Exotic Phenomena of Gauge Theory

Thursday, 4 June 2015 - Sunday, 7 June 2015

Toji Foundation of Culture, Wonju, Korea

Book of Abstracts

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Nonleptonic B Meson Decay in the Perturbative QCD approach

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Using perturbative QCD approach, charmless $B_{u,d,s} \to VT$ decays are predicted. Their branching ratios, polarization fractions and direct CP violations are calculated. Within this approach the polarization fractions and the branching ratios of $B \to \phi(K_2^{*-}, \bar{K}_2^{*0})$ agree with the observed experimental data. However, the branching ratios of $B \to \omega(K_2^{*-}, \bar{K}_2^{*0})$ cannot be explained, where the polarization fractions can be accommodated. The tree dominated channels with a vector meson emitted have longitudinal polarization fraction of 90%, while the penguin dominating ones have subtle polarization fractions. Fortunately, most branching ratios of $B_{u,d}$ decays are of the order 10^{-6}, which would be straight forward for experimental observations. For the B_s decays, the branching ratios can reach the order of 10^{-6} in a vector emitted tree dominated decays. However, in penguin dominated decays those are of order of 10^{-7} which need more experimental data to be observed.

Afternoon - Plenary (1st day) / 29

Tau neutrino physics in SHiP

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A new fixed target experiment at CERN, SHiP is planned to search for the hidden particles using charmed mesons produced with 400 GeV proton beam. This experiment is also ideal for the study of tau neutrinos.
I will present the cross section and the fluxes of the tau neutrinos and antineutrinos from the decay of the charmed meson, D_s. Also, I will discuss the estimation of the detectable events in this experiment.

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Highlights of recent Belle physics results

Author: Youngjoon Kwon[1]

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In this talk, we present recent highlights of the physics results from the Belle experiment. This includes the new measurements on B –> D(*) τ ν decays which can have significant implications for physics beyond the Standard Model such as 2HDM(II). In addition, we will discuss new results on dark sector search from Belle and other related results.

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The 3-3-1 Models and Implication to Astroparticle Physics

Author: Nguyen Thi Thuy[1]

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We study two versions of 3-3-1 model. The minimal 3-3-1 model behaved as the simple 3-3-1 model with the replication of \eta or of \chi can provide realistic dark matter candidates. The relic density is figured out as a function of the dark matter mass by using micrOMEGAs package. In addition, the 3-3-1 model with neutral fermions can be extended into 3-3-1-1 model by considering the lepton number as a local symmetry. We show that the 3-3-1-1 model can generate inflation as well as explain the baryon asymmetry of the Universe successfully.

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Study of medium effects on heavy-flavor production at RHIC

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Weak nonleptonic decays of Ωc^0 baryon to axial-vector meson

Author: Rohit Dhir[1]

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The axial-vector-emitting weak hadronic decays of the Ωc^0 baryon are investigated. After employing the
factorization and the pole model framework to predict their branching ratios, we derive the symmetry-breaking effects on axial-vector-meson-baryon couplings and effects of flavor dependence on baryon-baryon weak transition amplitudes and, consequently, on their branching ratios.

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Recent highlights of LHC/CMS results

Author: Hwidong Yoo[1]

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This year the LHC resumed its operation running at unprecedented 13 TeV energy in the center-of-mass frame. In this talk, we will present the status of new LHC operation as well as a few selected preliminary physics results from the CMS experiment.

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Triplet Dark Matter from leptogenesis

Author: Jae Ho Heo[1]

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A triplet dark matter candidate from the thermal leptogenesis is considered with building a model. The model is based on the standard two Higgs doublet model and seesaw mechanism with Higgs triplets. The parameters (couplings and masses) are adjusted for the observed small neutrino mass and the leptogenesis. Dark matter particles can annihilate and decay in this model. The time evolution of dark matter number is governed by (co)annihilations in the expanding universe, and its mass is constrained by the observed relic density. The dark matter can decay into final states with three leptons (two charged leptons and one neutrino). We investigate whether the decay in galaxy can account for cosmic ray anomalies in the positron and electron spectrum. A noticeable point is that if the dark matter decays into each lepton with different branching ratios, cosmic ray anomalies in AMS-02 measurements of the positron fraction and the Fermi LAT measurements of the electrons-plus-positrons flux could be simultaneously accounted for from its decay products.

