1998 年度 若手夏の学校 (素粒子論パート)

議論・質問 の ネタ帳[1]

研究とは何か知りたい! 最先端の話題って? などの疑問をもっている M1 達。
修論で尻に火のついている M2 達。
関連の研究をしていたり、手を出そうかなと思っている Doctor 達。
そして、とにかく興味をもっている人たち。
「 夏の学校 」という絶好のチャンスを、ほっておく手があるでしょうか?
いやあるわけがない!!
ということで、Doctor で論文を発表をしている人たちをまとめてみました。
この人たち (ここに載ってない人たちもいます) に質問を投げかけたり、議論することは決して損にはならないと思います。夕食後の暇な時間、友達つくりにいそしむのも、とても大切なことですが、せっかくのチャンスです、有効に活用しましょう!!!!
論文のタイトルやアブストの意味がわからない?
そんなの全然問題ではありません。
なぜなら、その意味を本人に聞けばいいのです。
(こんなことできる機会はなかなかありません!)
皆、優しく対応してくれることでしょう。
ただし、残念ながら僕たちがお手伝いできるのは、ここまでです。
後は、あなた自身の力で喋りたい相手を探しだし、話しかけてください。
ちょっとの勇気が後できっと役にたつことでしょう。
このネタ帳があなたの役に立ちますように …

[1] 宿泊者名簿に載っている Doctor 達とこちらで確認の取れている人の全論文リストです。

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hep-ph/9804262

Constraints of mixing angles from neutrino oscillation experiments and neutrinoless double beta decay

Abstract

From the analyses of the recent data of neutrino oscillation experiments (especially the CHOOZ and the Super KAMIOKANDE experiments), we discuss how these data affect the neutrinoless double beta decay ($(\beta\beta)_{0\nu}$) rate and vice versa assuming that neutrinos are Majorana particles. For the case that $m_1 \sim m_2 \ll m_3$ (m_i are neutrino masses), we obtain, from the data of the CHOOZ and Super KAMIOKANDE, $0.28 \lesssim \sin^2\theta_{23} \lesssim 0.76$ and $\sin^2\theta_{13} \lesssim 0.05$. Combining the latter constraint with the analysis of the "averaged" neutrino mass $\langle m_\nu \rangle$ appeared in $(\beta\beta)_{0\nu}$, we find that $\frac{\langle m_\nu \rangle - m_2}{m_3 - m_2} < \sin^2\theta_{13} \lesssim 0.05$, which leads to the constraint on $\langle m_\nu \rangle$ as $\langle m_\nu \rangle \lesssim 0.05 m_3 + (1-0.05) m_2$. For the case that $m_1 \ll m_2 \sim m_3$, we find that the data of neutrino oscillation experiments and $(\beta\beta)_{0\nu}$ imply the following constraints of mixing angles. If $0.95 m_3 \lesssim \langle m_\nu \rangle < m_3$, $0 \leq \sin^2\theta_{13} \leq \frac{m_3 + \langle m_\nu \rangle}{2m_3}$. If $\langle m_\nu \rangle \lesssim 0.95 m_3$, $\frac{\langle m_\nu \rangle - (1-0.05)m_3}{\langle m_\nu \rangle - (1+0.05)m_3} \lesssim \sin^2\theta_{12} \leq 1$ and $\frac{(1-0.05)m_3 - \langle m_\nu \rangle}{2m_3} \lesssim \sin^2\theta_{13} \leq \frac{m_3 + \langle m_\nu \rangle}{2m_3}$.

hep-ph/9711415

CP Violation in Neutrinoless Double Beta Decay and Neutrino Oscillation

Abstract

Taking possible CP violations into account, we discuss constraints on lepton mixing angles obtained from neutrinoless double beta decay and from neutrino oscillation for three flavour Majorana neutrinos.

[2] 順不同、敬称略。共同研究者の名前はすべて省いています。
[3] 名前、大学、学年、参加日程の順です。

From the CHORUS oscillation experiment, combined with the data from neutrinoless double beta decay, we show that the large angle solution for θ_{23} is improbable if the neutrino mass m_3 of the third generation is a candidate for hot dark matter.

hep-ph/9708397

CP Violation in Neutrinoless Double Beta Decay

Abstract

Taking possible CP violations into account, we discuss constraints on lepton mixing angles obtained from neutrinoless double beta decay and from neutrino oscillation for three flavour Majorana neutrinos.

From the CHORUS oscillation experiment, combined with the data from neutrinoless double beta decay, we show that the large angle solution for θ_{23} is improbable if the neutrino mass m_3 of the third generation is a candidate for hot dark matter.

