PHOENIX-2023

Report of Contributions

https://indico.cern.ch/e/1313315

Contribution ID: **1** Type: **Talk**

Interplay of Inert Higgs Doublet and Vector Like lepton in the Context of Dark Matter and Collider Signature

Tuesday, 19 December 2023 15:45 (15 minutes)

We discuss the interplay between the Inert Higgs Doublet (IDM) dark matter and a vector-like SU(2)_L triplet lepton (VLL), both of which are odd under Z_2 symmetry. A compressed mass spectrum and a sufficiently small Yukawa coupling allows co-annihilation and late decay of the VLL into the IDM sector, which affects the relic density of the pseudoscalar dark matter. The same two factors enable displaced decay of the VLL states, providing novel signatures involving hadronically quiet displaced multi-lepton final states. Such signatures to probe the model are studied at the 14 and 27 TeV LHC, as well as the 100 TeV FCC-hh. The detection possibilities at the CMS, ATLAS and the proposed detector MATHUSLA are thoroughly explored.

Institution

Reference publication/preprint

Designation

Student

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Presenter: SEN, CHANDRIMA

Session Classification: Parallel : Collider + BSM

Contribution ID: **2** Type: **Talk**

Coannihilation and scotogenic fermionic dark matter

Tuesday, 19 December 2023 14:30 (20 minutes)

Though the Standard Model assumes the neutrinos to be massless, the phenomenon of neutrino oscillation shows that they have tiny but non-zero masses. Scotogenic models, in which neutrino masses are generated at one-loop level and remain tiny due to loop suppression, are very interesting in this regard. In these models, since the beyond Standard Model (BSM) particles entering inside the neutrino-mass-loop are assumed to be odd under Z_2 symmetry, they can be considered as dark matter depending on their mass hierarchy. We have examined the phenomenology of fermionic dark matter in the singlet-triplet scotogenic model, especially in light of fermion-fermion and fermion-scalar coannihilation. In our analysis, we have considered constraints arising stability and perturbativity, electroweak precision observables, collider searches, charged lepton flavour violation (cLFV), relic density and direct detection experiments of dark matter. We find that bounds from collider and/or cLFV disfavour light fermionic dark matter of mass below 60 GeV. We also notice that fermion-scalar coannihilation is necessary to obtain viable fermionic dark matter within the mass range of 60 GeV to 100 GeV, and beyond 100 GeV fermion-scalar and fermion-fermion coannihilation play complementary roles in different regions of parameter space.

Reference publication/preprint

2308.09135

Designation

Postdoc

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Presenter: KARAN, Anirban

Session Classification: Parallel: DM + neutrino

Contribution ID: **3** Type: **Talk**

Exploring Sub-GeV Dark Matter Boosted by Diffuse Supernova Neutrino Background: Insights from XENONnT and LUX-ZEPLIN Experiments

Tuesday, 19 December 2023 16:45 (15 minutes)

In recent years, there has been a growing interest in the direct detection of sub-GeV dark matter, which is theoretically well-motivated. However, probing sub-GeV cold dark matter particles has posed a persistent challenge, as their typical momenta are insufficient to induce recoils above the thresholds of conventional direct detection experiments. Notably, even very strongly interacting dark matter within this mass range has been suggested to elude all observational bounds. However, recent studies have unveiled a novel approach to explore this elusive realm, wherein dark matter particles, typically non-relativistic, acquire semi-relativistic velocities. Here, we focus on the specific case of dark matter boosting through its interactions with the diffuse supernova neutrino background in the galaxy. This mechanism introduces a high-energy dark matter component capable of interacting with both electrons and nuclei in the detector, triggering a detectable recoil signal. Our study |1| meticulously analyzes data from the XENONnT |2| and LUX-ZEPLIN (LZ) |3| experiments, culminating in the derivation of robust constraints on the scattering cross sections of sub-GeV boosted dark matter with both electrons and nucleons. Additionally, we emphasize the imperative nature of considering Earth's attenuation effects for both electron and nuclei interactions, while also highlighting the substantial role played by finite nuclear size effects in the context of nuclear scattering. Lastly, we present a comparison of our findings with existing constraints, illuminating the complementarity and significance of the LZ and XENONnT data in probing the sub-GeV dark matter parameter space, thereby emphasizing their potential to unveil this enigmatic realm.

References

1. V. De Romeri, **A. Majumdar**, D. K. Papoulias, and R. Srivastava, "*XENONnT and LUX-ZEPLIN constraints on DSNB-boosted dark matter,*" arXiv:2309.04117 [hep-ph].
2. **XENON Collaboration**, E. Aprile et al., "*Search for New Physics in Electronic Recoil Data from XENONnT,*" Phys. Rev. Lett. 129 no. 16, (2022) 161805.
3. **LZ Collaboration**, J. Aalbers et al., "*First Dark Matter Search Results from the LUX-ZEPLIN (LZ) Experiment,*" Phys. Rev. Lett. 131 no. 4, (2023) 041002.

Reference publication/preprint

arXiv:2309.04117 [hep-ph]

Designation

Student

Institution

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Session Classification: Parallel: DM + neutrino

Contribution ID: **4** Type: **Talk**

Gravitational wave imprints of the doublet left-right symmetric model

Wednesday, 20 December 2023 15:15 (15 minutes)

We study the strong first-order phase transition (SFOPT) associated with $SU(2)_R \times U(1)_{B-L}$-breaking in the doublet left-right symmetric model (DLRSM), and the resulting stochastic gravitational wave (GW) background. For different values of the symmetry-breaking scale $v_R = 20,\ 30,$ and 50 TeV, we construct the one-loop finite temperature effective potential to explore the parameter space for SFOPT. We identify the region where the associated GW signature is detectable at planned GW observatories. A strong GW background favors a relatively light CP-even neutral scalar H_3, arising from the $SU(2)_R$ doublet. The $SU(2)_L$ subgroup of DLRSM is broken by three $vevs$: $\kappa_1,\ \kappa_2$, and v_L. We observe a preference for $\mathcal{O}(1)$ values of the ratio $w = v_L/\kappa_1$, but no clear preference for the ratio $r = \kappa_2/\kappa_1$. A large number of points with strong GW signal can be ruled out from precise measurement of the trilinear Higgs coupling and searches for H_3 at future colliders.

Reference publication/preprint

2309.12023

Designation

Student

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Presenter: Mr RINGE, Dhruv (Indian Institute of Technology Indore)

Session Classification: Parallel: BSM + Cosmology

Contribution ID: **5** Type: **Talk**

Search for light long-lived particles at future colliders

Tuesday, 19 December 2023 14:30 (20 minutes)

Our search for new physics scenarios beyond the standard model requires special attention to the light particles, as they could have escaped our conventional searches. We focus on the prospect of detecting light long-lived particles (LLP) coming from the decays of SM Higgs boson and B-mesons at future colliders. Dedicated LLP detectors can play a crucial role in probing highly displaced light LLPs having large decay lengths. We propose dedicated, optimistic LLP detectors for future colliders and compare their sensitivity with the proposed transverse detectors like MATHUSLA, CODEX-b for HL-LHC, and DELIGHT (Detector for long-lived particles at high energy of 100 TeV) for FCC-hh.

