Selected Abstracts from Other Physical Review Journals

Abstracts of papers which are published in **other Physical Review journals** *and may be of interest to Physical Review C readers are printed here. The Editors of Physical Review C routinely scan the abstracts of* **Physical Review D** *papers. Appropriate abstracts of papers in other Physical Review journals may be included upon request.*

Generalized parton distributions at $x \to 1$. Feng Yuan, *Department of Physics, University of Maryland, College Park, Maryland 20742, USA.* (Received 3 November 2003; published 24 March 2004)

Generalized parton distributions at large x are studied in the perturbative QCD approach. As $x \to 1$ and at finite t, there is no t dependence for the GPDs which means that the active quark is at the center of the transverse space. We also obtain the power behavior $H_q^\pi(x,\xi,t) \sim (1-x)^2/(1-\xi^2)$ for the pion, $H_q(x,\xi,t) \sim (1-x)^3/(1-\xi^2)^2$ and $E_q(x,\xi,t) \sim (1-x)^5/(1-\xi^2)^3 f(\xi)$ for the nucleon, where $f(\xi)$ represents the additional dependence on ξ. [Phys. Rev. D **69**, 051501 (2004)]

The evidence for a pentaquark signal and kinematic reflections. A. R. Dzierba, D. Krop, M. Swat, and S. Teige, *Department of Physics, Indiana University, Bloomington, Indiana 47405, USA;* A. P. Szczepaniak, *Department of Physics and Nuclear Theory Center, Indiana University, Bloomington, Indiana 47405, USA.* (Received 14 November 2003; published 25 March 2004)

Several recent experiments have reported evidence for a narrow baryon resonance with positive strangeness (Θ^+) at a mass of 1.54 GeV/c^2. Baryons with $S=+1$ cannot be conventional qqq states and the reports have thus generated much theoretical speculation about the nature of possible $S=+1$ baryons, including a 5-quark, or pentaquark, interpretation. We show that narrow enhancements in the K^+n effective mass spectrum can be generated as kinematic reflections resulting from the decay of mesons, such as the $f_2(1275)$, the $a_2(1320)$ and the $\rho_3(1690)$. [Phys. Rev. D **69**, 051901 (2004)]

Study of the exotic Θ^+ with polarized photon beams. Qiang Zhao, *Department of Physics, University of Surrey, Guildford, GU2 7XH, United Kingdom.* (Received 11 November 2003; published 26 March 2004)

We carry out an analysis of the pentaquark Θ^+ photoproduction with polarized photon beams. Kinematical and dynamical aspects are examined for the purpose of determining Θ^+'s spin and parity. It shows that the polarized photon beam asymmetry in association with certain dynamical properties of the production mechanism would provide further information on its quantum numbers. Facilities at SPring-8, JLab, ELSA, and ESRF will have access to them. [Phys. Rev. D **69**, 053009 (2004)]

Nonfactorizable contributions in B decays to charmonium: The case of $B^- \to K^- h_c$. P. Colangelo and F. De Fazio, *Istituto Nazionale di Fisica Nucleare, Sezione di Bari, 70126 Bari, Italy;* T.N. Pham, *Centre de Physique Théorique, Centre National de la Recherche Scientifique, UMR 7644 École Polytechnique, 91128 Palaiseau Cedex, France.* (Received 13 October 2003; published 26 March 2004)

Nonleptonic B to charmonium decays generally show deviations from the factorization predictions. For example, the mode $B^- \to K^- \chi_{c0}$ has been experimentally observed with a sizable branching fraction while its factorized amplitude vanishes. We investigate the role of rescattering effects mediated by intermediate charmed meson production in this class of decay modes, and consider $B^- \to K^- h_c$ with h_c the $J^{PC}=1^{+-}$ $\bar{c}c$ meson. Using an effective Lagrangian describing interactions of pairs of heavy-light $Q\bar{q}$ mesons with a quarkonium state, we relate this mode to the analogous mode with χ_{c0} in the final state. We find $\mathcal{B}(B^- \to K^- h_c)$ large enough to be measured at B factories, so that this decay mode could be used to study the poorly known h_c. [Phys. Rev. D **69**, 054023 (2004)]

