HK 48 Elektromagnetische und Hadronische Sonden

Zeit: Donnerstag 17:00–18:30 Raum: F

Gruppenbericht HK 48.1 Do 17:00 F

Sum-rule for the σ-meson — •Martin Schumacher[1], M.I. Levchuk[2], A.I. L vov[3], and A.I. Milstein[4] — [1]Zweites Physikalisches Institut der Universität, D-37077 Göttingen — [2]B.I. Stepanov Institute of Physics, BY-220072 Minsk, Belarus — [3]P.N. Lebedev Physical Institute, RU-117924 Moscow, Russia — [4]Budker Institute of Nuclear Physics, RU-630090 Novosibirsk, Russia

Arguments are found that the σ meson couples to two photons via its non-strange $q\bar{q}$ structure component. This ansatz leads to a quantitative explanation of the t-channel component of the difference of electromagnetic polarizabilities, $(\alpha-\beta)^t$, of the nucleon. The prediction is $(\alpha-\beta)^t_{p,n}=(5 \alpha_e g_{\pi NN})/(6\pi^2 m^2_\sigma f_\pi) =15.3$ in units of $10^{-4}{\rm fm}^3$ to be compared with the experimental values $(\alpha-\beta)^t_{p}=15.1\pm 1.3$ for the proton and $(\alpha-\beta)^t_{n}=14.8\pm 2.7$ for the neutron. The equivalent approach to exploit the $\pi\pi$ structure component of the σ meson via the BEFT sum rule leads to $(\alpha-\beta)^t_{p,n}=15.3\pm 1.3$, what also is in agreement with the experimental results. We show that the observed agreement of the two different predictions for $(\alpha-\beta)^t_{p,n}$ may be understood as a sum rule for the σ meson where the chiral partner of the π meson is linked together with the $f_0(600)$ particle observed in particle reactions where a resonant $\pi\pi$ intermediate state is involved.

Gruppenbericht HK 48.2 Do 17:30 F

Dispersion Theory and the Low Energy Constants for Pion Photoproduction — •Barbara Pasquini[1], Dieter Drechsel[2], and Lothar Tiator[2] — [1]Dipartimento di Fisica Nucleare e Teorica, Universita degli Studi di Pavia and INFN, Sezione di Pavia, Pavia, Italy — [2]Institut für Kernphysik, Universität Mainz

The relativistic amplitudes of pion photoproduction are evaluated by dispersion relations at $t = const$. The imaginary parts of the amplitudes are taken from the MAID model covering the absorption spectrum up to center-of-mass energies $W = 2.5$ GeV. For sub-threshold kinematics the amplitudes are expanded in powers of the two independent variables ν and t related to energy and momentum transfer. Subtraction of the corresponding series for the loop corrections allows one to determine the size of the counterterms of covariant baryon chiral perturbation theory. The proposed continuation of the amplitudes into the unphysical region provides a unique framework to derive the low-energy constants to any given order as well as an estimate of the higher order terms by global properties of the absorption spectrum.

Gruppenbericht HK 48.3 Do 18:00 F

Experimental determination of double-beta decay matrix elements thru charge-exchange reactions — •E.-W. Grewe, C. Bäumer, H. Dohmann, D. Frekers, S. Hollstein, S. Rakers, and J.-H. Thies — Institut für Kernphysik, Münster

The two neutrino double-beta decay represents a test case for our knowledge of nuclear wave functions. It is believed to proceed in at least two different modes: the neutrinoless ($0\nu\beta\beta$) and the two-neutrino ($2\nu\beta\beta$) mode. The decay mechanism is believed to be a combination of two virtual decays. Half-lives can be deduced from the involved nuclear matrix elements. The nuclear matrix element of the 2ν-mode can be experimentally determined using charge-exchange reactions at intermediate energies and extracting Gamow-Teller (GT) transition strengths[1]. Using the (d,^{2}He) reaction at the KVI (Groningen, NL) we recently measured the GT^+ distributions relevant for the double-beta decay of ^{64}Zn, ^{76}Ge and ^{96}Zr[2]. The resulting excitation energy spectra are presented and an overview about the state of the experiments is given.

[1] S. Rakers *et al.*, Phys. Rev. C 71, 054313 (2005)
[2] E.-W. Grewe and D. Frekers, submitted to Prog. Part. Nucl. Phys.(2005)