

Selected Abstracts from Other Physical Review Journals

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Solar neutrino fluxes with arbitrary ^3He mixing. V. Berezhinsky, *Istituto Nazionale di Fisica Nucleare, Laboratori Nazionali del Gran Sasso, I-67010 Assergi (AQ), Italy*; G. Fiorentini, *Dipartimento di Fisica dell'Università di Ferrara and Istituto Nazionale di Fisica Nucleare, Sezione di Ferrara, I-44100 Ferrara, Italy*; M. Lissia, *Istituto Nazionale di Fisica Nucleare, Sezione di Cagliari and Dipartimento di Fisica dell'Università di Cagliari, I-09042 Monserrato, Cagliari, Italy*. (Received 26 February 1999; published 24 November 1999)

The ^3He abundance is not constrained by helioseismic data. Mixing of ^3He inside the solar core by processes not included in the solar standard model (SSM) has been recently proposed as a possible solution to the solar neutrino problem. We have performed a model-independent analysis of solar neutrino fluxes using practically arbitrary ^3He mixing. In addition, we have been simultaneously varying within very wide ranges the temperature in the neutrino production zone and the astrophysical factors S_{17} and S_{34} of the $p + ^7\text{Be}$ and $^3\text{He} + ^4\text{He}$ cross sections. Seismic data are used as constraints, but the solar-luminosity constraint is not imposed. It is demonstrated that even allowing ^3He abundances higher by factors up to 16 than in the SSM, temperatures 5% (or more) lower, the astrophysical factor S_{17} up to 40% higher, and varying S_{34} in the range $(-20\%, +40\%)$, the best fit is still more than 5σ away from the observed fluxes. We conclude that practically arbitrary ^3He mixing combined with independent variations of temperature and cross sections cannot explain the observed solar neutrino fluxes. [S0556-2821(99)04622-6] [Phys. Rev. D **60**, 123002 (1999)]

Determination of neutrino incoming direction in the CHOOZ experiment and its application to supernova explosion location by scintillator detectors. M. Apollonio,³ A. Baldini,² C. Bemporad,² E. Caffau,³ F. Cei,² Y. Déclais,⁵ H. de Kerret,⁶ B. Dieterle,⁸ A. Etenko,⁴ L. Foresti,² J. George,⁸ G. Giannini,³ M. Grassi,² Y. Kozlov,⁴ W. Kropp,⁷ D. Kryn,⁶ M. Laiman,⁵ C. E. Lane,¹ B. Lefèvre,⁶ I. Machulin,⁴ A. Martemyanov,⁴ V. Martemyanov,⁴ L. Mikaelyan,⁴ D. Nicolò,² M. Obolensky,⁶ R. Pazzi,² G. Pieri,² L. Price,⁷ S. Riley,^{7,8} R. Reeder,⁸ A. Sabelnikov,⁴ G. Santin,³ M. Skorokhvatov,⁴ H. Sobel,⁷ J. Steele,¹ R. Steinberg,¹ S. Sukhotin,⁴ S. Tomshaw,¹ D. Veron,⁶ and V. Vyrodov,⁶ ¹*Drexel University, Philadelphia, Pennsylvania 19104* ²*INFN and University of Pisa, Pisa, Italy* ³*INFN and University of Trieste, Trieste, Italy* ⁴*Kurchatov Institute, Moscow, Russia* ⁵*LAPP-IN2P3-CNRS Annecy-le-Vieux, France* ⁶*PCC-IN2P3-CNRS Collège de France, Paris, France* ⁷*University of California, Irvine, California 92717* ⁸*University of New Mexico, Albuquerque, New Mexico 87131*. (Received 10 June 1999; published 6 December 1999)

The CHOOZ experiment has measured the antineutrino flux at about 1 km from two nuclear reactors to search for possible $\bar{\nu}_e \rightarrow \bar{\nu}_x$ oscillations with mass-squared differences as low as

10^{-3} eV^2 for full mixing. We show that the analysis of the $\sim 2700 \bar{\nu}_e$ events, collected by our liquid scintillation detector, locates the antineutrino source within a cone of half-aperture $\approx 18^\circ$ at the 68% C.L. We discuss the implications of this result for locating a supernova explosion. [S0556-2821(99)03823-0] [Phys. Rev. D **61**, 012001 (1999)]

Probing matter effects with neutrino long baseline experiments. Mohan Narayan and S. Uma Sankar, *Department of Physics, I.I.T., Powai, Mumbai 400076, India*. (Received 12 April 1999; published 6 December 1999)

