

Selected Abstracts from Physical Review D

Abstracts of papers published in Physical Review D which may be of interest to our readers are printed here.

Chiral perturbation theory analysis of the baryon magnetic moments reexamined. Loyal Durand and Phuoc Ha, *Department of Physics, University of Wisconsin-Madison, 1150 University Avenue, Madison, Wisconsin 53706*. (Received 22 December 1997; published 28 May 1998)

We reexamine critically the chiral expansion for the baryon magnetic moments including the contributions from loops which involve intermediate octet and decuplet baryons. We find that, contrary to some claims, the nonanalytic loop contributions of orders $m_s^{1/2}$ and $m_s \ln m_s$ are of the same general size because of large coupling factors for the latter, and that the decuplet contributions are as large as the octet contributions and must be included in a consistent calculation. There is no clear evidence of the convergence of the chiral series. The adequacy of the theory will not be established until dynamical models are able to calculate the contributions from the counterterms that largely hide the loop effects in fits to the data. [S0556-2821(98)00315-4] [Phys. Rev. D **58**, 013010 (1998)]

Proton-proton cross section at $\sqrt{s} \sim 30$ TeV. Ralph Engel,¹ T. K. Gaisser,¹ Paolo Lipari,² and Todor Stanev,¹ ¹*Bartol Research Institute, University of Delaware, Newark, Delaware 19716* ²*Dipartimento di Fisica and INFN, Università di Roma I, Piazzale A. Moro 2, 00185 Roma, Italy*. (Received 23 February 1998; published 9 June 1998)

There are both theoretical and experimental uncertainties in using data from cosmic-ray air showers to estimate hadronic cross sections above accelerator energies. We outline these problems and compare the physics used to extract σ_{pp}^{tot} from air shower data to the widely used parametrization of the proton-proton cross section of Donnachie and Landshoff and other contemporary models. We conclude that the published cosmic-ray cross section values do not strongly constrain σ_{pp}^{tot} fits from lower energy accelerator data. [S0556-2821(98)00715-2] [Phys. Rev. D **58**, 014019 (1998)]

Coherence of neutrino oscillations in the wave packet approach. C. Giunti, *INFN, Sezione di Torino, and Dipartimento di Fisica Teorica, Università di Torino, Via P. Giuria 1, I-10125 Torino, Italy*; C. W. Kim, *Department of Physics & Astronomy, The Johns Hopkins University, Baltimore, Maryland 21218 and School of Physics, Korea Institute for Advanced Study, Seoul 130-012, Korea*. (Received 19 November 1997; published 9 June 1998)

The temporal and spatial coherence widths of the microscopic process by which a neutrino is detected are incorporated in the quantum mechanical wave packet treatment of neutrino oscillations, confirming the observation of Kiers, Nussinov, and Weiss that an accurate measurement of the neutrino energy in the detection process can increase the coherence length. However, the wave packet

treatment presented here shows that the coherence length has an upper bound, determined by the neutrino energy and the mass-squared difference, beyond which the coherence of the oscillation process is lost. [S0556-2821(98)01415-5] [Phys. Rev. D **58**, 017301 (1998)]

Damping of differential rotation in neutron stars. Armen Sedrakian, *Center for Radiophysics and Space Research and Department of Astronomy, Cornell University, Ithaca, New York 14853*. (Received 17 March 1998; published 22 June 1998)

We derive the transport relaxation times for quasiparticle-vortex scattering processes via nuclear force, relevant for the damping of the differential rotation of superfluids in the quantum liquid core of a neutron star. The proton scattering off the neutron vortices provides the dominant resistive force on the vortex lattice at all relevant temperatures in the phase where neutrons only are in the paired state. If protons are superconducting, a small fraction of hyperons and resonances in the normal state would be the dominant source of friction on neutron and proton vortex lattices at the core temperatures $T \geq 10^7$ K. [S0556-2821(98)50314-1] [Phys. Rev. D **58**, 021301 (1998)]

Phase transitions and the mass-radius curves of relativistic stars. Lee Lindblom, *Theoretical Astrophysics 130-33, California Institute of Technology, Pasadena, California 91125*. (Received 2 March 1998; published 22 June 1998)

The properties of the mass-radius curves of relativistic stellar models constructed from an equation of state with a first-order phase transition are examined. It is shown that the slope of the mass-radius curve is continuous unless the discontinuity in the density at the phase transition point has a certain special value. The curve has a cusp if the discontinuity is larger than this value. The curvature of the mass-radius curve becomes singular at the point where the high density phase material first appears. This singularity makes the mass-radius curve appear on large scales to have a discontinuity in its slope at this point, even though the slope is in fact continuous on microscopic scales. Analytical formulas describing the behavior of these curves are found for the simple case of models with two-zone uniform-density equations of state. [S0556-2821(98)02114-6] [Phys. Rev. D **58**, 024008 (1998)]

