KEK-PH2018: “Posters”

[Date: February 14, 2018; Venue: Conference Hall, 1st floor San-Go-Kan building]

Probing Higgs self-coupling of a classically scale invariant model in e+e−→Zhh

Speaker: Yoshio Fujitani

A classically scale invariant extension of the standard model predicts large anomalous Higgs self-interactions. We compute missing contributions in previous studies for probing the Higgs triple coupling of a minimal model using the process $e^+e^- ¥to Zhh$. Employing a proper order counting, we compute the total and differential cross sections at the leading order, which incorporate the one-loop corrections between zero external momenta and their physical values. Discovery/exclusion potential of a future e^+e^- collider for this model is estimated. We also find a unique feature in the momentum dependence of the Higgs triple vertex for this class of models.

Indirect test of CP violation in extended Higgs sectors by precision measurements of Higgs boson couplings

Speaker: Katsuya Hashino (University of Toyama / Osaka university)

The electroweak baryogenesis is a scenario explaining the baryon asymmetry of the universe. In this scenario, we use an extended Higgs model to introduce the new effects of CP violation required by Sakharov conditions. The CP violating effects can be detected by the features of new particles and EDM. However new particles and EDM have not been discovered yet. In this talk, we focus on the indirect search of the Higgs boson couplings to explore the CP violating effects in two Higgs doublet model(2HDM) and discuss the analysis of the deviation of CP violating case and CP conserving case of 2HDM.

Correlation between the decays $h_0 \to \gamma\gamma$ and $h_0 \to gg$ in the MSSM with quark flavor violation

Speaker: Keisho Hidaka (国立大学法人 東京学芸大学)

We study the correlation between the loop-induced decays h^0 -> photon photon and h^0 -> gluon gluon in the Minimal Supersymmetric Standard Model (MSSM) with quark flavor violation (QFV), identifying h^0 with the Higgs boson with a mass of 125 GeV. We perform a MSSM parameter scan respecting theoretical constraints from vacuum stability conditions and experimental constraints, such as those from B meson data and electroweak precision data, as well as limits on supersymmetric (SUSY) particle masses from recent LHC experiments. We find that (i) the deviations of the decay widths Gamma(h^0 -> photon photon) and Gamma(h^0 -> gluon gluon) from the Standard Model (SM) values can be large (~+_O(10)%) simultaneously, (ii) there is a strong correlation between the two deviations, (iii) the deviation of the width ratio Gamma(h^0 -> photon photon)/Gamma(h^0 -> gluon gluon) from the SM value can be large (roughly +10% to +23%), and (iv) the SUSY QFV effects can have a significant impact on these deviations. Such large deviations can be observed at a future e^+e^- collider like ILC. In case the deviation patterns shown in this study are really observed, then this would strongly suggest the discovery of SUSY (the MSSM with QFV). (In collaboration with A. Bartl, H. Eberl and E. Ginina.)

Gravitational waves from first order electroweak phase transition in models with the $U(1)x$ gauge symmetry

Speaker: Toshinori Matsui (KIAS)

In this talk, we consider the standard model extension with a dark sector with the U(1)_X Abelian gauge symmetry, which is spontaneously broken by dark Higgs mechanism. We discuss patterns of the electroweak phase transition and detectability of gravitational waves (GWs) when strongly first order phase transition occurs. We find the collider bounds exclude a part of parameter space that could generate detectable GWs otherwise. We show that GWs produced in the multi-step phase transitions can be detected by future observations such as DECIGO and LISA. Furthermore, we discuss the complementarity of dark photon searches or dark matter searches with the GW observations in the models of the dark gauge symmetry. This talk is based on a collaboration with Katsuya Hashino, Shinya Kanemura, Mitsuru Kakizaki and Pyungwon Ko.

Revisiting regularization for the Higgs mass with Kaluza-Klein states and Casimir effect from extra dimensions

Speaker: Yoshio Matsumoto (National Institute of Technology, Tsuyama College)

We revisit regularization for the Higgs mass with one-loop contributions from all the Kaluza-Klein states in extra dimensional models. We also discuss Casimir effect to the Higgs mass and cosmological constant from extra dimensional spaces.

