

49th SLAC Summer Institute (SSI 2021)



Report of Contributions

Contribution ID: 4

Type: **not specified**

The muon magnetic moment: to the 2HDM and beyond

The recent measurement of the muon $g-2$ anomaly continues to defy a Standard Model explanation. Although such anomaly can be accommodated within the framework of two Higgs doublet models, one of the most popular scalar sector extensions, the allowed parameter space has been further restricted due to conflicts with several constraints. However, if one includes extra fermion content in the form of a generation of vector-like leptons that do not mix with the muon, the allowed parameter range that explains the anomaly is further extended, with previous issues being avoided. However, a new one appears. In this work we update previous analyses within the 2HDM alone and extend them with a new generation of vector-like leptons. Based on <https://arxiv.org/pdf/2104.03367.pdf>.

Primary authors: GONÇALVES, Bernardo (CFTP/IST); SHER, Marc; FERREIRA, P.M.; JOAQUIM, F.R.

Presenter: GONÇALVES, Bernardo (CFTP/IST)

Contribution ID: 8

Type: **not specified**

Development of Future Electromagnetic Calorimeter Technologies and Applications for the Electron-Ion Collider with GEANT 4 Simulations

The Electron-Ion Collider is a future collider planned to be built at BNL in about 2030. It will provide physicists with high luminosity and highly polarized beams with a wide range of nuclei species at different energies, covering an extensive kinematic range. The EIC physical goals include measuring the generalized parton distribution from Deeply Virtual Compton Scattering (DVCS) and Deeply Virtual Meson Production (DVMP) experiments, performing precision 3D imaging of the nuclei structure, studying color confinement and hadronization mechanisms, and understanding the spin structure of the proton. In order for the EIC to achieve its physics goals, a high-resolution electromagnetic calorimeter (EMCAL) is required to measure electrons and photons and to achieve good particle identification. We propose two design options for EIC EMCALs. The first technique is to improve the resolution tungsten/scintillating fiber (W/SciFi) EMCAL being built for sPHENIX with new technologies. The other possibility is to develop tungsten/shashlik (W/shashlik) EMCAL with better readout configuration to achieve better energy and position resolution. In this work, we will present the performance of sPHENIX W/SciFi EMCAL and the GEANT 4 detector simulation results of W and Pb shashlik EMCAL shower profiles, energy resolution, and merging probability of $^0 \rightarrow \gamma\gamma$ for future EIC experiments.

Primary author: Mr SHI, Zhaozhong (Massachusetts Institute of Technology)

Presenter: Mr SHI, Zhaozhong (Massachusetts Institute of Technology)

Contribution ID: 9

Type: **not specified**

The Higgs: What We Know & What We Want to Learn

Monday, 16 August 2021 09:05 (55 minutes)

Presenter: DAWSON, Sally (BNL)

Session Classification: Lectures

Contribution ID: **10**

Type: **not specified**

Q & A

Monday, 16 August 2021 10:00 (10 minutes)

Session Classification: Lectures

Contribution ID: **11**

Type: **not specified**

Welcome

Monday, 16 August 2021 09:00 (5 minutes)

Presenter: RIZZO, Thomas (SLAC)

Session Classification: Lectures

Contribution ID: 12

Type: **not specified**

Standard Model Higgs Basics (I)

Monday, 16 August 2021 10:20 (55 minutes)

Presenter: GORI, Stefania (UC Santa Cruz)

Session Classification: Lectures

Contribution ID: **13**

Type: **not specified**

Q & A

Monday, 16 August 2021 11:15 (15 minutes)

Session Classification: Lectures

Contribution ID: 14

Type: **not specified**

Higgs at LHC (I)

Monday, 16 August 2021 11:40 (55 minutes)

Presenter: KADO, Marumi (Università di Roma la Sapienza and CERN)

Session Classification: Lectures

Contribution ID: 15

Type: **not specified**

Q & A

Monday, 16 August 2021 12:35 (15 minutes)

Session Classification: Lectures

Contribution ID: 16

Type: **not specified**

Standard Model Higgs Basics (II)

Tuesday, 17 August 2021 09:00 (55 minutes)

Presenter: GORI, Stefania (UC Santa Cruz)

Session Classification: Lectures

Contribution ID: 17

Type: **not specified**

Q & A

Tuesday, 17 August 2021 09:55 (15 minutes)

Session Classification: Lectures

Contribution ID: **18**

Type: **not specified**

Higgs at LHC (II)

Tuesday, 17 August 2021 10:20 (55 minutes)

Presenter: KADO, Marumi (Università di Roma la Sapienza and CERN)

Session Classification: Lectures

Contribution ID: **19**

Type: **not specified**

Q & A

Tuesday, 17 August 2021 11:15 (15 minutes)

Session Classification: Lectures

Contribution ID: 20

Type: **not specified**

BSM Higgs (I)

Tuesday, 17 August 2021 11:40 (55 minutes)

Presenter: SHAH, Nausheen (Wayne State University)

Session Classification: Lectures

Contribution ID: **21**

Type: **not specified**

Q & A

Tuesday, 17 August 2021 12:35 (15 minutes)

Session Classification: Lectures

Contribution ID: 22

Type: **not specified**

Precision Calculations of Higgs Boson Production at Colliders

Wednesday, 18 August 2021 09:00 (55 minutes)

Presenter: MISTLBERGER, Bernhard (SLAC)

Session Classification: Lectures

Contribution ID: 23

Type: **not specified**

Q & A

Wednesday, 18 August 2021 09:55 (15 minutes)

Session Classification: Lectures

Contribution ID: 24

Type: **not specified**

Higgs at LHC (III)

Wednesday, 18 August 2021 10:20 (55 minutes)

Presenter: KADO, Marumi (Università di Roma la Sapienza and CERN)

Session Classification: Lectures

Contribution ID: 25

Type: **not specified**

Q & A

Wednesday, 18 August 2021 11:15 (15 minutes)

Session Classification: Lectures

Contribution ID: 26

Type: **not specified**

BSM Higgs (II)

Wednesday, 18 August 2021 11:40 (55 minutes)

Presenter: Prof. SHAH, Nausheen (Wayne State University)

Session Classification: Lectures

Contribution ID: 27

Type: **not specified**

Q & A

Wednesday, 18 August 2021 12:35 (15 minutes)

Session Classification: Lectures

Contribution ID: 28

Type: **not specified**

Precision Calculations of Higgs Partial Widths and Decays

Thursday, 19 August 2021 09:00 (55 minutes)

Presenter: FREITAS, Ayres (University of Pittsburgh)

Session Classification: Lectures

Contribution ID: 29

Type: **not specified**

Q & A

Thursday, 19 August 2021 09:55 (15 minutes)

Session Classification: Lectures

Contribution ID: **30**

Type: **not specified**

Higgs Boson Self-Interactions

Thursday, 19 August 2021 10:20 (55 minutes)

Presenter: VERNIERI, Caterina (SLAC)

Session Classification: Lectures

Contribution ID: **31**

Type: **not specified**

Q & A

Thursday, 19 August 2021 11:15 (15 minutes)

Session Classification: Lectures

Contribution ID: 32

Type: **not specified**

Higgs as a Portal to BSM (I)

Thursday, 19 August 2021 11:40 (55 minutes)

Presenter: SHELTON, Jessie (UIUC)

Session Classification: Lectures

Contribution ID: **33**

Type: **not specified**

Q & A

Thursday, 19 August 2021 12:35 (15 minutes)

Session Classification: Lectures

Contribution ID: 34

Type: **not specified**

Naturalness: Why is the Higgs Light ?