Status: RO

永谷　幸則
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hep-ph/9805455

Dynamical Symmetry Breaking in Fractal Space

Abstract

We formulate field theories in fractal space and show the phase diagrams of the coupling versus the fractal dimension for the dynamical symmetry breaking. We first consider the 4-dimensional Gross-Neveu (GN) model in the $(4-d)$-dimensional randomized Cantor space where the fermions are restricted to a fractal space by the high potential barrier of Cantor fractal shape. space. By the statistical treatment of this potential, we obtain an effective action depending on the fractal dimension. Solving the $1/N$ leading Schwinger-Dyson (SD) equation, we get the phase diagram of dynamical symmetry breaking with a critical line similar to that of the d-dimensional $(2 < d \leq 4)$ GN model except for the system-size dependence. We also consider QED_4 with

only the fermions formally compactified to d dimensions. Solving the ladder SD equation, we obtain the phase diagram of dynamical chiral symmetry breaking with a linear critical line, which is consistent with the known results for $d = 4$ (the Maskawa-Nakajima case) and $d = 2$ (the case with the external magnetic field).

hep-ph/9805455

Black Hole Baryogenesis

Abstract

We find that the Hawking radiation of black holes can create the baryon number in the Higgs phase vacuum of the extended standard model with 2-Higgs doublets. We propose new scenarios of baryogenesis based on the black holes, and one of our scenarios can explain the origin of baryon number in our universe, if most of the matter existed as primordial black holes.

青木 真由美
お茶大 *D2* 現象論

hep-ph/9612225

Electroweak baryogenesis from chargino transport in the supersymmetric model

Abstract

We study the baryon asymmetry of the universe in the supersymmetric standard model (SSM). At the electroweak phase transition, the fermionic partners of the charged SU(2) gauge bosons and Higgs bosons are reflected from or transmitted to the bubble wall of the broken phase. Owing to a physical complex phase in their mass matrix, these reflections and transmissions have asymmetries between CP conjugate processes. Equilibrium conditions in the symmetric phase are then shifted to favor a non-vanishing value for the baryon number density, which is realized through electroweak anomaly. We show that the resultant ratio of baryon number to entropy is consistent with its present observed value within reasonable ranges of SSM parameters, provided that the CP-violating phase intrinsic in the SSM is not much suppressed. The compatibility with the constraints on the parameters from the electric dipole moment of the neutron is also discussed.

hep-ph/9706287

Implications of baryon asymmetry for the electric dipole moment of the neutron

Abstract

We study baryogenesis at the electroweak phase transition of the universe within the framework of

the supersymmetric standard model (SSM) based on $N = 1$ supergravity.

This model contains a new source of CP violation in the mass-squared matrices for squarks, which could enable t squarks to mediate the charge transport mechanism for generating baryon asymmetry. The same CP-violating source also induces the electric dipole moment (EDM) of the neutron at the one-loop level. If the new CP-violating phase is not suppressed, it is shown, the t-squark transport can lead to baryon asymmetry consistent with its observed value within reasonable ranges of SSM parameters. For these parameter ranges the magnitude of the neutron EDM is predicted to be not much smaller than its present experimental upper bound.

hep-ph/9706499

Study of CP Violation: Electroweak Baryogenesis and Anomalous W-Boson Couplings

Abstract

The contributions from the Ochanomizu CP Study Group to the KEK meetings on "CP violation and its origin" (1993-1997) are summarized on electroweak baryogenesis and anomalous W-boson couplings. We survey planned new experiments which could examine some aspects studied in our contributions. We also discuss several issues on baryogenesis. Ten problems are presented for further studies.

hep-ph/9706500

Electric Dipole Moments of Neutron and Electron in Supersymmetric Model

Abstract

The electric dipole moments (EDMs) of the neutron and the electron are reviewed within the framework of the supersymmetric standard model (SSM) based on grand unified theories coupled to N=1 supergravity. Taking into account one-loop and two-loop contributions to the EDMs, we explore SSM parameter space consistent with experiments and discuss predicted values for the EDMs. Implications of baryon asymmetry of our universe for the EDMs are also discussed.

hep-ph/9801294

CP violation in the top-quark system through light squarks

Abstract

We study a decay rate asymmetry of the top quark in the supersymmetric standard model, taking into account the constraints from the electric dipole moments of the neutron and the electron. One CP-violating phase contained in the mass-squared matrices of squarks and sleptons is allowed to have an unsuppressed value, even if their masses are of order 100 GeV. Sizable CP violation could then occur in the production and decay of the top quark through interactions with top squarks. The asymmetry between the widths for the decays $t \to bW^+$ and $\bar{t} \to \bar{b}W^-$ can be of order 10^{-3}, which will possibly be detectable in the near future.

