

Selected Abstracts from Other Physical Review Journals

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Improved determination of the mass of the 1^{-+} light hybrid meson from QCD sum rules. H. Y. Jin, *Institute of Modern Physics, Zhejiang University, People's Republic of China, and Department of Physics and Engineering Physics, University of Saskatchewan, Saskatoon, Saskatchewan, Canada S7N 5E2*; J. G. Körner, *Institut für Physik, Johannes Gutenberg-Universität, D-55099 Mainz, Germany*; T. G. Steele, *Department of Physics and Engineering Physics, University of Saskatchewan, Saskatoon, Saskatchewan, Canada S7N 5E2*. (Received 19 November 2002; published 30 January 2003)

We calculate the next-to-leading order (NLO) α_s corrections to the contributions of the condensates $\langle\alpha G^2\rangle$ and $\langle\bar{q}q\rangle^2$ in the current-current correlator of the hybrid current $g\bar{q}(x)\gamma_\nu iF_{\mu\nu}^a T^a q(x)$ using the external field method in the Feynman gauge. After incorporating these NLO contributions into the Laplace sum rules, the mass of the $J^{PC}=1^{-+}$ light hybrid meson is recalculated using the QCD sum rule approach. We find that the sum rules exhibit enhanced stability when the NLO α_s corrections are included in the sum rule analysis, resulting in a 1^{-+} light hybrid meson mass of approximately 1.6 GeV. [Phys. Rev. D **67**, 014025 (2003)]

Three-generation study of neutrino spin-flavor conversion in supernovae and implication for the neutrino magnetic moment. Shin'ichiro Ando, *Department of Physics, School of Science, the University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan*; Katsuhiko Sato, *Department of Physics, School of Science, the University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan, and Research Center for the Early Universe, School of Science, the University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan*. (Received 23 July 2002; published 30 January 2003)

We investigate resonant spin-flavor (RSF) conversions of supernova neutrinos which are induced by the interaction of neutrino magnetic moment and supernova magnetic fields. From the formulation which includes all three-flavor neutrinos and antineutrinos, we give a new crossing diagram that includes not only ordinary Mikheyev-Smirnov-Wolfenstein (MSW) resonance but also a magnetically induced RSF effect. With the diagram, it is found that four conversions occur in supernovae: two are induced by the RSF effect and two by the pure MSW effect. We also numerically calculate neutrino conversions in supernova matter, using neutrino mixing parameters inferred from recent experimental results and a realistic supernova progenitor model. The results indicate that until 0.5 sec after the core bounce, the RSF-induced $\bar{\nu}_e \leftrightarrow \nu_\tau$ transition occurs efficiently (adiabatic resonance), when $\mu_\nu \gtrsim 10^{-12} \mu_B (B_0/5 \times 10^9 \text{ G})^{-1}$, where B_0 is the strength of the magnetic field at the surface of iron core. We also evaluate the energy spectrum as a function of $\mu_\nu B_0$ at the super-Kamiokande detector and the Sud-

bury Neutrino Observatory using the calculated conversion probabilities, and find that the spectral deformation might have the possibility to provide useful information on the neutrino magnetic moment as well as the magnetic field strength in supernovae. [Phys. Rev. D **67**, 023004 (2003)]

Constraints on models for proton-proton scattering from multistrange baryon data. F. M. Liu,^{1,2} J. Aichelin,¹ M. Bleicher,¹ H. J. Drescher,³ S. Ostapchenko,^{4,5} T. Pierog,¹ and K. Werner¹ ¹*SUBATECH, Universit de Nantes, IN2P3/CNRS, Ecole des Mines, Nantes, France*, ²*Institute of Particle Physics, Huazhong Normal University, Wuhan, China*, ³*Physics Department, New York University, New York, New York*, ⁴*Institut für Experimentelle Kernphysik, University of Karlsruhe, 76021 Karlsruhe, Germany*, ⁵*Moscow State University, Institute of Nuclear Physics, Moscow, Russia*. (Received 1 February 2002; revised manuscript received 28 October 2002; published 14 February 2003)

The recent data on pp collisions at 158 GeV provide severe constraints on string models: These measurements allow us for the first time to determine how color strings are formed in ultrarelativistic proton-proton collisions. [Phys. Rev. D **67**, 034011 (2003)]

General quasiparticle propagator and mass dependence in degenerate spin zero color superconductivity. Todd Fugleberg, *Department of Physics, Brookhaven National Laboratory, Upton, New York 11973*. (Received 28 August 2002; revised manuscript received 5 November 2002; published 19 February 2003)

The general quasiparticle propagator in dense quark matter including all spin zero diquark condensates is derived for equal mass quarks. Specialized to an NJL model, this propagator includes one new condensate Δ_3 in addition to the usual CFL condensate Δ_1 . The gap equation is solved in two NJL models and the dependence on the quark mass of the condensates and the gap is presented. Analytic approximations for the condensates are obtained and compared to exact numerical solutions. The results are shown to differ from those obtained by neglecting Δ_3 , especially for smaller values of Δ_1 . The two different NJL models presented are also shown to give different results when Δ_3 is not neglected. The methods used in this paper can be generalized to the physical case where only the strange quark is significantly massive. [Phys. Rev. D **67**, 034013 (2003)]

Experimental constraints on strangelets and other exotic nuclear matter. D. Javorsek II, *Department of Physics, Purdue University, West Lafayette, Indiana 47907, and 80th Flying Training Wing, United States Air Force, Sheppard Air Force Base,*