Friday, 20 August 2021 09:00 (55 minutes)

Presenter: CRAIG, Nathaniel (UC Santa Barbara)

Session Classification: Lectures

Contribution ID: 35

Type: **not specified**

Q & A

Friday, 20 August 2021 09:55 (15 minutes)

Session Classification: Lectures

Contribution ID: **36**

Type: **not specified**

Beyond the Standard Model Higgs Searches

Friday, 20 August 2021 10:20 (55 minutes)

Presenter: STEGGEMANN, Jan (EPFL)

Session Classification: Lectures

Contribution ID: 37

Type: **not specified**

Q & A

Friday, 20 August 2021 11:15 (15 minutes)

Session Classification: Lectures

Contribution ID: **38**

Type: **not specified**

Higgs as a Portal to BSM (II)

Friday, 20 August 2021 11:40 (55 minutes)

Presenter: SHELTON, Jessie (UIUC)

Session Classification: Lectures

Contribution ID: **39**

Type: **not specified**

Q & A

Friday, 20 August 2021 12:35 (15 minutes)

Session Classification: Lectures

Contribution ID: 40

Type: **not specified**

A history of the Higgs Mechanism

Monday, 23 August 2021 09:00 (55 minutes)

Presenter: QUIGG, Chris (Fermilab)

Session Classification: Lectures

Contribution ID: 41

Type: **not specified**

Q & A

Monday, 23 August 2021 09:55 (15 minutes)

Session Classification: Lectures

Contribution ID: 42

Type: **not specified**

Extending Higgs Measurement Capabilities (I)

Monday, 23 August 2021 10:20 (55 minutes)

Presenter: CEPEDA, Maria (CIEMAT)

Session Classification: Lectures

Contribution ID: 43

Type: **not specified**

Q & A

Monday, 23 August 2021 11:15 (15 minutes)

Session Classification: Lectures

Contribution ID: 44

Type: **not specified**

Role of the Higgs Sector in the Generation & Flavor Problem (I)

Monday, 23 August 2021 11:40 (55 minutes)

Presenter: ALTMANNSHOFER, Wolfgang (UC Santa Cruz)

Session Classification: Lectures

Contribution ID: 45

Type: **not specified**

Q & A

Monday, 23 August 2021 12:35 (15 minutes)

Session Classification: Lectures

Contribution ID: 46

Type: **not specified**

Higgs EFT (I)

Tuesday, 24 August 2021 09:00 (55 minutes)

Presenter: SANZ, Veronica (Universities of Valencia and Sussex)

Session Classification: Lectures

Contribution ID: 47

Type: **not specified**

Q & A

Tuesday, 24 August 2021 09:55 (15 minutes)

Session Classification: Lectures

Contribution ID: 48

Type: **not specified**

Q & A

Tuesday, 24 August 2021 11:15 (15 minutes)

Session Classification: Lectures

Contribution ID: 49

Type: **not specified**

Extending Higgs Measurement Capabilities (II)

Tuesday, 24 August 2021 10:20 (55 minutes)

Presenter: CEPEDA, Maria (CIEMAT)

Session Classification: Lectures

Contribution ID: 50

Type: **not specified**

Role of the Higgs Sector in the Generation & Flavor Problem (II)

Tuesday, 24 August 2021 11:40 (55 minutes)

Presenter: ALTMANNSHOFER, Wolfgang (UC Santa Cruz)

Session Classification: Lectures

Contribution ID: 51

Type: **not specified**

Q & A

Tuesday, 24 August 2021 12:35 (15 minutes)

Session Classification: Lectures

Contribution ID: 52

Type: **not specified**

Higgs EFT (II)

Wednesday, 25 August 2021 09:00 (55 minutes)

Presenter: SANZ, Veronica (Universities of Valencia and Sussex)

Session Classification: Lectures

Contribution ID: 53

Type: **not specified**

Q & A

Wednesday, 25 August 2021 09:55 (15 minutes)

Session Classification: Lectures

Contribution ID: 54

Type: **not specified**

Higgs at Future e+e- Colliders

Wednesday, 25 August 2021 10:20 (55 minutes)

Presenter: AZZI, Patrizia (INFN/CERN)

Session Classification: Lectures

Contribution ID: 55

Type: **not specified**

Q & A

Wednesday, 25 August 2021 11:15 (15 minutes)

Session Classification: Lectures

Contribution ID: 56

Type: **not specified**

Higgs & Flavor - Experiment

Wednesday, 25 August 2021 11:40 (55 minutes)

Presenter: URQUIJO, Phillip (The University of Melbourne)

Session Classification: Lectures

Contribution ID: 57

Type: **not specified**

Q & A

Wednesday, 25 August 2021 12:35 (15 minutes)

Session Classification: Lectures

Contribution ID: 58

Type: **not specified**

Higgs & Baryogenesis

Thursday, 26 August 2021 09:00 (55 minutes)

Presenter: MEADE, Patrick (Stonybrook Univ.)

Session Classification: Lectures

Contribution ID: 59

Type: **not specified**

Q & A

Thursday, 26 August 2021 09:55 (15 minutes)

Session Classification: Lectures

Contribution ID: **60**

Type: **not specified**

Higgs at Future Hadron Colliders

Thursday, 26 August 2021 10:20 (55 minutes)

Presenter: SELVAGGI, Michele (CERN)

Session Classification: Lectures

Contribution ID: **61**

Type: **not specified**

Q & A

Thursday, 26 August 2021 11:15 (15 minutes)

Session Classification: Lectures

Contribution ID: 62

Type: **not specified**

Higgs & Gravity Connection ?

Thursday, 26 August 2021 11:40 (55 minutes)

Presenter: SHAPOSHNIKOV, Mikhail (EPFL)

Session Classification: Lectures

Contribution ID: **63**

Type: **not specified**

Q & A

Thursday, 26 August 2021 12:35 (15 minutes)

Session Classification: Lectures

Contribution ID: **64**

Type: **not specified**

The Higgs Boson & Cosmology

Friday, 27 August 2021 09:00 (55 minutes)

Presenter: SHAPOSHNIKOV, Mikhail (EPFL)

Session Classification: Lectures

Contribution ID: 65

Type: **not specified**

Q & A

Friday, 27 August 2021 09:55 (15 minutes)

Session Classification: Lectures

Contribution ID: 66

Type: **not specified**

Higgs at Future Colliders: What Do We Learn ?

Friday, 27 August 2021 10:20 (55 minutes)

Presenter: PESKIN, Michael (SLAC)

Session Classification: Lectures

Contribution ID: 67

Type: **not specified**

Q & A

Friday, 27 August 2021 11:15 (15 minutes)

Session Classification: Lectures

Contribution ID: **68**

Type: **not specified**

The View Ahead

Friday, 27 August 2021 11:40 (55 minutes)

Presenter: HABER, Howard (University of California, Santa Cruz)

Session Classification: Lectures

Contribution ID: **69**

Type: **not specified**

Q & A

Friday, 27 August 2021 12:35 (15 minutes)

Session Classification: Lectures

Contribution ID: 70

Type: **not specified**

Higgs boson – multiparticle fields vs. Standard Model

In our view, the description of Higgs boson in Standard Model has the following problems:

- The Higgs boson in Standard Model has the weak isospin of $\frac{1}{2}$. At the same time, the analysis of experimental data on its decay channels [1] lead to a conclusion that all of the observed final states of the decay products have integer weak isospin. Since the Lagrangian of the Standard Model is symmetric relative to the global SU(2) transformation (the spontaneous breaking of symmetry applies to the ground state, not to the Lagrangian), the weak isospin must be conserved.
- The spontaneous breaking of symmetry is achieved due to the interaction containing the 4th power of the Higgs field. Such interaction is not introduced to any of the four known interactions, and it is not related to the localization of any symmetry. So this is a purely non-gauge, postulated interaction. As far as we know, there are no experimental confirmations of such interaction existence. The same is true for the Yukawa interaction of the fermion fields with the Higgs field.
- In Standard Model, the spontaneous breaking of symmetry is postulated, and not derived from the dynamical equations of the model.

We suggest to consider the Higgs field within the framework of the multiparticle fields model [2]. The quantized multiparticle fields describe the creation and annihilation of the particles which are the bound states of other particles, taking into account their inner structure. Within such model, the Higgs boson is considered as a bound state of two gauge bosons. In such case the spontaneous breaking of symmetry is not postulated, but is derived from the dynamical equations of the two-particle field. The self-action of the Higgs field is also not postulated, but is obtained as a result of the non-abelian gauge fields self-action. Thus, it is not considered a separate type of interaction, but rather as a manifestation of the weak interaction. Since the Higgs boson is a bound state of two gauge bosons in our model, it has integer weak isospin, which is in agreement with the experimental data on the Higgs boson decay channels.