hep-ph/9801296

Baryogenesis from top squark transport

Abstract

Baryon asymmetry of the universe is generated in the supersymmetric standard model (SSM) through the charge transport mechanism mediated by top squarks. Necessary CP violation originates from a complex phase contained in mass-squared matrices of squarks and sleptons. This complex phase also gives contributions to the electric dipole moments (EDMs) of the neutron and the electron. The amount of induced baryon asymmetry is consistent with its observed value within reasonable ranges of SSM parameters. The EDMs are predicted to be slightly smaller than their experimental upper limits.

hep-ph/9801351

Electroweak Baryogenesis and Neutron Electric Dipole Moment from Supersymmetry

Abstract

Baryogenesis at the electroweak phase transition is discussed within the framework of the supersymmetric standard model. Implications of baryon asymmetry for the electric dipole moment of the neutron are also studied.

hep-ph/9804457

Baryon asymmetry and neutron EDM

Abstract

Baryon asymmetry of the universe can be generated by new sources of CP violation intrinsic in supersymmetric extension of the standard model. This scenario predicts the neutron electric dipole moment to be not much smaller than its present experimental upper bound.

hep-ph/9805202

Decay Rate Asymmetry of the Top Quark through Light Squarks

Abstract

A decay rate asymmetry of the top quark is discussed within the framework of the supersymmetric standard model. Although new sources of CP violation in this model are severely constrained from the electric dipole moments of the neutron and the electron, there is a possibility that a top squark has a mass of around 100 GeV and CP violation in its interaction with a top quark is unsuppressed. Then partial widths could be different between the decays $t \to bW^+$ and $\bar{t} \to \bar{b}W^-$. The magnitude of this CP asymmetry can be of order 10^{-3}, which may be detectable in the near future.

浅川 恵理
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hep-ph/9803321

Current constraints on squark production scenarios for the excess of high Q^2 events at HERA

Abstract

We examine the stop production scenario for the anomalous excess of high Q^2 events observed at HERA, by taking into account the constraints coming from the leptoquark search at Tevatron and the atomic parity violation experiments. This scenario is shown to survive persistently even under the severe constraints from the other experiments. In the analysis, the branching ratios $B_{\tilde{t}_j}$ of the decay modes $\tilde{t}_j \to ed$ $(j = 1, 2)$ are found to be useful parameters, representing a number of unknown parameters in the SUSY models. By expressing the stop contribution to the cross section of deep inelastic ep scattering $\sigma(ep \to eX)$ in terms of $B_{\tilde{t}_1}$ and $B_{\tilde{t}_2}$, the allowed region is successfully identified in the parameter space of $B_{\tilde{t}_1}$ and $B_{\tilde{t}_2}$.

細道 和夫
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hep-th/9711072

Fermion Emission from Five-Dimensional Black Holes

Abstract

We calculate semiclassically the emission rate of spin 1/2 particles from charged, nonrotating black holes in D=5,N=8 supergravity. The relevant Dirac equation is solved by the same approximation as in the bosonic case. The resulting expression for the emission rate has a form which is predicted from D-brane effective field theory.

hep-th/9806010

Absorption of Fermions by D3-branes

Abstract

The absorption cross section of dilatinos by D3-branes is calculated by means of both classical type IIB supergravity and the effective gauge field theory on their worldvolume. The two methods give the same results, supporting the microscopic description of black holes in terms of D-branes and giving another evidence of AdS/superconformal reciprocity.

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hep-th/9712180

M-theory description of BPS string in 7-brane background

Abstract

We discuss the BPS configurations of IIB strings in the 7-brane background from M-theory viewpoint. We first obtain the hyperkähler geometry background of M-theory expected from the 7-brane solutions of the type IIB supergravity. We choose the appropriate complex structures of the background geometries and embed a membrane of M-theory holomorphically to obtain a BPS string configuration. The recently discussed BPS string configurations such as 3-string junctions and string networks in the flat background are generalized to the cases with the 7-brane backgrounds. The property of the BPS string configurations in the 7-brane backgrounds is in agreement with the previously known results from the IIB string viewpoint.

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hep-th/9805119

On the Generalized Gluing and Resmoothing Theorem

Abstract

this abstract is neglected when [addenda] or [errata] The generalized gluing and resmoothing theorem originally proved by LeClair, Peskin and Preitschopf, gives a powerful formula for the fused vertex obtained by contracting any two vertices in string field theories. Although the theorem is naturally expected to hold for the vertices at any loop level, the original proof was restricted to the vertices at

tree level. Here we present a simplified proof for the tree level theorem and then prove explicitly the extended version at one-loop level. We also find that a non-trivial sign factor, which depends on the string states to be contracted, appears in the theorem. This sign factor turns out to be essential for reproducing correctly the conformal field theory correlation function on the torus.

hep-th/9807066

BRS Invariance of Unoriented Open-Closed String Field Theory

Abstract

We present the full action for the unoriented open-closed string field theory which is based on the $\alpha = p^+$ HIKKO type vertices. The BRS invariance of the action is proved up to the terms which are expected to cancel the anomalous one-loop contributions. This implies that the system is invariant under the gauge transformations with open and closed string field parameters up to the anomalies.