Chiral dynamics and the growth of the nucleon's gluonic transverse size at small x. M. Strikman, *Pennsylvania State University, University Park, Pennsylvania 16802, USA;* C. Weiss, *Institut für Theoretische Physik, Universität Regensburg, D-93053 Regensburg, Germany.* (Received 26 August 2003; revised manuscript received 26 November 2003; published 16 March 2004)

We study the distribution of gluons in transverse space in the nucleon at moderately small x ($\sim 10^{-2}$). At large transverse distances (impact parameters) the gluon density is generated by the "pion cloud" of the nucleon, and can be calculated in terms of the gluon density in the pion. We investigate the large-distance behavior in two different approaches to chiral dynamics: (i) phenomenological soft-pion exchange; (ii) the large-N_c picture of the nucleon as a classical soliton of the pion field, which corresponds to degenerate N and Δ states. The large-distance contributions from the "pion cloud" cause a $\sim 20\%$ increase in the overall transverse size of the nucleon if x drops significantly below M_π/M_N. This is in qualitative agreement with the observed increase of the slope of the t dependence of the J/ψ photoproduction cross section at DESY HERA compared to fixed-target energies. We argue that the glue in the pion cloud could be probed directly in hard electroproduction processes accompanied by "pion knockout," $\gamma^* + N \to \gamma\ (\text{or } \rho, J/\psi) + \pi + N'$, where the transverse momentum of the emitted pion is large while that of the outgoing nucleon is restricted to values of order M_π. [Phys. Rev. D **69**, 054012 (2004)]

Single-spin polarization effects and the determination of timelike proton form factors. Stanley J. Brodsky,[1,2] Carl E. Carlson,[2,3] John R. Hiller,[4] and Dae Sung Hwang[5] [1]*Stanford Linear Accelerator Center, Stanford University, Stanford, California 94309, USA,* [2]*Thomas Jefferson National Accelerator Facility, 12000 Jefferson Avenue, Newport News, Virginia 23606, USA,* [3]*Nuclear and Particle Theory Group, Physics Department, College of William and Mary, Williamsburg, Virginia 23187-8795, USA,* [4]*Department of Physics, University of Minnesota-Duluth, Duluth, Minnesota 55812, USA,* [5]*Department of Physics, Sejong University, Seoul 143-747, Korea.* (Received 2 December 2003; published 23 March 2004)

We show that measurements of the proton's polarization in $e^+e^- \to p\bar{p}$ strongly discriminate between analytic forms of models which fit the proton form factors in the spacelike region. In particular, the single-spin asymmetry normal to the scattering plane measures the relative phase difference between the timelike G_E and G_M form factors. The expected proton polarization in the timelike region is large, of the order of several tens of percent. [Phys. Rev. D **69**, 054022 (2004)]

Excited baryon decay widths in large N_c QCD. Thomas D. Cohen, Daniel C. Dakin, and Abhinav Nellore, *Department of Physics, University of Maryland, College Park, Maryland 20742-4111, USA;* Richard F. Lebed, *Department of Physics and Astronomy, Arizona State University, Tempe, Arizona 85287-1504, USA.* (Received 15 October 2003; published 1 March 2004)

We study excited baryon decay widths in large N_c QCD. It was suggested previously that some spin-flavor mixed-symmetric baryon states have strong couplings of $O(N_c^{-1/2})$ to nucleons [implying narrow widths of $O(1/N_c)$], as opposed to the generic expectation based on Witten's counting rules of an $O(N_c^0)$ coupling. The calculation obtaining these narrow widths was performed in the context of a simple quark-shell model. This paper addresses the question of whether the existence of such narrow states is a general property of large N_c QCD. We show that a general large N_c QCD analysis does not predict such narrow states; rather they are a consequence of the extreme simplicity of the quark model.
11.15.Pg, 12.39.−x, 13.75.Gx, 14.20.Gk