1. P.A. Zyla et al. (Particle Data Group), Prog. Theor. Exp. Phys. 2020, 083C01 (2020) and 2021 update. (https://pdg.lbl.gov/2021/tables/contents_tables.html)
2. D.A. Ptashynskiy, T.M. Zelentsova, N.O. Chudak, K.K. Merkotan, O.S. Potiienko, V.V. Voitenko, O.D. Berezovskiy, V.V. Opyatyuk, O.V. Zharova, T.V. Yushkevich, I.V. Sharph, V.D. Rusov, Multiparticle fields on the subset of simultaneity, Ukrainian Journal of Physics 64(8), 732 (2019). <https://ujp.bitp.kiev.ua/index.php/ujp/article/view/2019394/1441>

Primary author: Ms YUSHKEVYCH, Tetiana (Odessa Polytechnic State University)

Co-authors: Dr POTIIENKO, Oleksii (Odessa Polytechnic State University); Dr CHUDAK, Nataliia (Odessa Polytechnic State University); Dr SHARPH, Ihor (Odessa Polytechnic State University)

Presenter: Ms YUSHKEVYCH, Tetiana (Odessa Polytechnic State University)

Contribution ID: 72

Type: **not specified**

Looking at overfitting within semi-supervision with Generative Adversarial Networks for physics searches at the LHC

The technique of semi-supervision can be used in searches for new physics where the signal plus background regions are not labelled. We employ semi-supervision but this technique has overfitting issues. We resort to GANs to mimic a Monte Carlo (MC) simulation which is very expensive computationally in order to perform toy MC studies. We propose Generative Adversarial Networks (GANs) as our main framework. GANs are powerful, but often suffer from number of issues including training instability or failure to converge. We henceforth go beyond vanilla GANs, by implementing a wasserstein GAN with gradient penalty (WGAN-GP) to achieve performance stability. We demonstrate the effectiveness of WGAN-GP on MC generated data and show that WGAN-GP achieves a better performance and is capable of generating perfect fakes with a good accuracy on a single GPU.

Primary author: LEBESE, Thabang (University of the Witwatersrand)

Presenter: LEBESE, Thabang (University of the Witwatersrand)

Contribution ID: 73

Type: **not specified**

Optimization of sensitivity for the Di-Higgs search in $b\bar{b}l\nu qq$ final state in the LHC data recorded by the ATLAS detector in pp collisions at $\sqrt{s} = 13$ TeV

We present a study to optimize the search for the Di-Higgs decay produced from gluon-gluon fusion with $b\bar{b}l\nu qq$ as the final state in the ATLAS experiment at the LHC using Monte Carlo simulated sample. A big challenge in observing this event is due to enormous background contamination, the dominant of which is due to the decay of $t\bar{t}$ decay. We use ROOT and its built-in multivariate analysis toolkit (TMVA) to run a sensitivity estimate using the Boosted Decision Tree algorithm to discriminate signal from the $t\bar{t}$ background. The performance of the algorithm to discriminate the background from the signal is based on the Signal significance, which is defined as $S/\sqrt{S+B}$.

Primary author: KAFLE, Pratik (Reed College)

Presenter: KAFLE, Pratik (Reed College)

Contribution ID: 74

Type: **not specified**

Next-to SV resummed Drell-Yan cross section beyond leading-logarithm

We present the resummed predictions for inclusive cross-section for Drell-Yan (DY) production up to next-to-next-to-leading logarithmic (NNLL) accuracy taking into account both soft virtual (SV) and next-to SV (NSV) threshold logarithms. We restrict ourselves to resummed contributions only from quark anti-quark initiated channels. The resummation is performed in Mellin-N space. We derive the N-dependent coefficients and the N-independent constants to the desired accuracy for our study. The resummed results are matched through the minimal prescription procedure with the fixed order results. We find that the resummation, taking into account the NSV terms, appreciably increases the cross-section while decreasing the sensitivity to the renormalization scale. We observe that, at 13 TeV LHC energies, the SV+NSV resummation at NLL (NNLL) gives about 8% (2%) corrections respectively to the NLO (NNLO) results for the considered Q range: 150-3500 GeV. In addition, the absence of quark gluon-initiated contributions to NSV part in the resummed terms leaves large factorization scale dependence indicating their importance at NSV level. We also study the numerical impact of N-independent constants and explore the ambiguity involved in exponentiating them. Finally, we present our predictions for the neutral Drell-Yan process at various center of mass of energies.

Primary author: SANKAR, aparna (IMSc, India)

Presenter: SANKAR, aparna (IMSc, India)

Contribution ID: 75

Type: **not specified**

Study of the associative production of the Higgs boson, W- and Z-bosons using different event generators

In this paper, the angular features of the signal and background processes of the associated production of the Higgs boson with W and Z bosons are presented. Signal and background processes are generated using the CompHEP, POWHEG and PYTHIA generators. Monte Carlo data are processed in the ROOT software. We also compared the shape of the distributions of kinematic variables obtained from different generators and found that the shape of these distributions is similar for different generators. Significant deviation of POWHEG distributions from other generators can be explained by the fact that it uses the next-to-leading order of perturbation theory for the cross section, while other generators use the leading order.

Primary author: MANASHOVA, Munira

Presenter: MANASHOVA, Munira

Contribution ID: 76

Type: **not specified**

Study of variability in radiation from the Blazar source 3C454.3

Blazars are the most promising sources of high energy emission in the known universe. They are a subclass of Active Galactic Nuclei (AGN) where the emission originates from a relativistic jet aligned at or close to the line of sight. Their broad band spectrum is predominantly non-thermal, extending from radio to gamma-ray energies. Blazars show very high flux variability across the electromagnetic spectrum. Here, we present a study of the long-term variability in radiation from the FSRQ 3C454.3 by constructing flux distributions using 10-year simultaneous optical and gamma ray observations from SPOL and Fermi-LAT, respectively. Also, we study flux distribution using X-ray data from AstroSat. We perform investigations of the temporal and spectral variability. As for the temporal analysis, we construct light-curves with the data from all the three bands. Further, we construct the Spectral Energy Distribution (SED) using X-ray data (LAXPC and SXT) and fit the SED with various models viz. power-law, log-parabola and broken power-law.

Primary author: GOSWAMI, Kaustav Dipta (Tezpur University)

Co-authors: KHATOON, Rukaiya (Tezpur University); Dr GOGOI, Rupjyoti (Tezpur University)

Presenter: GOSWAMI, Kaustav Dipta (Tezpur University)

Contribution ID: 77

Type: **not specified**

Gravitational Microlensing by Dark Matter Subhalos and Boson Stars

Multiple microlensing surveys have been conducted to place limits on primordial black holes in nearby dark matter halos. We show that these existing limits on PBHs can be recast to constrain dark matter lenses that are more spatially extended than PBHs. As two representative cases, we examine NFW subhalos and boson stars, which are predicted in many models such as axion mini-clusters and axion stars. For the Subaru-HSC survey, the finite size of the source stars must also be considered. we find that the survey can probe NFW subhalos up to $O(100)$ solar radii and boson stars up to $O(1000)$ solar radii.

Primary author: WANG, Zihui (NYU)

Presenter: WANG, Zihui (NYU)

Contribution ID: 78

Type: **not specified**

Looking for Beyond Standard Model short-lived particles with secondary production

Many New Physics scenarios contain new long-lived particles, leading to interesting experimental signatures such as, e.g., highly displaced decay signatures. Examples of such models are so-called portals which include coupling of BSM particle to ordinary matter through a renormalizable interaction. Going beyond such simple realisations of BSM physics, one can introduce non-minimal particle content where lighter particle can upscatter into heavier one in front of the detector, leading to interplay between short and long-lived regimes. We illustrate the prospects of such searches in representative LHC-based experiments FASER, SHiP and MATHUSLA for illustrative models with inelastic dark matter, neutrino dipole portal and dark neutrino portal, among others.