Reference publication/preprint

https://arxiv.org/pdf/2306.11803.pdf

Designation

Postdoc

Institution

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Session Classification: Parallel : Collider + BSM

Contribution ID: **6** Type: **Talk**

Large lepton number violation at colliders in linear seesaw

Tuesday, 19 December 2023 17:15 (15 minutes)

Small neutrino masses can be sourced by a tiny vacuum expectation value of a leptophilic Higgs doublet, and mediated by Quasi-Dirac heavy neutrinos. In such simplest linear seesaw picture the neutrino mass mediators can be accessible to colliders. We describe novel charged Higgs and heavy neutrino production mechanisms that can be sizeable at e^-e^+, $e^-\gamma$ and $\mu^-\mu^+$ colliders. and discuss some of the associated signatures. These may shed light on the Majorana nature of neutrinos and the significance of lepton number and lepton flavour non-conservation.

Reference publication/preprint

2304.06080

Designation

Student

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Presenter: BHARADWAJ, Praveen (Indian Institute of Science Education and Research, Bhopal)

Session Classification: Parallel : Collider + BSM

Contribution ID: **7** Type: **Talk**

Phenomenology of Dirac Scotogenic Model

Tuesday, 19 December 2023 17:15 (15 minutes)

The Dirac scotogenic model provides an elegant mechanism which explains small Dirac neutrino masses and neutrino mixing with a single symmetry simultaneously protecting the ‘’Diracness” of the neutrinos and the stability of the dark matter candidate. In addition to exploring the phenomenology of dark matter, we will also investigate the implications for lepton flavor violation, the muon anomalous magnetic moment and electroweak vacuum stability within this theoretical framework. These collective observations provide us with a set of predictions for lepton flavor-violating processes that can be readily tested in the near future. Additionally, the remaining parameter space yields predictions that are experimentally verifiable in relation to neutrino masses.

Reference publication/preprint

Designation

Student

Institution

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Presenter: Mr YADAV, Sushant (IISER Bhopal, India)

Session Classification: Parallel: DM + neutrino

Contribution ID: **8** Type: **Talk**

Neutrino Mass Sum Rules from Modular $\mathcal{A}_4$ Symmetry

Wednesday, 20 December 2023 16:30 (15 minutes)

Modular symmetries offer a dynamic approach to understanding the flavour structure of leptonic mixing. Using the modular $\mathcal{A}_4$ flavour symmetry integrated in a type-II seesaw, we propose a simple and minimalistic model that restricts the neutrino oscillation parameter space and, most importantly, introduces a sum rule in the physical neutrino masses. When combined with the mass squared differences observed in neutrino oscillations, this sum rule determines the absolute neutrino mass scale. This has significant implications for cosmology, neutrinoless double beta decay experiments and direct neutrino mass measurements. In Specifically, our model predicts $\sum_i m_i \approx 0.1$ eV for both normal and inverted ordering, and thus can be fully probed by the current generation of cosmological probes in the upcoming years.

Reference publication/preprint

Designation

Student

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Session Classification: Parallel: DM + neutrino

Contribution ID: **9** Type: **Talk**

Multi-Component Dark Matter: Identifying at Collider

Tuesday, 19 December 2023 15:10 (20 minutes)

In this talk, I will demonstrate how having two WIMPs, each with different masses, and mass splitting with the NLSP, generated at a collider through a decay chain, can result in double peaks in the missing energy or missing transverse momentum distribution of the multilepton signal. I will also outline a set of criteria to identify and segregate the second peak in the missing energy spectrum, after a careful analysis of the corresponding Standard Model background contribution.

Reference publication/preprint

JHEP 12 (2022) 049 (arXiv: 2202.12097)

Designation

Postdoc

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Session Classification: Parallel: DM + neutrino

Contribution ID: **10** Type: **Talk**

The dynamics and detection possibility of a pseudo-FIMP dark matter

Tuesday, 19 December 2023 17:30 (15 minutes)

In a two-component dark matter (DM) set-up, when DM_1 is in equilibrium with the thermal bath, the other one, DM_2, can be equilibrated only by the sizeable interaction with the DM_1, even without any connection with the visible-sector particles. We affirm that such DM candidates (DM_2) have unique 'freeze-out' characteristics impacting the relic density, direct, indirect and collider search implications, and propose to classify them as $\mathrm{pseudo-FIMP}$ (pFIMP). Here, We have accentuated the dynamics of pFIMP in a model-independent manner by solving the generic coupled Boltzmann Equations (cBEQ), as well as with a concrete model illustration. Also, we have illustrated its detectability for different kinds of model possibilities.

Reference publication/preprint

e-Print: 2212.07622, 2212.14846

Designation

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Institution

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Presenter: Mr PRADHAN, Dipankar (IIT Guwahati)

Session Classification: Parallel: DM + neutrino

Contribution ID: **11** Type: **Talk**

Leptogenesis and Dark Matter Through Relativistic Bubble Walls with Observable Gravitational Waves

Wednesday, 20 December 2023 14:30 (15 minutes)

We study a scenario where both dark matter (DM) and heavy right-handed neutrino (RHN) responsible for leptogenesis acquire masses by crossing the relativistic bubble walls formed as a result of a supercooled first order phase transition (FOPT) above electroweak scale. This leads to a large out-of-equilibrium abundance of RHN inside the bubble sufficient to produce the required lepton asymmetry. A classical conformal symmetry ensures the origin of mass via FOPT induced by a singlet scalar while also ensuring supercooling leading to enhanced gravitational wave (GW) amplitude within the sensitivity of present and future GW detectors. A minimal scenario with three RHN, one inert scalar doublet and one singlet scalar as additional fields beyond the standard model (BSM) is sufficient to realize this possibility which also favors inert RHN dark matter over inert scalar doublet. While low scale leptogenesis scenario can be probed at future GW detectors like LISA, a sufficiently high scale leptogenesis scenario can be constrained from LIGO-VIRGO data as well. We further show that the simultaneous requirement of satisfying baryon asymmetry and dark matter relic significantly restricts the mass spectrum of BSM particles.

Reference publication/preprint

JHEP 11 (2022) 136,arXiv:2304.08888

Designation

Student

Institution

Indian Institute of Technology Guwahati, Assam, India

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Presenter: SAHA, Indrajit (IIT Guwahati, India)

Session Classification: Parallel: BSM + Cosmology

Contribution ID: **12** Type: **Talk**

Thermalized One-Loop In-medium Baryon resonances in πN matter

Monday, 18 December 2023 16:30 (30 minutes)

We analyse the cross-sections for each of the $2 \to 2$ scattering processes with the modified propagator(s) at the finite temperature in the dense fluid of a strongly interacting pion nucleon system (πN) that are observed in relativistic heavy ion collisions and neutron star mergers. We examine the shape profile of the resulting transport coefficients like shear viscosity, bulk viscosity, and thermal conductivity in the hydrodynamical evolution of dissipative transient hot and dense nuclear matter using the thermalized one-loop in-medium effects of the iso-nucleon (938 MeV) and unstable baryonic resonances Roper (1440 MeV) and Delta (1232 MeV).

Reference publication/preprint

Designation

Faculty

Institution

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Presenter: KALIKOTAY, Pallavi (Department of Physics, Kazi Nazrual University, Asansol, West Bengal. India and Department of Physics, Jadavpur University, Kolkata -700032)

Session Classification: Plenary

Contribution ID: **13** Type: **Talk**

Majorons Revisited: light dark matter as FIMP

Tuesday, 19 December 2023 17:00 (15 minutes)

We show that Majoron, the pseudo-Nambu-Goldstone boson resulting from the spontaneous breaking of global lepton number symmetry, can present itself as a viable freeze-in type of dark matter in a mass range keV-GeV, thanks to the explicit higher dimensional Lepton number breaking operator. Interestingly, the proposal is restricted within the simplest extension of the Standard Model with two singlet right-handed neutrinos and a singlet scalar so to address light neutrino mass and spontaneous breaking of lepton number symmetry respectively. The desired amount of Majoron production takes place from the annihilations of right-handed neutrinos indicating an intriguing connection between neutrino physics and dark matter.