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Variational Method for X(3872)

Author: Aaron Park[1]

Co-authors: Su Houng Lee [1]; Woosung Park [1]

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Using the variational method, we calculate the mass of heavy tetraquark states in a nonrelativistic potential model with color confinement and spin hyperfine interaction. We investigate the stability of tetraquark states containing a heavy quark and an antiquark. We find that the lowest energy states just corresponds to the sum of the hadronic final states to which the X(3872) can decay.

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B \to X_s \gamma study using hadronic tagging method

Authors: Hanjin Kim[1]; Youngjoon Kwon[1]

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We present an inclusive study on the measurement of the branching fraction of the radiative B meson decay B \to X_s \gamma, using the full data sample collected with the Belle detector at the KEKB

asymmetric-energy e^{+}e^{-} collider, corresponding to 753\times10^6$ B\bar{B} pairs. One of the B mesons in the \Upsilon(4S) \to B\bar{B} decay is fully reconstructed in hadronic modes, and the radiative photon is sought in the decay of the other B meson. We plan to obtain the CP asymmetry and the isospin asymmetry according to the measured photon energy spectrum.

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Searching dark sector in rare B deacy

Author: Seokhee PARK[1]

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Find dark sector in Y(4S) resonance. ⊠⁰ decays into two vector particles, and the vector particles decay into lepton pair, electron and muon pair. The vector particle has mass < 2.6GeV, half of ⊠⁰. This is signal MC and generic MC study.

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Cosmic Rays Observed by COREA Prototype System at the North Side of Seoul

Author: Woo-Ram Cho[1]

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The COREA(COsmic ray Reaserch and Education Array) collaboration has installed a prototype array of plastic scintillation systems at Kyeonggibuk Science High School and Hansung Science High School to study cosmic ray events. In each site, three detector stations are installed, where each station cosists of four scintillation detectors. In this presentation, we report coincidence technique based on time information to detect high-energy air showers and analysis of features of cosmic ray data correlated with solar flare.

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General relativity and Non-Abelian gauge theory

Author: DongHoon Lee[1]

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Introduce an intuitive way of understanding the underlying differential geometrical structure behind general relativity and look over the structural analogy between general relativity and Non-Abelian gauge theory

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Dalitz Plot Study of B+ to pi+ pi0 pi0 at Belle

Author: Kyungho Kim[1]

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We present the Dalitz plot study on B+⟶π+π0π0 decay mode. We use Monte Carlo simulated samples based on a data sample of 711 fb-1 collected at the ϒ(4S) resonance energy, recorded by KEKB asymmetric-energy e+e- collider.

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Standard model and concepts of supersymmetry

Author: KyeongHyeon Min[1]

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Standard model is almost complete. In last 2013, we found higgs boson and we can explain many physical pheonomena to use standard model. But the standard model was not perfect because there are so many things that we cannot explain. For example, those are about dark matter, dark energy, gravity etc. Therefore we need some more comprehensive models and the theory of supersymmetry is the most adequate thing among them. So in my presentation, I will explain some topic about supersymmetry including the relation between SM and SUSY, the basic concepts of SUSY, the particles consisting of SUSY, and also the Minimal Supersymmetry Standard Model which is the concrete model of SUSY.

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Rare Isotope Science Project

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There are many atoms from Hydrogen to Livermorium(116). But in the nature, the largest atom is Uranium(92). From Neptunium(93), large and heavy atoms should be made artificial, combining two atoms, and going larger and heavier, the atom cannot stand longer and easily broken(fission).
This is same as neutron, in isotopes. When the number of neutron is much less or more than proton in a atom, the atom is easily broken also.
The fusion, fission processes which explain the fusion of two atoms and the fission of heavy atom are used, and have some relations between the number of proton, neutron and the mechanism.
There is not only periodic table which lists the atoms by the number of proton, but also a table of nuclides which lists all of atoms from heavy atom to isotopes related to the number of protons and neutrons. When looking the table of nuclides, intersting things can be found that there are a states which the atom is (relatively) stable at the specific numbers of protons and neturons, called Magic Number. These numbers can be derived by using specific potential well, with spherical harmonic oscillators and the spin-orbit coupling.