Evolution of inhomogeneous condensates: Self-consistent variational approach. D. Boyanovsky,¹ F. Cooper,² H. J. de Vega,³ P. Sodano,⁴ ¹*Department of Physics and Astronomy, University of Pittsburgh, Pittsburgh, Pennsylvania 15260* ²*Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545*

³*LPTHE, Université Pierre et Marie Curie (Paris VI) et Denis Diderot (Paris VII), Tour 16, 1er. étage, 4, Place Jussieu, 75252 Paris, Cedex 05, France* ⁴*Dipartimento di Fisica and Sezione INFN, Università di Perugia, 06100 Perugia, Italia.* (Received 12 February 1998; published 12 June 1998)

We establish a self-consistent variational framework that allows us to study numerically the non-equilibrium evolution of non-perturbative inhomogeneous field configurations including quantum back reaction effects. After discussing the practical merits and disadvantages of different approaches we provide a closed set of local and renormalizable update equations that determine the dynamical evolution of inhomogeneous condensates and can be implemented numerically. These incorporate self-consistently the back reaction of quantum fluctuations and particle production. This program requires the solution of a self-consistent inhomogeneous problem to provide initial Cauchy data for the inhomogeneous condensates and Green's functions. We provide a simple solvable ansatz for such an initial value problem for the sine-Gordon and ϕ^4 quantum field theories in one spatial dimension. We compare exact known results of the sine-Gordon model to this simple ansatz. We also study the linear sigma model in the large N limit in three spatial dimensions as a microscopic model for pion production in ultrarelativistic collisions. We provide a solvable self-consistent ansatz for the initial value problem with cylindrical symmetry. For this case we also obtain a closed set of local and renormalized update equations that can be numerically implemented. A novel phenomenon of spinodal instabilities and pion production arises as a result of a Klein paradox for large amplitude inhomogeneous condensate configurations. [S0556-2821(98)03014-8] [Phys. Rev. D **58**, 025007 (1998)]

Primordial abundances of ${}^6\text{Li}$, ${}^9\text{Be}$, and ${}^{11}\text{B}$ with neutrino degeneracy and gravitational constant variation. Jong Bock Kim, *Department of Physics, Hanyang University, Seoul 133-791, Korea* and *Department of Physics, Soonchunhyang University, Asan, Choongnam 336-745, Korea*; Joon Ha Kim and Hyun Kyu Lee, *Department of Physics, Hanyang University, Seoul 133-791, Korea.* (Received 15 September 1997; published 24 June 1998)

Recent measurements of deuterium abundances from QSO absorption spectra show two conflicting numbers, which differ by an order of magnitude. Allowing the neutrino degeneracy together with gravitational constant variation at the epoch of primordial nucleosynthesis, the implication of these observations on the ${}^6\text{Li}$, ${}^9\text{Be}$, and ${}^{11}\text{B}$ abundances is discussed. Within the permitted ranges consistent with D, ${}^4\text{He}$, and ${}^7\text{Li}$, we observe the strong η dependence of ${}^{11}\text{B}$ as in standard big-bang nucleosynthesis but no significant dependence is observed for ${}^6\text{Li}$ and ${}^9\text{Be}$. The predictions of ${}^6\text{Li}$ and ${}^9\text{Be}$ for low and high deuterium differ by an order of magnitude and predictions for ${}^{11}\text{B}$ differ by several orders of magnitude at most. [S0556-2821(98)01514-8] [Phys. Rev. D **58**, 027301 (1998)]

Three flavor implications of the result of the CHOOZ Collaboration. Mohan Narayan and G. Rajasekaran, *Institute of Mathematical Sciences, Chennai 600 113, India*; S. Uma Sankar, *Department of Physics, Indian Institute of Technology, Powai, Mumbai 400076, India.* (Received 17 December 1997; published 9 July 1998)

