

Selected Abstracts from Other Physical Review Journals

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Domain wall dynamics of phase interfaces. L. P. Csernai,^{1,2,3} J. I. Kapusta,³ and E. Osnes⁴ ¹*Theoretical and Computational Physics Section, University of Bergen, Allegaten 55, 5007 Bergen, Norway,* ²*KFKI Research Institute for Particle and Nuclear Physics, P.O. Box 49, 1525 Budapest, Hungary,* ³*School of Physics and Astronomy, University of Minnesota, 116 Church Street SE, Minneapolis, Minnesota 55455,* ⁴*Department of Physics, University of Oslo, P.O.Box 1048 Blindern, 0316 Oslo 3, Norway.* (Received 3 January 2002; published 10 February 2003)

The statics and dynamics of a surface separating two phases of a relativistic quantum field theory at or near the critical temperature typically make use of a free energy as a functional of an order parameter. This free energy functional also affords an economical description of states away from equilibrium. The similarities and differences between using a scalar field as the order parameter versus the energy density are examined, and a peculiarity is noted. We also point out several conceptual errors in the literature dealing with the dynamical prefactor in the nucleation rate. [Phys. Rev. D **67**, 045003 (2003)]

Implications of the KamLAND measurement on the lepton flavor mixing matrix and the neutrino mass matrix. Wan-lei Guo and Zhi-zhong Xing, *CCAST (World Laboratory), P.O. Box 8730, Beijing 100039, China, and Institute of High Energy Physics, Chinese Academy of Sciences, P.O. Box 918 (4), Beijing 100039, China.* (Received 10 December 2002; published 10 March 2003)

We explore some important implications of the KamLAND measurement on the lepton flavor mixing matrix V and the neutrino mass matrix M . The model-independent constraints on nine matrix elements of V are obtained to a reasonable degree of accuracy. We find that nine two-zero textures of M are compatible with current experimental data, but two of them are only marginally allowed. Instructive predictions are given for the absolute neutrino masses, Majorana phases of CP violation, effective masses of the tritium beta decay, and neutrinoless double beta decay. [Phys. Rev. D **67**, 053002 (2003)]

Yet another correlation in the analysis of CP violation using a neutrino oscillation experiment. Toshihiko Ota, *Department of Physics, Kyushu University, Hakozaki, Higashi-ku, Fukuoka 812-8581, Japan;* Joe Sato, *Department of Physics, Faculty of Science, Saitama University, Saitama, 338-8570, Japan.* (Received 8 November 2002; published 12 March 2003)

We investigate the effect induced by variations in the density profile of the Earth's interior using a long-baseline neutrino oscillation experiment. First, we point out two facts. (i) The most essential part of the matter profile is the first Fourier mode of the matter profile function; and (ii) the Earth models based on the study of

seismology include a large uncertainty for the first Fourier mode. Next, we show that there is a strong correlation between the average density value and the first Fourier coefficient in the analysis of the oscillation probability. This means that the matter profile effect induces an added uncertainty for the average matter parameter. Taking into account this extra uncertainty, we make numerical calculations for the sensitivity to the CP violation search and show that CP sensitivity is impaired by this added uncertainty within a large U_{e3} region. [Phys. Rev. D **67**, 053003 (2003)]

Manifest CP violation from Majorana phases. André de Gouvêa and Boris Kayser, *Theoretical Physics Department, Fermilab, P. O. Box 500, Batavia, Illinois 60510-0500;* Rabindra N. Mohapatra, *Department of Physics, University of Maryland, College Park, Maryland 20742.* (Received 7 December 2002; published 20 March 2003)

We hunt for and discuss manifestly CP -violating effects which are mediated by Majorana phases. These phases are present if the standard model neutrinos are Majorana particles. We argue that while Majorana phases do affect the strength of neutrinoless double beta decay (a well known fact), they do so in a way that involves no manifest violation of CP . The conditions for manifestly CP -violating phenomena—differences between the rates for CP -mirror-image processes—are presented, and three examples are discussed: (i) neutrino $\leftrightarrow$ antineutrino oscillation; (ii) rare decays of K and B mesons and their antiparticles; and (iii) the lepton asymmetry generated by the decay of hypothetical very heavy right-handed “see-saw” neutrinos. We also find that, for the case of degenerate light neutrinos, manifestly CP -violating effects in neutrino $\leftrightarrow$ antineutrino oscillation vanish, although flavor-changing transitions do not. Finally, we comment on leptogenesis with degenerate right-handed neutrinos, and contrast it with the neutrino $\leftrightarrow$ antineutrino oscillation case. [Phys. Rev. D **67**, 053004 (2003)]

Jet quenching in high energy heavy ion collisions by QCD synchrotronlike radiation. E. V. Shuryak and I. Zahed, *Department of Physics and Astronomy, State University of New York, Stony Brook, New York 11794-3800.* (Received 16 September 2002; published 31 March 2003)

We consider synchrotronlike radiation in QCD by generalizing Schwinger's treatment of quantum synchrotron radiation in QED to the case of a constant chromomagnetic field. We suggest a novel mechanism for *jet quenching* in heavy ion collisions, whereby high- p_t partons get depleted through strong (classical) color fields. The latter are encountered in the color glass condensate or in the form of expanding shells of exploding sphalerons. Unlike bremsstrahlung radiation through multiple soft rescattering, synchrotron radiation

converts a jet into a wide shower of soft gluons. We estimate the energy loss through this mechanism and suggest that it contributes significantly to the unexpectedly strong jet quenching observed at BNL RHIC. [Phys. Rev. D **67**, 054025 (2003)]

