

Selected Abstracts from Other Physical Review Journals

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Neutron production by cosmic-ray muons at shallow depth. F. Boehm,³ J. Busenitz,¹ B. Cook,³ G. Gratta,⁴ H. Henrikson,³ J. Kornis,¹ D. Lawrence,² K. B. Lee,³ K. McKinny,¹ L. Miller,⁴ V. Novikov,³ A. Piepke,^{1,3} B. Ritchie,² D. Tracy,⁴ P. Vogel,³ Y-F. Wang,⁴ and J. Wolf¹ (Palo Verde Collaboration) ¹*Department of Physics and Astronomy, University of Alabama, Tuscaloosa, Alabama 35487* ²*Department of Physics and Astronomy, Arizona State University, Tempe, Arizona 85287* ³*Department of Physics, California Institute of Technology, Pasadena, California 91125* ⁴*Physics Department, Stanford University, Stanford, California 94305.* (Received 23 June 2000; published 12 October 2000)

The yield of neutrons produced by cosmic ray muons at a shallow depth of 32 meters of water equivalent has been measured. The Palo Verde neutrino detector, containing 11.3 tons of Gd loaded liquid scintillator and 3.5 tons of acrylic, served as a target. The rate of one and two neutron captures was determined. Modeling the neutron capture efficiency allowed us to deduce the total yield of neutrons, $Y_{tot} = (3.60 \pm 0.09 \pm 0.31) \times 10^{-5}$ neutrons per muon and g/cm². This yield is consistent with previous measurements at similar depths. [Phys. Rev. D **62**, 092005 (2000)]

Strange quark mass from flavor breaking in hadronic τ decays. Joachim Kambor, *Institut für Theoretische Physik, Universität Zürich, CH-8057 Zürich, Switzerland*; Kim Maltman, *Department of Mathematics and Statistics, York University, 4700 Keele St., Toronto, Ontario, Canada M3J 1P3 and Special Research Centre for the Subatomic Structure of Matter, University of Adelaide, Adelaide, Australia 5005.* (Received 15 June 2000; published 11 October 2000)

The strange quark mass is extracted from a finite energy sum rule (FESR) analysis of the flavor-breaking difference of light-light and light-strange quark vector-plus-axial-vector correlators, using spectral functions determined from hadronic τ decay data. We point out problems for existing FESR treatments associated with potentially slow convergence of the perturbative series for the mass-dependent terms in the OPE over certain parts of the FESR contour, and show how to construct alternate weight choices which not only cure this problem, but also (1) considerably improve the convergence of the integrated perturbative series, (2) strongly suppress contributions from the region of s values where the errors on the strange current spectral function are still large and (3) essentially completely remove uncertainties associated with the subtraction of longitudinal contributions to the experimental decay distributions. The result is an extraction of m_s with statistical errors comparable to those associated with the current experimental uncertainties in the determination of the CKM angle, V_{us} . We find $m_s(1 \text{ GeV}) = 158.6 \pm 18.7 \pm 16.3 \pm 13.3 \text{ MeV}$ (where the first error is statistical, the second

due to that on V_{us} , and the third theoretical). [Phys. Rev. D **62**, 093023 (2000)]

Day-night asymmetry of high and low energy solar neutrino events in Super-Kamiokande and in the Sudbury Neutrino Observatory. G. L. Fogli,¹ E. Lisi,¹ D. Montanino,² and A. Palazzo,¹ ¹*Dipartimento di Fisica and Sezione INFN di Bari, Via Amendola 173, I-70126 Bari, Italy* ²*Dipartimento di Scienze dei Materiali dell'Università di Lecce, Via Arnesano, I-73100 Lecce, Italy.* (Received 3 August 2000; published 25 October 2000)

In the context of solar ν oscillations among active states, we briefly discuss the current likelihood of Mikheyev-Smirnov-Wolfenstein solutions to the solar ν problem, which appear to be currently favored at large mixing, where small Earth regeneration effects might still be observable in Super-Kamiokande (SK) and in the Sudbury Neutrino Observatory (SNO). We point out that, since such effects are larger at high (low) solar ν energies for high (low) values of the mass square difference δm^2 , it may be useful to split the night-day rate asymmetry in two separate energy ranges. We show that the difference Δ of the night-day asymmetry at high and low energy may help to discriminate the two large-mixing solutions at low and high δm^2 through a sign test, both in SK and in SNO, provided that the sensitivity to Δ can reach the (sub)percent level. [Phys. Rev. D **62**, 113003 (2000)]