We analyze the recent result of the CHOOZ Collaboration in the context of mixing and oscillations between all the three neutrino

flavors. If one assumes the hierarchy among the vacuum mass eigenvalues $\delta_{21} \ll \delta_{31}$ where $\delta_{21} = \mu_2^2 - \mu_1^2$ and $\delta_{31} = \mu_3^2 - \mu_1^2$, then the CHOOZ result puts a strong constraint on the allowed values of the (13) mixing angle ϕ . It is also shown that, in light of the CHOOZ result, the maximum contribution of the $\nu_\mu \leftrightarrow \nu_e$ oscillation channel to the atmospheric neutrino anomaly is less than 7 percent, thus demonstrating that the atmospheric neutrino anomaly is mainly due to $\nu_\mu \leftrightarrow \nu_\tau$ oscillations. Most importantly the CHOOZ result now excludes a large part of the three flavor parameter space which was previously allowed as solutions to the solar and atmospheric neutrino problems. [S0556-2821(98)50415-8] [Phys. Rev. D **58**, 031301 (1998)]

Measurements of the $\Delta(1232)$ transition form factor and the ratio σ_n/σ_p from inelastic electron-proton and electron-deuteron scattering. L. M. Stuart,^{2,4,10} P. E. Bosted,¹ L. Andivahis,¹ A. Lung,¹ J. Alster,¹² R. G. Arnold,¹ C. C. Chang,⁵ F. S. Dietrich,⁴ W. R. Dodge,⁷ R. Gearhart,¹⁰ J. Gomez,³ K. A. Griffioen,⁸ R. S. Hicks,⁶ C. E. Hyde-Wright,¹³ C. Keppel,¹ S. E. Kuhn,¹¹ J. Lichtenstadt,¹² R. A. Miskimen,⁶ G. A. Peterson,⁶ G. G. Petratos,⁹ S. E. Rock,¹ S. H. Rokni,⁶ W. K. Sakumoto,⁹ M. Spenagos,¹ K. Swartz,¹³ Z. Szalata,¹ and L. H. Tao,¹ ¹*The American University, Washington, D.C. 20016* ²*University of California, Davis, California 95616* ³*TJNAF, Newport News, Virginia 23606* ⁴*Lawrence Livermore National Laboratory, Livermore, California 94550* ⁵*University of Maryland, College Park, Maryland 20742* ⁶*University of Massachusetts, Amherst, Massachusetts 01003* ⁷*National Institute of Standards and Technology, Gaithersburg, Maryland 20899* ⁸*University of Pennsylvania, Philadelphia, Pennsylvania 19104* ⁹*University of Rochester, Rochester, New York 14627* ¹⁰*Stanford Linear Accelerator Center, Stanford, California 94309* ¹¹*Stanford University, Stanford, California 94305* ¹²*University of Tel-Aviv, Ramat Aviv, Tel-Aviv 69978, Israel* ¹³*University of Washington, Seattle, Washington 98195.* (Received 19 December 1996; published 23 June 1998)

Measurements of inclusive electron-scattering cross sections using hydrogen and deuterium targets in the region of the $\Delta(1232)$ resonance are reported. A global fit to these new data and previous data in the resonance region is also reported for the proton. Transition form factors have been extracted from the proton cross sections for this experiment over the four-momentum transfer squared range $1.64 < Q^2 < 6.75$ (GeV/c)² and from previous data over the range $2.41 < Q^2 < 9.82$ (GeV/c)². The results confirm previous reports that the $\Delta(1232)$ transition form factor decreases more rapidly with Q^2 than expected from perturbative QCD. The ratio of σ_n/σ_p in the $\Delta(1232)$ resonance region has been extracted from the deuteron data for this experiment in the range $1.64 < Q^2 < 3.75$ (GeV/c)² and for a previous experiment in the range $2.4 < Q^2 < 7.9$ (GeV/c)². A study has been made of the model dependence of these results. This ratio σ_n/σ_p for $\Delta(1232)$ production is slightly less than unity, while σ_n/σ_p for the nonresonant cross sections is approximately 0.5, which is consistent with deep inelastic scattering results. [S0556-2821(98)01513-6] [Phys. Rev. D **58**, 032003 (1998)]

Magnetic and axial vector form factors as probes of orbital angular momentum in the proton. M. Casu and L. M. Sehgal, *Institut für Theoretische Physik (E), RWTH Aachen, D-52056 Aachen, Germany.* (Received 16 March 1998; published 24 June 1998)

