Selected Abstracts from Other Physical Review Journals

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Implications of recent solar neutrino observations: An analysis of charged current data. C. V. K. Baba, D. Indumathi, and M. V. N. Murthy, *The Institute of Mathematical Sciences, Chennai 600 113, India.* (Received 8 January 2002; published 3 April 2002)

We have analyzed the recent results from the observation of charged current $\nu_e d \rightarrow e^- pp$ events from solar neutrinos by the Sudbury Neutrino Observatory (SNO) assuming neutrino oscillations with three active flavors. The data seem to prefer a low mass-squared difference and large mixing angle solution (the so-called LOW solution) in (12) parameter space. However, when combined with the gallium charged current interaction data from GALLEX and GNO, distinct (1σ) allowed regions corresponding to the large mixing angle (LMA) and small mixing angle (SMA) appear while the LOW solution is disfavored up to 3σ standard deviation. The physical electron neutrino survival probability corresponding to these best fit solutions are then determined and analyzed for their energy dependence. [Phys. Rev. D **65**, 073033 (2002)]

Model-independent constraint on the neutrino mass spectrum from the neutrinoless double beta decay. Zhi-zhong Xing, *CCAST (World Laboratory), P.O. Box 8730, Beijing 100080, China, and Institute of High Energy Physics, P.O. Box 918 (4), Beijing 100039, China.* (Received 5 February 2002; published 4 April 2002)

We present a concise formula to relate the effective mass term of the neutrinoless double beta decay to a single neutrino mass, two Majorana CP-violating phases and four observables of neutrino oscillations for a generic neutrino mass spectrum. If the alleged evidence for the neutrinoless double beta decay is taken into account, one may obtain a rough but model-independent constraint on the absolute scale of neutrino masses— it is most likely to be in the range between 0.1 eV and 1 eV. [Phys. Rev. D **65**, 077302 (2002)]

Supernova 1987A bound on neutrino spectra for *r*-process nucleosynthesis. C. J. Horowitz, *Nuclear Theory Center and Department of Physics, Indiana University, Bloomington, Indiana 47405.* (Received 30 October 2001; published 29 March 2002)

The neutrino driven wind during a core collapse supernova is an attractive site for *r*-process nucleosynthesis. The initial electron fraction Y_e in the wind depends on observable neutrino energies and luminosities. The mean antineutrino energy is limited by supernova SN 1987A data while lepton number conservation constrains the ratio of antineutrino to neutrino luminosities. If Y_e, in the wind, is to be suitable for rapid neutron capture nucleosynthesis, then the mean electron neutrino energy could be significantly lower than that predicted in present supernova simulations. Alternatively, there could be a rapid increase of the mean antineutrino energy at late times. However, this is not seen in the SN 1987A data. Finally, there could be new neutrino physics such as oscillations to sterile neutrinos. [Phys. Rev. D **65**, 083005 (2002)]

Oscillation effects on neutrino decoupling in the early universe. Steen Hannestad, *NORDITA, Blegdamsvej 17, DK-2100 Copenhagen, Denmark.* (Received 22 November 2001; published 9 April 2002)

In the early universe, neutrinos decouple from equilibrium with the electromagnetic plasma at a temperature which is only slightly higher than the temperature where electrons and positrons annihilate. Therefore neutrinos to some extent share in the entropy transfer from e^+e^- to other species, and their final temperature is slightly higher than the canonical value $T_\nu=(4/11)^{1/3}T_\gamma$. We study neutrino decoupling in the early universe with effects of neutrino oscillations included, and find that the change in neutrino energy density from e^+e^- annihilations can be about 2–3 % higher if oscillations are included. The primordial helium abundance can be changed by as much as 1.5×10^{-4} by neutrino oscillations. [Phys. Rev. D **65**, 083006 (2002)]

Numerical evolutions of nonlinear *r*-modes in neutron stars. Lee Lindblom, *Theoretical Astrophysics 130-33, California Institute of Technology, Pasadena, California 91125;* Joel E. Tohline, *Department of Physics and Astronomy, Louisiana State University, Baton Rouge, Louisiana 70803;* Michele Vallisneri, *Theoretical Astrophysics 130-33, California Institute of Technology, Pasadena, California 91125.* (Received 20 September 2001; published 9 April 2002)