橋本 幸士
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hep-th/9704125

D-brane and Gauge Invariance in Closed String Field Theory

Abstract

We construct a system of bosonic closed string field theory coupled to a D-brane. The interaction between the D-brane and closed

string field is introduced using the boundary state which is a function of constant field strength $F_{\mu\nu}$ and the tilt θ^i_μ of the D-brane. We find that the gauge invariance requirement on the system determines the $(F_{\mu\nu}, \theta^i_\mu)$-dependence of the normalization factor of the boundary state as well as the form of the purely $(F_{\mu\nu}, \theta^i_\mu)$ term of the action. Correspondence between the action in the present formalism and the low energy effective action (bulk + D-brane actions) in the σ-model approach is studied.

hep-th/9803127

3-String Junction and BPS Saturated Solutions in $SU(3)$ Supersymmetric Yang-Mills Theory

Abstract

We construct BPS saturated regular configurations of $\mathcal{N} = 4$ $SU(3)$ supersymmetric Yang-Mills theory carrying non-parallel electric and magnetic charges. These field theory BPS states correspond to the string theory BPS states of 3-string junctions connecting three different D3-branes by regarding the $\mathcal{N} = 4$ supersymmetric Yang-Mills theory as an effective field theory on parallel D3-branes.

hep-th/9804164

Multi-Pronged Strings and BPS Saturated Solutions in $SU(N)$ Supersymmetric Yang-Mills Theory

Abstract

Extending our previous work on $SU(3)$, we construct spherically symmetric BPS saturated regular configurations of $\mathcal{N} = 4$ $SU(N)$ supersymmetric Yang-Mills theory preserving 1/4 supersymmetry, and investigate their features. We also give exact solutions in the case some of the free parameters of the general solutions take certain values. These field theory BPS states correspond to the string theory BPS states of multi-pronged strings connecting N different D3-branes by regarding the $\mathcal{N} = 4$ supersymmetric Yang-Mills theory as an effective field theory on parallel D3-branes. We compare our solutions with multi-pronged strings in string picture.

吉岡 興一
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Infra-Red Fixed Points

in an Asymptotically Non-Free Theory

Abstract

We investigate the infrared fixed point structure in asymptotically free and asymptotically non-free theory. We find that the ratios of couplings converge strongly to their infrared fixed points in the asymptotically non-free theory.

hep-ph/9705449

Finite SUSY GUT Revisited

Abstract

We analyze finite supersymmetric SU(5) GUT taking into account the problem in the Higgs potential and threshold corrections to gauge and Yukawa couplings at GUT and SUSY scales which is important in case of large tan β model. We find that even with these finiteness conditions, which are very restrictive, there are parameter regions where low-energy experimental values are consistently reproduced and the Higgs potential actually realizes both constraints for large tan β and radiative electroweak symmetry breaking, provided that a free parameter is introduced in the boundary condition of the Higgs mixing mass parameter.

hep-ph/9710417

Neutrino Mass Texture with Large Mixing

Abstract

We propose a simple texture for the right-handed Majorana mass matrix to give a large ν_μ–ν_τ mixing angle and hierarchical left-handed neutrino mass pattern. Consistently with the Dirac mass texture of the quark sector realizing the CKM mixing, this naturally explains the recent experimental results on both the atmospheric neutrino anomaly observed by the Superkamiokande collaboration and the solar neutrino problem. In this texture the right-handed Majorana mass of the third generation is of the order of GUT scale, which is favorable for reproducing the observed bottom-tau mass ratio.

hep-ph/9712530

Quark and Lepton Mass Matrix in Asymptotically

Abstract

We analyze fermion mass-matrix structure in an asymptotically non-free model with $4 + \bar{1}$ generations. The texture at GUT scale is uniquely determined by supposing that the masses of heavy up-type quarks (top and charm) are realized as their infrared fixed point values. By assuming the $SO(10)$ GUT-like relations for Yukawa couplings in this model, this texture can explain all fermion masses and quark mixing with only one small parameter which is almost equal to the Cabibbo angle.

hep-ph/9806400

Sterile Neutrinos in a Grand Unified Model

Abstract

The recent experimental results indicating the neutrino oscillations may strongly suggest that at least one more light neutrino species is required in order to reconcile the existing data. In the simple GUT frameworks, this fact seems difficult to preserve the parallelism between quarks and leptons. In this letter, we investigate an $SO(10)$ grand unified model with a pair of extra generations in addition to the known three ones. Using the GUT relations, the obtained neutrino mass matrix naturally indicates that one of the $SU(2)_L$ singlet (sterile) neutrino is very light and has large mixing with muon neutrino, which can explain the atmospheric neutrino anomaly, and the

hot dark matter neutrino is also provided. The solar neutrino problem can be solved by the mixing with muon neutrino consistently with quark mixing, namely, the Cabibbo angle.

