Selected Abstracts from Other Physical Review Journals

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Neutrino-mixing-generated lepton asymmetry and the primordial ^{4}He abundance. Xiangdong Shi, George M. Fuller, and Kevork Abazajian, *Department of Physics, University of California, San Diego, La Jolla, California 92093-0319.* (Received 11 February 1999; published 20 August 1999)

It has been proposed that an asymmetry in the electron neutrino sector may be generated by resonant active-sterile neutrino transformations during big bang nucleosynthesis (BBN). We calculate the change in the primordial ^{4}He yield Y resulting from this asymmetry, taking into account both the time evolution of the ν_e and $\overline{\nu_e}$ distribution function and the spectral distortions in these. We calculate this change in two schemes: (1) a lepton asymmetry directly generated by ν_e mixing with a lighter right-handed sterile neutrino ν_s, and (2) a lepton asymmetry generated by a $\nu_\tau \leftrightarrow \nu_s$ or $\nu_\mu \leftrightarrow \nu_s$ transformation which is subsequently partially converted to an asymmetry in the $\nu_e\overline{\nu_e}$ sector by a matter-enhanced active-active neutrino transformation. In the first scheme, we find that the percentage change in Y is between -1% and 9% (with the sign depending on the sign of the asymmetry), bounded by the Majorana mass limit $m_{\nu_e} \lesssim 1$ eV. In the second scheme, the maximal percentage reduction in Y is 2%, if the lepton number asymmetry in neutrinos is positive; otherwise, the percentage increase in Y is $\lesssim 5\%$ for $m^2_{\nu_\mu,\nu_\tau} - m^2_{\nu_s} \lesssim 10^4$ eV. We conclude that the change in the primordial ^{4}He yield induced by a neutrino-mixing-generated lepton number asymmetry can be substantial in the upward direction, but limited in the downward direction. [S0556-2821(99)01418-6] [Phys. Rev. D **60**, 063002 (1999)]

Is there a 4.5 PeV neutron line in the cosmic ray spectrum? Robert Ehrlich, *Physics Department, George Mason University, Fairfax, Virginia 22030.* (Received 8 April 1999; published 7 September 1999)

Recently we presented a model to fit the cosmic ray spectrum using the hypothesis that the electron neutrino is a tachyon. The model predicted the existence of a neutron flux in the cosmic rays in a narrow region centered on $E = 4.5 \pm 2.2$ PeV. The published literature on Cygnus X-3 reveals just such a 6σ spike of neutral particles centered on $E = 4.5$ PeV. A second prediction of the model concerning integrated neutron fluxes at several energies also is consistent with published data. A specific further test of the model is proposed.
[S0556-2821(99)01019-X] [Phys. Rev. D **60**, 073005 (1999)]

Solar neutrinos and the eclipse effect. Mohan Narayan,[1] G. Rajasekaran,[1] Rahul Sinha,[1] and C. P. Burgess,[2] [1]*Institute of Mathematical Sciences, Madras 600 113, India* [2]*Physics Department, McGill University, Montréal, Québec, Canada, H3A 2T8.* (Received 12 March 1998; revised manuscript received 3 May 1999; published 8 September 1999)

The solar neutrino counting rate in a real time detector such as Super-Kamiokanda, SNO, or Borexino is enhanced due to neutrino oscillations in the Moon during a partial or total solar eclipse. The enhancement is calculated as a function of the neutrino parameters in the case of three flavor mixing. This enhancement, if seen, can further help to determine the neutrino parameters. [S0556-2821(99)01117-0] [Phys. Rev. D **60**, 073006 (1999)]

Four-neutrino mass spectra and the Super-Kamiokande atmospheric up-down asymmetry. S. M. Bilenky, *Joint Institute for Nuclear Research, Dubna, Russia and Institute for Theoretical Physics, University of Vienna, Boltzmanngasse 5, A-1090 Vienna, Austria;* C. Giunti, *INFN, Sezione di Torino, and Dipartimento di Fisica Teorica, Università di Torino, Via P. Giuria 1, I-10125 Torino, Italy;* W. Grimus and T. Schwetz, *Institute for Theoretical Physics, University of Vienna, Boltzmanngasse 5, A-1090 Vienna, Austria.* (Received 23 March 1999; published 8 September 1999)

In the framework of schemes with mixing of four massive neutrinos, which can accommodate the atmospheric, solar and LSND ranges of Δm^2 and contain three active neutrinos and a sterile one, we show that, in the whole region of $\Delta m^2_{\mathrm{LSND}}$ allowed by LSND, the Super-Kamiokande up-down asymmetry excludes all mass spectra with a group of three close neutrino masses separated from the fourth mass by the LSND gap of order 1 eV. Only two schemes with mass spectra in which two pairs of close masses are separated by the LSND gap can describe the Super-Kamiokande up-down asymmetry and all other existing neutrino oscillation data. [S0556-2821(99)03419-0] [Phys. Rev. D **60**, 073007 (1999)]

