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.*

Large nucleation distances from impurities in the cosmological quark-hadron transition. Michael B. Christiansen and Jes Madsen, *Institute of Physics and Astronomy, University of Aarhus, DK-8000 Århus C, Denmark.* (Received 4 December 1995)

We calculate the mean nucleation distance $d_{\rm nuc}$ in a first order cosmological quark-hadron phase transition. For homogeneous nucleation we find that self-consistent inclusion of curvature energy reduces $d_{\rm nuc}$ to $\lesssim 2$ cm. However, impurities can lead to heterogeneous nucleation with $d_{\rm nuc}$ of several meters, a value high enough to change the outcome of big bang nucleosynthesis. [S0556-2821(96)01110-1] [Phys. Rev. D **53**, 5446 (1996)]

Amplitude analysis of the $\overline{N}N\to\pi^-\pi^+$ reaction. W. M. Kloet, *Department of Physics and Astronomy, Rutgers University, Piscataway, New Jersey 08855;* F. Myhrer, *Department of Physics and Astronomy, University of South Carolina, Columbia, South Carolina 29208 and NORDITA, Blegdamsvej 17, DK-2100 Copenhagen Ø, Denmark.* (Received 26 October 1995)

A simple partial wave amplitude analysis of $\overline{p}p\to\pi^-\pi^+$ has been performed for data in the range $p_{\rm lab}=$ 360–1000 MeV/c, where remarkably few partial waves are required to fit the data. Furthermore, the number of required J values does not change in this energy range. However, the resulting set of partial wave amplitudes is not unique. We discuss possible measurements with polarized beam and target which will severely restrict and help resolve the present analysis ambiguities. New data from the reaction $p\,\overline{p}\to\pi^0\pi^0$ alone are insufficient for that purpose. [S0556-2821(96)03411-X] [Phys. Rev. D **53**, 6120 (1996)]

Nuclear dependence in direct photon production. Xiaofeng Guo and Jianwei Qiu, *Department of Physics and Astronomy, Iowa State University, Ames, Iowa 50011.* (Received 11 December 1995)

We calculate the nuclear dependence of direct photon production in hadron-nucleus collisions. In terms of a multiple scattering picture, we factorize the cross section for direct photon production into calculable short-distance partonic parts times multiparton correlation functions in nuclei. We present the hadron-nucleus cross section as A^α times the hadron-nucleon cross section. Using information on the multiparton correlation functions extracted from photon-nucleus experiments, we compute the value of α as a function of transverse momentum of the direct photon. We also compare our results with recent data from Fermilab experiment E706. [S0556-2821(96)05211-3] [Phys. Rev. D **53**, 6144 (1996)]

Nucleon spin and the mixing of axial vector mesons. Michael Birkel, *Theoretical Physics, University of Oxford, 1 Keble Road, Oxford OX1 3NP, United Kingdom;* Harald Fritzsch, *Ludwig-Maximilians-Universität, Sektion Physik, Theresienstrasse 37, D-80333 München, Germany and Max-Planck-Institut für Physik, Werner-Heisenberg-Institut, Föhringer Ring 6, D-80805 München, Germany.* (Received 21 December 1995)

It is shown that the QCD anomaly may lead to an abnormal mixing behavior of the axial vector mesons similar to the pseudoscalar mesons. These mixing effects, involving a gluonic axial vector state, generate a nonvanishing strange quark component in the nucleon. They reduce the matrix element of the singlet axial vector in comparison to the value obtained in a naive quark model. The results are in agreement with the data obtained in the polarized lepton-nucleon scattering experiments. [S0556-2821(96)00911-3] [Phys. Rev. D **53**, 6195 (1996)]

Inverse neutrinoless double β decay reexamined. G. Bélanger,[1] F. Boudjema,[1] D. London,[2] and H. Nadeau,[3] [1]*Laboratoire de Physique Théorique ENSLAPP Chemin de Bellevue, Bôite Postale 110, F-74941 Annecy-le-Vieux, Cedex, France* [2]*Laboratoire de Physique Nucléaire, Université de Montréal, C.P. 6128, Montréal, Québec, Canada H3C 3J7* [3]*Physics Department, McGill University, 3600 University Street, Montréal, Québec, Canada H3A 2T8.* (Received 6 September 1995)