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Diquark Sum Rules for Exotic Baryons

Author: Sungsik Noh[1]

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We want to calculate the masses of Lambda*(1405) and N*(1535) through the diquark sum rules with the interpolating field proposed by the diquark cluster picture for the penta-quark components in baryons. According to the paper, International Journal of Modern Physics A Vol. 21, No. 27 (2006), B. S. Zou, the penta-quark components could be dominant for some excited baryons and the diquark cluster picture for the penta-quark components in baryons also gives a natural explanation for the longstanding mass-reverse problem of N*(1535), N*(1440) and Lambda*(1405) resonances as well as the unusual decay pattern of the N*(1535) resonance.

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QCD sum rules for sigma hyperons in nuclear matter

Author: Giju Gue[1]

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Reproducing the paper(Jin, Xue-Min et al. Phys.Rev. C51 (1995) 347), We calculate the wilson coefficients of operator product expansion(OPE). Through this calculation, we will Study outline of the method, dispersion relation, operator product expansion(OPE), Borel transform, and propagator.

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Renormalization of dimension 6 gluon operators

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We identify the independent dimension 6 twist 4 gluon operators and calculate their renormalization in the pure gauge theory. By constructing the renormalization group invariant combinations, we find the scale invariant condensates that can be estimated in nonperturbative calculations and used in QCD sum rules for heavy quark systems in medium.

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Search for massive invisible particle X^0 in B^+ \to e^+ X^0 and B^+ \to \mu^+ X^0 decays

Author: Chan Seok Park[1]

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We present a search for a non-Standard-Model particle X^0 in the mass range 0.1-1.8 GeV/c in B^+ \to e^+ X^0 and B^+ \to \mu^+ X^0 decays. The results are obtained from a 711 fb^{-1} data sample collected at the Y(4S) resonance, with the Belle detector at the KEKB energy asymmetric e^+ e^- collider. One B meson is fully reconstructed in a hadronic mode to enable the precise analysis of the signal decay's lepton in the recoiling partner B meson. We find no evidence of a signal and upper limits of branching fractions are set.

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Study of B0 –> l+ tau- using untagged method at Belle

Author: YoungSoo Sohn[1]

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The lepton-flavor-violating B decays B0 –> l+ tau- (l = e, mu) are forbidden in the Standard Model(SM) in the absence of nonzero neutrino masses, but can occur via one-loop diagrams if neutrino oscillations are included. In this presentation, suppression of background using Neural Network and signal sensitivity and expected upper limit will be presented. In addition, systematic uncertainty will be presented a little bit.

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Heavy Ion Simulation using Geant4

Author: Chan Young Lee[1]

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RAON is the heavy ion accelerator of the Rare Isotope Science Project (RISP), which is carried by Institute for Basic Science (IBS) in Korea. As its name shows, RISP has the plan to produce rare isotopes and RAON is their key item of the plan.
Geant4 is the toolkit for the simulation of the passage of particles through matter. Using Geant4, plenty types of experiments could be run with the Monte-Carlo based simulation.
This Research is the validation of the simulation of the experiment which is planned for RAON. The simulation of the collision between Uranium-238 and liquid Hydrogen target is compared to the expriment data from the paper written by J. Taieb et al..

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The Conceptual Introduction to Black Holes

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The talk is about the very familiar, but only a little known astronomical object, the black holes. They could be mostly described classically by Schwarzschild metric, from which almost every property of them would be derived. We focus on the introduction to concepts, especially about the observable phenomena. We can identify black holes in two different kinds by whether rotating one or not. There are three parameters describing the macroscopic phenomena of rotating black holes, mass, electric charge, and angular momentum, which would be dealt in the talk in detail. Hawking radiation, essentially non-classical phenomenon would be introduced in the final step.

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Nuclear symmetry energy in QCD phase

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In dense quark phase, one can imagine two situation. Normal quark pahse and color superconducting phase. For the normal phase, the quark matter symmetry energy can be obtained from hard dense loop(HDL) resummed grand potential. It reduces symmetry energy. In superconducting phase, symmetry energy becomes almost 3 times of one for the normal matter as liberal degree of freedom reduces to 1/3 of the normal matter. We expect that the reduction of symmetry energy by HDL becomes vanish in 2SC phase as the rest mass can not be asymmetrized as in normal phase. Updated results will be presented.