Reference publication/preprint

https://arxiv.org/abs/2212.08404

Designation

Student

Institution

IIT Guwahati

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Presenter: MANNA, Soumen Kumar

Session Classification: Parallel: DM + neutrino

Contribution ID: **17** Type: **Talk**

Constraining New Physics with Possible DM Signatures from the Study of Low Energy Processes

Tuesday, 19 December 2023 15:30 (15 minutes)

We constrain the parameter space of a simplified fermionic dark matter model with a spin-0 mediator from low energy processes. FCNC observables like neutral pseudoscalar meson mixing, rare decays of B_0, B_s^0, K meson, global fit of all the $b \to s\ell\ell$ observables, invisible decays of B and K meson are considered along with FCCC observables like $t \to bW_\mu$ anomalous coupling. Other processes like W-mass anomaly given by CDF(2022) and various observables from Z-pole will also contribute to constrain the SM-mediator couplings. All the processes consdided will come in this model via penguin loop diagram. Depending on the mass of the mediator, model is studied for high mass region $M_S \geq 100GeV$ and low mass region ($M_S \leq 10GeV$) since different observables give significant bound for different regions. We also studied the DM phenomenology where relic density, direct detection crosssection and indirect bound from DM annihilation rate to SM particles are taken into account. Tight bounds on couplings are obtained which can be used for ither phenomenological studies.

Reference publication/preprint

Designation

Student

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Presenter: Ms KOLAY, Lipika (IIT Guwahati)

Session Classification: Parallel: DM + neutrino

Contribution ID: **18** Type: **Poster**

Constraining an extra dimensional U(1)Lmu – Ltau model through electron-neutrino elastic scattering

Wednesday, 20 December 2023 15:00 (15 minutes)

Extra dimensional models are very popular and useful framework to address
many important problems in particle physics. On the other hand extension of the Standard Model (SM) with an extra U(1)Lmu−Ltau gauge group is a great motivation to solve muon (g-2) anomaly (recently 5.1 sigma deviation). Here we considered an extra dimensional U(1)Lmu – Ltau model where only the Kaluza-Klein (KK) modes of the extra dimensional gauge boson can propagate in the bulk and the other SM particles are localised on the SM brane. In this work, we consider constrains on our model from the experiment e.g. CHARM-II, through a powerful process to explore new physics beyond the Standard Model which includes electron-neutrino elastic scattering. We find interesting shape of the allowed region when the inverse size of the extra dimension is around 100 MeV. Also, we will check the parameter space in our model to solve muon (g-2) anomaly.

Reference publication/preprint

Designation

Student

Institution

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Presenter: Mr CHAKRABORTY, Dibyendu (Shiv Nadar Institution of Eminence)

Session Classification: Parallel: DM + neutrino

Contribution ID: **19** Type: **Talk**

Exploring Prospects on an U(1) Lmu – Ltau Extra Dimensional Model by DUNE Near Detector

Wednesday, 20 December 2023 16:45 (15 minutes)

Extra dimensions (ED) offer a valuable tool for constructing intricate models and exploring potential new physics phenomena. Our focus is to extand Standard Model (SM) by introducing an U(1) Lmu – Ltau gauge group in the framework of ED, which serves as a compelling initiative aimed at addressing the muon (g – 2) anomaly. In this model, only the Kaluza-Klein (KK) modes of the extra dimensional gauge boson traverse the bulk, while Standard Model particles remain localized on the SM brane . To validate our model, we rigorously looking at the prospects from the incoming DUNE Near Detector experiment on neutrino-electron elastic scattering. Looking ahead, this methodology holds the promise of generating unique signatures that align with constraints from diverse experiments such as CHARM-II and thereby offering a new way to investigate the structure of an extra spacetime dimension.

Reference publication/preprint

Designation

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Presenter: KAUSHIK, Ayushi (SHIV NADAR UNIVERSITY, GREATER NOIDA)

Session Classification: Parallel: BSM + Cosmology

Contribution ID: **20** Type: **Talk**

Exploring a Novel Dark Hyper Charge Model.

Wednesday, 20 December 2023 17:15 (15 minutes)

We will explore the extensions of the Standard Model (SM) incorporating a new $U(1)$ gauge symmetry. These extensions introduce modifications to the SM's gauge anomaly conditions, which in turn impose restrictions on the charges of fermions. While well-studied solutions, such as $B-L$ and linear combinations of $B-L$ and hypercharge, offer straightforward anomaly cancellations, the exploration of non-trivial chiral solutions has been lacking in the literature. Our research delves into these uncharted chiral solutions, presenting a comprehensive set of solutions for gauge anomaly cancellation through the inclusion of three new right-handed beyond the Standard Model (BSM) fermions (RHNs). These RHNs possess elevated $U(1)x$ charges when compared to their SM counterparts, emphasizing the prominence of decays of new bosons into RHNs. Remarkably, these RHNs emerge as promising candidates for dark matter, with their interactions facilitated by the presence of a Z' boson satisfying the properties of dark matter. We confirm that our proposed dark matter candidate, denoted as $N1$, within a mass range M_{N_1}
$gtrsim150$ GeV, successfully adheres to all pertinent dark matter characteristics and existing constraints.

Reference publication/preprint

Designation

Student

Institution

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Session Classification: Parallel: BSM + Cosmology

Contribution ID: **21** Type: **Poster**

Leptogenesis studied in left-right symmetric model with A_4 modular symmetry

Wednesday, 20 December 2023 17:00 (15 minutes)

In this work, Left-Right Symmetric (LRSM) has been realized with the modular group of level 3, that is, $\Gamma(3)$ and weight 2, which is isomorphic to non-abelian discrete symmetry group A_4. It is a well-known fact that there are physics beyond the Standard Model framework, where several phenomenological studies can be carried out. In our present work, we are concerned about the study of leptogenesis in modular symmetric LRSM.
The advantage of using modular symmetry is that, we do not require the use of any extra particles (flavons) for obtaining the desired results within the realization of the model. In the present study, we are concerned about the phenomena of 'Resonant Leptogenesis (RL)' within the framework of Left-Right Symmetric Model. Some figures have been plotted to show the variation of baryon asymmetry parameter with the parameters incorporated within modular symmetry and it has been found that the results are well within the bounds set by the experiments which suggests that the study of leptogenesis via $\Gamma(3)$ modular realization can prove to be a consistent theory and would help us in studying further phenomenology hereafter.

Reference publication/preprint

Designation

Student

Institution

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Session Classification: Parallel: BSM + Cosmology

Contribution ID: **22** Type: **Talk**

Searching for effects beyond SMEFT in flavour physics

Tuesday, 19 December 2023 17:00 (15 minutes)

Effective field theory (EFT) offers a powerful framework for indirect searches of physics beyond the Standard Model (BSM). Standard Model Effective Field Theory (SMEFT) is one of the most common EFT approaches for such searches. In SMEFT, the $SU(2)_L \times U(1)_Y$ electroweak (EW) symmetry of the Standard Model is linearly realized. However, it is possible that more general EFTs, such as the Higgs Effective Field Theory (HEFT), where the EW symmetry is non-linearly realized, are needed to describe experimental data. Identifying the most suitable EFT description above the EW scale would be critical in order to understand the nature of Higgs and the mode of realization of EW symmetry. In this work, we study the possibility of flavour physics observables in distinguishing between SMEFT and HEFT effects. We explore the effects of scalar and vector new-physics operators that contribute to the charged current process $b \to c\tau\nu_\tau$. The angular distribution of $\Lambda_b \to \Lambda_c(\to \Lambda\pi)\tau\bar{\nu}_\tau$ decay is sensitive to the 6-dimensional effective operators $O_V^{LR} = (\bar{\tau}\gamma^\mu P_L \nu_\tau)(\bar{c}\gamma_\mu P_R b)$, which is present in HEFT but suppressed in SMEFT. We identify the angular observables that can have significant contribution from O_V^{LR}, and hence would be useful for pointing out not only BSM physics but also physics beyond SMEFT. We further find that constraining the branching ratio of $B_c \to \tau\bar{\nu}_\tau$ would be crucial in performing this task.