Nonlinear evolution of the gravitational radiation (GR) driven instability in the *r*-modes of neutron stars is studied by full numerical 3D hydrodynamical simulations. The growth of the *r*-mode instability is found to be limited by the formation of shocks and breaking waves when the dimensionless amplitude of the mode grows to about three in value. This maximum mode amplitude is shown by numerical tests to be rather insensitive to the strength of the GR driving force. Upper limits on the strengths of possible nonlinear mode-mode coupling are inferred. Previously unpublished details of the numerical techniques used are presented, and the results of numerous calibration runs are discussed. [Phys. Rev. D **65**, 084039 (2002)]

Big bang nucleosynthesis constraints on bulk neutrinos. H. S. Goh and R. N. Mohapatra, *Department of Physics, University of Maryland, College Park, Maryland 20742.* (Received 17 October 2001; revised manuscript received 3 January 2002; published 2 April 2002)

We examine the constraints imposed by the requirement of successful nucleosynthesis on models with one large extra hidden space dimension and a single bulk neutrino residing in this dimension. We solve the Boltzmann kinetic equation for the thermal distribution of the Kaluza-Klein modes and evaluate their contribution to the energy density at the big bang nucleosynthesis epoch to constrain the size of the extra dimension $R^{-1} \equiv \mu$ and the parameter $\sin^2 2\theta$ which characterizes the mixing between the active and bulk neutrinos. [Phys. Rev. D **65**, 085018 (2002)]

Vacuum replicas in QCD. P. J. A. Bicudo and J. E. F. T. Ribeiro, *Grupo Teórico de Altas Energias (GTAE), Centro de Física das Interacções Fundamentais (CFIF), Departamento de Física, Instituto Superior Técnico, Avenida Rovisco Pais, P-1049-001 Lisboa, Portugal;* A. V. Nefediev, *Grupo Teórico de Altas Energias (GTAE), Centro de Física das Interacções Fundamentais (CFIF), Departamento de Física, Instituto Superior Técnico, Avenida Rovisco Pais, P-1049-001 Lisboa, Portugal, and Institute of Theoretical and Experimental Physics, 117218, B. Cheremushkinskaya 25, Moscow, Russia.* (Received 18 December 2001; published 8 April 2002)

The properties of the vacuum are addressed in two- and four-dimensional quark models for QCD. It is demonstrated that two-dimensional QCD (the 't Hooft model) possesses only one possible vacuum state—the solution to the mass-gap equation, which provides spontaneous breaking of chiral symmetry (SBCS). On the contrary, the four-dimensional theory with confinement modeled by the linear potential with a Coulomb OGE interaction not only has a chirally noninvariant ground vacuum state, but possesses an excited vacuum replica, which also exhibits SBCS and can be realized as a metastable intermediate state of hadronic systems. We discuss the influence of this vacuum replica on physical observables as well as on the possibility of probing the vacuum background fields in QCD. [Phys. Rev. D **65**, 085026 (2002)]

Status of four-neutrino mass schemes: A global and unified approach to current neutrino oscillation data. M. Maltoni, T. Schwetz, and J. W. F. Valle, *Instituto de Física Corpuscular, C.S.I.C./Universitat de València, Edificio Institutos de Paterna, Apartado 22085, E-46071 Valencia, Spain.* (Received 18 December 2001; published 23 April 2002)

We present a unified global analysis of neutrino oscillation data within the framework of the four-neutrino mass schemes $(3+1)$ and $(2+2)$. We include all data from solar and atmospheric neutrino experiments, as well as information from short-baseline experiments including the Liquid Scintillation Neutrino Detector (LSND). If we combine only solar and atmospheric neutrino data, $(3+1)$ schemes are clearly preferred, whereas short-baseline data in combination with atmospheric data prefer $(2+2)$ models. When combining all data in a global analysis, the $(3+1)$ mass scheme gives a slightly better fit than the $(2+2)$ case, though all four-neutrino schemes are presently acceptable. The LSND result disfavors the three-active neutrino scenario with only $\Delta m^2_{\rm sol}$ and $\Delta m^2_{\rm atm}$ at 99.9% C.L. with respect to the four-neutrino best-fit model. We perform a detailed analysis of the goodness of fit to identify which subset of the data is in disagreement with the best-fit solution in a given mass scheme. [Phys. Rev. D **65**, 093004 (2002)]