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hep-th/9705069

Deformations of $\mathcal{N} = 2$ Dualities to $\mathcal{N} = 1$ Dualities in SU, SO and USp Gauge Theories

Abstract

We study deformations of dualities in finite $\mathcal{N} = 2$ supersymmetric QCD. Adding mass terms for some quarks and the adjoint matter to the finite $\mathcal{N} = 2$ theory, which is known to have dual descriptions, the correspondence of gauge invariant operators between the original and dual theory is deformed. As a result, we naturally obtain N.Seiberg's $\mathcal{N} = 1$ duality. Furthermore, we discuss the origin of the meson and superpotential in the dual theory. This approach can be applied to $SU(N)$, $SO(N)$, and $USp(2N)$ gauge theories, and we analyze all these cases.

hep-th/9804114

Comments on Duality in MQCD

Abstract

We clarify some ambiguous points in a derivation of duality via brane exchange using M-theory language, and propose a "proof" of duality in MQCD. Actually, duality in MQCD is rather trivial and does not need a complicated proof. The problem is how to interpret it in field theory language. We examine BPS states in $\mathcal{N} = 2$ theory and find the particle correspondence under duality. In the process, we also find some exotic particles in $\mathcal{N} = 2$ MQCD, and we observe an interesting phenomenon in type IIA string theory, namely, that fundamental strings are converted into D2-branes via the exchange of two NS5-branes. We also discuss how we should understand Seiberg's $\mathcal{N} = 1$ duality from exact duality in MQCD.

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hep-th/9705069

Deformations of $\mathcal{N} = 2$ Dualities to $\mathcal{N} = 1$ Dualities in SU, SO and USp Gauge Theories

Abstract

We study deformations of dualities in finite $\mathcal{N} = 2$ supersymmetric QCD. Adding mass terms for some quarks and the adjoint matter to the finite $\mathcal{N} = 2$ theory, which is known to have dual descriptions, the correspondence of gauge invariant operators between the original and dual theory is deformed. As a result, we naturally obtain N.Seiberg's $\mathcal{N} = 1$ duality. Furthermore, we discuss the origin of the meson and superpotential in the dual theory. This approach can be applied to $SU(N)$, $SO(N)$, and $USp(2N)$ gauge theories, and we analyze all these cases.

hep-ph/9805457

A Model with Simultaneous Dynamical Breaking of Supersymmetry and GUT Gauge Symmetry

Abstract

We try to construct a model in which supersymmetry and grand unified gauge symmetry are dynamically broken at the same time. In this model SUSY breaking is mediated mainly by massive vector multiplet, and a new solution for the μ problem is proposed.

石本　志高
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hep-th/9609184

Feigin-Fuchs Representations for Nonequivalent Algebras of $N = 4$ Superconformal Symmetery

Abstract

The $N = 4$ $SU(2)_k$ superconformal algebra has the global automorphism of $SO(4) \approx SU(2) \times SU(2)$ with the *left* factor as the Kac-Moody gauge symmetry. As a consequence, an infinite set of independent algebras labeled by

ρ corresponding to the conjugate classes of the *outer* automorphism group $SO(4)/SU(2)=SU(2)$ are obtained à la Schwimmer and Seiberg. We construct Feigin-Fuchs representations with the ρ parameter embedded for the infinite set of the $N = 4$ nonequivalent algebras. In our construction the extended global $SU(2)$ algebras labeled by ρ are self-consistently represented by fermion fields with appropriate boundary conditions.

石村 直也
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hep-ph/9805457

A Model with Simultaneous Dynamical Breaking of Supersymmetry and GUT Gauge Symmetry

Abstract

We try to construct a model in which supersymmetry and grand unified gauge symmetry are dynamically broken at the same time. In this model SUSY breaking is mediated mainly by massive vector multiplet, and a new solution for the μ problem is proposed.