Reference publication/preprint

arXiv: 2305.16007

Designation

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Presenter: Mr KARMAKAR, Siddhartha (Tata Institute of Fundamental Research, Mumbai)

Session Classification: Parallel : Collider + BSM

Contribution ID: **23** Type: **Talk**

Wave-Packet Effects: A Solution for Isospin Anomalies in Vector-Meson Decay

Tuesday, 19 December 2023 11:00 (30 minutes)

There is a long-standing anomaly in the ratio of the decay width for $\psi(3770) \to D^0\overline{D^0}$ to that for $\psi(3770) \to D^+D^-$ at the level of $9.5\,\sigma$. A similar anomaly exists for the ratio of $\phi(1020) \to K_L^0 K_S^0$ to $\phi(1020) \to K^+K^-$ at $2.1\,\sigma$. In this study, we reassess the anomaly through the lens of Gaussian wave-packet formalism. Our comprehensive calculations include the localisation of the overlap of the wave packets near the mass thresholds as well as the composite nature of the initial-state vector mesons. The results align within $\sim 1\sigma$ confidence level with the Particle Data Group's central values for a physically reasonable value of the form-factor parameter, indicating a resolution to these anomalies. We also check the deviation of a wave-packet resonance from the Briet-Wigner shape and find that wide ranges of the wave-packet size are consistent with the experimental data.

Reference publication/preprint

arXiv:2308.09933 [hep-ph], Accepted for publication in EPJC

Designation

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Shiv Nadar Institution of Eminence

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Presenter: NISHIWAKI, Kenji (Shiv Nadar Institute of Eminence)

Session Classification: Plenary

Contribution ID: **24** Type: **Talk**

Phenomenology of an asymmetric Scotogenic model

Tuesday, 19 December 2023 16:30 (15 minutes)

In this study, we propose a new version of the Scotogenic model, it is an economically appealing theoretical framework which addresses two problems of particle physics, neutrino mass generation and dark matter. The Scotogenic model generates neutrino mass via a 1-loop Feynman diagram by extending the standard model by the Z_2 discrete symmetry.
In our model, we extend the standard model by Z_4, it preserves the divergence cancellation of the loop induced neutrino mass generation, not requiring symmetry between the right and left side of the loop. To constrain our model, we investigate lepton flavour violation of our model through $l_\alpha \to l_\beta + \gamma$ radiative decay. We also take into account results from neutrino oscillation experiments using the Casas-Ibarra parametrization. Additionally, we have also considered dark matter phenomenology, where our Majorana fermion dark matter candidate is able to avoid latest LUX-ZEPLIN direct detection constraints and can reproduce the correct dark matter relic density via the lepton portal as well as for the Higgs portal. We show a viable parameter space of our model which satisfies all the constraints mentioned.

Reference publication/preprint

Designation

Student

Institution

Shiv Nadar Institution of Eminence

Primary author: JOBU, Noel (Shiv Nadar University)

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Presenter: JOBU, Noel (Shiv Nadar University)

Session Classification: Parallel: DM + neutrino

Contribution ID: **25** Type: **Talk**

Realizing Electroweak Baryogenesis in connection to dark sector

Wednesday, 20 December 2023 15:15 (15 minutes)

We propose that electroweak baryogenesis (EWBG) scenario can be operative with the help of an additional SM scalar singlet which is not only responsible for making the electroweak phase transition strongly of first order but also acts as a mediator between the SM and a dark sector. The dark sector is equipped with a singlet-doublet fermion framework that, apart from explaining the observed relic abundance, provides the source of CP violation required for EWBG. This dark sector CP violation is transported in front of the bubble walls and generates a chiral asymmetry for dark sector particles, which in turn gives rise to a SM leptonic chemical potential. This net lepton charge asymmetry is then converted into a baryon number asymmetry through the weak Sphaleron processes. We identify regions of parameter space that can simultaneously explain the observed baryon asymmetry and the correct dark matter relic density and estimate the gravitational wave production as an outcome of strongly first order electroweak phase transition.

Reference publication/preprint

Designation

Student

Institution

Indian Institute of Technology Guwahati

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Co-author: Prof. SIL, Arunansu (IIT Guwahati)

Presenter: BHANDARI, Dipendu

Session Classification: Parallel: DM + neutrino

Contribution ID: **26** Type: **Poster**

Exploring Axions through the Photon Ring of a Spherically Symmetric Black Hole

Wednesday, 20 December 2023 17:15 (15 minutes)

In this study, we examine the phenomenon of photon axion conversion occurring in the spacetime surrounding a black hole. Observations of the black hole in the center of the M87 galaxy (M87 *) through the Event Horizon Telescope imaged polarized synchrotron emission at 230 GHz on event horizon scales. Specifically, we focus on the potential existence of a magnetic field around the supermassive black hole M87*, which could facilitate the conversion of photons into axions in close proximity to the photon sphere. While photons traverse through the curved spacetime, they spend time near the photon sphere, where conversion of these photons into axions takes place. Photons with an impact parameter below a critical value will enter the black hole's event horizon, while those with exactly the critical impact parameter will move in an unstable circular orbit around the black hole which eventually results in a bright ring. The conversion of photons to axions reduces the number of photons escaping the photon sphere, resulting in a dimming effect on the bright ring. To explore the possibilities of detecting these hypothetical axion particles, we propose observing the photon sphere using higher resolution telescopes. By doing so, we can gain valuable insights into the conversion mechanism as well as the nature of the spherically symmetric black hole geometry. Moreover, we also investigate how the photon ring luminosities are affected if the black hole possesses a charge parameter. For instance apart from U(1) electric charge, the presence of extra dimension may induce a tidal charge with a characteristic signature. It is important to note that the success of the conversion mechanism relies on the axion-photon coupling and mass. As a result, the modified luminosity of the black hole's photon ring offers a valuable means of constraining the axion's mass and coupling parameter within a certain range. Thus our findings contribute to a better understanding of photon axion conversion in the environment of a black hole spacetime and helps us explore the possible existence of extra spatial dimension.

Reference publication/preprint

https://arxiv.org/abs/2310.05908

Designation

Student

Institution

Indian Association for the Cultivation of Science

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Presenter: SARKAR, Pratick (Indian Association for the Cultivation of Science)

Session Classification: Parallel: DM + neutrino

Contribution ID: **27** Type: **Talk**

Exotic Particles at LHC and Future Colliders

Monday, 18 December 2023 17:00 (30 minutes)

The Large Hadron Collider (LHC) has already put very strong limits on the Beyond Standard Model particle masses. In most of the LHC searches, it is commonly assumed that these exotic particles are directly produced at the colliders or they decay directly to the Standard Model particles. But, theories such as the Pati Salam Model, Composite Higgs and Little Higgs scenarios suggest that the interaction among different exotic particles can exist, which in turn revels exciting new signatures. Due to the long decay chain, large number of particles are present at the final state. As a result, the search processes at the collider become challenging. In this talk, I will discuss the discovery and exclusion aspects of such alternative searches at the Large Hadron collider and future colliders such as International Linear Collider and Muon Collider.

