HK 36 Theorie

Zeit: Mittwoch 16:30–18:30 Raum: B

Gruppenbericht

HK 36.1 Mi 16:30 B

Die Deltaresonanz in effektiver Feldtheorie — •Natalia Wies[1], Christian Hacker[1], Jambul Gegelia[1,2] und Stefan Scherer[1] — [1]Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, J.J. Becherweg 45, 55099 Mainz — [2]High Energy Physics Institute of TSU , Tbilisi, Georgia

Die Deltaresonanz wird als expliziter Freiheitsgrad in der baryonischen chiralen Störungstheorie betrachtet. Die allgemeinsten Wechselwirkungsterme von Pionen, Nukleonen und Deltas, die alle zugrundeliegenden Symmetrien erfüllen, werden konstruiert. Das Problem der Konsistenz der Wechselwirkungsterme wird analysiert, das bei Systemen mit Spin $\geq$ 1 aufgrund der Zwangsbedingungen eine große Rolle spielt. Zusammen mit dem EOMS- bzw. Infrarotrenormierungsschema erhalten wir einen manifest lorentzinvarianten Formalismus mit einem systematischen Zählschema. Der so erarbeitete Formalismus wird zur Berechnung der Nukleonmasse, des Pion-Nukleon-Sigmaterms, sowie der Pion-Nukleonstreuung angewendet.

\Zitat{1}{C. Hacker, N. Wies, J. Gegelia und S. Scherer, arXiv:hep-ph/0505043, akzeptiert zur Veröffentlichung in Phys. Rev. C (2005).}

Gruppenbericht

HK 36.2 Mi 17:00 B

Coupled-channel study of crypto-exotic baryons with charm — •Julian Hofmann and M.F.M. Lutz — GSI, Planck Str. 1, 64291 Darmstadt

Identifying a zero-range exchange of vector mesons as the driving force for the s-wave scattering of pseudo-scalar mesons off the baryon ground states, a rich spectrum of molecules is formed. We argue that chiral symmetry and large-N_c considerations determine that part of the interaction which generates the spectrum. An anti-triplet of bound states with negative charm is predicted. We suggest the existence of strongly bound crypto-exotic baryons, which contain a charm-anti-charm pair. A narrow nucleon resonance is found at mass 3.52 GeV. It is a coupled-channel bound state of the $(\eta_c\, N), (\bar{D}\,\Sigma_c)$ system. This resonance is part of an octet. Furthermore a singlet hyperon states at mass 3.23 GeV is observed as a consequence of coupled-channel interactions of the $(\bar{D}_s\,\Lambda_c), (\bar{D}\,\Xi_c)$ states. Most striking is the small width of about 1 MeV. The octet states may be significantly broader due to a strong coupling to channels containing an η'. The two so far observed s-wave baryons with charm one are recovered. We argue that the $\Lambda_c(2880)$ is not a s-wave state. In addition to those states we predict the existence of about ten narrow s-wave baryon states with masses below 3 GeV.

HK 36.3 Mi 17:30 B

Light Cone Sum Rules for $\gamma^* N \to \Delta$ Transition Form Factors — •Gerhard Peters[1], Vladimir Braun[1], Alexander Lenz[1], and Anatoly Radyushkin[2,3] — [1]Universitaet Regensburg, D-93040 Regensburg — [2]Old Dominion University, Norfolk, VA 23529 — [3]Jefferson Laboratory, Newport News, VA 23606, USA

In this talk a theoretical framework is suggested for the calculation of $\gamma^* N \to \Delta$ transition form factors using the light-cone sum rule approach. Leading-order sum rules are derived and compared with the existing experimental data. We find that the transition form factors in a several GeV region are dominated by the "soft" contributions that can be thought of as overlap integrals of the valence components of the hadron wave functions. Our results for the dominant magnetic form factor $G_M(Q^2)$ are rather close to the experimental data in the region above $Q^2 \sim 2$ GeV^2. We believe that the light-cone sum rule approach currently offers the best compromise between theoretical rigor and the applicability to present and planned experiments involving elastic and transition form factors for baryons. One goal of such studies is to determine nucleon distribution amplitudes from the data on form factors, similar as parton distributions are extracted from the measured deep inelastic structure functions. This work presents a step in this direction.