高橋 篤史
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math/9801050

K. Saito's Duality for Regular Weight Systems and Duality for Orbifoldized Poincare Polynomials

Abstract

We will show that the duality for regular weight system introduced by K. Saito can be interpreted as the duality for the orbifoldized Poincare polynomial $\chi(W, G)(y, \bar{y})$.

math/9802059

Primitive Forms, Topological LG Models Coupled to Gravity and Mirror Symmetry

Abstract

In this paper, we will describe the mathematical foundation of topological Landau–Ginzburg (LG) models coupled to gravity at genus 0 in terms of primitive forms. In particular, we can give a natural explanation for the large phase space.

We also discuss the mirror symmetry for Calabi–Yau manifolds and $\mathbf{CP}^1$ in our context. We see that the mirror partner of $\mathbf{CP}^1$ is the theory of primitive form associated to $f = z + qz^{-1}$.

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hep-ph/9805336

Constraints on Supersymmetric $SO(10)$ GUTs with Sum Rules among Soft Masses

Abstract

We study phenomenological aspects of supersymmetric $SO(10)$ GUTs with sum rules among soft SUSY breaking parameters. In particular, the sum rule related to the stau mass leads to the constraints from the requirements of successful electroweak breaking and the positivity of stau mass squared. The bottom quark mass is also estimated.

小池正史
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hep-ph/9703351

CP Violation and Matter Effect in Long Baseline Neutrino Oscillation Experiments

Abstract

We show simple methods how to separate pure CP violating effect from matter effect in long baseline neutrino oscillation experiments with three generations of neutrinos. We give compact formulae for neutrino oscillation probabilities assuming one of the three neutrino masses (presumably ν_τ mass) to be much larger than the other masses and the effective mass due to matter effect. Two methods are shown: One is to observe envelopes of the curves of oscillation probabilities as functions of neutrino energy; a merit of this method is that only a single detector is enough to determine the presence of CP violation. The other is to compare experiments with at least two different baseline lengths; this has a merit that it needs only narrow energy range of oscillation data.

hep-ph/9707203

CP- and T-Violation Effects in Long Baseline Neutrino Oscillation Experiments

Abstract

We examine how large CP- and T-violation effects are allowed in long baseline neutrino experiments with three generations of neutrinos, considering both the solar neutrino deficit and the atmospheric neutrino anomaly. We considerd two cases: When we attribute only the atmospheric neutrino anomaly to neutrino oscillation and assume the constant transition probability of $\nu_{\rm e}$ to explain the solar neutrino deficit, we may have large CP-violation effect. When we attribute both the atmospheric neutrino anomaly and the solar neutrino deficit to neutrino oscillation, we can see sizable T- violation effects. In this case, however, we cannot ignore the matter effect and we will not see the pure CP- violation effect. We also show simple methods how to separate pure CP violating effect from the matter effect. We give compact formulae for neutrino oscillation probabilities assuming one of the three neutrino masses (presumably ν_τ mass) to be much larger than the other masses and the effective mass due to matter effect.

Two methods are shown: One is to observe envelopes of the curves of oscillation probabilities as functions of neutrino energy; a merit of this method is that only a single detector is enough to determine the presence of CP violation. The other is to compare experiments with at least two different baseline lengths; this has a merit that it needs only narrow energy range of oscillation data.

hep-ph/9803212

Effects of Matter Density Fluctuation in Long Baseline Neutrino Oscillation Experiments

Abstract

The effects of matter density fluctuation in long baseline neutrino oscillation experiments are studied. Effects of short wavelength fluctuations are in general irrelevant. Effects of long wavelength fluctuations must be checked on a case-by-case basis. As an example we checked the fluctuation effects and showed its irrelevance in a case of K2K experiments.

千喜良 祐一
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hep-ph/9804279

The Sliding Singlet Mechanism with Gauge Mediated Supersymmetry Breaking

Abstract

The sliding singlet mechanism is one of the most interesting solutions of the triplet-doublet splitting problem. We analyze this mechanism in the gauge mediated supersymmetry breaking scenario. We show that the sliding singlet mechanism does not work in the naive gauge mediation scenario because of the singlet linear terms derived from the gravity, although F term is much smaller than the one in the gravity mediation scenario. We also consider the extension in order for the sliding singlet mechanism to work.