Model independent information on solar neutrino oscillations. M. V. Garzelli, *Dipartimento di Fisica Teorica, Università di Torino, and INFN, Sezione 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, and School of Physics, Korea Institute for Advanced Study, Seoul 130-012, Korea.* (Received 15 December 2001; published 23 April 2002)

We present the results of a Bayesian analysis of solar neutrino data in terms of $\nu_e \to \nu_{\mu,\tau}$ oscillations, independent from the standard solar model predictions for the solar neutrino fluxes. We show that such a model independent analysis allows us to constrain the values of the neutrino mixing parameters in limited regions around the usual regions. Furthermore, there is a strong indication in favor of large neutrino mixing and large values of Δm^2 (the LMA region). We calculate also the allowed ranges of the neutrino fluxes and we show that they are in good agreement with the standard solar model prediction. In particular, the ratio of the ^{8}B flux with its standard solar model prediction is constrained in the interval $[0.45, 1.42]$ with 99.73% probability. Finally, we show that the hypothesis of no neutrino oscillations is strongly disfavored in a model independent way with respect to the hypothesis of neutrino oscillations. [Phys. Rev. D **65**, 093005 (2002)]

Lepton transmutation in the dualized standard model. José Bordes, *Departament Fisica Teorica, Universitat de Valencia, calle Dr. Moliner 50, E-46100 Burjassot (Valencia), Spain;* Chan Hong-Mo, *Rutherford Appleton Laboratory, Chilton, Didcot, Oxon, OX11 0QX, United Kingdom;* Tsou Sheung Tsun, *Mathematical Institute, University of Oxford, 24-29 St. Giles', Oxford OX1 3LB, United Kingdom.* (Received 10 December 2001; published 29 April 2002)

The successful explanation of fermion mixing and of the fermion mass hierarchy by the dualized standard model (DSM) scheme is based on the premise of a fermion mass matrix rotating in generation space with changing scales at a certain speed, which could in principle lead to a sizable flavor violation observable in high sensitivity experiments such as BaBar. However, a full perturbative calculation to one-loop order reported here shows that this kinematical, flavor-violating effect of a rotating-mass matrix is off-set in the DSM by parallel effects from rotating-wave functions and vertices, giving in the end only very small flavor violations which are unlikely to be detectable by present experiments. The result means that at least for the present the DSM scheme has survived yet another threat to its validity, which has indeed been its most stringent and dangerous to date. It also provides some clarification of certain concepts connected with the rotating mass matrix which had previously been found puzzling. [Phys. Rev. D **65**, 093006 (2002)]

Role of the 't Hooft interaction in the calculation of the mixing angles of the $\eta(547)$ and $\eta'(958)$ mesons. C. M. Shakin and Huangsheng Wang, *Department of Physics and Center for Nuclear Theory, Brooklyn College of the City University of New York, Brooklyn, New York 11210.* (Received 30 August 2001; published 12 April 2002)