MSW effect in quantum field theory. Christian Y. Cardall, *Department of Physics & Astronomy, State University of New York at Stony Brook, Stony Brook, New York 11794-3800;* Daniel J. H. Chung, *Randall Physics Laboratory, University of Michigan, Ann Arbor, Michigan 48109-1120.* (Received 12 April 1999; published 13 September 1999)

We show in detail the general relationship between the Schrödinger equation approach to calculating the MSW effect and the quantum field-theoretical S-matrix approach. We show the precise form a generic neutrino propagator must have to allow a physically meaningful ''oscillation probability'' to be decoupled from neutrino production fluxes and detection cross sections, and explicitly list the conditions—not realized in cases of current experimental interest—in which the field theory approach would be useful. [S0556-2821(99)01619-7] [Phys. Rev. D **60**, 073012 (1999)]

Extracting the dipole cross section from photo- and electroproduction total cross-section data. J. R. Forshaw,[1] G. Kerley,[2] and G. Shaw,[2] [1]*Theory Division, CERN, 1211 Geneva 23, Switzerland* [2]*Department of Physics and Astronomy, University of Manchester, Manchester M13 9PL, England.* (Received 9 March 1999; published 3 September 1999)

We report on a successful attempt to extract the cross section for the high-energy scattering of color dipoles of fixed transverse size off protons using electroproduction and photoproduction total cross-section data, subject to the constraint provided by the ratio of the overall photon dissociation cross section to the total cross section. [S0556-2821(99)04317-9] [Phys. Rev. D **60**, 074012 (1999)]

Quark description of hadronic phases. Thomas Schäfer and Frank Wilczek, *School of Natural Sciences, Institute for Advanced Study, Princeton, New Jersey 08540.* (Received 8 April 1999; published 7 September 1999)

We extend our proposal that major universality classes of hadronic matter can be understood, and in favorable cases calculated, directly in the microscopic quark variables, to allow for a splitting between strange and light quark masses. A surprisingly simple but apparently viable picture emerges, featuring essentially three phases, distinguished by whether strangeness is conserved (standard nuclear matter), conserved modulo 2 (hypernuclear matter), or locked to color (color flavor locking). These are separated by sharp phase transitions. There is also, potentially, a quark phase matching hadronic K condensation. The smallness of the secondary gap in two-flavor color superconductivity corresponds to the disparity between the primary dynamical energy scales of QCD and the much smaller energy scales of nuclear physics. [S0556-2821(99)06717-X] [Phys. Rev. D **60**, 074014 (1999)]

Parton distributions for the octet and decuplet baryons. C. Boros and A. W. Thomas, *Department of Physics and Mathematical Physics, and Special Research Center for the Subatomic Structure of Matter, University of Adelaide, Adelaide 5005, Australia.* (Received 17 February 1999; published 8 September 1999)

We calculate the parton distributions for both polarized and unpolarized octet and decuplet baryons, using the MIT bag, dressed by mesons. We show that the hyperfine interaction responsible for the Δ-N and Σ^0-Λ splittings leads to large deviations from $SU(3)$ and $SU(6)$ predictions. For the Λ we find significant polarized, nonstrange parton distributions which lead to a sizable Λ polarization in polarized, semi-inclusive ep scattering. We also discuss the flavor symmetry violation arising from the meson cloud associated with the chiral structure of baryons. [S0556-2821(99)06417-6] [Phys. Rev. D **60**, 074017 (1999)]

Neutrino oscillations and R-parity violating collider signals. S. Y. Choi, Eung Jin Chun, Sin Kyu Kang, and Jae Sik Lee, *School of Physics, Korea Institute for Advanced Study, 207-43 Cheongryangri-dong, Dongdaemun-gu, Seoul 130-012, Korea.* (Received 24 March 1999; published 7 September 1999)

R-parity and L violation in the MSSM could be the origin of the neutrino oscillation observed in Super-Kamiokande. A distinctive feature of this framework is that it can be tested in colliders by observing decay products of the destabilized LSP. We examine all the possible decay processes of the neutralino LSP assuming that the bilinear contribution to neutrino masses dominates over the trilinear one which gives rise to the solar neutrino mass. We find that it is possible to probe neutrino oscillations through colliders in most of the R-parity conserving MSSM parameter space. [S0556-2821(99)01717-8] [Phys. Rev. D **60**, 075002 (1999)]

Implication of Super-Kamiokande data on R-parity violation. Eung Jin Chun and Jae Sik Lee, *School of Physics, Korea Institute for Advanced Study, 207-43 Cheongryangri-dong, Dongdaemun-gu, Seoul 130-012, Korea.* (Received 2 November 1998; published 8 September 1999)

R-parity violating bilinear (soft) terms in the supersymmetric standard model are the leading source for nonzero neutrino masses and mixing. We point out that the mixing between neutralinos (charginos) and neutrinos (charged leptons) driven by the bilinear terms take factorized forms, which may enable us to probe the neutrino mixing parameters in a collider. It is then shown that the Super-Kamiokande data on atmospheric neutrinos require all the baryon number violating couplings to be substantially suppressed: $\lambda''_{\rm any}<10^{-9}$. [S0556-2821(99)02117-7] [Phys. Rev. D **60**, 075006 (1999)]