Reference publication/preprint

https://arxiv.org/abs/2112.09451

Designation

Faculty

Institution

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Primary author: KUMAR, nilanjana

Presenter: KUMAR, nilanjana

Session Classification: Plenary

Contribution ID: **28** Type: **Talk**

Viability of Boosted Light Dark Matter in a Two-component Scenario

Wednesday, 20 December 2023 16:45 (15 minutes)

We study the two-component boosted dark matter (DM) scenario in a neutrinophilic two-Higgs doublet model (ν2HDM), which comprises one extra Higgs doublet with a MeV scale CP-even scalar H. This model is extended with a light (~ 10 MeV) singlet scalar DM $\phi 3$, which is stabilized under the existing Z2 symmetry and can only effectively annihilate through scalar H. As the presence of a light H modifies the oblique parameters to put tight constraints on the model, the introduction of vectorlike leptons (VLL) can potentially salvage the issue. These additional vector-like doublet N and one vector-like singlet χ are also stabilized through the Z2 symmetry. The lightest vectorlike mass eigenstate $\chi 1$ (~ 100 GeV) can be the potential second DM component of the model. Individual scalar and fermionic DM candidates have Higgs/Z mediated annihilation, restricting the fermion DM in a narrow mass region while a somewhat broader mass region is allowed for the scalar DM. In a coupled scenario, light DM $\phi 3$ gets its boost from the $\chi 1$ annihilation while the fermionic DM opens up a new annihilation channel $\chi 1 \chi 1 \longrightarrow \phi 3 \phi 3$: decreasing the relic density. This paves the way for more fermionic DM mass with an under-abundant relic, a region of [35-60] GeV compared to a smaller [40-50] GeV window for the single component fermion DM. On the other hand, the $\phi 3$ resonant annihilation gets diluted due to boosting effects in kinematics, which increases the DM relic leading to a smaller allowed region. To achieve an under-abundant relic, the total DM relic will be dominated by the $\chi 1$ contribution. While there is a region with $\phi 3$ contribution dominating the total DM, the combined relic becomes over-abundant. Therefore, a sub-dominant (~ 5%) boosted scalar is the most favorable light DM candidate to be probed for detection.

Reference publication/preprint

arxiv number 2310.09349

Designation

Student

Institution

SRM University AP

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Presenter: BASU, Arindam (SRM University AP Andhra Pradesh)

Session Classification: Parallel: DM + neutrino

Contribution ID: **29** Type: **Talk**

Bubble dynamics of first order electroweak phase transitions

Monday, 18 December 2023 14:30 (30 minutes)

The early Universe represents a unique laboratory for frontier physics, providing extreme conditions and amazing chances to test theoretical models. A large class of cosmological phenomena may allow us to probe particle physics at energy scales much beyond the reach of current and future colliders. Within this class, first order phase transitions cover a privileged role since they may leave behind several imprints. Among the others, a stochastic background of gravitational waves could be an invaluable experimental handle to the physics beyond the Standard Model, possibly related to the electroweak sector, and complementing collider searches. The crucial properties of cosmological relics depend on the dynamics of the bubbles nucleated during the phase transition: how they interact with the surrounding plasma and the friction they experience. In this talk we discuss about a substantial step forward in the quantitative theoretical description of the bubble dynamics, allowing for unprecedented precision in the extraction of physical observables such as the bubble speed and efficiency factors.

Reference publication/preprint

Designation

Faculty

Institution

Università della Calabria

Primary author: DELLE ROSE, Luigi (Università della Calabria)

Presenter: DELLE ROSE, Luigi (Università della Calabria)

Session Classification: Plenary

Contribution ID: **31** Type: **Talk**

Boosted Top Tagging through Flavour-violating interactions at the LHC

Tuesday, 19 December 2023 17:30 (15 minutes)

We focus on a rare, exotic decay channel of the top quark, t → cH, with H decaying to a pair of b-quarks produced at the High Luminosity runs of the Large Hadron Collider. For our study, we propose and implement a new jet tagging algorithm, which is efficient in identifying the said decay mode of the boosted top using a large-R jet with b- and c-tagged jets inside it. Identifying observables that can effectively discriminate the signal from the Standard Model (SM) backgrounds we perform a Multi Variate Analysis (MVA) and compared the results of two different boosting algorithms, viz., XGBoost and AdaBoost. The comparative analysis of the performance of the proposed top tagger to the conventional cut-based top taggers establishes the proposed tagger to be more efficient than others. Furthermore, we use the game theoretic approach SHAP, to understand the contribution of each observable towards the result of the tagger. Using the tagger for a vector-like quark Y, having a b-quark and a c-quark in the final state, we observe clear resonance peak of the large-R jet at the mass of the Y, signifying the tagger to be also efficient to probe a BSM particle giving the same final state topology, as the above-mentioned top quarks with flavour-violating decay mode.

Reference publication/preprint

arXiv:2310.10763

Designation

Student

Institution

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Presenter: CHOWDHURY, Shreecheta (SRM University-AP)

Session Classification: Parallel : Collider + BSM

Contribution ID: **33** Type: **Talk**

Scotogenic $U(1)_{L_\mu - L_\tau}$ origin of $(g-2)_\mu$, W-mass anomaly and 95 GeV excess

Wednesday, 20 December 2023 16:30 (15 minutes)

We study a scotogenic extension of the minimal gauged $L_\mu - L_\tau$ model, including three right-handed singlet fermions and a scalar doublet all odd under an in-built Z_2 symmetry to explain the anomalous magnetic moments of the muon, CDF-II W-mass anomaly, and the 95 GeV excess reported by the CMS collaboration. While the minimal model can successfully explain the muon $(g-2)$ and CDF-II W-mass anomalies, the required diphoton signal strength for the 95 GeV scalar, together with that of the SM Higgs, can not be obtained in the minimal model. The same can, however, be explained by incorporating two additional scalar doublets whose only role is to contribute radiatively to diphoton decay modes of the light, neutral scalars. Due to the scotogenic extension, the model remains consistent with the observed properties of light neutrinos and dark matter in the Universe.

Reference publication/preprint

2310.11953

Designation

Student

Institution

IIT Hyderabad

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Presenter: Mr PAUL, Partha Kumar (IIT Hyderabad)

Session Classification: Parallel: BSM + Cosmology

Contribution ID: **34** Type: **Talk**

Self-interacting dark matter and the GRB221009A event

Wednesday, 20 December 2023 14:30 (15 minutes)

In this work, we explore the intriguing possibility of connecting self-interacting dark matter (SIDM) with the recently observed exceptionally bright and long-duration gamma-ray burst (GRB221009A). The proposed minimal scenario involves a light scalar mediator, simultaneously enabling dark matter (DM) self-interaction and explaining the observed very high energy photons from GRB221009A reported by Large High Altitude Air Shower Observatory (LHAASO) data. The scalar's mixing with the Standard Model Higgs boson allows for its production at the GRB site, which will then propagate escaping attenuation by the extragalactic background light. These scalars, if highly boosted, have the potential to explain LHAASO's data. Moreover, the same mixing also facilitates DM-nucleon or DM-electron scatterings at terrestrial detectors, linking SIDM phenomenology to the GRB221009A events. This manuscript presents the parameter space meeting all constraints and offers an exciting opportunity to explore SIDM in future direct search experiments using insights from the GRB observation.

