1st IUEP Mini-Workshop: Physics Opportunities at Future Colliders

Report of Contributions

https://indico.cern.ch/e/754958

Contribution ID: **1** Type: **not specified**

Closing remark

Sunday 7 October 2018 16:00 (10 minutes)

Contribution ID: **2** Type: **not specified**

Four top quarks at LHC and beyond

Saturday 6 October 2018 10:00 (1h 30m)

Presenter: CHOI, Su Yong (Korea University (KR))

Session Classification: Session 1 : Four tops

Contribution ID: **3** Type: **not specified**

Higgs EFT Precision Analysis for Higgs and Top Quarks

Saturday 6 October 2018 12:30 (40 minutes)

Presenter: JUNG, Sunghoon

Session Classification: Session 2 : di-Higgs

Contribution ID: **4** Type: **not specified**

Report of double Higgs boson production search at CMS

Saturday 6 October 2018 13:10 (40 minutes)

The search for standard model double Higgs boson (hh) production at CMS is presented, using final states from various decay channels: HH->b b b b, b b VV, b b tau tau, and b b gamma gamma. The hh production serves to measure the self-coupling of the Higgs boson the rate of which is small in the SM. However, contributions from beyond standard models (BSM) can significantly enhance the rate. Furthermore, many BSM particles may decay to hh that can be manifested as a resonance in the hh invariant mass spectrum.

Presenter: LEE, Sangeun (Kyungpook National University (KR))

Session Classification: Session 2 : di-Higgs

Contribution ID: **5** Type: **not specified**

Machine learning approaches to the Higgs boson self coupling

Saturday 6 October 2018 13:50 (35 minutes)

Machine learning is now widely used in many fields of high energy physics. In particular, many important results have been improved in relation to the Higgs physics phenomena. Based on previous studies for Higgs-pair production in $HH \to b\bar{b}\gamma\gamma$ channel at the HL-LHC, we apply the machine learning approaches to the study of self-coupling of Higgs particle. We show that the various machine learning methods including the Deep Neural Network (DNN) can give the better performance in disentangling signal and backgrounds.

Presenter: PARK, Jubin (Chonnam National University)

Session Classification: Session 2 : di-Higgs

Contribution ID: **6** Type: **not specified**

Machine learning with augmentation for boosting di-Higgs searches

Saturday 6 October 2018 14:25 (35 minutes)

Augmentation of invisible information with respect to many hypothetical models of background and signal processes, can highly improve the performance of the machine learning classifiers for HEP event discrimination. In this regard di-Higgs searches in the channels with multiple invisible final states, is one of the most important applications. Focusing on the di-Higgs channels with 2 bottom quarks + 0/1/2 leptons/taus + MET from bbWW and bbtautau productions, we introduce various augmentation schemes and ways to build better multi-class classifiers using deep neural networks. We conclude our study with demonstration how much the new deep learning classifiers supervised by physical augmentation, can improve the discovery potential of di-Higgs production at the LHC, and discuss on the implications for future collider study.

Presenter: Dr CHO, Won Sang (Seoul National University)

Session Classification: Session 2 : di-Higgs

Contribution ID: **7** Type: **not specified**

B-meson anomalies and Higgs physics in flavored U(1)$^{'}$ model

Saturday 6 October 2018 15:30 (50 minutes)

We consider a simple extension of the Standard Model with flavor-dependent U(1)', that has been proposed to explain some of B-meson anomalies recently reported at LHCb. The U(1)′ charge is chosen as a linear combination of anomaly-free B_3 − L_3 and L_\mu − L_\tau. In this model, the flavor structure in the SM is restricted due to flavor-dependent U(1)' charges, in particular, quark mixings are induced by a small vacuum expectation value of the extra Higgs doublet. As a result, it is natural to get sizable flavor-violating Yukawa couplings of heavy Higgs bosons involving the bottom quark. In this article, we focus on the phenomenology of the Higgs sector of the model including extra Higgs doublet and singlet scalars. We impose various bounds on the extended Higgs sector from Higgs and electroweak precision data, B-meson mixings and decays as well as unitarity and stability bounds, then discuss the productions and decays of heavy Higgs bosons at the LHC.

Presenter: PARK, Chan Beom (IBS)

Session Classification: Session 3 : charged Higgs

Contribution ID: **8** Type: **not specified**

Exotic decays of the charged Higgs boson via vectorlike quark loops

Saturday 6 October 2018 16:20 (50 minutes)

The search strategy of a charged Higgs boson critically depends on its mass relative to the top quark mass. In the frame of two Higgs doublet model, the charged Higgs boson mass determines the main search channel: for the heavy charged Higgs boson, it is into a top quark and a bottom quark; for the light charged Higgs boson, it is into a tau lepton associated with a tau neutrino. The blind spot is where the charged Higgs boson mass is very similar to the top quark mass, which requires alternative decay channel. One clean channel is into a photon associated with a W boson, which should happen only through loops. The SM quarks only lead to very suppressed branching ratio of the order of 10ˆ(-5). We extend the fermion sector including vectorlike quarks and show that the branching ratio can be as large as 10ˆ(-3). Another interesting decay mode into a W boson accompanying a Z boson is also studied.