Primary authors: JODŁOWSKI, Krzysztof (NCBJ); Dr KLING, Felix (SLAC); Prof. ROSZKOWSKI, Leszek (NCBJ); Dr TROJANOWSKI, Sebastian (NCBJ)

Presenter: JODŁOWSKI, Krzysztof (NCBJ)

Contribution ID: 79

Type: **not specified**

Suppressing beam background using FastBDT at Belle II

The Belle II detector is situated inside an electron-positron collider in Japan called SuperKEKB and has been in operation since 2019. Like other B Factories of the past, Belle II is partly responsible for performing rare B decay analyses, and in such analyses, the variable E_{extra} is an important tool for signal yield extraction and background suppression, with many key analyses depending on the power of E_{extra} to increase the significance of their measurements. However, the resolution of E_{extra} for signal is greatly hampered by the presence of beam background, and with Belle II continuously reaching higher luminosities, this problem will continue to worsen. Therefore, it is imperative that scalable, efficient and accurate tools to suppress the impact of beam background are developed. This project focuses on the development of a multivariate analysis technique, centered around the FastBDT classifier, to identify and suppress beam background. Classifiers were trained on various subsets of cluster-related features, with source distributions for each feature obtained from $e^+e^- \rightarrow \mu^+\mu^-$ events for beam background photons and $B^0\bar{B}^0$ events for signal photons. It was observed that a FastBDT classifier trained on features describing the cluster energy, position and shape performed well at distinguishing between signal and beam background photons. Applying this classifier to a $B^0 \rightarrow D^*l$ analysis demonstrated its ability to improve the resolution of E_{extra} for signal. Further investigations showed that training the classifier on additional features such as the timing of the cluster and its proximity to nearby tracks further improved both the accuracy of the classifier, and the background suppression capabilities of E_{extra} . However, recent developments have shown that, although the performance of current FastBDT classifiers is promising, there are some issues with the validity of the current source distributions that need to be addressed before the classifier can be confidently applied to any rare B decay analyses.

Primary authors: Ms CHEEMA, Priyanka (University of Sydney/Belle II); CHEAIB, Racha (DESY)

Presenter: Ms CHEEMA, Priyanka (University of Sydney/Belle II)

Contribution ID: **80**Type: **not specified**

Constraining neutrino non-standard interactions from low energy neutrino experiments

The standard three-active neutrino oscillation picture would be modified in the presence of neutrino non-standard interactions (NSIs). In a model-independent manner, I shall review dimension-6 SMEFT operators that can induce such NSIs. Then, by focusing on terrestrial neutrino oscillation experiments Daya Bay, Double Chooz, RENO, T2K, NOvA, as well as T2HK, DUNE, JUNO and JUNO-TAO in the near future, I will discuss their sensitivity to new physics in SMEFT. Results on neutral current NSIs from COHERENT and precision measurements of N_{eff} at both Planck and CMB-S4 will also be discussed.

Primary author: DU, Yong (ITP CAS)

Presenter: DU, Yong (ITP CAS)

Contribution ID: 81

Type: **not specified**

On Next-to-Soft Resummation to Inclusive Cross-sections and Rapidity distributions

We present a formalism that resums threshold enhanced large logarithms to all orders in perturbation theory for the production of a pair of leptons in Drell-Yan process and of Higgs boson in gluon fusion as well as in bottom quark annihilation. As for the inclusive cross-section, the rapidity distribution is a prime candidate to benefit from threshold resummation, hence we apply the same formalism to rapidity distributions for the aforementioned processes as well. We use collinear factorization and renormalization group invariance to achieve this.

We find that the resummed result is a solution to Sudakov type differential equation and hence it can predict soft plus virtual (SV) contributions as well as next to SV (NSV) contributions to all orders in the strong coupling constant.

The z space resummed result is shown to have an integral representation which allows us to resum the large logarithms of the form $\log^i(N)$ retaining $1/N$ corrections resulting from NSV terms. We also show that in N space, tower of logarithms $a_s^n/N^\alpha \log^{2n-\alpha}(N)$, $a_s^n/N^\alpha \log^{2n-1-\alpha}(N) \dots$ etc for $\alpha = 0, 1$ are summed to all orders in a_s .

Primary authors: MUKHERJEE, POOJA (The Institute of Mathematical Sciences); Ms A. H., Aj-jath (The Institute of Mathematical Sciences); Prof. V., Ravindran (The Institute of Mathematical Sciences); Ms SANKAR, Aparna (The Institute of Mathematical Sciences); Ms TIWARI, Surabhi (The Institute of Mathematical Sciences)

Presenter: MUKHERJEE, POOJA (The Institute of Mathematical Sciences)

Contribution ID: 82

Type: **not specified**

Search for higgsinos with the ATLAS detector

Many supersymmetry models of general gauge mediation or gauge-mediated supersymmetry breaking predict gravitinos as the lightest supersymmetric particle with higgsino-dominated neutralinos as the next-to-lightest supersymmetric particle. This poster presents a search for pair-produced higgsinos each decaying to a Higgs boson and gravitino in the $b\bar{b}$ Higgs boson decay channel. The search uses the full Run 2 dataset of the ATLAS detector with an integrated luminosity of 126 fb^{-1} in pp collisions at $\sqrt{s} = 13 \text{ TeV}$. Higgsinos with mass less than 300 GeV are targeted in this analysis, which will be combined with an analysis targeting higgsinos with mass greater than 300 GeV. The backgrounds are dominated by difficult-to-model QCD multijet events and are estimated using a novel data-driven approach utilizing a reweighting boosted decision tree. The expected limits show strong sensitivity to the target scenarios.

Primary author: HANK, Michael (University of Chicago)

Presenter: HANK, Michael (University of Chicago)

Contribution ID: 83

Type: **not specified**

Search for non-resonant di-Higgs production in the $b\bar{b}\gamma\gamma$ final state at 13 TeV with the ATLAS experiment

The $b\bar{b}\gamma\gamma$ channel is one of the most sensitive HH final states for measuring the Higgs self-coupling and di-Higgs production cross-section. This analysis capitalizes on the clean signature of the two photons in the final state combined with the high branching ratio of $H \rightarrow b\bar{b}$. This talk will present the latest non-resonant ATLAS $HH \rightarrow b\bar{b}\gamma\gamma$ results with the full Run 2 dataset of 139 /fb at 13 TeV. The analysis uses a multivariate approach to target high and low HH mass regions to maximize the sensitivity to modifications of the Higgs self-coupling. This result sets the observed (expected) upper limits on the non-resonant HH production cross-section at a 95% confidence level at 130 fb (180 fb), which corresponds to 4.1x (5.5x) the Standard Model value. The analysis provides the strongest observed (expected) limits on the self-coupling of $-1.5-6.7$ ($-2.4-7.7$) to date.

Primary author: PEARKES, Jannicke (SLAC)

Presenter: PEARKES, Jannicke (SLAC)

Contribution ID: 85

Type: **not specified**

Search for long-lived particles decaying into two muons in proton-proton collisions at $\sqrt{s}=13\text{TeV}$ using data collected with high rate triggers

A search for displaced dimuon resonances is performed using proton-proton collisions at a center-of-mass energy of 13 TeV, collected by the CMS experiment at the LHC in 2017–2018, corresponding to an integrated luminosity of 101 fb⁻¹. The data sets used in this search were collected using a dedicated dimuon trigger stream with low transverse momentum thresholds, recorded at high rate by retaining a reduced amount of trigger-level information, in order to explore otherwise inaccessible phase space at low dimuon mass and non-zero displacement from the interaction point. We find no significant excess, and use the data to set stringent constraints on a wide range of mass and lifetime hypotheses for models of physics beyond the standard model where a Higgs boson decays to a pair of long-lived dark photons, or where a long-lived scalar resonance arises from the decay of a B hadron.

Primary author: ROUTRAY, Hardik (Rutgers University)

Presenter: ROUTRAY, Hardik (Rutgers University)

Contribution ID: 86

Type: **not specified**

Search for Higgs Boson pair production in the $HH \rightarrow b\bar{b}ll + MET$ final states with ATLAS detector at LHC

A search for Higgs Boson pair production via vector boson fusion and decaying to b-quarks and $WW/ZZ/\gamma\gamma$ final states is underway using the Run-2 dataset collected by ATLAS at $\sqrt{s} = 13$ TeV, corresponding to 139 fb of 2015-2018 providing a completely new signature in the Higgs sector. This search can give constraints on the parameters of the Higgs coupling with vector bosons, especially the quadruple coupling of $VVhh$, using a non-resonant signature. In this analysis a VBF selection is added to the ggF-analysis selection and optimized by comparing the backgrounds and newly produced VBF signal MCs. In this talk we will present an overview of the analysis, Event definition/selection and the classification results of ggF signal and VBF varied coupling modifiers with a Neural network method and will show also some results from the previously published papers (related to HH production).