Recent work has shown that the singlet-octet mixing angles of the $\eta(547)$ and $\eta'(958)$ are different. That may be demonstrated either in extended chiral perturbation theory or by analysis of a large body of experimental data. The conclusion is that the $\eta(547)$ is almost entirely of octet character, while the $\eta'(958)$ is mainly of singlet character with about 10% octet component. It is possible to calculate the mixing angles and decay constants in our generalized Nambu–Jona-Lasinio (NJL) model, which includes a covariant model of confinement. Our model is able to give a good account of the mass values of the $\eta(547)$, $\eta'(958)$, $\eta(1295)$, and $\eta(1440)$ mesons. (We also provide predictions for the mass values of a large number of radially excited states.) It is well known that the $U_A(1)$ symmetry is broken, so that we only have eight pseudo Goldstone bosons, rather than the nine we would have otherwise. In the NJL model that feature may be introduced by including the 't Hooft interaction in the Lagrangian. That interaction reduces the energy of the octet state somewhat and significantly increases the energy of the singlet state, making it possible to fit the mass values of the $\eta(547)$ and $\eta'(958)$ in the NJL model when the 't Hooft interaction is included. In this work, we derive the equations of a covariant random phase approximation that may be used to study the nonet of pseudoscalar mesons. We demonstrate that a consistent treatment of the 't Hooft interaction leads to excellent results for the singlet-octet mixing angles. (The values obtained for the singlet and octet decay constants are also quite satisfactory.) It may be seen that the difference between the up (or down) constituent quark mass and the strange quark mass induces singlet-octet mixing that is too large. However, the 't Hooft interaction contains singlet-octet coupling that enters into the theory with a sign opposite to that of the term arising from the difference of the quark mass values, leading to quite satisfactory results. In this work we present the wave function amplitudes for a number of states of the eta mesons. (The inclusion of pseudoscalar–axial-vector coupling is important for our analysis and results in the need to specify eight wave function amplitudes for each state of the eta mesons.) We present the values of the various constants that parametrize our generalized NJL model and which give satisfactory values of the eta meson masses, decay constants, and mixing angles. It is found that the calculated mass values for the $\eta(1295)$ and $\eta(1440)$ are quite insensitive to variation of the parameters of the model whose values have largely been fixed in our earlier studies of other light mesons. [Phys. Rev. D **65**, 094003 (2002)]

Elusiveness of infrared critical exponents in Landau gauge Yang-Mills theories. C. S. Fischer, R. Alkofer, and H. Reinhardt, *Institute for Theoretical Physics, University of Tübingen, Auf der Morgenstelle 14, D-72076 Tübingen, Germany.* (Received 21 February 2002; published 22 April 2002)

We solve a truncated system of coupled Dyson-Schwinger equations for the gluon and ghost propagators in $SU(N_c)$ Yang-Mills theories in Faddeev-Popov quantization on a four-torus. This compact space-time manifold provides an efficient mean to solve the gluon and ghost Dyson-Schwinger equations without any angular approximations. We verify that analytically two powerlike solutions in the very far infrared seem possible. However, only one of these solutions can be matched to a numerical solution for nonvanishing momenta. For a bare ghost-gluon vertex this implies that the gluon propagator is only weakly infrared vanishing, $D_{gl}(k^2) \propto (k^2)^{2\kappa-1}$, $\kappa \approx 0.595$, and the ghost propagator is infrared singular, $D_{gh}(k^2) \propto (k^2)^{-\kappa-1}$. For nonvanishing momenta our solutions are in agreement with the results of recent SU(2) Monte Carlo lattice calculations. The running coupling possesses an infrared fixed point. We obtain $\alpha(0) = 8.92/N_c$ for all gauge groups $SU(N_c)$. Above one GeV the running coupling rapidly approaches its perturbative form. [Phys. Rev. D **65**, 094008 (2002)]

Polarized version of the CCFM equation for gluons. Martin Maul, *Department of Theoretical Physics, Lund University, Sölvegatan 14A, SE-223 62 Lund, Sweden.* (Received 26 November 2001; revised manuscript received 12 February 2002; published 24 April 2002)

A derivation for a polarized CCFM evolution equation which is suitable to describe the scaling behavior of the unintegrated polarized gluon density is given. We discuss the properties of this polarized CCFM equation and compare it to the standard CCFM equation in the unpolarized case. [Phys. Rev. D **65**, 094010 (2002)]

Phase space veto method for next-to-leading order event generators in hadronic collisions. Matt Dobbs, *Department of Physics and Astronomy, University of Victoria, P.O. Box 3055, Victoria, British Columbia, Canada V8W 3P6.* (Received 30 November 2001; published 29 April 2002)