Phenomenological study of very special relativity

Speaker: Alekha Chandra Nayak (Indian Institute of Technology, Kanpur)

The special theory of relativity has been experimentally tested to unprecedented degree of accuracy. The Standard model of particle physics respects Lorentz invariance and successfully describes all particle interactions. However, it breaks several discrete symmetries such as P, T, CP or CT, which were once thought to be preserved in nature. With the violation of these discrete symmetries, it is possible that only a subgroup of the Lorentz group may be preserved in nature. The resulting framework along with translational symmetry is known as very special relativity (VSR). It turns out that this is both necessary and sufficient to explain the null result of Michelson-Morley experiment and its consequences. VSR has a preferred direction which manifestly breaks Lorentz invariance. Remarkably it provides an alternative approach for neutrino masses which does not require addition of a new fields in the Standard Model and it also conserves lepton number. We study collider, astrophysical and cosmological implications of models based on VSR.

$R(D*)$ in a general two Higgs doublet model

Speaker: Syuhei Iguro (Nagoya University)

This poster is based on the paper:arXiv:1708.06176 10.1016/j.nuclphysb.2017.10.014.
We summarized possible derivations for R(D^(*)) and implications for LHC experiment in the context of General Two Higgs Doublet Model.

A hidden U(1) gauge symmetry model realizing a neutrino specific two Higgs doublet model

Speaker: Takaaki Nomura (KIAS)

In this talk, we discuss a neutrinophilic two Higgs doublet model realized by hidden local U(1) symmetry in which active neutrinos are Dirac type, and a fermionic DM candidate is naturally induced as a result of remnant symmetry. Then we investigate relic density of DM taking into account interactions with new gauge boson. We also discuss other DM phenomenology such as possibility of direct and indirect detection.

Dynamical scalegenesis via multiple seesaw mechanisms

Speaker: Shohei Okawa (Nagoya University)

We propose a model which accounts for the dynamical origin of the electroweak symmetry breaking (EWSB), directly linking to the mass generation of dark matter (DM) candidates and active neutrinos. The standard model is weakly charged under the U(1) B-L gauge symmetry, in conjunction with newly introduced three right-handed Majorana neutrinos and the B-L Higgs. The model is built on the classical scale invariance, that is dynamically broken by a new strongly coupled sector, that is called the hypercolor (HC) sector, which is also weakly coupled to the B-L gauge. At the HC strong scale, the simultaneous breaking of the EW and B-L gauge symmetries is triggered by dynamically induced multiple seesaw mechanisms, namely bosonic seesaw mechanisms. Thus, all of the origins of masses are provided singly by the HC dynamics: that is what we call the dynamical scalegenesis. We also find that a HC baryon, with a mass on the order of a few TeV, can be stabilized by the HC baryon number and the B-L charge, so identified as a DM candidate. The HC-baryon DM can be measured through the large magnetic moment coupling generated from the HC dynamics, or the B-L gauge boson portal in direct detection experiments.

Signals of the gauge-Higgs unification in lepton colliders

Speaker: Yuta Orikasa (Czech Technical University)

We have studied effects of Kaluza-Klein excited neutral vector bosons in the gauge-Higgs unification model at future lepton collider experiments with polarized beams. I show the significant deviations in the energy and polarization dependence in the cross section, the lepton forward-backward asymmetry and the left-right asymmetry from the standard model.

Di-hadronic molecular systems

Speaker: Dharmesh Rathaud (SVNIT-Surat, India)

Gravity mediation saves Universal Extra Dimensions

Speaker: Divya Sachdeva (University of Delhi)

The Universal Extra Dimension(UED) paradigm has been very popular as it not only includes a natural candidate for the Dark Matter particle but also addresses several issues related to particle physics. Non-observations at the Large Hadron Collider, though, has brought the paradigm into severe tension. However, a particular 5-dimensional UED model emerges from a six-dimensional space-time with nested warping. The AdS6 bulk protects both the Higgs mass as well as the UED scale without invoking unnatural parameter values. The graviton excitations in the sixth direction open up new (co-)annihilation channels for the Dark Matter particle, thereby allowing for phenomenological consistency, otherwise denied to the minimal UED scenario. The model leads to unique signatures in both satellite-based experiments as well as the LHC.

Hyper Weakly Interacting light $U(1)_s$ from the String Compactifications

Speaker: Shohei Uemura (Kyoto Sangyo University)

String compactifications often provide extra gauge fields. In IIB flux compactifications, the gauge couplings of gauge fields are suppressed by the volumes of the branes, and their masses are sometimes suppressed by the volumes, too. Hence, the Large Volume Scenario naturally provide very weakly interacting light extra gauge fields. A part of the SM fields may be charged under the gauge field and the gauge symmetry may be regarded as an extra symmetry, such as U(1) B-L or a lepton number.
In such cases, we find that the gauge symmetry can explain the discrepancy of the muon (g-2).