We have recently examined the static properties of the baryon octet (magnetic moments and axial vector coupling constants) in a generalized quark model in which the angular momentum of a polarized nucleon is partly spin $\langle S_z \rangle$ and partly orbital $\langle L_z \rangle$. The orbital momentum was represented by the rotation of a flux tube connecting the three constituent quarks. The best fit is obtained with $\langle S_z \rangle = 0.08 \pm 0.15$, $\langle L_z \rangle = 0.42 \pm 0.14$. We now consider the consequences of this idea for the q^2 dependence of the magnetic and axial vector form factors. It is found that the isovector magnetic form factor $G_M^{\text{isovector}}(q^2)$ differs in shape from the axial form factor $F_A(q^2)$ by an amount that depends on the spatial distribution of orbital angular momentum. The model of a rigidly rotating flux tube leads to a relation between the magnetic, axial vector and matter radii, $\langle r^2 \rangle_{\text{mag}} = f_{\text{spin}} \langle r^2 \rangle_{\text{axial}} + \frac{5}{2} f_{\text{orb}} \langle r^2 \rangle_{\text{matt}}$, where $f_{\text{orb}}/f_{\text{spin}} = \frac{1}{3} \langle L_z \rangle / G_A$, $f_{\text{spin}} + f_{\text{orb}} = 1$. The shape of $F_A(q^2)$ is found to be close to a dipole with $M_A = 0.92 \pm 0.06$ GeV. [S0556-2821(98)03415-8] [Phys. Rev. D **58**, 033002 (1998)]

Update on atmospheric neutrinos. M. C. Gonzalez-Garcia,^{1,2} H. Nunokawa,¹ O. L. G. Peres,¹ T. Stanev,³ J. W. F. Valle,¹ ¹*Departament de Física Teòrica, Instituto de Física Corpuscular—C.S.I.C., Universitat de València 46100 Burjassot, València, Spain* ²*Instituto de Física Teórica, Universidade Estadual Paulista, Rua Pamplona 145, 01405-900 São Paulo, Brazil* ³*Bartol Research Institute, University of Delaware, Newark, Delaware 19716.* (Received 21 January 1998; published 7 July 1998)

We discuss the impact of recent experimental results on the determination of atmospheric neutrino oscillation parameters. We use all published results on atmospheric neutrinos, including the preliminary large statistics data of Super-Kamiokande. We reanalyze the data in terms of both $\nu_\mu \rightarrow \nu_\tau$ and $\nu_\mu \rightarrow \nu_e$ channels using new improved calculations of the atmospheric neutrino flux. We compare the sensitivity attained in atmospheric neutrino experiments with those of accelerator and reactor neutrino oscillation searches, including the recent CHOOZ experiment. We briefly comment on the implications of atmospheric neutrino data in relation to future searches for neutrino oscillations with long baselines, such as the K2K, MINOS, ICARUS, and NOE experiments. [S0556-2821(98)02215-2] [Phys. Rev. D **58**, 033004 (1998)]

Long-baseline neutrino oscillation experiments and CP violation in the lepton sector. S. M. Bilenky, *Joint Institute for Nuclear Research, Dubna, Russia and INFN, Sezione di Torino, and Dipartimento di Fisica Teorica, Università di Torino, Via P. Giuria 1, I-10125 Torino, Italy*; C. Giunti, *INFN, Sezione di Torino, and Dipartimento di Fisica Teorica, Università di Torino, Via P. Giuria 1, I-10125 Torino, Italy*; W. Grimus, *Institute for Theoretical Physics, University of Vienna, Boltzmanngasse 5, A-1090 Vienna, Austria.* (Received 30 December 1997; published 12 June 1998)

We discuss possibilities to investigate the effects of CP (and T) violation in the lepton sector in neutrino oscillation experiments. We consider the effects of CP violation in the framework of two schemes of mixing of four massive neutrinos that can accommodate the results of all neutrino oscillation experiments. Using the constraints on the mixing parameters that follow from the results of short-baseline neutrino oscillation experiments, we derive rather strong upper bounds on the effects of CP violation in $\bar{\nu}_\mu \leftrightarrow \bar{\nu}_e$ transitions in long-baseline neutrino oscillation experiments. We show that the effects of CP violation in $\bar{\nu}_\mu \leftrightarrow \bar{\nu}_\tau$ transitions in long-

baseline oscillation experiments can be as large as is allowed by the unitarity of the mixing matrix. The matter effects, which complicate the problem of searching for CP violation in long-baseline experiments, are discussed in detail. We consider the T-odd asymmetries whose measurement could allow to reveal T and CP violation in the lepton sector independently from matter effects. [S0556-2821(98)02313-3] [Phys. Rev. D **58**, 033001 (1998)]

Effective chiral meson-baryon Lagrangian from quark-diquark flavor dynamics. D. Ebert, *Institut für Physik, Humboldt-Universität zu Berlin, Invalidenstraße 110, 10115 Berlin, Germany*; Th. Jurke, *Max-Planck-Institut für Gravitationsphysik, Schlaatzweg 1, 14473 Potsdam, Germany.* (Received 29 December 1997; published 16 June 1998)