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hep-th/9705100

The Information Loss Problem of Black Hole and the First Order Phase Transition in String Theory

Abstract

In recent years, Susskind, Thorlacius and Uglum have proposed the model for strings near a black hole horizon in order to represent the quantum mechanical entropy of the black hole and to solve the information loss problem. But, this model is insufficient because they did not consider the metric modification by massive strings and did not explain how to bring out the information from the inside of the horizon. In this paper, we present a possible intuitive model for the time development of black hole in order to solve the information loss problem. In this model, we assume that the first order phase transition occurs near the Hagedorn temperature and the string gas changes to hypothetical matter with vanishing entropy and energy, which we call 'the Planck solid'. We also study the background geometry of black hole in this picture and find out that there is no singularity within the model.

hep-th/9705099

Correlation between momentum modes and winding modes in Brandenberger-Vafa's string cosmological model

Abstract

Brandenberger and Vafa has proposed the string cosmological model based on T-duality. In this model, they took the toroidal target space, and introduced the new position $\tilde{x}$ conjugate to the winding mode, in addition to the position x conjugate to the momentum mode. Then they can describe the universe larger than string scale by coordinate x and the one smaller than it by coordinate $\tilde{x}$. In this way, they

never encounter the singularity seen in the standard Big Bang scenario. The most interesting phenomena in this model is the transition from $\tilde{x}$-space to x-space when the size of universe is nearly string scale. Here, we define the dispersion of momentum number m times winding number w as the 'correlation' of momentum modes and winding modes. Then using the statistical mechanics of strings on the torus, we calculate the correlation in low and high temperature limits, and we consider the possibility that we can observe this effect today, but we will see that it is unlikely observable.

hep-th/9703064

T-Duality and Time - development of a 2+1 Dimensional String Universe

Abstract

The time-development of a model of 2+1 dimensional torus universe is studied based on background field equations which follow from a string theory. The metrics in various cases are characterized by a real parameter which specifies a ratio of the lengths of two independent cycles. When the parameter is a rational number, the space is asymptotically stretched along a cycle while the other cycle kept finite. When the parameter is an irrational number, the lengths of two cycles, as well as the space volume (area), grow in proportion to the proper time t for an observer sitting at rest in this universe in the asymptotic region.

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hep-th/9609151

Infinity Cancellation, Type I' Compactification and String $\mathcal{S}$-Matrix Functional

Abstract

Nonvanishing tadpoles and possible infinities associated in the multiparticle amplitudes are discussed with regard to the disk and RP^2 diagrams of the Type I' compactification. We find that the infinity cancellation of $SO(32)$ type I theory

extends to this case as well despite the presence of tadpoles localized in the D-brane world-volume and the orientifold surfaces. Formalism of string $\mathcal{S}$-matrix generating functional is presented to find a consistent string background as c-number source function: we find this only treats the cancellation of the tadpoles in the linearized approximation. Our formalism automatically provides representation of the string amplitudes on this background to all orders in α'.

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hep-th/9707258

Higgs Branch of $N = 2$ SQCD and M theory Branes

Abstract

Higgs branch of $N = 2$ SQCD is studied from the M theory viewpoint. With a differential geometrical proof of the s-rule besides an investigation on the global symmetry of M theory brane configurations, an exact description of the baryonic and non-baryonic branches in terms of M theory is presented. The baryonic branch root is also studied. The "electric" and "magnetic" descriptions of the root are shown to be related with each other by the brane exchange in M theory.

hep-th/9711117

A Proof of Brane Creation via M-theory

Abstract

We study configurations of a single M fivebrane in the geometry $\mathbf{R}^7 \times Q$ where Q is the Taub-NUT space. Taking the IIA limit at each value of their modulus, two possibilities of the IIA configuration are revealed. One consists of a NS fivebrane and a D sixbrane while the other consists of a NS fivebrane, a D sixbrane and a D fourbrane. In

the latter case the fourbrane is shown to be suspended by the fivebrane and the sixbrane. This appearance of fourbrane can be interpreted in Type IIA picture as the result of the crossing of the fivebrane and the sixbrane.

hep-th/9712029

On the Baryonic Branch Root of $N = 2$ MQCD

Abstract

We investigate the brane exchange in the framework of $N = 2$ MQCD by using a specific family of M fivebrane configurations relevant to describe the baryonic branch root. An exchange of M fivebranes is realized in the Taub-NUT geometry and controlled by the moduli parameter of the configurations. This family also provides two different descriptions of the root. These descriptions are examined carefully using the Taub-NUT geometry. It is shown that they have the same baryonic branch and are shifted each other by the brane exchange.

hep-th/9803123

Orientifold 4-plane in brane configurations and $N = 4$ $USp(2N_c)$ and $SO(N_c)$ theory

Abstract

We consider brane configurations in elliptic models which represent softly broken $N = 4$ $USp(2N_c)$ and $SO(N_c)$ theory. We generalize the notion of the O4 plane, so that it is compatible with the symmetry in the covering space of the elliptic models. By using this notion of the O4 plane, we find the curve for softly broken $N = 4$ $USp(2N_c)$ and that for $SO(N_c)$ theory as infinite series expansions. For the USp case, we can present the expansion as a polynomial.