Primary author: EL MOUSSAOUY, Ali (Universite Hassan II, Ain Chock (MA))

Presenter: EL MOUSSAOUY, Ali (Universite Hassan II, Ain Chock (MA))

Contribution ID: 87

Type: **not specified**

Is the local Lorentz invariance of general relativity implemented by gauge bosons that have their own Yang-Mills-like action?

General relativity with fermions has two independent symmetries: general coordinate invariance and local Lorentz invariance. General coordinate invariance is implemented by the Levi-Civita connection and by Cartan's tetrads both of which have as their action the Einstein-Hilbert action. It is suggested here that local Lorentz invariance is implemented not by a combination of the Levi-Civita connection and Cartan's tetrads known as the spin connection, but by independent Lorentz bosons L^{ab}_i that gauge the Lorentz group, that couple to fermions like Yang-Mills fields, and that have their own Yang-Mills-like action. Lorentz bosons couple to fermion number and generate a spin-dependent static potential that violates the weak equivalence principle. If a Higgs mechanism makes them massive, then the static potential also violates the inverse-square law. Experiments put upper bounds on the strength of such a potential for masses $m_L < 20$ eV. These upper limits imply that Lorentz bosons, if they exist, are nearly stable and contribute to dark matter.

Primary author: Prof. CAHILL, Kevin (University of New Mexico)

Presenter: Prof. CAHILL, Kevin (University of New Mexico)

Contribution ID: 88

Type: **not specified**

Dark matter, muon anomalous magnetic moment, and the XENON1T excess

Recently, the XENON1T detector observed an excess in its electronic recoil events in the low-energy region $\sim 1 - 5$ keV. We explore a possible dark matter (DM) explanation of the excess by invoking a simple extension of one real and two complex scalar fields comprising the dark sector beyond the Standard Model (SM). The light real scalar, while acting as a mediator between the SM sector and the dark sector, contributes to the magnetic moment of the muon as well. In this study we identify the region of the extended parameter space which simultaneously explains the long-standing muon ($g - 2$) anomaly, the requisite relic abundance of dark matter as well as the XENON1T excess via inelastic down-scattering of the dark scalar, while satisfying all relevant experimental, astrophysical and cosmological constraints.

Primary author: Mr MAHARANA, Suvam (University of Delhi)

Co-authors: Prof. CHOUDHURY, Debajyoti (University of Delhi); Ms SAHDEV, Vandana (University of Delhi); Dr SACHDEVA, Divya (Indian Institute of Science Education and Research Pune)

Presenter: Mr MAHARANA, Suvam (University of Delhi)

Contribution ID: 89

Type: **not specified**

Calculation of Mass and Spin of Remnant Black Holes (RBH) from Compact Binary Mergers

As Gravitational waves were detected in 2017 by LIGO and VIRGO collaborations, it gained a lot of interest. In this project, we find the final mass and spin of the RBH using a mathematical model. After analyzing the data from GW190521, we find that the final spin is 0.77 and mass of the system is 141.17M. It is also found that they are inversely proportional and the data sets fit the model with an accuracy of more than 90 percent. This proves that the model we chose for data analysis can also be used to study other properties of RBH as well.

Primary author: Ms SACHDEVA, Nitika (BHAGWAN PARSHURAM INSTITUTE OF TECHNOLOGY)

Presenter: Ms SACHDEVA, Nitika (BHAGWAN PARSHURAM INSTITUTE OF TECHNOLOGY)

Contribution ID: 90

Type: **not specified**

Combined Higgs measurements in SMEFT with the ATLAS experiment

Abstract:

The experimental study of the Higgs boson at the Large Hadron Collider is rapidly progressing over the past decade. The hunt for the elusive boson is now evolving to measuring kinematics properties of the Higgs boson interacting with other particles.

These detailed measurements provides an opportunity to study novel physical phenomena which occur at energies which are much large than those reached by particle collisions at the LHC. The Standard Model Effective Field Theory (SMEFT) lays the theoretical foundation that predicts how these signatures looks like in the ATLAS detector. This sets the stage to consistently scrutinise deviation of the data with respect to Standard Model prediction.

The latest combined Higgs measurements measure kinematic regions defined in the simplified template cross-section framework in the decay channels of $H \rightarrow \gamma\gamma$, $H \rightarrow ZZ^* \rightarrow 4l$, and $H \rightarrow b\bar{b}$ using the full Run-2 proton-proton collision dataset at $\sqrt{s} = 13$ TeV collected with the ATLAS detector in the years 2015-2018.

There are a large number of SMEFT operators that affect these measurements, however many operators have similar effects on the measurement and the challenge is therefore to identify the set of directions that can be constrained. In this work, we have identified ten linear combinations of SMEFT operators that can be probed with this analysis.

Primary author: BALASUBRAMANIAN, Rahul (Nikhef)

Presenter: BALASUBRAMANIAN, Rahul (Nikhef)

Contribution ID: 91

Type: **not specified**

Collider and GW complementarity in the 2HDM

The knowledge of the Higgs potential is crucial for understanding the origin of the mass and thermal history of our universe. We show how collider measurements and observations of stochastic gravitational-wave signals can complement each other to explore the multiform scalar potential in the 2HDM. Accounting for theoretical and current experimental constraints, we analyze the key ingredients in the shape of the Higgs potential triggering the transmutation in phase transition, from the smooth cross-over to the strong first order phase transition, focusing on the barrier formation and the upliftment of the true vacuum. In particular, we observe that $\xi_c > 1$ regime is favored for lower scalar masses, rendering strong extra motivation for collider searches. We contrast the dominant collider signals at the HL-LHC with observable gravitational wave signals at LISA.

Primary authors: KALADHARAN, Ajay (Oklahoma State University); Dr DORIVAL, Goncalves (Oklahoma State University); Dr YONGCHENG, Wu (Oklahoma State University)

Presenter: KALADHARAN, Ajay (Oklahoma State University)

Contribution ID: 92

Type: **not specified**

Directly Probing the Higgs-top Coupling at High Scales

The top-quark Yukawa coupling y_t is the strongest interaction of the Higgs boson in the Standard Model (SM) with $y_t \sim 1$. Due to its magnitude, it plays a central role in Higgs phenomenology in the SM and would be most sensitive to physics beyond the Standard Model. The top Yukawa can be directly measured at the LHC via top pair production in association with a Higgs boson $t\bar{t}h$. We study new physics effects for the Higgs-top coupling at high scales, using jet substructure techniques. We present the high-luminosity LHC sensitivity to new physics parametrized in the EFT framework and through a general Higgs-top form factor.

Primary authors: MAMMEN ABRAHAM, Roshan (Oklahoma State University); GONCALVES, Dorival (Oklahoma State University); HAN, Tao (University of Pittsburgh); LEUNG, Sze Ching Iris (University of Pittsburgh); QIN, Han (University of Pittsburgh)

Presenter: MAMMEN ABRAHAM, Roshan (Oklahoma State University)

Contribution ID: 93

Type: **not specified**

Hubble Selection of the Weak Scale: possibility from QCD quantum phase transition

During inflation, a scalar field undergoes a quantum diffusion following the de-Sitter temperature. Aided by the greater Hubble rate at higher potential, the quantum diffusion can make the global distribution of the field climb up the potential. If the potential exhibits a criticality at the maximum point, the field distribution can be sharply located near there. We show a possibility from QCD phase transition that it can have a critical point near the weak scale, so that the “Hubble selection” may account for the Higgs hierarchy problem.

Primary author: Mr KIM, TaeHun (Seoul National University)

Co-author: Prof. JUNG, Sunghoon (Seoul National University)

Presenter: Mr KIM, TaeHun (Seoul National University)

Contribution ID: 94

Type: **not specified**

Nonstandard MSSM scenarios with a mass of CP-odd Higgs boson lighter than the top-quark mass

The possibility of a mass of a CP-odd Higgs boson, which is lighter than the top quark mass M_t , is considered within the MSSM framework where an effective theory at the scale M_t is the Two-Higgs-doublet model (THDM).