The approach of path integral hadronization is applied to an SU(2) model of quark-diquark flavor dynamics. Within such a scheme we derive an effective chiral meson-baryon Lagrangian, where the Goldberger-Treiman relation, found earlier at the quark-meson level, is now reestablished at the composite hadron level. Masses and coupling constants of composite hadrons are then calculable by the parameters of the underlying microscopic quark-diquark picture. [S0556-2821(98)00115-5] [Phys. Rev. D **58**, 034001 (1998)]

Antihydrogen production and accuracy of the equivalent photon approximation. C. A. Bertulani, *Instituto de Física, Universidade Federal do Rio de Janeiro, 21945-970 Rio de Janeiro, RJ, Brazil*; G. Baur, *Forschungszentrum Jülich, Postfach 1913, D-52425 Jülich, Germany.* (Received 10 November 1997; published 30 June 1998)

The production of antihydrogen in flight in $\bar{p}$ -nucleus collisions is calculated theoretically in the plane wave Born approximation (which is equivalent to the straight line semiclassical approximation). Antihydrogen has been produced in this way at CERN LEAR and is presently studied at Fermilab at various $\bar{p}$ energies. Dirac wave functions for the leptons are used, taking first order ($Z\alpha$) corrections into account. Analytical results are obtained for differential cross sections. Total cross sections are obtained by numerical integration. The dependence on the transverse momentum transfer is studied and the accuracy of the equivalent photon approximation and a recent variant by Munger, Brodsky, and Schmidt is discussed as a function of beam energy. [S0556-2821(98)05613-6] [Phys. Rev. D **58**, 034005 (1998)]

Quarkonium polarization in nonrelativistic QCD and the quark-gluon plasma. Sourendu Gupta, *Theory Group, Tata Institute of Fundamental Research, Homi Bhabha Road, Bombay 400005, India.* (Received 5 February 1998; published 30 June 1998)

We examine angular distributions of leptons arising from the decay of J/ψ in inclusive hadroproduction. Taking into account feed-down contributions from $\chi_{1,2}$, a flat distribution emerges without fine tuning parameters. Changes in the ratio of direct to total J/ψ cross sections would change this distribution significantly. Such angular distributions are, therefore, confirmatory tests of the J/ψ suppression signal for the production of a quark-gluon plasma. Re-

lated effects are predicted for the Y . [S0556-2821(98)03215-9] [Phys. Rev. D **58**, 034006 (1998)]

Strong decays of heavy hadrons in heavy quark effective theory.

W. Roberts, *Department of Physics, Old Dominion University, Norfolk, Virginia 23529 and Thomas Jefferson National Accelerator Facility, 12000 Jefferson Ave., Newport News, Virginia 23606*. (Received 12 August 1997; published 1 July 1998)

We discuss the application of the tensor formalism of HQET to the strong decays of heavy hadrons. We treat both meson and baryon decays, and note that all of our results are in agreement with the “spin-counting” arguments of Isgur and Wise. We briefly discuss the possible extension of the formalism to include $1/m$ corrections. [S0556-2821(98)00815-7] [Phys. Rev. D **58**, 034007 (1998)]

An extension of the statistical bootstrap model to include strangeness. Implications on particle ratios.

A. S. Kapoyannis, C. N. Ktorides, and A. D. Panagiotou, *University of Athens, Division of Nuclear and Particle Physics, GR-15771 Athens, Greece*. (Received 22 December 1997; published 6 July 1998)

The statistical bootstrap model (SBM) is extended to describe hadronic systems which carry the quantum number of strangeness. The study is conducted in the three-dimensional space (T, μ_q, μ_s) of temperature, up-down, and strange chemical potentials, respectively, wherein the existence of a “critical” surface is established, which sets the limits of the hadronic phase of matter. A second surface, defined by the null expectation value of strangeness number ($\langle S \rangle = 0$) is also determined. The approach of the latter surface to the critical one becomes the focal point of the present considerations. Two different versions of the extended SBM are examined, corresponding to the values 2 and 4 for the exponent α , which determines the asymptotic falloff of the mass spectrum $\rho(m)$. It is found that the $\alpha = 4$ version has decisive physical advantages. This model is subsequently adopted to discuss (strange) particle ratios pertaining to multiparticle production processes, for which a thermal equilibrium mode of description applies. [S0556-2821(98)06413-3] [Phys. Rev. D **58**, 034009 (1998)]

Proton-proton spin correlations at charm threshold and quarkonium bound to nuclei.