Higher moments of nucleon spin structure functions in heavy baryon chiral perturbation theory and in a resonance model. Chung-Wen Kao, *Department of Physics and Astronomy, University of Manchester, Manchester, M13 9PL, United Kingdom;* D. Drechsel and S. Kamalov, *Institut für Kernphysik, Johannes Gutenberg-Universität, D-55099 Mainz, Germany;* M. Vanderhaeghen, *Department of Physics, College of William and Mary, Williamsburg, Virginia 23187, USA, and Jefferson Laboratory, Newport News, Virginia 23606, USA.* (Received 4 November 2003; published 26 March 2004)

The third moment d_2 of the twist-3 part of the nucleon spin structure function g_2 is generalized to arbitrary momentum transfer Q^2 and is evaluated in heavy baryon chiral perturbation theory up to order $O(p^4)$ and in a unitary isobar model (MAID). We show how to link d_2 as well as higher moments of the nucleon spin structure functions g_1 and g_2 to nucleon spin polarizabilities. We compare our results with the most recent experimental data, and find a good description of these available data within the unitary isobar model. We proceed to extract the twist-4 matrix element f_2 which appears in the $1/Q^2$ suppressed term in the twist expansion of the spin structure function g_1 for the proton and neutron. [Phys. Rev. D **69**, 056004 (2004)]

Effects of color superconductivity on the structure and formation of compact stars. A. Drago, *Dipartimento di Fisica, Università di Ferrara and INFN, Sezione di Ferrara, 44100 Ferrara, Italy;* A. Lavagno, *Dipartimento di Fisica, Politecnico di Torino and INFN, Sezione di Torino, 10129 Torino, Italy;* G. Pagliara, *Dipartimento di Fisica, Università di Ferrara and INFN, Sezione di Ferrara, 44100 Ferrara, Italy.* (Received 5 November 2003; published 26 March 2004)

We show that if color superconducting quark matter forms in hybrid or quark stars it is possible to satisfy most of the recent observational boundaries on the masses and radii of compact stellar objects. An energy of the order of 10^{53} erg is released in the conversion from a (metastable) hadronic star into a (stable) hybrid or quark star in the presence of a color superconducting phase. If the conversion occurs immediately after the deleptonization of the protoneutron star, the released energy can help supernovae to explode. If the conversion is delayed the energy released can power a gamma-ray burst. A delay between the supernova and the subsequent gamma-ray burst is possible, in agreement with the delay proposed in the recent analysis of astrophysical data. [Phys. Rev. D **69**, 057505 (2004)]

Cosmological variation of the deuteron binding energy, strong interaction, and quark masses from big bang nucleosynthesis. V. F. Dmitriev, *School of Physics, The University of New South Wales, Sydney NSW 2052, Australia, and Budker Institute of Nuclear Physics, 630090, Novosibirsk-90, Russia;* V. V. Flambaum, *School of Physics, The University of New South Wales, Sydney NSW 2052, Australia, and Institute for Advanced Study, Einstein Drive, Princeton, New Jersey 08540, USA;* J. K. Webb, *School of Physics, The University of New South Wales, Sydney NSW 2052, Australia.* (Received 3 November 2003; published 10 March 2004)

