

HK 56 Elektromagnetische und Hadronische Sonden

Zeit: Freitag 14:00–15:45

Raum: F

Gruppenbericht

HK 56.1 Fr 14:00 F

Neutrino Interactions with Nucleons and Nuclei — •TINA LEITNER, LUIS ALVAREZ-RUSO und ULRICH MOSEL — Institut für Theoretische Physik, Universität Giessen, Germany

We have developed a model to describe the interactions of neutrinos with nucleons and nuclei via charged and neutral currents in the energy range up to about 2 GeV. The elementary νN reaction is then dominated by quasielastic scattering and $\Delta(1232)$ production.

For neutrino nucleon collisions we use a fully relativistic formalism which incorporates state-of-the-art parameterizations of the form factors for both the nucleon and the $N - \Delta$ transition.

The model has then been extended to finite nuclei, taking into account nuclear effects such as Fermi motion, Pauli blocking (both within the local density approximation) and nuclear binding in a density and momentum dependent mean field potential. The in-medium modification of the Δ resonance due to Pauli blocking and collisional broadening has also been included. Final state interactions are implemented by means of the Boltzmann-Uehling-Uhlenbeck (BUU) coupled-channel transport model; they lead to absorption, charge exchange, a redistribution of energy and the production of new particles.

We have investigated inclusive as well as exclusive channels as pion production and nucleon knockout and have found that in-medium effects in νA scattering, and in particular final state interactions, are not negligible. Our results show that the understanding of those effects are crucial for current and future neutrino experiments.

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HK 56.2 Fr 14:30 F

Fate of vector meson dominance or fate of QCD sum rules in a nuclear medium — •STEFAN LEUPOLD — Institut für Theoretische Physik, Universität Giessen, Germany

In vacuum, QCD sum rules and vector meson dominance provide two important and successful concepts of hadron physics and its connection to QCD. QCD sum rules are designed to connect low-energy (hadronic) information with QCD perturbation theory improved by the inclusion of condensates. The vector meson dominance assumption states that all interaction of the photon with hadrons is mediated by vector mesons. It is shown that it is impossible that both concepts still hold in a nuclear environment. At least one of the two concepts must become invalid in the medium. The technical tools used for the purely analytical proof are weighted finite energy sum rules and dispersion relations for the forward scattering amplitude of an electromagnetic current on a nucleon.

HK 56.3 Fr 14:45 F

^4He photodisintegration with realistic nuclear forces — •SONIA BACCA¹, DORON GAZIT², NIR BARNEA², WINFRIED LEIDEMANN³, and GIUSEPPINA ORLANDINI³ — ¹GSI, Plankstr. 1, 64291, Darmstadt, Germany — ²The Racah Institute of Physics, The Hebrew University, 91904, Jerusalem, Israel — ³Dipartimento di Fisica, Universita' di Trento, I-38050 Povo, Italy and INFN, Gruppo Collegato di Trento

We present the first calculation of the total photodisintegration cross section of ^4He with realistic two- and three-body nuclear forces.

We make use of the of the Lorentz Integral Transform (LIT) method to reduce the continuum problem to a bound-state-like equation [1]. We solve it by performing expansions in terms of hyperspherical harmonics (HH). Convergence is accelerated treating the nucleon-nucleon Argonne V18 potential with the powerful approach of effective interaction in the HH (EIH) [2]. The three-body force Urbana IX is also included, though as bare interaction. The main effect of meson exchange currents is taken into account via the Siegert theorem, in the unretarded dipole approximation.

The cross section exhibits a pronounced giant dipole peak. Good agreement with experimental data ((γ, n) from TUNL and (γ, p) from LLL) is found close to threshold, but at higher energy the experimental situation is still not settled.

[1] V.D. Efros, W. Leidemann, and G. Orlandini, Phys. Rev. Lett. **78**, 4015 (1997).

[2] N. Barnea, W. Leidemann and G. Orlandini, Phys. Rev. C **61**, 054001 (2000); Nucl. Phys. **A693**, 565 (2001).

HK 56.4 Fr 15:00 F

Shell Model Monte Carlo in the pn-formalism — •CEM OEZEN¹ and DAVID J. DEAN² — ¹Gesellschaft für Schwerionenforschung mbH, Planckstraße 1, 64291 Darmstadt, GERMANY — ²Physics Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831, USA

We report on the development of a new shell-model Monte Carlo algorithm, which uses the proton-neutron formalism. Shell model Monte Carlo methods, within the isospin formulation, have been successfully used in large-scale shell-model calculations. Motivation for this work is to extend the feasibility of these methods to shell-model studies involving non-identical proton and neutron valence spaces. We show the viability of the new approach with some test results. Finally, we use a realistic effective nucleon-nucleon interaction in the model space described by $(1p_{1/2}, 0g_{9/2})$ proton and $(1d_{5/2}, 2s_{1/2}, 1d_{3/2}, 0g_{7/2}, 0h_{11/2})$ neutron orbitals above the ^{88}Sr core to calculate ground-state energies, binding energies, $B(E2)$ strengths, and study pairing properties of the even-even $^{90-104}\text{Zr}$ and $^{92-106}\text{Mo}$ isotope chains.

HK 56.5 Fr 15:15 F

Need of a three-dimensional time for describing charged leptons — •CHRISTIAN YTHIER and GENEVIEVE MOUZE — Universite de Nice, France

Since any charged particle has a mass, and since any rest-mass is related to a rest-frequency by Einstein's double relation, a connection between charge and the impressive value of the rest-frequencies has to be searched for. An extension of the views of L.de Broglie (1) and R.P. Feynman (2) is suggested, in which the conservation of charge in a hydrogen atom is expressed by a closed loop in a three-dimensional time. This new point of view not only leads to increased symmetry of time and space and to an explanation of the uncertainty relations, but also suggests a tentative explanation of the fractional charge of the quarks, of the helicity concept, and even of inertia and inertial forces. Since the creation of a neutral lepton requires an additional 3D-space orthogonal to the 3D-time, six extra-dimensions have to be added to the 4D-space-time of special relativity. (1) L.de Broglie, Annales de Physique 3 (1925)22; (2) R.P. Feynman, Phys.Rev.76 (1948)749.

HK 56.6 Fr 15:30 F

Study of the reaction $\pi^+\pi^-\gamma$ at KLOE — •DEBORA LEONE — Institute fuer Experimentelle Kernphysik, Universitaet Karlsruhe, Postfach 3640, 76021 Karlsruhe

The KLOE experiment at the electron-positron collider DAPHNE has recently proven the feasibility of using initial state radiation (ISR) in e^+e^- annihilations for precision measurements of the hadronic cross section. This new method, dubbed Radiative Return, allows us to measure hadronic cross sections over a variable energy range $M^2(\text{hadr}) < s$ at particle factories which operate at a fixed centre-of-mass energy s . In the recently published KLOE measurement of the pion form factor, the events used had been where the ISR photon is emitted at small polar angles, which reduces background from FSR but leads to a suppression of the threshold region $M^2(\pi^+\pi^-) < 0.35 \text{ GeV}^2$. We are now performing a complementary analysis using events using ISR photons emitted at large angles to the beam, hence are tagged and the threshold region becomes accessible. Preliminary results for the cross section are presented, as well as a measurement of the charge asymmetry, which allows a unique test of the FSR model used for the description of the photon radiation from pions.