Guy F. de Tera mond and Randall Espinoza, *Escuela de Física, Universidad de Costa Rica, San José, Costa Rica*; Manuel Ortega-Rodríguez, *Department of Applied Physics, Stanford University, Stanford, California 94309*. (Received 14 August 1997; published 8 July 1998)

The anomalous behavior of the spin-spin correlation at large momentum transfer in pp elastic scattering is described in terms of the degrees of freedom associated with the onset of the charm threshold. A nonperturbative analysis based on the symmetries of QCD is used to extract the relevant dynamics of the charmonium-proton interaction. The enhancement to pp amplitudes and their phase follow from analyticity and unitarity, giving a plausible explanation of the spin anomaly. The interaction between $c\bar{c}$ and light quarks in nuclei may form a distinct kind of nuclear matter: nuclear bound quarkonium. [S0556-2821(98)02315-7] [Phys. Rev. D **58**, 034012 (1998)]

Light meson spectra and instanton-induced forces. F. Brau and C. Semay, *Université de Mons-Hainaut, Place du Parc 20, B-7000 Mons, Belgium*. (Received 27 February 1998; published 9 July 1998)

The spinless Salpeter equation supplemented by an instanton-induced force is used to describe the spectra of light mesons, including the pseudoscalar ones. The coupling constants of the instanton-induced potential, as well as the quark constituent masses, are not treated as simple free parameters but are calculated from the underlying instanton theory. Quite good results are obtained provided the quarks are considered as effective degrees of freedom with a finite size. A further test of the model is performed by calculating the electromagnetic mass differences between S-wave mesons. [S0556-2821(98)05815-9] [Phys. Rev. D **58**, 034015 (1998)]

Neutrino dispersion in a minimal SUSY standard model with explicitly broken R parity at finite temperature and density.

M. Anwar Mughal and K. Ahmed, *Department of Physics, Quaid-i-Azam University, Islamabad, Pakistan*. (Received 14 October 1997; revised manuscript received 23 February 1998; published 8 July 1998)

We study the refraction of a light neutrino through a medium. In this connection, we extend a (vacuum) field theory supersymmetric standard model with explicitly broken R parity to a finite temperature and density, where sfermions coupled to fermions give rise to chirality conserving as well as chirality violating corrections to neutrino transitions. The refractive index of the neutrino undergoing such transitions in a heat bath of finite density is then calculated in this framework. Some of the implications of these results to the solar neutrino problem, supernovas, and in the early universe are discussed and compared with earlier works. [S0556-2821(98)04213-1] [Phys. Rev. D **58**, 035010 (1998)]

Nuclear dependence in the Drell-Yan transverse momentum distribution.

Xiaofeng Guo, *Department of Physics, Columbia University, New York, New York 10027*. (Received 24 November 1997; published 12 June 1998)

We calculate the nuclear enhancement in the Drell-Yan transverse momentum distribution in hadron-nucleus collisions. In terms of the multiple scattering picture, we compute the contributions from double scattering. Applying the generalized factorization theorem, we express the nuclear enhancement in terms of twist-4 nuclear parton correlation functions. Using the known information on these twist-4 parton correlation functions, we estimate the nuclear enhancement for Drell-Yan pairs in the large q_T region. We also discuss the source of nuclear suppression in the small q_T region. [S0556-2821(98)06913-6] [Phys. Rev. D **58**, 036001 (1998)]

Low-energy expansion for pion-pion scattering and crossing symmetry in dispersion relations.

B. Ananthanarayan, *Centre for Theoretical Studies, Indian Institute of Science, Bangalore 560 012, India*. (Received 17 February 1998; published 26 June 1998)

We show that a suitable setting for a comparison of the low-energy representation for pion-pion scattering amplitudes, with a dispersive representation for these amplitudes, is provided by certain crossing symmetric dispersion relations. We begin with a dis-

cussion of fixed- t dispersion relations and discuss the origin of crossing constraints that arise in this context when we consider resonance saturation with certain $l \geq 2$ states. We demonstrate that the approach advocated here does not require us to enforce such constraints. Our results are contrasted with those from fixed- t dispersion relations. We finally discuss the numerical import of our results. [S0556-2821(98)02515-6] [Phys. Rev. D **58**, 036002 (1998)]