The theoretical analysis was performed in the model approximation where only the effects of the third generation squark mixing are taken into account whenever the other supersymmetric particles decouple, i.e. the scale hierarchy is $m_A < M_t < M_s$ (m_A is a mass of pseudoscalar, M_s is an average mass of stop quarks masses). In this simple approximation, the free parameters are the ratio of Higgs doublet vacuum expectation values $\tan\beta$, the trilinear couplings of interactions of Higgs fields and third generation of squarks A_t , A_b , the mass parameter of Higgsino μ , and M_s . Calculation of radiative corrections to the Higgs sector were performed by EFT methods.

It was found that such a possibility is realized in the nonstandard MSSM regime with large A_t , A_b , and μ (of about $3 M_s$), M_s of about 1-2 TeV, $\tan\beta$ of about 2-5, and in a case when 1-loop threshold corrections to dimension-six operators to effective Higgs potential are taken into account.

The analysis of such MSSM regime includes unitarity constraints modified by dimension-six operators, the renormalization scale dependence of 1-loop threshold corrections to self-coupling of Higgs potential (λ_i , $i=1,\dots,7$) as well as the RG effects. It was noted that the results are sensitive to the value of the strong coupling constant.

The results were applied to the description of excess at the invariant mass of muon pair 28 GeV with obtained cross-sections of about 0.01–0.40 fb and 0.03–0.90 fb for 8 и 13 TeV correspondingly.

Primary author: FEDOTOVA, Elena (SINP MSU)

Presenter: FEDOTOVA, Elena (SINP MSU)

Contribution ID: 95

Type: **not specified**

Momentum Dependence in BSM Higgs couplings

The presence of heavy new physics generally alters the Standard Model (SM) Higgs couplings predictions. In many models, we expect that momentum effects decouple as the new heavy states are integrated out. However, these effects can be important in situations of significant off-shellness at collider experiments. We study the momentum dependence of different beyond the SM scenarios, using form factors to encode the p^2 effect on the Higgs couplings. Our focus is on the effects of new strongly interacting sectors, like composite Higgs models with general scalar, vector-like fermions or vectorial resonances. We show a significant enhancement of order p^2/Λ^2 over the expected v^2/Λ^2 predictions for the BSM scenarios studied. These effects are competitive with the momentum independent coupling modifications, changing the predictions of the models. Additionally, the use of form factors modifies the shapes of the kinematic distributions, providing new opportunities for LHC signals.

Primary authors: BITTAR, Pedro (University of São Paulo); Prof. BURDMAN, Gustavo (Universidade de São Paulo)

Presenter: BITTAR, Pedro (University of São Paulo)

Contribution ID: 96

Type: **not specified**

η Meson Properties in Chiral SU(3) Model

The topic is focused on the properties of η meson by following the approach of the chiral SU(3) model. We are dealing with the Lagrangian density of chiral SU(3) model that has exchange vector and scalar field terms and a hypothetical glueball field χ , to incorporate the scale invariance property of QCD. This phenomenological model explains effective meson interactions in the chiral limit and also preserves the broken scale invariance of QCD. Using the chiral Lagrangian density, we reviewed the work on η N interaction in hot and dense asymmetric nuclear matter. The major attraction of studying η meson is its negative mass shift and optical potential. The total Lagrangian of the chiral SU(3) model is solved and the non-linear coupled equations are deduced for vector and scalar fields. Furthermore, the equation of motion for the dispersion relation can be evaluated using the η N Lagrangian density. This dispersion relation gives the required effective mass and the momentum-dependent optical potential of η meson. This attractive potential can be utilized further to study the possibility of η -nucleon bound states within the chiral effective model, using Numerov Method. Variation in the mass shift is plotted by changing the scattering length, involving different parameters.

Primary author: Ms TIWARI, Shivanshi (Dr. B. R. Ambedkar National Institute of Technology Jalandhar)

Presenter: Ms TIWARI, Shivanshi (Dr. B. R. Ambedkar National Institute of Technology Jalandhar)

Contribution ID: 97

Type: **not specified**

On-Shell Symmetry Breaking and Higgs Mechanism

I present an on-shell description of symmetry breaking. Consider a group G in the UV, and a subgroup H in the IR. By demanding that the on-shell three particle amplitudes in the IR match consistently to their UV counterparts, I show how relations among their couplings and masses emerge, as well as an on-shell description of the Higgs mechanism.

Primary author: BACHU, Brad (Princeton University)

Presenter: BACHU, Brad (Princeton University)

Contribution ID: 98

Type: **not specified**

The top quark electro-weak couplings after LHC Run 2

Recent measurements at the Large Hadron Collider allow for a robust and precise characterisation of the electro-weak interactions of the top quark. We present the results of a global analysis at next-to-leading order precision including LHC, LEP/SLD and Tevatron data in the framework of the Standard Model Effective Field Theory. We include a careful analysis of the impact of correlations among measurements, as well as of the uncertainties in the Effective Field Theory setup itself. We find remarkably robust global fit results, with central values in good agreement with the Standard Model prediction, and 95% probability bounds on Wilson coefficients that range from ± 0.35 to $\pm 8 \text{ TeV}^{-2}$. This result represents a considerable improvement over previous studies, thanks to the addition of differential cross-section measurements in associated production processes of top quarks and neutral gauge bosons.

Primary author: Dr MORENO LLÁCER, María (IFIC (CSIC-Uni.Valencia))

Co-authors: Dr PERELLÓ, Martín (IFIC (CSIC-Uni.Valencia)); Dr PEÑUELAS, Ana (IFIC (CSIC-Uni.Valencia)); Mr MIRALLES, Víctor (IFIC (CSIC-Uni.Valencia)); Mr MIRALLES LÓPEZ, Marcos (IFIC (CSIC-Uni.Valencia)); Dr VOS, Marcel (IFIC (CSIC-Uni.Valencia))

Presenter: Dr MORENO LLÁCER, María (IFIC (CSIC-Uni.Valencia))

Contribution ID: 99

Type: **not specified**

Test of the Realism in Particle Physics

The Realism [1], which is based on the properties of classical objects can be violated in quantum world. Assumption that observables of the system can jointly exist (Classical realism) and Locality can be wrong in Quantum Mechanics [2].

Test of the Realism can be done with Wigner inequalities [3]. There should be three dichotomous variables in Wigner inequalities and these inequalities consist of probabilities of detecting correlated properties between pairs of entangled particles. As dichotomous variables neutral pseudoscalar mesons [4] (states with certain flavour, states with certain CP-parity and states with certain mass and lifetime) can be considered.

In this work theoretical proof of the violations of 3-time-dependent Wigner inequalities [1]:

