsformfaktoren der pseudoskalaren Mesonen (P) stellt eine Möglichkeit dar, die intrinsische Struktur von Hadronen zu untersuchen. Ferner sind die Übergangsformfaktoren der leichten Mesonen wichtige Größen bei der Berechnung des Beitrags der hadronischen Licht-Licht-Streuung zum anomalen magnetischen Moment des Myons.

Diese Übergangsformfaktoren lassen sich z.B. mit dem Crystal Ball Aufbau am MAMI (Mainzer Mikrotron) oder mit BES-III am BEPC-II (Beijing Electron Positron Collider) messen. Am MAMI werden Mesonzerfälle $P \to \gamma^*\gamma \to e^+e^-\gamma$ mit zeitartigen Impulsüberträgen ($0 < q^2 < m_P^2$) studiert. Die Mesungen am BEPC-II werden hingegen über $\gamma^*\gamma \to P$ im raumartigen Bereich ($-5GeV^2 < q^2 < 0GeV^2$) durchgeführt.

In diesem Beitrag wird zunächst in die Physik der elektromagnetischen Übergangsformfaktoren eingeführt. Anschließend werden die Experimente am MAMI und am BEPC-II vorgestellt und Messungen und Machbarkeitsstudien zur Bestimmung der elektromagnetischen Übergangsformfaktoren mit dem Crystal Ball und dem BES-III Detektor diskutiert.

HK 1.2 Mo 14:30 RW 1

Measurement of hadronic electromagnetic form factors in BESIII — •Cristina Morales Morales — Helmholtz Institute Mainz, SB1, Johann-Joachim-Becher-Weg 36, 55128 Mainz

The feasibility of a measurement of the electric and magnetic nucleon form factors through radiative return in different e^+e^- colliders has been studied. In particular, the conditions of the BABAR and BESIII experiments have been reproduced and compared. The estimates presented here are based on the integrated luminosity of 10 fb^{-1} which will be collected at $\sqrt{s} = 3.77$ GeV by BESIII in the coming years and the luminosity of 232 fb^{-1} at $\sqrt{s} = 10.6$ GeV published by BABAR. The analysis is based on an extension of the generator PHOKHARA 7.0 including the nucleon-antinucleon final states in the presence of initial state radiation including NLO, and other hadronic channels like $e + e- \to \Lambda\bar{\Lambda}\gamma$ up to Born level. The analysis of the angular distribution of $e + e- \to N\bar{N}\gamma$ allows us to extract the time-like electromagnetic form factors of nucleons and other hadrons and the expected resolution of such measurements in BESIII. In particular the cases of neutrons, protons and lambdas in the final state are presented here, with emphasis in the proton case.

HK 1.3 Mo 14:45 RW 1

New insights on the nucleon form factors — •Ina Lorenz, Hans-Werner Hammer, and Ulf-G. Meissner — Helmholtz-Institut für Strahlen- und Kernphysik und Bethe-Center for Theoretical Physics, Universität Bonn

A dispersion theoretical analysis of the recent electron-proton scattering data from Mainz [1] is presented. The two-pion continuum is considered explicitly. Possible deviations from earlier analyses and their impact on the proton electromagnetic radii are discussed. Our results are confirmed by a continued fraction ansatz. Furthermore, the dependence of the results on the data range is discussed. [2]

[1] J. C. Bernauer et al., Phys. Rev. Lett. 105 (2010) 242001, http://arXiv.org/abs/1007.5076.

[2] I. Lorenz, Master thesis, in preparation.

HK 1.4 Mo 15:00 RW 1

Nucleon form factors in Lattice QCD — •Benjamin Jäger — Institut für Kernphysik und Helmholtz Institut Mainz, Mainz, Germany

The electromagnetic form factors of the nucleon, given by the Pauli- and Dirac form factor, allow to obtain information about the structure of a nucleon. Fundamental quantities, like the charge distribution within the nucleon, can be derived from these form factors.

Lattice QCD delivers an ab initio method to treat the non-perturbative region of QCD. We use non-perturbatively O(a) improved Wilson fermions with two dynamical quarks to compute the relevant matrix elements. We present some preliminary results for the vector form factors, including a preliminary study of systematic uncertainties of the lattice approach like volume and cutoff effects.

HK 1.5 Mo 15:15 RW 1

Feasibility studies of proton electromagnetic form factors with the PANDA detector — •Dmitry Khaneft for the PANDA-Collaboration — KPH, Mainz University, Mainz, Germany — HIM, Mainz, Germany

Perspectives of measuring the proton electromagnetic form factors in the time-like region with the PANDA detector at the FAIR facility are presented. First simulations using the PANDAroot simulation framework for both the signal $\bar{p}p \to e^+e^-$ and main background $\bar{p}p \to \pi^+\pi^-$ channel have been performed. For the simulation of signal events, the hypotheses for the ratio of the electric and magnetic Sachs form factors $|G_E|/|G_M| = 0, 1, 3$ have been considered independently for a number of $\bar{p}p$ center of mass energy values. Based on the simulation results, an efficient set of selection cuts to discriminate signal from background has been developed. Preliminary results on background suppression factors are shown.

HK 1.6 Mo 15:30 RW 1

Resummation of fermionic in-medium ladder diagrams to all orders — •Norbert Kaiser — Physik-Department, Technische Universität München

A system of fermions with a short-range interaction proportional to the scattering length a is studied at finite density. At any order a^n, we evaluate the complete contributions to the energy per particle $\bar{E}(k_f)$ arising from combined (multiple) particle-particle and hole-hole rescatterings in the medium. This novel result is achieved by decomposing the particle-hole propagator into the vacuum propagator plus a medium-insertion. The emerging series in ak_f can be summed to all orders in form of a double-integral over an arctangent function. Taking the unitary limit $a \to \infty$, one obtains the value $\xi = 0.507$ for the universal Bertsch parameter. Extensions of the resummation method by including the s-wave effective range r_s and a (spin-independent) p-wave contact interaction are presented. We perform also an exact (5-loop) calculation of a three-body contact interaction to second order.

Supported in part by BMBF, GSI, and the DFG Cluster of Excellence: Origin and Structure of the Universe.

HK 1.7 Mo 15:45 RW 1

Analytic Structure of Ghosts and Gluons from DSEs in Landau Gauge — •Stefan Strauss[1], Christian Fischer[1], and Christian Kellermann[2] — [1]Institut für theoretische Physik, JLU Gießen, Gießen, Germany — [2]Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany

We report on results for the analytic structure of the Landau gauge ghost and gluon propagators in the complex momentum plane. The hierarchy of Dyson-Schwinger equations is truncated in such a way that the propagators are in good agreement with lattice results at real spacelike Euclidean momenta. In contrast to expectations from Gribov-Zwanziger-like effective theories our results indicate the absence of pole singularities in the complex part of the momentum plane. Additionally, both propagators show branch cut singularities for real timelike momenta and are positivity violating.