

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.

Self-consistent study on color transport in the quark-gluon plasma at a finite chemical potential. Hou Defu, *Institute of Particle Physics, Hua-Zhong Normal University, Wuhan 430070, China*; Stefan Ochs, *Institut für Theoretische Physik, 93040 Uni Regensburg, Germany and Institute of Particle Physics, Hua-Zhong Normal University, Wuhan 430070, China*; Li Jiarong, *Institute of Particle Physics, Hua-Zhong Normal University, Wuhan 430070, China*. (Received 27 November 1995)

We calculate the relaxation time self-consistently to study the damping of collective color modes and the color conductivity in a QGP by deriving self-consistent equations for the damping rates of gluons and quarks to leading order QCD by thermal field dynamics including a chemical potential for quarks. We show that the damping rates are not sensitive to the chemical potential whereas color conductivity is enhanced considerably. [S0556-2821(96)01320-3] [Phys. Rev. D **54**, 7634 (1996)]

Nucleosynthesis and the mass of ν_τ reexamined. Steen Hannestad and Jes Madsen, *Institute of Physics and Astronomy, University of Aarhus, DK-8000 Århus C., Denmark*. (Received 14 August 1996)

In a recent Letter we presented the first numerical treatment of the full set of Boltzmann equations for the evolution of an MeV Majorana τ neutrino in the early Universe. The conclusion was that mass limits from big bang nucleosynthesis were significantly weakened compared to previous investigations. An error in our numerical code unfortunately invalidates the results. We present here the correct results that lead to a strengthening of earlier mass limits based on the integrated Boltzmann equation. [S0556-2821(96)02024-3] [Phys. Rev. D **54**, 7894 (1996)]

Measurement of monoenergetic neutrons from the $\overline{p}d$ reaction at rest. M. Chiba,⁷ K. Doi,⁶ T. Fujitani,⁶ K. Inoue,⁵ J. Iwahori,¹ M. Kawaguti,¹ M. Kobayashi,³ M. Koike,² T. Kozuki,⁶ S. Kurokawa,³ H. Kusumoto,⁶ H. Nagano,⁶ Y. Nagashima,⁶ T. Omori,⁶ S. Sugimoto,⁶ M. Takasaki,³ F. Takeuchi,⁴ M. Tsuchiya,⁶ M. Ueda,⁶ Y. Yamaguchi,⁶ and H. Yoshida¹ (Fukui-INS-KEK-Kyoto Sangyo-Meisei-Osaka-Tokyo Metropolitan Collaboration) ¹*Faculty of Engineering, Fukui University, Fukui 910, Japan* ²*Institute for Nuclear Study, University of Tokyo, Tanashi, Tokyo 138, Japan* ³*National Laboratory for High Energy Physics (KEK), Tsukuba 305, Japan* ⁴*Faculty of Science, Kyoto Sangyo University, Kitaku, Kyoto 603, Japan* ⁵*Faculty of Science and Technology, Meisei University, Hino 191, Japan* ⁶*Physics Department, Osaka University, Toyonaka, Osaka 560, Japan* ⁷*Physics Department, Tokyo Metropolitan University, Hachioji 192-03, Japan*. (Received 15 July 1996)

To search for baryonium states, a highly sensitive experiment with good statistics has been carried out at KEK by using an anti-proton beam, deuterium target, and time-of-flight counter together with a modularized NaI(Tl) detector. At the 4σ level, no narrow peaks due to the production of baryonia in the $\overline{p}d \rightarrow Bn$ reaction have been observed in the neutron spectra. At lower significance levels, however, we have observed four narrow peaks with 3.7σ – 3.5σ , and two at an even lower significance level, in different charge-multiplicity final states. The recoil momentum distribution of the neutrons has been extracted for the channel with zero charge prongs. The energy spectra for γ rays in coincidence with the neutron have been also obtained. [S0556-2821(97)03901-5] [Phys. Rev. D **55**, 40 (1997)]

Heidelberg-Moscow $\beta\beta$ experiment with ^{76}Ge : Full setup with five detectors. M. Günther, J. Hellmig, G. Heusser, M. Hirsch, H. V. Klapdor-Kleingrothaus, B. Maier, H. Päs, F. Petry, Y. Ramachers, H. Strecker, and M. Völlinger, *Max-Planck-Institut für Kernphysik, Heidelberg, Germany*; A. Balysh, S. T. Belyaev, A. Demehin, A. Gurov, I. Kondratenko, D. Kotelnikov, and V. I. Lebedev, *Russian Science Center Kurchatov Institute, 123 182 Moscow, Russia*; A. Müller, *Istituto Nazionale di Fisica Nucleare, I-67010 Assergi, Italy*. (Received 20 December 1995)