Two-loop analysis of axial vector current propagators in chiral perturbation theory. Eugene Golowich, *Department of Physics and Astronomy, University of Massachusetts, Amherst, Massachusetts 01003*; Joachim Kambor, *Institut für Theoretische Physik, Universität Zürich, CH-8057 Zürich, Switzerland*. (Received 13 March 1998; published 8 July 1998)

We perform a calculation of the isospin and hypercharge axial vector current propagators [$\Delta_{A3}^{\mu\nu}(q)$ and $\Delta_{A8}^{\mu\nu}(q)$] to two loops in $SU(3) \times SU(3)$ chiral perturbation theory. A large number of $\mathcal{O}(p^6)$ divergent counterterms are fixed, and complete two-loop renormalized expressions for the pion and eta masses and decay constants are obtained. The calculated isospin and hypercharge axial vector polarization functions are used as input in new chiral sum rules, valid to second order in the light quark masses. Some phenomenological implications of these sum rules are considered. [S0556-2821(98)06015-9] [Phys. Rev. D **58**, 036004 (1998)]

When the wavepacket is unnecessary. L. Stodolsky, *Max-Planck-Institut für Physik (Werner-Heisenberg-Institut), Föhringer Ring 6, 80805 München, Germany*. (Received 4 March 1998; published 9 July 1998)

We point out that many wavepacket discussions for the coherence properties of particle beams are unnecessary since they deal with stationary sources; and when the problem is stationary, essentially all information is in the energy spectrum. This recognition allows a simple answer to a number of long-debated points, usually framed in terms of the "length of the wavepacket." In particular we discuss neutrino oscillations, and some issues in neutron physics. The question as to whether two simple beams with the same energy spectrum are distinguishable is answered negatively for stationary situations. The question as to whether neutrino oscillations should be thought of as taking place between states of the same energy or the same momentum is answered in favor of energy for stationary situations. The consequences for proposals involving the ${}^7\text{Be}$ neutrino line of the Sun, the observation of oscillations in supernova neutrinos, and wavepacket studies with neutrons are briefly discussed, as well as the connection with the coherence notions of quantum optics. [S0556-2821(98)03315-3] [Phys. Rev. D **58**, 036006 (1998)]

Color mixing in high-energy hadron collisions. Chun Wa Wong, *Department of Physics and Astronomy, University of California, Los Angeles, California 90095-1547*. (Received 25 March 1998; published 22 June 1998)

The color mixing of mesons propagating in a nucleus is studied with the help of a color-octet Pomeron partner present in the two-gluon model of the Pomeron. For a simple model with four meson-nucleon channels, color mixings are found to be absent for pointlike mesons and very small for mesons of small sizes. These results

seem to validate the absorption model with two independent color components used in recent analyses of the nuclear absorption of J/ψ mesons produced in nuclear reactions.

[S0556-2821 (98)07015-5] [Phys. Rev. D **58**, 037501 (1998)]

Comment on "Unpolarized and polarized quark distributions in the large- N_c limit." H. Weigel, *Institute for Theoretical Physics, Tübingen University, Auf der Morgenstelle 14, D-72076 Tübingen, Germany*; L. Gamberg, *Department of Physics and Astronomy, University of Oklahoma, 440 West Brooks Avenue, Norman, Oklahoma 73019-0225*; H. Reinhardt, *Institute for Theoretical Physics, Tübingen University, Auf der Morgenstelle 14, D-72076 Tübingen, Germany*. (Received 11 September 1997; published 30 June 1998)

The recent article by Diakonov *et al.* [Phys. Rev. D **56**, 4069 (1997)] on quark distributions in a chiral quark soliton model is critically discussed with regard to the stability of the soliton and the interpretation of the calculated quark distributions.

[S0556-2821(98)00615-8] [Phys. Rev. D **58**, 038501 (1998)]

On nucleon parton distributions from the chiral quark-soliton model. D. I. Diakonov, *NORDITA, Blegdamsvej 17, 2100 Copenhagen Ø, Denmark*; Yu. Petrov and P. V. Pobylitsa, *Petersburg Nuclear Physics Institute, Gatchina, St. Petersburg 188 350, Russia*; M. V. Polyakov and C. Weiss, *Institut für Theoretische Physik II, Ruhr-Universität Bochum, D-44780 Bochum, Germany*. (Received 1 December 1997; published 30 June 1998)

We outline the logic of calculating leading-twist parton distributions in the chiral quark-soliton model of the nucleon, and reply to the criticism in the previous Comment by Weigel *et al.* [S0556-2821(98)00515-3] [Phys. Rev. D **58**, 038502 (1998)]