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A reanalysis of data from a recent search for ultraheavy isotopes of gold and iron leads to new constraints on several classes of exotic objects. These include strangelets, MEMOs (metastable exotic multihypernuclear objects), and CHAMPs (charged massive particles) which may have been present in the data, but which could have nonetheless gone undetected due to the design of the original experiment. As a result of the new analysis we are able to greatly enlarge the exclusion regions for exotic particles of mass M and charge Z , and provide limits as low as 10^{-11} for small M/Z , and 10^{-7} for M/Z up to 120. [Phys. Rev. D 67, 034015 (2003)]

Hadronic collisions in the linked dipole chain model. Gösta Gustafson, Leif Lönnblad, and Gabriela Miu, *Department of Theoretical Physics, Sölvegatan 14A, S-223 62 Lund, Sweden*. (Received 10 October 2002; published 27 February 2003)

We apply the linked dipole chain model to hadronic collisions using a modified version of the LDCMC Monte Carlo program. In particular, we investigate the effects of multiple scatterings, which in this framework are reformulated in terms of the production of multiple chains of dipoles. We find, among other things, that this way of describing multiple scatterings is less sensitive to the treatment of soft, nonperturbative, scatterings. Although the results presented here are only at the parton level, by comparing with the corresponding results from PYTHIA we are confident that our model will be able to describe the essential features of high-energy hadronic collisions, including the underlying events and jet-pedestal effects in high- $p_{\perp}$ events. The model should also be applicable to estimates of the transverse energy flow in high-energy heavy ion collisions, of interest in analyses of signals for quark-gluon plasma formation. [Phys. Rev. D 67, 034020 (2003)]

Melting the diquark condensate in two-color QCD: A renormalization group analysis. J. Wirstam, *Swedish Defense Research Agency (FOI), S-172 90 Stockholm, Sweden*; J. T. Lenaghan, *Department of Physics, University of Virginia, 382 McCormick Rd., Charlottesville, Virginia 22904-4714*; K. Splittorff, *Department of Physics and Astronomy, SUNY, Stony Brook, New York 11794*. (Received 20 November 2002; published 27 February 2003)

We use a Landau theory and the ϵ expansion to study the superfluid phase transition of two-color QCD at a nonzero temperature T and baryonic chemical potential μ . At low T , and for N_f flavors of massless quarks, the global $SU(N_f) \times SU(N_f) \times U(1)$ symmetry is spontaneously broken by a diquark condensate down to $Sp(N_f) \times Sp(N_f)$ for any $\mu > 0$. As the temperature increases, the diquark condensate melts, and at sufficiently large T the symmetry is restored. Using renormalization group arguments, we find that in the presence of the chiral anomaly term there can be a second order phase transition when $N_f = 2$ or $N_f \geq 6$, while the transition is first order for $N_f = 4$. We discuss the relevance of these results for the

emergence of a tricritical point recently observed in lattice simulations. [Phys. Rev. D 67, 034021 (2003)]

Valence quarks in the QCD plasma: Quark number susceptibilities and screening. Rajiv V. Gavai and Sourendu Gupta, *Department of Theoretical Physics, Tata Institute of Fundamental Research, Homi Bhabha Road, Mumbai 400005, India*. (Received 12 November 2002; published 7 February 2003)

We investigate the quark sector of quenched QCD for $1.5 \leq T/T_c \leq 3$ in the continuum limit, using two different lattice discretizations of quarks and extrapolating from lattice spacings between $1/4T$ and $1/14T$. At these temperatures, the flavor off-diagonal susceptibility χ_{ud}/T^2 is compatible with zero at each lattice spacing, and hence also in the continuum limit. In the continuum limit, the light quark susceptibilities are about 10% less than the ideal gas results even at the highest T , in agreement with hard thermal loop predictions but marginally below a resummed perturbative computation. For the mass range appropriate to the strange quark, the flavor diagonal susceptibility is significantly smaller. Our estimate of the Wroblewski parameter is compatible with observations at BNL RHIC and CERN SPS. The continuum limit of screening masses in all (local) quark bilinears is very close to the ideal gas results. [Phys. Rev. D 67, 034501 (2003)]

Modeling generalized parton distributions to describe deeply virtual Compton scattering data. A. Freund, *Institut für Theoretische Physik, Universität Regensburg, D-93040 Regensburg, Germany*; M. McDermott, *Division of Theoretical Physics, Department of Mathematical Sciences, University of Liverpool, Liverpool, L69 3BX, United Kingdom*; M. Strikman, *The Pennsylvania State University, Department of Physics, University Park, Pennsylvania 16802*. (Received 25 September 2002; published 10 February 2003)

We present a new model for generalized parton distributions (GPDs), based on the aligned jet model, which successfully describes the deeply virtual Compton scattering (DVCS) data from H1, ZEUS, HERMES and CLAS. We also present an easily implementable and flexible algorithm for their construction. This new model is necessary since the most widely used models for GPDs, which are based on factorized double distributions, cannot, in their current form, describe the DVCS data when employed in a full QCD analysis. We demonstrate explicitly the reason for the shortcoming in the data description. We also highlight several nonperturbative input parameters which could be used to tune the GPDs, and the t dependence, to the DVCS data using a fitting procedure. [Phys. Rev. D 67, 036001 (2003)]

Can the polarization of the strange quarks in the proton be positive? Elliot Leader, *Imperial College London, Prince Consort Road, London, SW7 2BW, England*; Dimiter B. Stamenov, *Institute for Nuclear Research and Nuclear Energy, Bulgarian Academy of Sciences, Blvd. Tsarigradsko Chaussee 72, Sofia 1784, Bulgaria*. (Received 2 December 2002; published 26 February 2003)

Recently, the HERMES Collaboration at DESY, using a leading order QCD analysis of their data on semi-inclusive deep inelastic production of charged hadrons, reported a marginally positive polarization for the strange quarks in the proton. We argue that a non-negative polarization is almost impossible. [Phys. Rev. D 67, 037503 (2003)]