A method for organizing next-to-leading order QCD calculations using a veto which enforces the cancellations between virtual and real emission diagrams is applied to hadronic collisions. The method employs phase space slicing with the slicing parameter determined dynamically event-by-event. It allows for the generation of unweighted events and can be consistently merged with a parton shower. The end product is more intuitive for the end user, as it is probabilistic, and can be easily interfaced to general purpose showering and hadronization programs to obtain a complete event description suitable for experimental analyses. As an example an event generator for the process $p\overset{(-)}{p} \to Z + X$ at next-to-leading order is presented and interfaced consistently to the PYTHIA shower and hadronization package. [Phys. Rev. D **65**, 094011 (2002)]

Baryon magnetic moments in the effective quark Lagrangian approach. Yu. A. Simonov, *State Research Center, ITEP, Moscow, Russia;* J. A. Tjon, *Institute for Theoretical Physics, University of Utrecht, The Netherlands, and KVI, University of Groningen, The Netherlands;* J. Weda, *Institute for Theoretical Physics, University of Utrecht, The Netherlands.* (Received 22 October 2001; published 3 May 2002)

An effective quark Lagrangian is derived from first principles through bilocal gluon field correlators. It is used to write down equations for baryons, containing both perturbative and nonperturbative fields. As a result one obtains magnetic moments of octet and decuplet baryons without the introduction of constituent quark masses and using only string tension as input. Magnetic moments come out on average in reasonable agreement with experiment, except for nucleons and Σ^-. The predictions for the proton and neutron are shown to be in close agreement with the empirical values once we choose the string tension to yield the proper nucleon mass. Pionic corrections to the nucleon magnetic moments have been estimated. In particular, the total result of the two-body current contributions is found to be small. Inclusion of the anomalous magnetic moment contributions from pion and kaon loops leads to an improvement of the predictions. [Phys. Rev. D **65**, 094013 (2002)]

Coherent QCD phenomena in the coherent pion-nucleon and pion-nucleus production of two jets at high relative momenta. L. Frankfurt, *School of Physics and Astronomy, Tel Aviv University, 69978 Tel Aviv, Israel;* G. A. Miller, *Department of Physics, Box 351560, University of Washington, Seattle, Washington 98195-1560;* M. Strikman, *Department of Physics, Pennsylvania State University, University Park, Pennsylvania 16802.* (Received 26 October 2000; published 6 May 2002)

We use QCD to compute the cross section for high-energy coherent production of a dijet (treated as a $q\bar{q}$ moving at high relative transverse momentum, κ_t) from a nucleon and a nuclear target. The direct evaluation of the relevant Feynman diagrams shows that, in the target rest frame, the space-time evolution of this reaction is dominated by the process in which the high κ_t $q\bar{q}$ component (point-like configuration) of the pion wave function is formed before reaching the target. This point-like configuration then interacts through a two-gluon exchange with the target. In the approximation of keeping the leading order in powers of α_s and in the leading logarithmic approximation in $\alpha_s \ln(\kappa_t^2/\Lambda_{QCD}^2)$, the amplitudes for other processes are shown to be smaller by at least a power of α_s and/or the powers of Sudakov-type form factors and the small probability, w_2, to find a $q\bar{q}$ pair with no gluons at an average separation between constituents. Thus the high κ_t component of the pion wave function, including the contribution of Gegenbauer polynomials of rank $n>0$, can be measured in principle at sufficiently large values of κ_t^2. At large values of κ_t^2, the resulting dominant amplitude is proportional to $z(1-z)\alpha_s(k_t^2)\kappa_t^{-4}[\ln(\kappa_t^2/\Lambda^2)]^{C_F/\beta}$ [z is the fraction light cone $(+)$ momentum carried by the quark in the final state, β is the coefficient in the running coupling constant] times the skewed gluon distribution of the target. For pion scattering by a nuclear target, this means that at fixed $x_N=2\kappa_t^2/s$ (but $\kappa_t^2\to\infty$) the nuclear process in which there is only a single interaction is the most important one to contribute to the reaction. Thus in this limit color transparency phenomena should occur—initial and final state interaction effects are absent for sufficiently large values of κ_t. These findings are in accord with the recent experiment performed at Fermilab. We also reexamine a potentially important nuclear multiple scattering correction which is positive and varies as the length of the nucleus divided by an extra factor of $1/\kappa_t^4$. The meaning of the signal obtained from the experimental measurement of pion diffraction into two jets is also critically examined and significant corrections are identified. We show also that for values of κ_t achieved at fixed target energies, dijet production by the electromagnetic field of the nucleus leads to an insignificant correction which gets more important as κ_t increases. We explain also that the same regularities are valid for photoproduction of forward light quark dijets. [Phys. Rev. D **65**, 094015 (2002)]