We use big bang nucleosynthesis calculations and light element abundance data to constrain the relative variation of the deuteron binding energy since the Universe was a few minutes old, $\delta Q = Q(BBN) - Q(\text{present})$. Two approaches are used, first treating the baryon to photon ratio η as a free parameter, but with the additional freedom of varying δQ, and second using the WMAP value of η and solving only for δQ. Including varying Q yields a better fit to the observational data than imposing the present day value, rectifying the discrepancy between the ^{4}He abundance and the deuterium and ^{7}Li abundances, *and* yields good agreement with the independently determined η_{WMAP}. Using η_{WMAP}, the minimal deviation consistent with the data is significant at about the 4σ level; $\delta Q/Q = -0.019 \pm 0.005$. If the primordial ^{4}He abundance lies towards the low end of values in the literature, this deviation is even larger and more statistically significant. Taking the light element abundance data at face value, our result may be interpreted as

variation of the dimensionless ratio $X=m_s/\Lambda_{\mathrm{QCD}}$ of the strange quark mass and strong scale: $\delta X/X=(1.1\pm0.3)\times10^{-3}$. These results provide a strong motivation for a more thorough exploration of the potential systematic errors in the light element abundance data. [Phys. Rev. D **69**, 063506 (2004)]

Interaction of a TeV scale black hole with the quark-gluon plasma at CERN LHC. Andrew Chamblin, *Department of Physics, Queen Mary, University of London, Mile End Road, London E1 4NS, England;* Fred Cooper and Gouranga C. Nayak, *T-8, Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545, USA.* (Received 3 February 2003; published 17 March 2004)

If the fundamental Planck scale is near 1 TeV, then parton collisions with a high enough center-of-mass energy should produce black holes. The production rate for such black holes has been extensively studied for the case of a proton-proton collision at $\sqrt{s}=14$ TeV and for a lead-lead collision at $\sqrt{s}=5.5$ TeV at CERN LHC. As the parton energy density is much higher in lead-lead collisions than in *pp* collisions at LHC, one natural question is whether the produced black holes will be able to absorb the partons formed in the lead-lead collisions and eventually absorb the quark-gluon plasma formed at LHC. The accretion rate of the black hole is proportional to the energy density of the plasma and the evaporation rate is proportional to T^{4+d}, where d is the number of extra dimensions, so it is easy to determine what energy density is necessary to stabilize the black hole. The question we address here is how to make a reasonable estimate of the energy density of the plasma in the expected out of equilibrium initial conditions at LHC. For this purpose we use a combination of PQCD and a reasonable ansatz for the single-particle distribution functions of partons. Using this approach, we find that the energy density of partons formed in lead-lead collisions at LHC is about 500 GeV/fm^3, leading to the rate of absorption for one of these black holes being much smaller than the rate of evaporation. More precisely, we show that for the black hole mass to increase via parton absorption the typical energy density of quarks and gluons should be of the order of 10^{10} GeV/fm^3. We also find that the typical lifetime of the black hole formed at LHC is found to be a small fraction of a fm/c. [Phys. Rev. D **69**, 065010 (2004)]

Additional evidence of nuclear emissions during acoustic cavitation. R. P. Taleyarkhan,[1] J. S. Cho, C. D. West, R. T. Lahey, Jr., R. I. Nigmatulin,[4] and R. C. Block, [1]*Purdue University, West Lafayette, Indiana 47907, USA,* [2]*Oak Ridge Associated Universities, Oak Ridge, Tennessee 37830, USA,* [3]*Rensselaer Polytechnic Institute, Troy, New York 12180, USA,* [4]*Russian Academy of Sciences, 6 Karl Marx Street, Ufa 450000, Russia.* (Received 13 May 2003; published 22 March 2004)

Time spectra of neutron and sonoluminescence emissions were measured in cavitation experiments with chilled deuterated acetone. Statistically significant neutron and gamma ray emissions were measured with a calibrated liquid-scintillation detector, and sonoluminescence emissions were measured with a photomultiplier tube. The neutron and sonoluminescence emissions were found to be time correlated over the time of significant bubble cluster dynamics. The neutron emission energy was less than 2.5 MeV and the neutron emission rate was up to $\sim4\times10^5$ n/s. Measurements of tritium production were also performed and these data implied a neutron emission rate due to D-D fusion which agreed with what was measured. In contrast, control experiments using normal acetone did not result in statistically significant tritium activity, or neutron or gamma ray emissions. [Phys. Rev. E **69**, 036109 (2004)]