$$\begin{aligned}
&\left[w(a_+^{(2)}(t_2) \cap b_+^{(1)}(t_1)) - w(a_+^{(2)}(t_2) \cap c_+^{(1)}(t_0)) - w(a_+^{(2)}(t_2) \cap b_-^{(1)}(t_1)) \right. \\
&\quad \left. + w(a_+^{(2)}(t_2) \cap c_-^{(1)}(t_0)) + w(a_+^{(2)}(t_2) \cap b_-^{(1)}(t_1)) \right] \\
&\quad \left[w(b_+^{(1)}(t_1) \cap c_+^{(1)}(t_0)) - w(b_+^{(1)}(t_1) \cap c_-^{(1)}(t_0)) \right. \\
&\quad \left. + w(b_-^{(1)}(t_1) \cap c_+^{(1)}(t_0)) - w(b_-^{(1)}(t_1) \cap c_-^{(1)}(t_0)) \right] \\
&\quad \left[w(b_+^{(1)}(t_1) \cap b_+^{(1)}(t_0)) - w(b_+^{(1)}(t_1) \cap b_-^{(1)}(t_0)) \right. \\
&\quad \left. + w(b_-^{(1)}(t_1) \cap b_+^{(1)}(t_0)) - w(b_-^{(1)}(t_1) \cap b_-^{(1)}(t_0)) \right] \\
&\quad \left[w(c_+^{(1)}(t_0) \cap c_+^{(2)}(t_2)) - w(c_+^{(1)}(t_0) \cap c_-^{(2)}(t_2)) \right. \\
&\quad \left. + w(c_-^{(1)}(t_0) \cap c_+^{(2)}(t_2)) - w(c_-^{(1)}(t_0) \cap c_-^{(2)}(t_2)) \right] \\
&\quad \left[w(c_+^{(1)}(t_0) \cap b_+^{(1)}(t_1)) - w(c_+^{(1)}(t_0) \cap b_-^{(1)}(t_1)) \right. \\
&\quad \left. + w(c_-^{(1)}(t_0) \cap b_+^{(1)}(t_1)) - w(c_-^{(1)}(t_0) \cap b_-^{(1)}(t_1)) \right] \\
&\quad \left[w(c_+^{(1)}(t_0) \cap b_+^{(1)}(t_0)) - w(c_+^{(1)}(t_0) \cap b_-^{(1)}(t_0)) \right. \\
&\quad \left. + w(c_-^{(1)}(t_0) \cap b_+^{(1)}(t_0)) - w(c_-^{(1)}(t_0) \cap b_-^{(1)}(t_0)) \right] \\
&\quad \left[w(c_+^{(1)}(t_0) \cap c_+^{(2)}(t_2)) - w(c_+^{(1)}(t_0) \cap c_-^{(2)}(t_2)) \right. \\
&\quad \left. + w(c_-^{(1)}(t_0) \cap c_+^{(2)}(t_2)) - w(c_-^{(1)}(t_0) \cap c_-^{(2)}(t_2)) \right] \\
&\quad \left[w(c_+^{(1)}(t_0) \cap b_+^{(1)}(t_1)) - w(c_+^{(1)}(t_0) \cap b_-^{(1)}(t_1)) \right. \\
&\quad \left. + w(c_-^{(1)}(t_0) \cap b_+^{(1)}(t_1)) - w(c_-^{(1)}(t_0) \cap b_-^{(1)}(t_1)) \right] \\
&\quad \left[w(c_+^{(1)}(t_0) \cap b_+^{(1)}(t_0)) - w(c_+^{(1)}(t_0) \cap b_-^{(1)}(t_0)) \right. \\
&\quad \left. + w(c_-^{(1)}(t_0) \cap b_+^{(1)}(t_0)) - w(c_-^{(1)}(t_0) \cap b_-^{(1)}(t_0)) \right]
\end{aligned}$$

in systems of K^0 , B_s , D^0 - mesons [5] is shown. The inequalities is tested for the Bell pure state

$$|\Psi^-\rangle:$$

$$|\Psi^-\rangle =$$

$$\frac{1}{\sqrt{2}} (|M^{(2)}\rangle - |\bar{M}^{(1)}\rangle - |\bar{M}^{(2)}\rangle + |M^{(1)}\rangle), \text{ where } M - \text{a certain meson, and also for Werner state, where backgr}$$

and t_2 of this inequality were found in systems of neutral pseudoscalar mesons. Also it was shown that for experimental testing time-dependent Wigner inequalities are more prospective than time-independent Wigner inequalities.

[1] N. Nikitin, K. Toms, Phys. Rev. D 95, 052103 (2017).

[2] A. Einstein, B. Podolsky and N. Rosen, Phys. Rev. 47, 777 (1935).

[3] E. P. Wigner, Am. J. Phys. 38, 1005 (1970).

[4] F. Uchiyama, Phys. Lett. A 231, 295 (1997).

[5] A. Efimova, J. of Phys.: Conf. Ser. 1439 012008 (2020).

Primary author: Ms EFIMOVA, ANNA (M.V. Lomonosov Moscow State University)

Presenter: Ms EFIMOVA, ANNA (M.V. Lomonosov Moscow State University)

Contribution ID: **100**Type: **not specified**

Lepton Flavor Violating Mixings at 2-Loop from the S-Matrix

Standard Model has lepton flavor conservation as an accidental symmetry, and there has been a great deal of experimental effort went into detecting events leading to its violation (LFV) in search of signs for new physics. Muon decays into electrons and an electron & photon are two promising examples to such events in near future. In this ongoing work, we consider dimension 6 operators in Standard Model EFT that account for these decays and draw a picture of renormalization group mixings above electroweak scale between LFV dim-6 operators up to two loops. We present a handy way of extracting two loop anomalous dimensions using the on-shell S-matrix and unitarity cuts, and we explicitly calculate some of them.

Primary authors: GUMUS, Mehmet Asim (Sissa); ELIAS-MIRO, Joan (ICTP)

Presenter: GUMUS, Mehmet Asim (Sissa)

Contribution ID: 101

Type: **not specified**

Search for the Decay of the Higgs Boson to Charm Quarks with the ATLAS Experiment

The measurements at the Large Hadron Collider(LHC), so far, have established Higgs Yukawa couplings to Fermions are close to the Standard Model(SM) expectation for the 3rd Fermion generation. However, the rather ad hoc assumption of universal Yukawa coupling for other Fermion generations has a little experimental constraint. This is very challenging to probe due to small branching fractions, extensive quantum chromodynamics(QCD) backgrounds, and difficulties in jet flavor identification. A direct search by the ATLAS experiment for the SM Higgs boson decaying to a pair of charm quarks is presented. The dataset delivered by the LHC in pp collisions at $s\sqrt{= 13}$ TeV and recorded by the ATLAS detector corresponds to an integrated luminosity of 139 fb⁻¹. Charm tagging algorithms are optimized to distinguish c-quark jets from both light flavor jets and b-quark jets. The analysis method is validated with the study of diboson (WW, WZ, and ZZ) production, with observed (expected) significances of 2.6(2.2) standard deviations above the background-only hypothesis for the (W/Z)Z($\rightarrow cc^-$) process and 3.8(4.6) standard deviations for the (W/Z)W($\rightarrow cq$) process. The (W/Z)H($\rightarrow cc^-$) search yields an observed (expected) limit of 26(31) times the predicted cross-section times branching fraction for a Higgs boson with a mass of 125 GeV, corresponding to an observed (expected) constraint on the charm Yukawa coupling modifier $|\kappa_c| < 8.5(12.4)$, at the 95% confidence level.

Primary author: XU, Zijun (SLAC)

Presenter: XU, Zijun (SLAC)

Contribution ID: **102**Type: **not specified**

New Generation RCE system for the Rd53 Pixel Front End chip readout

The RCE (Reconfigurable Cluster Element) platform is a general-purpose system-on-chip data acquisition system, which is broadly deployed in various experiments, including ATLAS. A new generation of bench-top RCE system, based on Xilinx UltraScale+ MPSoC, is developed to support the Rd53a/b module and system testing with high performance. The RCE system also serves as the primary platform for validating the data transmission design of the ATLAS ITk pixel system with the same or equivalent components as the eventual ITk pixel system.

Primary author: XU, Zijun (SLAC)

Presenter: XU, Zijun (SLAC)

Contribution ID: 103

Type: **not specified**

#73 Optimization of sensitivity for the Di-Higgs search in $b\bar{b}l\nu qq$ final state in the LHC data recorded by the ATLAS detector in pp collisions at $\sqrt{s} = 13$ TeV

Wednesday, 18 August 2021 13:30 (1h 15m)

Presenter: KAFLE, Pratik (Reed College)

Session Classification: Poster Session

Contribution ID: **104**

Type: **not specified**

#76 Study of variability in radiation from the Blazar source 3C454.3

Wednesday, 18 August 2021 13:30 (1h 15m)

Presenter: GOSWAMI, Kaustav Dipta (Tezpur University)

Session Classification: Poster Session

Contribution ID: **105**

Type: **not specified**

#77 Gravitational Microlensing by Dark Matter Subhalos and Boson Stars

Wednesday, 18 August 2021 13:30 (1h 15m)

Presenter: WANG, Zihui (NYU)

Session Classification: Poster Session

Contribution ID: **106**

Type: **not specified**

#92 Directly Probing the Higgs-top Coupling at High Scales

Wednesday, 18 August 2021 13:30 (1h 15m)

Presenter: MAMMEN ABRAHAM, Roshan (Oklahoma State University)

Session Classification: Poster Session

Contribution ID: **107**

Type: **not specified**

#93 Hubble Selection of the Weak Scale: possibility from QCD quantum phase transition

Wednesday, 18 August 2021 13:30 (1h 15m)

Presenter: KIM, TaeHun (Seoul National University)

Session Classification: Poster Session

Contribution ID: **108**

Type: **not specified**

#99 Test of the Realism in Particle Physics

Wednesday, 18 August 2021 13:30 (1h 15m)

Presenter: EFIMOVA, ANNA (M.V. Lomonosov Moscow State University)