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hep-th/9711073

Exact Results in $N_c = 2$ IIB Matrix Model

Abstract

We investigate $N_c = 2$ case of IIB matrix model, which is exactly soluble. We calculate the partition function exactly and obtain a finite result without introducing any cut-off. We evaluate some correlation functions consisting of Wilson loops.

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hep-th/9806139

Berry's Connection and $USp(2k)$ Matrix Model

Abstract

Berry's connection is computed in the $USp(2k)$ matrix model. In T dualized quantum mechanics, the Berry phase exhibits a residual interaction taking place at a distance $m_{(f)}$ from the orientifold surface via the integration of the fermions in the fundamental representation. This is interpreted as a coupling of the magnetic $D2$ with the electric $D4$ branes. We make a comment on the Berry phase associated with the $6D$ nonabelian gauge anomaly whose cancellation selects the number of flavours $n_f = 16$.

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hep-th/9706219

Moduli Space of Global Symmetry in $N = 1$ Supersymmetric Theories and the Quasi-Nambu-Goldstone Bosons

Abstract

We derive the moduli space for the global symmetry in $N = 1$ supersymmetric theories. We show, at the generic points, it coincides with the space of quasi-Nambu-Goldstone (QNG) bosons, which appear besides the ordinary Nambu-Goldstone (NG) bosons when global symmetry G breaks down spontaneously to its subgroup H with preserving $N = 1$ supersymmetry. At the singular points, most of the NG bosons change to the QNG bosons and the unbroken global symmetry is enhanced. The G-orbits parametrized by the NG bosons are the fibre at the moduli space and the singular points correspond to the point where H-orbit (in G-orbit) shrinks. We also show the low-energy effective Lagrangian is the arbitrary function of the orbit map.

hep-th/9805038

Low Energy Theorems in N=1 Supersymmetric Theory

Abstract

In $N = 1$ supersymmetric theories, quasi Nambu-Goldstone (QNG) bosons appear in addition to ordinary Nambu-Goldstone (NG) bosons when the global symmetry G breaks down spontaneously. We investigate two-body scattering amplitudes of these bosons in the low-energy effective Lagrangian formalism. They are expressed by the curvature of Kähler manifold. The scattering amplitudes of QNG bosons are shown to coincide with those of NG bosons though the effective Lagrangian contains an arbitrary function, and those with odd number of QNG bosons all vanish.

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hep-ph/9709367

Reconstruction of quark mass matrices in the NNI form from the experimental data

Abstract

We examined the question that what is a general form of quark mass matrices which is achieved by the transformation that leaves the left-handed gauge interaction invariant. In particular, we analyzed in detail the Fritzsch-type and the Branco-Silva-Marcos-type parametrization. Both parametrizations contain ten parameters and can be expressed by

the experimental data. We explicitly reconstructed quark mass matrices in terms of quark masses and CKM parameters for the Fritzsch-type parametrization.

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hep-th/9610016

Topological Field Theory and Second-Quantized Five-Branes

Abstract

We construct the six-dimensional topological field theory appropriate to describe the ground-state configurations of D5-branes. A close examination on the degenerations of D5-branes gives us the physical observables which can be regarded as the Poincaré duals of the cycles of the moduli space. These observables are identified with the creation opeartors of the bound states of D5-branes and lead to the second quantization of five-branes. This identification of the bound states with the cycles also provides their topological stability and suggests that the bound states of five-branes have internal structures. The partition function of the second-quantized five-branes is also discussed.

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hep-th/9712054

Renormalization Group Flow near the Superconformal Points in $N = 2$ Supersymmetric Gauge Theories

Abstract

The behavior of the beta-function of the low-energy effective coupling in the $N = 2$ supersymmetric $SU(2)$ QCD with several massive matter hypermultiplets and in the $SU(3)$ Yang-Mills theory is determined near the superconformal points in the moduli space. The renormalization group flow is unambiguously fixed by looking at limited types of deformation near the superconformal points. It is pointed out that the scaling dimension of the beta-function is controlled by the scaling behavior of moduli parameters and the relation between them is explicitly worked out. Our scaling dimensions of the beta-functions are consistent in part with the results obtained recently by Bilal and Ferrari in a different method for the $SU(2)$ QCD.

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hep-ph/9804245

e^-e^- Collisions Mediated by Composite Neutrinos

Abstract

The lepton number violating process, $e^-e^- \to W^-W^-$ has been widely discussed in the Majorana neutrino exchange mechanism. Here, we discuss this process in a composite neutrino model where excited Majorana neutrinos are exchanged. We found several qualitatively different features from the neutrino exchange case: (1) The longitudinally polarized W's are not produced, (2) the neutrinoless double beta decay does not constrain much and a much larger cross section is expected, and (3) CP violating phases may be explored because all excited neutrinos are heavy so that large mixings among them are expected.