Simultaneous interpretation of K and B anomalies in terms of chiral-flavorful vectors

Speaker: Kei Yamamoto (KMI, Nagoya University)

We address the presently reported significant flavor anomalies in the Kaon and B meson systems such as the CP violating Kaon decay epsilon’/epsilon and lepton-flavor violating B meson decays (RK(*),D(*)), by proposing flavorful and chiral vector bosons as the new physics constitution at around TeV scale. The chiral-flavorful vectors (CFVs) are introduced as a 63-plet of the global SU(8) symmetry, identified as the one-family symmetry for left-handed quarks and leptons in the standard model (SM) forming the 8-dimensional vector. Thus the CFVs include massive gluons, vector leptoquarks, and W0,Z0-type bosons, which are allowed to have flavorful couplings with left-handed quarks and leptons, and flavor-universal couplings to right-handed ones, where the latter arises from mixing with the SM gauge bosons. The flavor texture is assumed to posses a “minimal” structure to be consistent with the current flavor measurements on the K and B systems: thus the current K and B anomalies can simultaneously be interpreted by the presence of CFVs. The contributions to Kaon rare decays K -> pi nu nu are also discussed.

Improved analysis for CLFV processes $\mu N(eN) \to \tau X$ with gluon operators

Speaker: Masato Yamanaka (Maskawa Institute)

We revisit charged lepton flavor violating (CLFV) scattering processes $\ell_{i} N \to \tau X \, (\ell_{i} \ni e, \mu)$ mediated by Higgs. We point out that a new subprocess $\ell_{i} g \to \tau g$ via the effective interactions of Higgs and gluon gives the dominant contribution to $\ell_{i} N \to \tau X$ for an incident beam energy of $E_{\ell} \lesssim 1\,\text{TeV}$ in fixed target experiments. Furthermore, in the light of quark number conservation, we consider quark pair-production processes $\ell_{i} g \to \tau q \bar{q}$ (q denotes quarks) instead of $\ell_{i} q \to \tau q$. This corrects the threshold energy of each subprocess contributing to $\sigma(\ell_{i} N \to \tau X)$. Reevaluation of $\sigma(\ell_{i} N \to \tau X)$ including all of relevant subprocesses shows that the search for $\ell_{i} N \to \tau X$ could serve a complementary opportunity with other relevant processes to shed light on the Higgs CLFV.

High-p_T diphoton production near top-loop threshold

Speaker: Hiroshi Yokoya (KIAS)

Diphoton signal at hadron colliders which has been used for the searches of Higgs-boson and BSM particles can also accomplish the determination of the short-distance mass of top-quark by using the invariant-mass spectrum near the top-loop threshold. We study the top-loop threshold effects in diphoton plus jet production at hadron colliders which are parts of the NLO corrections to the inclusive diphoton production at hadron colliders. By the direct computation of the top-quark one-loop amplitude, we formulate the NRQCD amplitudes near the top-loop threshold where the top-quarks are non-relativistic and form (color-singlet and spin-singlet) bound-state. We find that interferences of the tree-level amplitudes and the op-loop amplitudes are small, and also the contributions from color-octet top anti-top intermediate state are suppressed near their threshold. Thus, we find the inclusive diphoton production can well described by the gluon-fusion process with ISR effects which do not change the shape of the mass spectrum. Our finding supports the NRQCD prediction of the diphoton mass spectrum near the top-loop threshold, and the method of top-quark mass determination by using the diphoton mass spectrum at the LHC and a future 100 TeV collider.

Dark Gauge U(1) and the DAMPE Signal

Speaker: Mohammadreza Zakeri (Institute of Theoretical Physics (ITP), CAS)

DArk Matter Particle Explorer (DAMPE) has measured a tentative peak excess at an energy of around 1.4 TeV in the flux of high energy cosmic ray electrons and positrons. We consider a gauge U(1) extension of the Standard Model, where the U(1) gauge boson is light and it can decay to an electron-positron pair. We also add a heavy fermionic dark matter that is captured in the Sun, such that the dark gauge boson resulting from the dark matter annihilations can then decay to an electron-positron pair. We explore the parameter space for such a model and see if it can generate the 1.4 TeV excess measured by the DAMPE.