Reference publication/preprint

https://doi.org/10.1103/PhysRevD.108.083038

Designation

Student

Institution

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Presenter: SINGH THOUNAOJAM, Vicky (Indian Institute of Technology, Hyderabad)

Session Classification: Parallel: DM + neutrino

Contribution ID: **35** Type: **Talk**

Singlet-doublet fermion dark matter with Dirac neutrino mass, (g – 2)μ and ∆Neff

Wednesday, 20 December 2023 14:45 (15 minutes)

We study the possibility of generating light Dirac neutrino mass via scotogenic mechanism where singlet-doublet fermion dark matter (DM) plays non-trivial role in generating one-loop neutrino mass, anomalous magnetic moment of muon $(g-2)_\mu$ as well as additional relativistic degrees of freedom $\Delta N_{\rm eff}$ within reach of cosmic microwave background (CMB) experiments. We show that the Dirac nature of neutrinos can bring interesting correlations within the parameter space satisfying the $(g-2)_\mu$ anomaly and DM relic density and the effective relativistic degrees of freedom $\Delta N_{\rm eff}$. While we stick to thermal singlet doublet DM with promising detection prospects, both thermal and non-thermal origin of $\Delta N_{\rm eff}$ have been explored. In addition to detection prospects of the model at DM, $(g-2)$ and other particle physics experiments, it remains verifiable at future CMB experiments like CMB-S4 and SPT-3G.

Reference publication/preprint

https://doi.org/10.48550/arXiv.2310.03721

Designation

Student

Institution

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Presenter: KUMAR SAHOO, Sujit (Indian Institute of Technology Hyderabad)

Session Classification: Parallel: DM + neutrino

Contribution ID: **36** Type: **Talk**

Probing Dark Matter-Electron Interactions in the Cosmic Microwave Background Radiation

Wednesday, 20 December 2023 17:00 (15 minutes)

Cosmological observations offer valuable methods for probing various characteristics of Dark Matter (DM). We examine the cosmological implications of higher-dimensional Non-Relativistic Effective Field Theory (EFT) operators for Dark Matter(DM) - electron interactions. We focus on velocity-independent operators and simultaneously incorporate DM-electron scattering and DM annihilation into electron-positron pair in the background equations. We utilize the Planck 2018 Cosmic Microwave Background Radiation (CMBR) dataset to constrain these effective operators. Our analysis underscores the importance of simultaneously accounting for scattering and annihilation processes when constraining effective operators, as they are governed by the same operators. We observe that the constraints change considerably (depending on the DM mass) from the studies where only DM-electron scattering or DM annihilation is taken into account.

Reference publication/preprint

Designation

Student

Institution

Shiv Nadar Institution of Eminence (Deemed to be University)

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Presenter: DHYANI, Rahul (Shiv Nadar Institution of Eminence (Deemed to be University))

Session Classification: Parallel: DM + neutrino

Contribution ID: **37** Type: **Talk**

Radiative Corrections to the Direct Detection of the Higgsino-like Neutralino Dark Matter: Spin-Independent Interactions

Wednesday, 20 December 2023 15:45 (15 minutes)

The lightest Neutralino is a good Dark Matter (DM) candidate
in the R-parity conserving Minimal Supersymmetric Standard Model (MSSM). In this work, we consider light Higgsino-like Neutralino as the Lightest
Stable Particle (LSP), thanks to a relatively small μ parameter. We then estimate the prominent radiative corrections to the Neutralino-Neutralino-Higgs boson vertices.
We show that these corrections can significantly affect the
spin-independent direct detection cross-section for Higgsino-like Neutralino, even reaching close to 100% in certain regions of the parameter space. These corrections, therefore, play an essential role in deducing constraints on the mass of the Higgsino-like Neutralino Dark Matter and thus the μ parameter.

Reference publication/preprint

Designation

Student

Institution

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Presenter: PASHA, Syed Adil (Shiv Nadar Institution of Eminence, Greater Noida)

Session Classification: Parallel: DM + neutrino

Contribution ID: **38** Type: **Talk**

$\mathcal{Z}_N \times \mathcal{Z}_M$ Flavour Symmetry

The $\mathcal{Z}_N \times \mathcal{Z}_M$ symmetry is a novel flavour symmetry, that can provide an explanation to the flavour structure of the Standard Model through the Froggatt-Nielsen mechanism. We have investigated the flavour bounds on the minimal $\mathcal{Z}_2 \times \mathcal{Z}_5$, and a non-minimal $\mathcal{Z}_2 \times \mathcal{Z}_9$ version of this symmetry using the current quark and lepton flavour physics data as well as the future projected sensitivities of the quark and lepton flavour effects. It turns out that the future high-luminosity phase-I and II of the LHCb are going to play a crucial role in constraining the parameters of the minimal and the non-minimal $\mathcal{Z}_2 \times \mathcal{Z}_N$ flavour symmetries.

Reference publication/preprint

https://doi.org/10.1140/epjc/s10052-023-11471-5

Designation

Student

Institution

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Presenter: Ms SINGH, Neelam (Indian Institute of Technology, BHU, Varanasi)

Session Classification: Parallel : Collider + BSM

Contribution ID: **39** Type: **Talk**

Light Dirac neutrino portal dark matter with gauged B-L symmetry

Tuesday, 19 December 2023 15:45 (15 minutes)

We study a scenario where origin of dark matter is related to the Dirac nature of neutrino, known as the light Dirac neutrino portal dark matter (DNPDM). In such DNPDM set up, light dirac neutrinos take the role of mediating the interactions between dark matter (DM) and standard model (SM) bath. Here, we consider a UV complete model in gauged B-L framework extended by three species of right handed neutrinos (ν_R), two singlet scalars ϕ_1 and ϕ_2 and a Dirac fermion ψ which acts as DM. While the neutrino mass is generated from ν_R, the two scalars ϕ_1 and ϕ_2 with non-zero B-L charge help in realising light Dirac neutrino portal DM and spontaneous B-L symmetry breaking respectively. The beyond SM particles interact among themselves via yukawa coupling depending on which, we have both feebly interacting massive particle (FIMP) and weakly interacting massive particle (WIMP) type DM. We consider both the possibilities and find out the model parameters consistent with DM abundance and effective number of relativistic species, $N_{\rm eff}$. We also study the constraint obtained from structure formation for FIMP type DM. The model not only gives rise to the desired DM phenomenology with observable $\Delta \mathrm{N_{eff}}$, but also leads to new constraints in the gauged $B-L$ parameter space not obtained previously.