Session Classification: Poster Session

Contribution ID: **109**

Type: **not specified**

#100 Lepton Flavor Violating Mixings at 2-Loop from the S-Matrix

Wednesday, 18 August 2021 13:30 (1h 15m)

Presenter: GUMUS, Mehmet Asim (Sissa)

Session Classification: Poster Session

Contribution ID: 110

Type: **not specified**

#101 Search for the Decay of the Higgs Boson to Charm Quarks with the ATLAS Experiment

Wednesday, 18 August 2021 13:30 (1h 15m)

Presenter: XU, Zijun (SLAC)

Session Classification: Poster Session

Contribution ID: 111

Type: **not specified**

#04 The muon magnetic moment: to the 2HDM and beyond

Thursday, 19 August 2021 07:30 (1h 15m)

Presenter: GONÇALVES, Bernardo (CFTP/IST)

Session Classification: Poster Session

Contribution ID: 112

Type: **not specified**

#70 Higgs boson — multiparticle fields vs. Standard Model

Thursday, 19 August 2021 07:30 (1h 15m)

Presenter: YUSHKEVYCH, Tetiana (Odessa National Polytechnic University)

Session Classification: Poster Session

Contribution ID: 113

Type: **not specified**

#78 Looking for Beyond Standard Model short-lived particles with secondary production

Thursday, 19 August 2021 07:30 (1h 15m)

Presenter: JODŁOWSKI, Krzysztof (NCBJ)

Session Classification: Poster Session

Contribution ID: 114

Type: **not specified**

#79 Suppressing beam background using FastBDT at Belle II

Thursday, 19 August 2021 07:30 (1h 15m)

Presenter: CHEEMA, Priyanka (University of Sydney/Belle II)

Session Classification: Poster Session

Contribution ID: 115

Type: **not specified**

#80 Constraining neutrino non-standard interactions from low energy neutrino experiments

Thursday, 19 August 2021 07:30 (1h 15m)

Presenter: DU, Yong (ITP CAS)

Session Classification: Poster Session

Contribution ID: 116

Type: **not specified**

#86 Search for Higgs Boson pair production in the HH \rightarrow bbll + MET final states with ATLAS detector at LHC

Thursday, 19 August 2021 07:30 (1h 15m)

Presenter: EL MOUSSAOUY, Ali (Universite Hassan II, Ain Chock (MA))

Session Classification: Poster Session

Contribution ID: 117

Type: **not specified**

#88 Dark matter, muon anomalous magnetic moment, and the XENON1T excess

Thursday, 19 August 2021 07:30 (1h 15m)

Presenter: MAHARANA, Suvam (University of Delhi)

Session Classification: Poster Session

Contribution ID: 118

Type: **not specified**

#94 Nonstandard MSSM scenarios with a mass of CP-odd Higgs boson lighter than the top-quark mass

Thursday, 19 August 2021 07:30 (1h 15m)

Presenter: FEDOTOVA, Elena (SINP MSU)

Session Classification: Poster Session

Contribution ID: **119**

Type: **not specified**

#74 Next-to SV resummed Drell-Yan cross section beyond leading-logarithm

Tuesday, 24 August 2021 13:30 (1h 15m)

Presenter: SANKAR, aparna (IMSc, India)

Session Classification: Poster Session

Contribution ID: 120

Type: **not specified**

#81 On Next-to-Soft Resummation to Inclusive Cross-sections and Rapidity distributions

Tuesday, 24 August 2021 13:30 (1h 15m)

Presenter: MUKHERJEE, POOJA (The Institute of Mathematical Sciences)

Session Classification: Poster Session

Contribution ID: 121

Type: **not specified**

#83 Search for non-resonant di-Higgs production in the $bb\gamma\gamma$ final state at 13 TeV with the ATLAS experiment

Tuesday, 24 August 2021 13:30 (1h 15m)

Presenter: PEARKES, Jannicke (SLAC)

Session Classification: Poster Session

Contribution ID: 122

Type: **not specified**

#87 Is the local Lorentz invariance of general relativity implemented by gauge bosons that have their own Yang-Mills-like action?

Tuesday, 24 August 2021 13:30 (1h 15m)

Presenter: CAHILL, Kevin (University of New Mexico)

Session Classification: Poster Session

Contribution ID: 123

Type: **not specified**

#90 Combined Higgs measurements in SMEFT with the ATLAS experiment

Tuesday, 24 August 2021 13:30 (1h 15m)

Presenter: BALASUBRAMANIAN, Rahul (Nikhef)

Session Classification: Poster Session

Contribution ID: 124

Type: **not specified**

#96 η Meson Properties in Chiral SU(3) Model

Thursday, 26 August 2021 13:30 (1h 15m)

Presenter: TIWARI, Shivanshi (Dr. B. R. Ambedkar National Institute of Technology Jalandhar)

Session Classification: Poster Session

Contribution ID: 125

Type: **not specified**

#98 The top quark electro-weak couplings after LHC Run 2

Tuesday, 24 August 2021 13:30 (1h 15m)

Presenter: MORENO LLÁCER, María (IFIC, (CSIC - Univ. of Valencia))

Session Classification: Poster Session

Contribution ID: 126

Type: **not specified**

#102 New Generation RCE system for the Rd53 Pixel Front End chip readout

Tuesday, 24 August 2021 13:30 (1h 15m)

Presenter: XU, Zijun (SLAC)

Session Classification: Poster Session

Contribution ID: 127

Type: **not specified**

#08 Development of Future Electromagnetic Calorimeter Technologies and Applications for the Electron-Ion Collider with GEANT 4 Simulations

Thursday, 26 August 2021 13:30 (1h 15m)

Presenter: SHI, Zhaozhong (Massachusetts Institute of Technology)

Session Classification: Poster Session

Contribution ID: 128

Type: **not specified**

#72 Looking at overfitting within semi-supervision with Generative Adversarial Networks for physics searches at the LHC

Thursday, 26 August 2021 13:30 (1h 15m)

Presenter: LEBESE, Thabang (University of the Witwatersrand)

Session Classification: Poster Session

Contribution ID: **129**

Type: **not specified**

#82 Search for higgsinos with the ATLAS detector

Thursday, 26 August 2021 13:30 (1h 15m)

Presenter: HANK, Michael (University of Chicago)

Session Classification: Poster Session

Contribution ID: 130

Type: **not specified**

#85 Search for long-lived particles decaying into two muons in proton-proton collisions at $\sqrt{s}=13\text{TeV}$ using data collected with high rate triggers

Thursday, 26 August 2021 13:30 (1h 15m)

Presenter: ROUTRAY, Hardik (Rutgers University)

Session Classification: Poster Session

Contribution ID: 131

Type: **not specified**

#89 Calculation of Mass and Spin of Remnant Black Holes (RBH) from Compact Binary Mergers

Thursday, 26 August 2021 13:30 (1h 15m)

Presenter: SACHDEVA, NITIKA (BHAGWAN PARSHURAM INSTITUTE OF TECHNOLOGY)

Session Classification: Poster Session

Contribution ID: 132

Type: **not specified**

#91 Collider and GW complementarity in the 2HDM

Thursday, 26 August 2021 13:30 (1h 15m)

Presenter: KALADHARAN, Ajay (Oklahoma State University)

Session Classification: Poster Session

Contribution ID: 133

Type: **not specified**

#95 Momentum Dependence in BSM Higgs couplings

Thursday, 26 August 2021 13:30 (1h 15m)

Presenter: BITTAR, Pedro (University of São Paulo)

Session Classification: Poster Session

Contribution ID: 134

Type: **not specified**

#97 On-Shell Symmetry Breaking and Higgs Mechanism

Thursday, 26 August 2021 13:30 (1h 15m)

Presenter: BACHU, Brad (Princeton University)

Session Classification: Poster Session

Contribution ID: 135

Type: **not specified**

#75 Study of the associative production of the Higgs boson, W- and Z-bosons using different event generators

Thursday, 19 August 2021 07:30 (1h 15m)

Presenter: MANASHOVA, Munira

Session Classification: Poster Session

Contribution ID: 136

Type: **not specified**

#75 Study of the associative production of the Higgs boson, W- and Z-bosons using different event generators

Presenter: MANASHOVA, Munira

Session Classification: Poster Session