Partially quenched nucleon-nucleon scattering. Silas R. Beane, *Institute for Nuclear Theory, University of Washington, Seattle, Washington 98195-1550*; Martin J. Savage, *Department of Physics, University of Washington, Seattle, Washington 98195-1560*. (Received 8 November 2002; published 12 March 2003)

Nucleon-nucleon scattering is studied to next-to-leading order in a partially quenched extension of an effective field theory used to describe multi-nucleon systems in QCD. The partially quenched nucleon-nucleon amplitudes will play an important role in relating lattice simulations of the two-nucleon sector to nature. [Phys. Rev. D **67**, 054502 (2003)]

Status of a supersymmetric flavor violating solution to the solar neutrino puzzle with three generations. H. K. Dreiner, *Physikalisches Institut, Nussallee 12, D-53115 Bonn, Germany*; G. Moreau, *Physikalisches Institut, Nussallee 12, D-53115 Bonn, Germany, and Service de Physique Théorique, CP225, Université Libre de Bruxelles, Bld. du Triomphe, 1050 Brussels, Belgium*. (Received 22 November 2002; published 12 March 2003)

We present a study of a three neutrino flavor transition model based on supersymmetric interactions that violate R parity. These interactions induce flavor violating scattering reactions between solar matter and neutrinos. The model does not contain any vacuum mass or mixing angle for the first generation neutrino. Instead, the effective mixing in the first generation is induced via the new interactions. The model provides a natural interpretation of the atmospheric neutrino anomaly, and is consistent with reactor experiments. We determine all R -parity violating couplings which can contribute to the effective neutrino oscillations, and summarize the present laboratory bounds. Independent of the specific nature of the (supersymmetric) flavor violating model, the experimental data on the solar neutrino rates and the recoil electron energy spectrum are inconsistent with the theoretical predictions. The confidence level of the χ^2 analysis ranges between $\sim 10^{-4}$ and $\sim 10^{-3}$. The incompatibility arises because we cannot simultaneously accommodate the new SNO results together with the recoil electron energy spectrum from Super-Kamiokande in our model. We conclude that a nonvanishing vacuum mixing angle for the first generation neutrino is necessary in our model. We expect this also to apply to the solutions based on other flavor violating interactions having constraints of the same order of magnitude. [Phys. Rev. D **67**, 055005 (2003)]

Nambu-Goldstone bosons in CP violating theory with Majorana masses. Darwin Chang, *NCTS and Physics Department, National Tsing Hua University, Hsinchu 30043, Taiwan, Republic of China, and Physics Department, University of Illinois at Chicago, Chicago, Illinois 60607-7059*; Wai-Yee Keung, *Physics Department, University of Illinois at Chicago, Chicago, Illinois 60607-7059*; Chen-Pin Yeh, *NCTS and Physics Department, National Tsing Hua University, Hsinchu 30043, Taiwan, Republic of China*. (Received 1 November 2002; published 28 March 2003)

We derive some properties of the Nambu-Goldstone boson coupling in theories that have CP violation and Majorana masses. We show explicitly that its diagonal coupling to a Majorana fermion is pseudoscalar not scalar. Some potentially useful off-diagonal properties are also derived. We also show, in the process, that the Goldstone theorem often produces interesting and nontrivial identities in matrix theory which may be hard to prove otherwise. [Phys. Rev. D **67**, 055007 (2003)]

Quantum dynamics of phase transitions in broken symmetry $\lambda\phi^4$ field theory. Fred Cooper, *Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545*; John F. Dawson, *Department of Physics, University of New Hampshire, Durham, New Hampshire 03824*; Bogdan Mihaila, *Physics Division, Argonne National Laboratory, Argonne, Illinois 60439*. (Received 22 August 2002; published 28 March 2003)

We perform a detailed numerical investigation of the dynamics of a single component “explicitly broken symmetry” $\lambda\phi^4$ field theory in $1+1$ dimensions, using a Schwinger-Dyson equation truncation scheme based on ignoring vertex corrections. In an earlier paper, we called this the bare vertex approximation (BVA). We assume here that the initial state is described by a Gaussian density matrix peaked around some nonzero value of $\langle\phi(0)\rangle$, and characterized by a single particle Bose-Einstein distribution function at a given temperature. We compute the evolution of the system using three different approximations: the Hartree approximation, the BVA, and a related two-particle irreducible (2PI) $1/N$ expansion, as a function of coupling strength and initial temperature. In the Hartree approximation, the static phase diagram shows that there is a first order phase transition for this system. As we change the initial starting temperature of the system, we find that the BVA relaxes to a new final temperature and exhibits behavior consistent with a second order phase transition. We find that the average fields equilibrate for arbitrary initial conditions in the BVA, unlike the behavior exhibited by the Hartree approximation, and we illustrate how $\langle\phi(t)\rangle$ and $\langle\chi(t)\rangle$ depend on the initial temperature and on the coupling constant. The Fourier transform of the two-point functions at late times can be fitted by a Bose-Einstein distribution function whose temperature is independent of momentum. We interpret this as evidence for thermalization. [Phys. Rev. D **67**, 056003 (2003)]