Reference publication/preprint

Designation

Student

Institution

Indian Institute of Technology Guwahati

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Presenter: DAS, Nayan (Indian Institute of Technology, Guwahati)

Session Classification: Parallel: DM + neutrino

Contribution ID: **40** Type: **Talk**

SMEFT analysis of charged lepton flavor violating B-meson decays

Tuesday, 19 December 2023 14:50 (20 minutes)

Charged lepton flavor violation (cLFV) processes, potentially important for various Beyond the Standard Model Physics scenarios, are analyzed in the Standard Model Effective Field Theory (SMEFT) framework. We consider the most relevant 2 quark-2 lepton $(2q2\ell)$ operators for the leptonic and semi-leptonic LFV B-decay (LFVBD) processes $B_s \to \mu^+ e^-, B^+ \to K^+ \mu^+ e^-, B^0 \to K^{*0} \mu^+ e^-$, and $B_s \to \phi \mu^- e^+$. We analyse the interplay among the Wilson coefficients responsible for these LFVBDs and other cLFV processes like CR($\mu \to$ e), $\ell_i \to \ell_j \gamma$, $\ell_i \to \ell_j \ell_k \ell_m$ and $Z \to \ell_i \ell_j$, to find the maximal possible LFV effects in B-meson decays. We probe the scale of new physics in relation to the constraints imposed by both classes of the LFV decays while considering both the present bounds and future expectations. In view of proposed experiments at LHCb-II and Belle II to study charged LFV processes, we have also provided the upper limits on the indirect constraints on such LFVBDs. For the processes where B meson is decaying to $\mu^\pm$ and $e^\mp$, we show that new physics can be constrained by an enhancement of 2-4 orders of magnitude on the current sensitivities of the BRs of $B^+ \to K^+ \mu^+ e^-, B^0 \to K^{*0} \mu^+ e^-$and $B_s \to \phi \mu^\pm e^\mp$.

Reference publication/preprint

Designation

Postdoc

Institution

Indian Association for the Cultivation of Science (IACS), Kolkata

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Presenter: Dr ROY, Joydeep (Indian Association for The Cultivation of Science (IACS), Kolkata)

Session Classification: Parallel : Collider + BSM

Contribution ID: **43** Type: **Talk**

$W-$mass and lepton $g-2$ in extended inert 2HDM

Monday, 18 December 2023 18:00 (30 minutes)

The new muon $g-2$ measurement yields about 5.1 sigma deviation from the Standard Model (SM) prediction. Moreover, the measurement of the W boson mass performed by the CDF experiment at the Tevatron shows a significant deviation not only from the SM value but also with the other precision measurements performed at LEP and LHC. In this work, we address these two discrepancies by extending the inert two Higgs Doublet Model (2HDM) with a SM gauge singlet complex scalar field and a singlet Vector-like Lepton (VLL) field. We obtain the allowed parameter space constrained from the Higgs decays to gauge Bosons at LHC, LEP II data and electro-weak precision measurements. This constrained parameter space is used to calculate the anomalous magnetic moment of leptons and $W-$boson mass. We find that the parameter space of the model constrained from the electroweak precision experiments can simultaneously explain the $W-$boson mass and lepton magnetic moment anomalies.

Reference publication/preprint

JHEP 11 (2021) 056, arXiv: 2109.02586 [hep-ph]

Designation

Faculty

Institution

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Presenter: BHARADWAJ, Hrishabh

Session Classification: Plenary

Contribution ID: **44** Type: **Talk**

Renormalization-group improved Higgs to two gluons decay rate

We investigate the renormalization group scale and scheme dependence of the $H \to gg$ decay rate at the order N^4LO in renormalization-group summed perturbative theory, which employs the summation of all renormalization-group accessible logarithms including the leading and subsequent four sub-leading logarithmic contributions to the full perturbative series expansion. The main advantage of this approach is the closed-form analytic expressions, which represent the summation of all RG-accessible logarithms in the perturbative series that is known to a given order. The new renormalization-group summed expansion for the $H \to gg$ decay rate shows an improved behaviour by exhibiting a reduced sensitivity to the renormalization-group scale. Moreover, we study the higher-order behaviour of the $H \to gg$ decay width using the asymptotic $Padé$ approximant method in four different renormalization schemes. Furthermore, the higher-order behaviour is independently investigated in the framework of the asymptotic $Padé$-Borel approximant method where generalized Borel-transform is used as an analytic continuation of the original perturbative expansion. The predictions of the asymptotic $Padé$-Borel approximant method are found to be in agreement with that of the asymptotic $Padé$ approximant method.

Reference publication/preprint

arXiv.2205.06061v2 [hep-ph]

Designation

Student

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Presenter: RES. SCHOLAR, PHYSICS, IIT(BHU), VARTIKA SINGH (Indian Institute of Technology, BHU)

Session Classification: Parallel: BSM + Cosmology

Contribution ID: **45** Type: **Talk**

Complementary Probe of Beyond the Standard Model Physics with Gravitational Waves from Electroweak Phase Transition

Wednesday, 20 December 2023 14:45 (15 minutes)

Studying cosmic phase transitions is a key focus in modern cosmology and particle physics. Both new and existing physics at any scale can be responsible for catalyzing either a first, second, or cross-over phase transition, which could be thermal or non-thermal with an observable imprint, such as stochastic gravitational waves (GW). Understanding the sources of such primordial waves can serve as complementary to the collider searches of new physics beyond the Standard Model (BSM). Strong first-order phase transitions (SFOPT), a necessary ingredient for Electroweak Baryogenesis (EWBG) to incorporate the observed baryon asymmetry, can also give rise to GWs. We explored two BSM frameworks: one supersymmetric (SUSY) and one non-SUSY model as promising candidates for Electroweak Baryogenesis (EWBG) that can produce detectable gravitational waves (GWs) at space-based detectors. For a SUSY extended model scenario, the $\mathcal{Z}_3$ -invariant Next-to-Minimal Supersymmetric Standard Model is (NMSSM) extended with a right-handed neutrino (RHN) superfield, and we found that strong first-order phase transitions (FOPTs) may occur in regions favoring a light right-handed sneutrino-like state below 125 GeV, with predicted GWs detectable within the sensitivity range of DECIGO-corr, U-DECIGO, U-DECIGO-corr [[1]]. Additionally, we propose a multi-component dark matter (DM) scenario involving the neutral part of a $Y = 0$ scalar triplet and a Majorana fermion. Our investigation explores the parameter space for strong phase transitions, correct relic density, and direct detection compatibility, offering an alternative probe to the collider experiments.

1 P. Borah, P. Ghosh, S. Roy and A. K. Saha, Electroweak Phase Transition in a Right-Handed Neutrino Superfield Extended NMSSM JHEP 08 (2023) 029, [2301.05061][hep-ph]

Reference publication/preprint

Designation

Student

Institution

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Presenter: Mr BORAH, Pankaj (Indian Institute of Technology Delhi)

Session Classification: Parallel: BSM + Cosmology

Contribution ID: **46** Type: **Talk**

Dynamic Radius Jet Clustering Algorithm

Tuesday, 19 December 2023 15:10 (20 minutes)

The emergence of jets, bunches of collimated hadrons, in high-energy colliders is a prevalent phenomenon. In the current LHC context, along with traditional narrow QCD jets, the study of fat jets, which may appear as a result of the decay of a heavy particle, has become an essential part of collider studies. Current jet clustering algorithms, namely k_t-type sequential recombination algorithms, use fixed radius parameters for the formation of jets from the hadrons of an event in a collider. The appearance of differently-sized jets in a single event from such algorithms is, therefore, impossible to achieve. In our work, we made an attempt to form differently-sized jets via the dynamic radius chosen during the evolution of each jet. Instead of keeping the constant radius parameter of the standard k_t-type sequential recombination algorithms, we allowed the radius to vary dynamically based on the local kinematics and distribution in the η-ϕ plane around each evolving jet. In this talk, I will discuss our methodology of the dynamic radius jet algorithm. I will then present the usefulness of the algorithm at the 13˜TeV LHC through some example processes from SM and BSM scenarios.