Quasivacuum solar neutrino oscillations. G. L. Fogli,¹ E. Lisi,¹ D. Montanino,² and A. Palazzo,¹ ¹*Dipartimento di Fisica and Sezione INFN di Bari, Via Amendola 173, I-70126 Bari, Italy* ²*Dipartimento di Scienza dei Materiali dell'Università di Lecce, Via Arnesano, I-73100 Lecce, Italy* (Received 30 May 2000; published 25 October 2000)

We discuss in detail solar neutrino oscillations with $\delta m^2/E$ in the range $[10^{-10}, 10^{-7}] \text{ eV}^2/\text{MeV}$. In this range, which interpolates smoothly between the so-called “just-so” and “Mikheyev-Smirnov-Wolfenstein” oscillation regimes, neutrino flavor transitions are increasingly affected by matter effects as $\delta m^2/E$ increases. As a consequence, the usual vacuum approximation has to be improved through the matter-induced corrections, leading to a “quasivacuum” oscillation regime. We perform accurate numerical calculations of such corrections, using both the true solar density profile and its exponential approximation. Matter effects are shown to be somewhat overestimated in the latter case. We also discuss the role of Earth crossing and of energy smearing. Prescriptions are given to implement the leading corrections in the quasivacuum oscillation range. Finally, the results are applied to a global analysis

of solar ν data in a three-flavor framework. [Phys. Rev. D **62**, 113004 (2000)]

Evidence for a $K_0^*(1730)$ meson resonance. C. M. Shakin and Huangsheng Wang, *Department of Physics and Center for Nuclear Theory, Brooklyn College of the City University of New York, Brooklyn, New York 11210*. (Received 20 June 2000; published 7 November 2000)

In our systematic study of light meson spectra we predicted K_0^* meson states at 1416, 1738, and 1999 MeV. (These were the 1^3P_0 , 2^3P_0 , and 3^3P_0 states of our model, respectively.) However, in the data tables we only find the $K_0^*(1430)$ and $K_0^*(1950)$. In this work, we discuss a body of evidence that suggests that there is a K_0^* resonance at about 1730 MeV. This evidence is taken from the systematics of $q\bar{q}$ states recently discussed by Anisovich, Anisovich, and Sarantsev, as well as from a recent study of S -wave $K\pi$ scattering by Jamin, Oller, and Pich. [Phys. Rev. D **62**, 114014 (2000)]

Longitudinal resolution in a large relativistic nucleus: Adding a dimension to the McLerran-Venugopalan model. C. S. Lam and Gregory Mahlon, *Department of Physics, McGill University, 3600 University Street, Montréal, Québec H3A 2T8 Canada*. (Received 14 July 2000; published 9 November 2000)

We extend the McLerran-Venugopalan model for the gluon distribution functions of very large nuclei to larger values of the longitudinal momentum fraction x_F . Because gluons with larger values of x_F begin to resolve the longitudinal structure of the nucleus, we find that it is necessary to set up a fully three-dimensional for-

malism for performing the calculation. We obtain a relatively compact expression for the gluon number density provided that the nucleus is sufficiently large and consists of color-neutral nucleons. Our expressions for the gluon number density saturate at small transverse momenta. The nuclear dependence we obtain is such that the number of gluons increases more slowly than the number of nucleons as the size of the nucleus is increased. [Phys. Rev. D **62**, 114023 (2000)]

Graviton production in relativistic heavy-ion collisions. Sean C. Ahern, John W. Norbury, and William J. Poyser, *Physics Department, University of Wisconsin-Milwaukee, P.O. Box 413, Milwaukee, Wisconsin 53201*. (Received 14 April 2000; published 16 October 2000)

We study the feasibility of producing the graviton of the novel Kaluza-Klein theory in which there are d large compact dimensions in addition to the 4 dimensions of Minkowski spacetime. We calculate the cross section for producing such a graviton in nucleus-nucleus collisions via t -channel $\gamma\gamma$ fusion using the semiclassical Weizsäcker-Williams method and show that it can exceed the cross section for graviton production in electron-positron scattering by several orders of magnitude. [Phys. Rev. D **62**, 116001 (2000)]

Nuclear matrix element uncertainties in short range $0\nu\beta\beta$ decay. H. V. Klapdor-Kleingrothaus and H. Päs, *Max-Planck-Institut für Kernphysik, P.O. Box 103980, D-69029 Heidelberg, Germany*. (Received 5 May 2000; published 30 October 2000)

The evaluation of short range contributions to neutrinoless double beta decay has been challenged due to criticism of the ansatz of the nuclear matrix element calculations. We comment on the criticism and uncertainties of these calculations and the effect on the derived limits. [Phys. Rev. D **62**, 117301 (2000)]