We consider $\nu_\mu \rightarrow \nu_e$ oscillations in long baseline experiments within a three flavor oscillation framework. A non-zero measurement of this oscillation probability implies that the (13) mixing angle ϕ is non-zero. We consider the effect of neutrino propagation through the matter of Earth's crust and show that, given the constraints from solar neutrino and CHOOZ data, matter effects enhance the mixing for neutrinos rather than for anti-neutrinos. We need data from two different experiments with different baseline lengths (such as K2K and MINOS) to discern the effect of the matter term. [S0556-2821(00)04201-6] [Phys. Rev. D **61**, 013003 (1990)]

Common hierarchical lepton mass textures for atmospheric and solar neutrino oscillations. Ehab Malkawi, *Department of Physics, Jordan University of Science & Technology, Irbid-22110, Jordan and Theory Group, KEK, Tsukuba, Ibaraki 305-0801, Japan*. (Received 12 July 1999; published 9 December 1999)

We propose and study a common hierarchical mass texture for both charged lepton and neutrino sectors. The texture gives rise to large $\nu_\mu \leftrightarrow \nu_\tau$ mixing. Also it leads to the small angle MSW effect solution for solar neutrino data. It naturally gives a small $\nu_e \leftrightarrow \nu_\tau$ oscillation relevant to the CHOOZ result in certain mass limits. A special case of only four input parameters leads to a consistent solution to neutrino oscillation and lepton masses. [S0556-2821(99)02223-7] [Phys. Rev. D **61**, 013006 (1999)]

Neutrinos from stellar collapse: Effects of flavor mixing. Gautam Dutta, D. Indumathi, M. V. N. Murthy, and G. Rajasekaran, *The Institute of Mathematical Sciences, Chennai 600 113, India*. (Received 22 July 1999; published 10 December 1999)

We study the effect of nonvanishing masses and mixings among neutrino flavors on the detection of neutrinos from stellar collapse

by a water Cherenkov detector. We consider a realistic framework in which there are three neutrino flavors whose mass squared differences and mixings are constrained by the present understanding of solar and atmospheric neutrinos. We also include the effects of high dense matter within the supernova core. We find that the number of events due to the dominant process involving electron antineutrinos may change dramatically for some allowed mixing parameters. Furthermore, contributions from charged-current scattering off oxygen atoms in the detector can be considerably enhanced due to flavor mixing; such events have a distinct experimental signature since they are backward peaked. [S0556-2821(99)05423-5] [Phys. Rev. D **61**, 013009 (1999)]

Color neutrality and the gluon distribution in a very large nucleus. C. S. Lam and Gregory Mahlon, *Department of Physics, McGill University, 3600 University Street, Montréal, QC, Canada H3A 2T8.* (Received 9 July 1999; published 1 December 1999)

We improve the McLerran-Venugopalan model for the gluon distribution functions in very large nuclei by imposing the condition that the nucleons should be color neutral. We find that enforcing color neutrality cures the infrared divergences in the transverse coordinates which are present in the McLerran-Venugopalan model. Since we obtain well-defined expressions for the distribution functions, we are able to draw unambiguous conclusions about various features of the model. In particular, we show that the gluon distribution functions in the absence of quantum corrections behave as $1/x_F$ to all orders in the coupling constant. Furthermore, our distribution functions exhibit saturation at small transverse momenta. The normalization of the distribution function we obtain is not arbitrary but specified in terms of the nucleon structure. We derive a sum rule for the integral of the gluon distribution function over transverse momenta, and show that the non-Abelian contributions serve only to modify the shape of the transverse momentum distribution. We obtain a relatively simple expression for the mean value of the transverse momentum-squared. The connection between the McLerran-Venugopalan model and the Dokshitzer-Gribov-Lipatov-Altarelli-Parisi equation is discussed quantitatively. Finally, we illustrate our results in terms of a simple nuclear model due to Kovchegov. [S0556-2821(00)00301-5] [Phys. Rev. D **61**, 014005 (1990)]

Structure and production of lambda baryons. C. Boros, *Department of Physics and Mathematical Physics and Special Research Center for the Subatomic Structure of Matter, University of Adelaide, Adelaide 5005, Australia*; J. T. Londergan, *Department of Physics and Nuclear Theory Center, Indiana University, Bloomington, Indiana 47408*; A. W. Thomas, *Department of Physics and Mathematical Physics and Special Research Center for the Subatomic Structure of Matter, University of Adelaide 5005, Australia.* (Received 5 August 1999; published 7 December 1999)