Neutrino oscillations in the dualized standard model. José Bor-des, *Departament Física Teòrica, Universitat de València, calle Dr. Moliner 50, E-46100 Burjassot (Valencia), Spain*; Chan Hong-Mo, *Rutherford Appleton Laboratory, Chilton, Didcot, Oxon, OX11 0QX, United Kingdom*; Jakov Pfaudler, *Department of Physics, Theoretical Physics, University of Oxford, 1 Keble Road, Oxford, OX1 3NP, United Kingdom*; Tsou Sheung Tsun, *Mathematical Institute, University of Oxford, 24-29 St. Giles', Oxford, OX1 3LB, United Kingdom*. (Received 25 February 1998; published 17 July 1998)

A method developed from the dualized standard model for calculating the quark CKM matrix and masses is applied to the parallel problem in neutrino oscillations. Taking the parameters determined from quarks and the masses of two neutrinos: $m_3^2 \sim 10^{-2} - 10^{-3} \text{ eV}^2$ suggested by atmospheric neutrino data and $m_2^2 \sim 10^{-10} \text{ eV}^2$ suggested by the long-wavelength oscillation solution of the solar neutrino problem, one obtains from a parameter-free calculation all the mixing angles in reasonable agreement with existing experiments. However, the scheme is found not to accommodate comfortably the mass values $m_2^2 \sim 10^{-5} \text{ eV}^2$ suggested by the MSW solution for solar neutrinos. [S0556-2821(98)05715-4] [Phys. Rev. D **58**, 053003 (1998)]

Oblate Skyrmions. F. Leblond and L. Marleau, *Département de Physique, Université Laval, Québec, Canada G1K 7P4*. (Received 10 July 1997; revised manuscript received 25 September 1997; published 15 July 1998)

The spherically symmetric hedgehog ansatz used in the description of the Skyrmion is believed to be inadequate for rotational states such as the nucleon ($I=J=\frac{1}{2}$) and the Δ ($I=J=\frac{3}{2}$) due to centrifugal forces. We study here a simple alternative: an oblate spheroidal solution which leads to lower masses for these baryons. As one might expect, the shape of the solution is flatter as one increases $I=J$ whether or not the size of the soliton is allowed to change or not. [S0556-2821(98)04015-6] [Phys. Rev. D **58**, 054002 (1998)]

QCD analysis of diffractive and leading-proton DIS structure functions in the framework of fracture functions. D. de Florian, *Theoretical Physics Division, CERN, CH 1211 Geneva 23, Switzerland*; R. Sassot, *Departamento de Física, Universidad de Buenos Aires, Ciudad Universitaria, Pabellón 1 (1428) Buenos Aires, Argentina*. (Received 8 April 1998; published 20 July 1998)

We present a combined QCD analysis of recent data produced by the H1 and ZEUS Collaborations on the diffractive and leading-proton deep inelastic positron-proton scattering structure functions $F_2^{D(3)}$ and $F_2^{LP(3)}$, respectively. It is shown that the QCD framework for semi-inclusive processes, based on fracture functions, allows a unified treatment of both diffractive and leading-proton processes,

and offers a precise perturbative QCD description for them, alternative to those that rely on model-dependent assumptions, such as Regge factorization, or other nonperturbative approaches.

[S0556-2821(98)07115-X] [Phys. Rev. D **58**, 054003 (1998)]

Bilinear R -parity violation in neutrinoless double beta decay.

Amand Faessler and Sergey Kovalenko, *Institute für Theoretische Physik der Universität Tübingen, Auf der Morgenstelle 14, D-72076 Tübingen, Germany*; Fedor Simkovic, *Department of Nuclear Physics, Comenius University, Mlynská dolina F1, 84215 Bratislava, Slovakia*. (Received 20 January 1998; published 16 July 1998)

We discuss some phenomenological issues of the effective quark-lepton operators emerging from the bilinear lepton-Higgs couplings in the superpotential and in the soft supersymmetry breaking sector of the supersymmetric models with explicit R -parity violation. The contribution of these operators to the neutrinoless double beta decay ($0\nu\beta\beta$) is derived. The corresponding nuclear matrix elements are calculated within the renormalized quasiparticle random phase approximation, which includes the Pauli effect of fermion pairs and does not collapse for the physical values of the nuclear force strength. On this basis we extract from the experimental data new stringent limits on the first generation mass parameter characterized the lepton-Higgs bilinear coupling and on the electron sneutrino vacuum expectation value. [S0556-2821(98)04615-3] [Phys. Rev. D **58**, 055004 (1998)]