Mesons in a Poincaré covariant Bethe-Salpeter approach. R. Alkofer, P. Watson, and H. Weigel, *Institute for Theoretical Physics, Tübingen University, D-72076 Tübingen, Germany.* (Received 7 February 2002; published 9 May 2002)

We develop a covariant approach to describe the low-lying scalar, pseudoscalar, vector, and axial-vector mesons as quark-antiquark bound states. This approach is based on an effective interaction modeling the nonperturbative structure of the gluon propagator that enters the quark Schwinger-Dyson and meson Bethe-Salpeter equations. We consistently treat these integral equations by precisely implementing the quark propagator functions that solve the Schwinger-Dyson equations into the Bethe-Salpeter equations in the relevant kinematical region. We extract the meson masses and compute the pion and kaon decay constants. We obtain a quantitatively correct description for pions, kaons, and vector mesons while the calculated spectra of scalar and axial-vector mesons suggest that their structure is more complex than being quark-antiquark bound states. [Phys. Rev. D **65**, 094026 (2002)]

Oscillating color transparency in $\pi A\to\pi p(A-1)$ and $\gamma A\to\pi N(A-1)$. Pankaj Jain, *Department of Physics, IIT Kanpur, Kanpur 208 016, India;* Bijoy Kundu, *Physics Department, University of Virginia, Charlottesville, Virginia 22903;* John P. Ralston, *Department of Physics and Astronomy, University of Kansas, Lawrence, Kansas 66045.* (Received 5 January 2001; revised manuscript received 22 February 2002; published 9 May 2002)

We study the energy dependence of 90° c.m. fixed angle scattering of $\pi p\to\pi' p'$ and $\gamma p\to\pi^+ n$ at large momentum transfer. The experimental data are found to be well described in terms of complex interfering short and long distance amplitudes with dynamical phases induced by Sudakov effects. We calculate the color transparency ratio for the corresponding processes in nuclear environments $\pi A\to\pi' p(A-1)$ and $\gamma A\to\pi N(A-1)$, taking nuclear filtering into account. We predict that the transparency ratio for these reactions will oscillate with energy. This provides an important test of the Sudakov phase shift and nuclear filtering hypothesis, which can be checked in upcoming experiments. [Phys. Rev. D **65**, 094027 (2002)]

Instanton effects in QCD at high baryon density. T. Schäfer, *Department of Physics, Duke University, Durham, North Carolina 27708, Department of Physics, SUNY Stony Brook, Stony Brook, New York 11794, and Riken-BNL Research Center, Brookhaven National Laboratory, Upton, New York 11973.* (Received 26 February 2002; published 14 May 2002)

We study instanton effects in QCD at very high baryon density. In this regime instantons are suppressed by a large power of

(Λ_{QCD}/μ), where Λ_{QCD} is the QCD scale parameter and μ is the baryon chemical potential. Instantons are nevertheless important because they contribute to several physical observables that vanish to all orders in perturbative QCD. We study, in particular, the chiral condensate and its contribution $m_{GB}^2 \sim m\langle\bar{\psi}\psi\rangle$ to the masses of Goldstone bosons in the CFL phase of QCD with $N_f=3$ flavors. We find that at densities $\rho\sim(5-10)\rho_0$, where ρ_0 is the density of nuclear matter, the result is dominated by large instantons and subject to considerable uncertainties. We suggest that these uncertainties can be addressed using lattice calculations of the instanton density and the pseudoscalar diquark mass in QCD with two colors. We study the topological susceptibility and Witten-Veneziano type mass relations in both $N_c=2$ and $N_c=3$ QCD. [Phys. Rev. D **65**, 094033 (2002)]