We discuss the quark parton structure of the Λ baryon and the fragmentation of quarks into Λ baryons. We show that the hyperfine interaction, responsible for the Δ - N and Σ^0 - Λ mass splittings, leads not only to sizable $SU(3)$ and $SU(6)$ symmetry breaking in the quark distributions of the Λ , but also to significant polarized

non-strange quark distributions. The same arguments suggest flavor asymmetric quark fragmentation functions and non-zero polarized non-strange quark fragmentation functions. The calculated fragmentation functions give a good description of all measured observables. We predict significant positive Λ polarization in semi-inclusive DIS experiments while models based on $SU(3)$ flavor symmetry predict zero or negative Λ polarization. Our approach also provides a natural explanation for the dependence of the maximum of the $\xi = \ln(1/z)$ spectrum on the mass of the particles produced in e^+e^- annihilation. [S0556-2821(00)00701-3] [Phys. Rev. D **61**, 014007 (1990)]

Hard-thermal-loop resummation of the thermodynamics of a hot gluon plasma. Jens O. Andersen, Eric Braaten, and Michael Strickland, *Physics Department, Ohio State University, Columbus, Ohio 43210.* (Received 2 June 1999; published 13 December 1999)

We calculate the thermodynamic functions of a hot gluon plasma to leading order in hard-thermal-loop (HTL) perturbation theory. Effects associated with screening, gluon quasiparticles, and Landau damping are resummed to all orders. The ultraviolet divergences generated by the HTL propagator corrections can be canceled by a counterterm that depends on the thermal gluon mass parameter. The HTL thermodynamic functions are compared to those from lattice gauge theory calculations and from quasiparticle models. For reasonable values of the HTL parameters, the deviations from lattice results for $T > 2T_c$ have the correct sign and roughly the correct magnitude to be accounted for by next-to-leading order corrections in HTL perturbation theory. [S0556-2821(00)01001-8] [Phys. Rev. D **61**, 014017 (1990)]

CP violation in vacuum neutrino oscillation experiments. A. M. Gago,^{1,2} V. Pleitez,³ R. Zukanovich Funchal¹ ¹*Instituto de Física, Universidade de São Paulo, C. P. 66.318, 05389-970 São Paulo, Brazil* ²*Sección Física, Departamento de Ciencias, Pontificia Universidad Católica del Perú, AP 1762 Lima, Perú* ³*Instituto de Física Teórica-UNESP, R. Pamplona 145, 01405-900 São Paulo, Brazil.* (Received 12 August 1999; published 7 December 1999)

We discuss the use of the CP asymmetry parameter (A_{CP}) as a possible observable of CP violation in the leptonic sector. In order to do this, we study for a wide range of values of L/E the behavior of this asymmetry for the corresponding maximal value of the CP violation factor allowed by all the present experimental limits on neutrino oscillations in vacuum and the recent Super-Kamiokande atmospheric neutrino result. We work in the three neutrino flavor framework. [S0556-2821(00)05401-1] [Phys. Rev. D **61**, 016004 (1990)]

Pion-baryon coupling constants in light cone QCD sum rules. T. M. Aliev and M. Savci, *Physics Department, Middle East Technical University, 06531 Ankara, Turkey.* (Received 12 April 1999; published 13 December 1999)

We calculate the $\pi\Sigma\Lambda$ and $\pi\Sigma\Sigma$ coupling constants in light cone QCD sum rules for the structure $\sigma_{\alpha\beta}\gamma_5 p^\alpha q^\beta$. A comparison of our

results on these coupling constants with the predictions of SU(6) symmetry is presented. [S0556-2821(99)06323-7] [Phys. Rev. D **61**, 016008 (1999)]

Magnetic oscillations in dense cold quark matter with four-fermion interactions. D. Ebert, *Theory Division, CERN, CH 1211 Geneva 23, Switzerland and Institut für Physik, Humboldt-Universität, D-10115 Berlin, Germany*; K. G. Klimenko, *Institute for High Energy Physics, 142284 Protvino, Moscow Region, Russia*; M. A. Vdovichenko and A. S. Vshivtsev, *Moscow Institute of Radio-Engineering, Electronics and Automatic Systems, 117454 Moscow, Russia*. (Received 11 May 1999; published 16 December 1999)

The phase structures of Nambu–Jona-Lasinio models with one or

two flavors are investigated at nonzero values of μ and H , where H is an external magnetic field and μ is the chemical potential. In the phase portraits of both models there arise infinitely many massless chirally symmetric phases, as well as massive ones with spontaneously broken chiral invariance, reflecting the existence of infinitely many Landau levels. Phase transitions of first and second orders and a lot of tricritical points have been shown to exist in phase diagrams. In the massless case, such a phase structure leads unavoidably to the standard van Alphen–de Haas magnetic oscillations of some thermodynamical quantities, including magnetization, pressure and particle density. In the massive case we find an oscillating behavior not only for thermodynamical quantities, but also for a dynamical quantity as the quark mass. In addition, in this case we have nonstandard, i.e., nonperiodic, magnetic oscillations, since the frequency of oscillations is an H -dependent quantity. [S0556-2821(99)03022-2] [Phys. Rev. D **61**, 025005 (1999)]