The full setup of the Heidelberg-Moscow double β decay experiment is presented. This experiment gives at present the most stringent upper bound, improving the neutrino mass limit into the sub-eV range. Out of 19.2 kg of 86% enriched ^{76}Ge five crystals were grown with a total mass of 11.51 kg. Since February 1995 all five detectors, corresponding to 10.96 kg active mass, are in regular operation in the Gran Sasso underground laboratory, four of them in a common shield. No signal is observed for the neutrinoless double β decay ($0\nu\beta\beta$). The measured data from the first three enriched detectors with a statistical significance of 13.60 kg yr result in a new half-life limit of $T_{1/2}(0^+ \rightarrow 0^+) > 7.4 \times 10^{24}$ yr (90% C.L.). With this limit a Majorana mass of the neutrinos larger than 0.6 eV (90% C.L.) is excluded. From the data taken in the previously operated setup with three enriched detectors in a common shielding and a statistical significance of 10.58 kg yr new results are extracted for the two neutrino double β decay ($2\nu\beta\beta$) of ^{76}Ge . The procedure of a quantitative and model-independent description of the background via a Monte Carlo simulation is outlined in some detail. The combined result is $T_{1/2}^{2\nu} = [1.77^{+0.01}_{-0.01}(\text{stat})^{+0.13}_{-0.11}(\text{sys})] \times 10^{21}$ yr. Further on the results concerning new Majoron models and the impact on SUSY parameters are briefly reviewed. Future improvements on the background with the application of digital pulse shape analysis are discussed and an outlook on the future of $\beta\beta$ research is given. [S0556-2821(96)01523-8] [Phys. Rev. D **55**, 54 (1996)]

Interaction of a small-size wave packet with a hadron target. L. Frankfurt, *School of Physics and Astronomy, Raymond and Beverly Sackler Faculty of Exact Sciences, Tel Aviv University, 69978 Tel*

Aviv, Israel; A. Radyushkin, *Physics Department, Old Dominion University, Norfolk, Virginia 23529 and Thomas Jefferson National Accelerator Facility, Newport News, Virginia 23606*; M. Strikman, *Department of Physics, Pennsylvania State University, University Park, Pennsylvania 16802*. (Received 23 April 1996)

We calculate in QCD the cross section for the scattering of an energetic small-size wave packet off a hadron target. We use our results to study the small- σ behavior of $P_{\pi N}(\sigma)$, the distribution over the cross section for the pion-nucleon scattering, in the leading α_s order. [S0556-2821(97)01001-1] [Phys. Rev. D **55**, 98 (1997)]

Ground-state baryon masses in an equally mixed scalar-vector linear potential model. S. N. Jena, M. R. Behera, and S. Panda, *Post Graduate Department of Physics, Berhampur University, Berhampur-760007, Orissa, India*. (Received 6 July 1995)

Taking into account the pionic self-energy of the baryons, the color-electrostatic and magnetostatic energies due to one-gluon exchange, and the corrections due to the center-of-mass motion, the ground-state masses of the octet baryons are calculated in a chiral symmetric potential model of independent quarks. The effective potential representing phenomenologically the nonperturbative gluon interactions, including gluon self-couplings, is chosen with equally mixed scalar and vector parts in a linear form. The physical masses of the baryons so obtained with the strong coupling constant $\alpha_c=0.576$ agree very well with the corresponding experimental values. [S0556-2821(96)02323-5] [Phys. Rev. D **55**, 291 (1996)]

Strange hadronic loops of the proton: A quark model calculation. Paul Geiger, *Department of Physics, Carnegie Mellon University, Pittsburgh, Pennsylvania 15213*; Nathan Isgur, *Jefferson Lab, 12 000 Jefferson Avenue, Newport News, Virginia 23606*. (Received 13 May 1996)

Nontrivial $q\bar{q}$ sea effects have their origin in the low- Q^2 dynamics of strong QCD. We present here a quark model calculation of the contribution of $s\bar{s}$ pairs arising from a *complete* set of OZI-allowed strong Y^*K^* hadronic loops to the net spin of the proton, to its charge radius, and to its magnetic moment. The calculation is performed in an “unquenched quark model” which has been shown to preserve the spectroscopic successes of the naive quark model and to respect the OZI rule. We speculate that an extension of the calculation to the nonstrange sea will show that most of the “missing spin” of the proton is in orbital angular momenta. [S0556-2821(97)00601-2] [Phys. Rev. D **55**, 299 (1997)]

Is CP violation observable in long baseline neutrino oscillation experiments? Morimitsu Tanimoto, *Science Education Laboratory, Ehime University, 790 Matsuyama, Japan*. (Received 23 August 1996)

We have studied CP violation originating from the phase of the neutrino-mixing matrix in the long baseline neutrino oscillation experiments. The direct measurement of CP violation is the difference of the transition probabilities between CP -conjugate channels. In those experiments, the CP -violating effect is not suppressed if the highest neutrino mass scale is taken to be 1–5 eV, which is appropriate for the cosmological hot dark matter. Assuming the hierarchy for the neutrino masses, the upper bounds of CP violation have been calculated for three cases, in which mixings are constrained by the recent short baseline ones. The calculated upper bounds are larger than 10^{-2} , which will be observable in the long baseline accelerator experiments. The matter effect, which is not CP invariant, has been also estimated in those experiments. [S0556-2821(97)01701-3] [Phys. Rev. D **55**, 322 (1997)]