Presenter: SONG, Jeonghyeon

Session Classification: Session 3 : charged Higgs

Contribution ID: **9** Type: **not specified**

H+ Searches: Summary of cH+arged 2018 workshop and prospects

Saturday 6 October 2018 17:10 (50 minutes)

Since the discovery of SM-like Higgs boson, new physics search has been very actively performed. It is interesting that most of the new physics predicts Higgs mechanism with extended Higgs sectors, which means the charged Higgs bosons must exist. Searches for charged Higgs bosons have been performed below and above the top quark mass, however no significant excess is reported. Here the recent experimental search results and the highlight of the cH+arged 2018 workshop are introduced for vigorous discussions for the prospects of H+ search.

Presenter: YU, Geum Bong (Seoul National University (KR))

Session Classification: Session 3 : charged Higgs

Contribution ID: **10** Type: **not specified**

The ILC project status

Sunday 7 October 2018 10:00 (1h 15m)

The ILC is a linear electron-positron collider at center of mass energy of 250 GeV. It is optimized for the precision study of the Higgs boson which acts as a probe for physics beyond the standard model. Its high sensitivity may allow certain new particles to be found that are not easily detected at the LHC. The basic technologies are now ready and the Japanese government is in the final phase of evaluating its case. In this talk, we overview the technical and political status of the ILC.

Presenter: YAMAMOTO, Hitoshi (University of Tokyo)

Session Classification: Session 4 : ILC

Contribution ID: **11** Type: **not specified**

The ILC physics case

Sunday 7 October 2018 11:15 (1h 15m)

We summarize the physics case for the International Linear Collider (ILC). We review the key motivations for the ILC presented in the literature, updating the projected measurement uncertainties for the ILC experiments in accord with the expected schedule of operation of the accelerator and the results of the most recent simulation studies. The focus is on 250 GeV energy which is the updated plan for the stage one.(1506.06992 and its update)

Presenter: DO KIM, Hyung

Session Classification: Session 4 : ILC

Contribution ID: **12** Type: **not specified**

Massive spin-2 mediated dark matter

Sunday 7 October 2018 13:30 (35 minutes)

A massive spin-2 particle can act as the mediator between dark matter and standard model particles through the energy momentum tensor in the spin-2 mediated dark matter model. The scattering amplitudes between dark matter and standard model particles are examined by effective theory and consisted of effective operators after the mediator is integrated out. The differential event rate with spin-2 mediator can be estimated for direct detection. The spin-2 particle can be produced and bounded through dijet resonance search with mono-photon at the LHC. We discuss the interplay between dark matter relic density condition, direct detection and collider searches.

Presenter: KANG, Yoo-Jin (Chung-Ang University)

Session Classification: Session 4 : Dark Matter

Contribution ID: **13** Type: **not specified**

Time-information at colliders

Sunday 7 October 2018 14:05 (35 minutes)

We study the kinematics of long-lived particles which decay inside the detector using precision timing information. We consider the event with two long-lived particles which decay to visible and invisible particles. We reconstruct 4-momentum of long-lived particles as well as invisible particles by solving kinematic equations with and without the timing information. Without using the timing information, the kinematic equation is only solved in very special case. But using the timing information we can solve it in general cases. With this method, we can find out more information of long-lived particles at the collider.

Presenter: KANG, Dongwoo

Session Classification: Session 4 : Dark Matter

Contribution ID: **14** Type: **not specified**

Phenomenology of dark gauge group at the LHC

Sunday 7 October 2018 14:40 (40 minutes)

A dark sector which contains dark matter may have its own gauge group structure. Depending on a gauge structure and corresponding charge of dark matter, collider phenomenology can be different. In this talk, I will talk about U(1) and SU(3) dark gauge group and distinctive signature at the LHC.

Presenter: PARK, Myeonghun

Session Classification: Session 4 : Dark Matter

Contribution ID: **15** Type: **not specified**

Energetic axion-like particles from decaying dark matter

Sunday 7 October 2018 15:20 (40 minutes)

We consider a model of decaying axino-like particle dark matter with lifetime around the age of the universe. Its late decay to gravitino plus axion-like particle is able to solve small-scale problems. We will also show a distinct signature of the axion-like particle from the axino-like particle decay.

Presenter: BAE, Kyu Jung (IBS)

Session Classification: Session 4 : Dark Matter