We critically reexamine the prospects for the observation of the $\Delta L=2$ lepton-number-violating process $e^-e^-\to W^-W^-$ using the e^-e^- option of a high-energy e^+e^- collider (NLC). We find that, except in the most contrived scenarios, constraints from neutrinoless double β decay render the process unobservable at an NLC of $\sqrt{s}<2$ TeV. Other $\Delta L=2$ processes such as $\gamma\gamma\to\ell^+\ell^+W^-W^-$, $e^-\gamma\to\nu_e\ell^-\ell^-W^+$, $e^-e^-\to\nu_e\nu_e\ell^-\ell^-$ ($\ell=\mu,\tau$), and $e^-\gamma\to e^+W^-W^-$, which use various options of the NLC, require a $\sqrt{s}$ of at least 4 TeV for observability. [S0556-2821(96)00611-X] [Phys. Rev. D **53**, 6292 (1996)]

Dynamical growth rate of hadron bubbles in a baryon-free quark-gluon plasma. Franco Ruggeri and William A. Friedman, *Physics Department, University of Wisconsin, Madison, Wisconsin 53706.* (Received 30 November 1995)

We evaluate the factor κ appearing in Langer's expression for the nucleation rate extended to the case of hadron bubbles forming in a zero-baryon-number-cooled quark-gluon plasma. We consider both the absence and presence of viscosity. [S0556-2821(96)03611-9] [Phys. Rev. D **53**, 6543 (1996)]

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Chaotic behavior of particle production in branching processes. Zhen Cao and Rudolph C. Hwa, *Institute of Theoretical Science and Department of Physics, University of Oregon, Eugene, Oregon 97403.* (Received 30 October 1995)

The notion of chaotic behavior is examined for particle production in branching processes. Two types of branching are considered: non-Abelian gauge interaction and an Abelian cascade model. Properties of the production processes are investigated by Monte Carlo simulation. The ''temporal'' behavior is studied by following the fluctuations in the multiplicities of each generation as the branching evolves. The ''spatial'' behavior is described in terms of the fluctuations of the normalized factorial moments from event to event. The information dimension and a new entropy index are determined. When all the measures are taken together, they collectively give a strong suggestion that the QCD branching process is chaotic, while the Abelian cascade model is not. [S0556-2821(96)00111-7] [Phys. Rev. D **53**, 6608 (1996)]

Effects of instantons on the excited baryons and two-nucleon systems. Sachiko Takeuchi, *Department of Public Health and Environmental Science, School of Medicine, Tokyo Medical and Dental University, 1-5-45 Yushima, Bunkyo, Tokyo 113, Japan.* (Received 11 September 1995)

The effects of the spin-orbit and the tensor parts of the instanton-induced interaction on the excited positive- and negative-parity nonstrange baryons and on the two-nucleon systems are investigated. The spin-orbit force from the instanton-induced interaction cancels most of that from the one-gluon exchange in the excited baryons while the spin-orbit force in the nucleon systems remains strong after the inclusion of the instanton-induced interaction. The model including the spin-orbit and the tensor terms of the instanton-induced interaction as well as the one-gluon exchange is found to reproduce successfully the excited baryon mass spectrum and the scattering phase shifts of two nucleons in the spin-triplet relative P-wave state. [S0556-2821(96)04811-4] [Phys. Rev. D **53**, 6619 (1996)]

Charge form factor of π and K mesons. F. Cardarelli,[1] I. L. Grach,[2] I. M. Narodetskii,[2] E. Pace,[1,3] G. Salmè,[4] and S. Simula,[4] [1]*Istituto Nazionale di Fisica Nucleare, Sezione Tor Vergata, Via della Ricerca Scientifica, I-00133 Roma, Italy* [2]*Institute of Theoretical and Experimental Physics, Moscow 117259, Russia* [3]*Dipartimento di Fisica, Università di Roma ''Tor Vergata,'' Via della Ricerca Scientifica, I-00133 Roma, Italy* [4]*Istituto Nazionale di Fisica Nucleare, Sezione Sanità, Viale Regina Elena 299, I-00161 Roma, Italy.* (Received 17 March 1995)

The charge form factor of π and K mesons is evaluated adopting a relativistic constituent quark model based on the light-front formalism. The relevance of the high-momentum components of the meson wave function, for values of the momentum transfer accessible to CEBAF energies, is illustrated. The predictions for the elastic form factor of π and K mesons are compared with the results of different relativistic approaches, showing that the measurements of the pion and kaon form factors planned at CEBAF could provide information for discriminating among various models of the meson structure. [S0556-2821(96)05911-5] [Phys. Rev. D **53**, 6682 (1996)]