HK 36.4 Mi 17:45 B

The coupled-channel analysis of the $K\Lambda$ photoproduction in the nucleon resonance energy region — •Vitaly Shklyar, Horst Lenske und Ulrich Mosel — Institut für Theoretische Physik, Universität Giessen, Germany

The coupled–channel problem for the reactions $\pi N \to \pi N$, $2\pi N$, ηN, ωN, $K\Lambda$, $K\Sigma$ and $\gamma N \to \gamma N$, ηN, ωN, $K\Lambda$, $K\Sigma$ is solved within a unitary effective Lagrangian approach. Recent experimental data on $K\Lambda$ photoproduction in the nucleon resonance energy region from CLAS, SPAHIR, and SPring-8 are analysed to extract the nucleon resonance contibution for the process of interest. The results of calculations and the resonance couplings to the $K\Lambda$ final state are presented and discussed.

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HK 36.5 Mi 18:00 B

New Approaches in Relativistic Mean-Field Calculations of Nuclei — •Stefan Typel — GSI, Darmstadt, Germany

Modern relativistic mean-field models describe ground state properties of atomic nuclei with great success. The nucleon wave functions are found by solving the Dirac equation with scalar and vector self-energies. In standard approaches the Dirac Hamiltonian is diagonalized in a set of basis functions (e.g. of the harmonic oscillator) or on a mesh after discretization. As an alternative, a relativistic extension of the Lagrange mesh method is presented. It combines the virtues of both approaches and gives very accurate results with little computational effort.

A correct description of pairing effects is essential for extracting, e.g. one-nucleon separation energies. In conventional calculations the Hartree-Bogoliubov method or the even simpler BCS approach is used with well-known deficiencies. In this contribution, an approach beyond the mean-field description is discussed that is based on a shell-model like diagonalization with a certain residual pairing interaction. For a consistent treatment of pairing in deformed and spherical nuclei, angular momentum projection has to be considered.

HK 36.6 Mi 18:15 B

Modellunabhängige Untersuchung der Diracstruktur der Nukleon-Nukleon Wechselwirkung — •Oliver Plohl, Christian Fuchs, Eric van Dalen und Amand Faessler — Institut für Theoretische Physik, Universität Tübingen, Auf der Morgenstelle 14, D-72076 Tübingen

Relativistisch sowie nicht-relativistisch formulierte moderne Nukleon-Nukleon Potentiale (Bonn, CD-Bonn, Nijmegen, Argonne, Idaho, V_{lowk}) werden mit Hilfe von Projektionsmethoden auf eine relativistische Operator Struktur abgebildet. Dies erlaubt es, diese zum Teil sehr unterschiedlichen theoretischen Ansätze auf der Ebene von covarianten Amplituden zu vergleichen. Es wurde eine bemerkenswerte Übereinstimmung aller Potentiale festgestellt. Ausgehend von den covarianten Amplituden lässt sich die relativistische Selbstenergie Σ in Kernmaterie in Hartree-Fock Näherung berechnen. Als Konsequenz der relativisitischen Beschreibung treten in Kernmaterie, unabhängig vom verwendeten Potential, mehrere hundert MeV grosse skalare und vektorielle Felder auf. Die Existenz dieser großen Felder ist somit eine modellunabhängige Eigenschaft der Nukleon-Nukleon Wechselwirkung, welche bereits durch deren Vakuumstruktur erzwungen wird. Die Größenordnung der Skalar/Vektor-Felder ist bereits auf Tree Level festgelegt.