Neutrino masses through the seesaw mechanism in 3-3-1 models. J. C. Montero, C. A. de S. Pires, and V. Pleitez, *Instituto de Física Teórica, Universidade Estadual Paulista, Rua Pamplona, 145, 01405-900 São Paulo, SP, Brazil.* (Received 19 December 2001; published 15 April 2002)

Some years ago it was shown by Ma that in the context of the electroweak standard model there are, at the tree level, only three ways to generate small neutrino masses by the seesaw mechanism via one effective dimension-five operator. Here we extend this approach to 3-3-1 chiral models showing that in this case there are several dimension-five operators and we also consider their tree level realization. [Phys. Rev. D **65**, 095001 (2002)]

Regge analysis of diffractive and leading baryon structure functions from deep inelastic scattering. M. Batista, R. J. M. Covolan, and J. Montanha, *Instituto de Física Gleb Wataghin, Universidade Estadual de Campinas, Unicamp, 13083-970 Campinas, São Paulo, Brazil.* (Received 2 June 2000; revised manuscript received 11 January 2002; published 19 April 2002)

In this paper we present a combined analysis of the H1 data on leading baryon and diffractive structure functions from DIS, which are handled as two components of the same semi-inclusive process. The available structure function data are analyzed in a series of fits in which three main exchanges are taken into account: the Pomeron, Reggeon, and pion. For each of these contributions, Regge factorization of the correspondent structure function is assumed. By this procedure, we extract information about the interface between the diffractive, Pomeron-dominated, region and the leading proton spectrum, which is mostly ruled by secondary exchanges. One of the main results is that the relative Reggeon contribution to the semi-inclusive structure function is much smaller than the one obtained from an analysis of the diffractive structure function alone. [Phys. Rev. D **65**, 096006 (2002)]

Thermal fluctuations in the interacting pion gas. M. Stephanov, *Department of Physics, University of Illinois, Chicago, Illinois 60607-7059, and RIKEN-BNL Research Center, Brookhaven National Laboratory, Upton, New York 11973.* (Received 24 October 2001; published 7 May 2002)

We derive the two-particle fluctuation correlator in a thermal gas of π mesons to the lowest order in an interaction due to a resonance exchange. A diagrammatic technique is used. We discuss how this result can be applied to event-by-event fluctuations in heavy-ion collisions, in particular, to search for the critical point of QCD. As a practical example, we determine the shape of the rapidity correlator. [Phys. Rev. D **65**, 096008 (2002)]

Twist-four corrections to the violation of the Callan-Gross relation in nuclei. P. Castorina, *Dipartimento di Fisica, Università di Catania, INFN, Sezione di Catania, Corso Italia 57, I-95129, Catania, Italy.* (Received 20 December 2001; published 19 April 2002)

The twist-four QCD contributions to the violation of the Callan-Gross relation per nucleon in a nucleus are phenomenologically evaluated by including in an effective way the nuclear modifications. Numerical estimates are obtained on the small-x and small-Q^2 behavior of the ratio R^A/R^D. The results support the idea that the observed enhancement is due to higher twist effects and directly correlated to nuclear shadowing in deep inelastic scattering. [Phys. Rev. D **65**, 097502 (2002)]

Mechanism for the double-spin asymmetry in electromagnetic ρ production at HERMES. N. I. Kochelev, *Bogoliubov Laboratory of Theoretical Physics, JINR, Dubna, Moscow region, 141980, Russia;* D.-P. Min and A. V. Vinnikov, *School of Physics and Center for Theoretical Physics, Seoul National University, Seoul 151-747, Korea;* V. Vento, *Departament de Física Teòrica and Institut de Física Corpuscular, Universitat de València–CSIC, E-46100, Burjassot (Valencia), Spain.* (Received 9 January 2002; published 2 May 2002)

We calculate the contribution of meson and Pomeron exchanges to the double-spin asymmetry in ρ-meson electromagnetic production at HERMES energies. We show that the observed double-spin asymmetries, which are large, can be explained by the interference between the natural parity f_2-secondary Reggeon and the unnatural parity anomalous f_1 exchanges. [Phys. Rev. D **65**, 097504 (2002)]