Reference publication/preprint

https://doi.org/10.1103/PhysRevD.108.075004

Designation

Postdoc

Institution

Indian Institute of Science Education and Research Kolkata

Primary authors: Prof. MUKHOPADHYAYA, Biswarup (Indian Institute of Science Education and Research Kolkata); Dr SINGH, Ritesh (Indian Institute of Science Education and Research Kolkata); Dr SAMUI, Tousik (Indian Institute of Science Education and Research Kolkata)

Presenter: Dr SAMUI, Tousik (Indian Institute of Science Education and Research Kolkata)

Session Classification: Parallel : Collider + BSM

Contribution ID: **48** Type: **Talk**

Signatures of the inert triplet model from vector boson fusion at a muon collider

Tuesday, 19 December 2023 16:30 (15 minutes)

The Inert Triplet Model (ITM) is a much-studied Dark Matter model that extends the Standard Model (SM) of particle physics with a scalar $SU(2)$ triplet having hypercharge $Y = 0$. The various DM experiments rule out a significant portion of the parameter space, cornering the model to an allowed region of TeV scale masses. The compressed mass spectrum of the scalars lead to displaced decays, which promise to be definitive Beyond the Standard Model (BSM) signatures. However, production rates of such heavy particles at the LHC is very low, and hence we focus on discovery signatures at a multi-TeV muon collider. Production of these BSM scalars via vector boson fusion (VBF) at the muon collider is studied for two centre-of-mass energies of 6 TeV and 10 TeV. Disappearing track signatures with Forward muons are analysed for the model, and sensitivity estimates are presented in multiple final states.

Reference publication/preprint

Designation

Student

Institution

Indian Institute of Technology Hyderabad

Primary author: PARASHAR, Snehashis (IIT Hyderabad)

Presenter: PARASHAR, Snehashis (IIT Hyderabad)

Session Classification: Parallel : Collider + BSM

Contribution ID: **50** Type: **Talk**

Dark Matter and Collider Signals in the Alternative Left-Right Model

Wednesday, 20 December 2023 09:00 (45 minutes)

Left-right symmetric models fill in some of the lacunae in the Standard Model, such as providing an explanation for parity and neutrino masses. But the additional bosons in the theory must be heavy to avoid flavor-changing neutral currents, and the models lack a natural dark matter candidate. The Alternative Left-Right Model, emerging from E6 grand unification, is an attractive variation of the usual Left-Right Symmetric Model because it rectifies both these problems.
We present an analysis of this model, including a large set of theoretical and experimental constraints, with a particular emphasis on dark matter (which can be fermionic or bosonic) and collider signals for exotic quarks and light bosons, in particular the W'.
We also examine flavour-changing decays of the top quark, enhanced in the Alternative Left-Right Model through the presence of exotic quarks, allowing these to be probed indirectly.

Reference publication/preprint

Designation

Faculty

Institution

Concordia University

Primary author: FRANK, Mariana (Concordia University)

Presenter: FRANK, Mariana (Concordia University)

Session Classification: Plenary

Contribution ID: **51** Type: **Talk**

Relic Density Aspects of a Boosted Light Dark Matter Scenario

Monday, 18 December 2023 17:30 (30 minutes)

Light dark matter (DM) is getting increasingly more important in our quest to probe the dark sector physics. Direct detection of a sub-GeV scale dark matter is difficult as it lacks sufficient kinematic heft to have significant nuclear or electron recoil. In this regard, a boosted dark matter plays an interesting role. Before attempting to detect a boosted dark matter, we explore a possible BSM scenario where a boosted DM arises very naturally as an artefact of the model construction. We also show how one can have a boosted DM in a two component dark sector, where a TeV scale heavier fermion DM can annihilate to a lighter scalar DM: gives it a boost. Both the heavier and lighter DM relic densities receive potential modification in the boosted scenario. We investigate the allowed parameter space in the context of relic density, once taking the two dark matter candidates individually and then taking them together in a coupled scenario, where boost effects can be important.

Reference publication/preprint

2310.09349 [hep-ph]

Designation

Faculty

Institution

Ramakrishna Mission Residential College (Autonomous), Vivekananda Centre for Research

Primary author: SADHUKHAN, Soumya (Ramakrishna Mission Residential College (Autonomous), Vivekananda Centre for Research, Narendrapur, Kolkata, West Bengal, India-700149)

Presenter: SADHUKHAN, Soumya (Ramakrishna Mission Residential College (Autonomous), Vivekananda Centre for Research, Narendrapur, Kolkata, West Bengal, India-700149)

Session Classification: Plenary

Contribution ID: **52** Type: **Talk**

Probing Dark Matter Interactions in the Light of CMBR

Monday, 18 December 2023 15:30 (30 minutes)

In the standard cosmology, Dark Matter (DM) is generally assumed to be non-interacting. However, in several well-motivated particle physics models, which include a DM candidate, it participates in various interactions. In particular, we have considered interactions of DM
with neutrinos and electrons. Such interactions, if present in the early Universe, can leave imprints in the anisotropies observed in the Cosmic Microwave Background Radiation (CMBR). We have investigated such scenarios in light of CMBR data from the Planck collaboration. Considering specific forms of interactions, we further obtain the constraints on the relevant lagrangian parameters.

Reference publication/preprint

Designation

Faculty

Institution

Shiv Nadar IoE Deemed to be University

Primary authors: CHATTERJEE, Arindam; PAUL, Arnab (IACS); Mr DHYANI, Rahul (SNIoE)

Presenter: CHATTERJEE, Arindam

Session Classification: Plenary

Contribution ID: **55** Type: **Talk**

Thermal correction to Dark matter annihilation processes at NLO

Wednesday, 20 December 2023 15:30 (15 minutes)

In a scattering process in a thermal plasma, thermal fluctuation alongside with quantum fluctuation affects the annihilation cross section of particles. This is important in the context to dark matter annihilation cross section since the relic densities are now being more precisely measured. We investigate the effect of thermal fluctuation on the annihilation cross section of a $SU(2)\times U(1)$ singlet, bino-like thermal dark matter particle χ of mass $m_\chi \sim \mathcal{O}(0.1 - 1\ TeV)$, annihilating to standard model fermion $(f^0, f^-)^T$ through scalar channel (ϕ^+, ϕ^0) of mass $m_\phi > m_\chi$, in an MSSM inspired BSM theory with Yukawa interaction ($\mathcal{L} \supset \lambda\lambda\,\overline{\chi}P_L f^-\phi^+ + h.c.$), utilizing generalized Grammer and Yennie technique in thermal field theory in real-time formalism. We find the IR divergences cancel at NLO order between real and virtual photon corrections. In particular, we find the finite reminder shows a quadratic dependence of the scattering cross section on temperature $\sigma_T \propto T^2$, for the process $\chi\bar{\chi} \to f\bar{f}$ at NLO, on considering various kinematically allowed cases, in the limit where the heavy scalars are assumed to be non-dynamical. Contribution arises from both the cases, with photon or fermion to be thermal, both giving rise to T^2 terms.

Keywords : Dark Matter, IR divergences, Thermal Field Theory

Reference publication/preprint

Designation

Student

Institution

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Presenter: Mr BUTOLA, Prabhat (Homi Bhabha National Institute, Mumbai & The Institute of Mathematical Sciences, Chennai)

Session Classification: Parallel: DM + neutrino

Contribution ID: **57** Type: **Talk**

Astrophysical Q-balls and their gravitational microlensing signature

Wednesday, 20 December 2023 15:00 (15 minutes)

Recent developments in dark matter research have spiked investigations into extended configurations within this mysterious sector. Depending on various parameters within the underlying dark matter model, these extended structures may exhibit distinct properties. Furthermore, investigating their gravitational microlensing signature will be instrumental for observational purposes. In my talk, I will elucidate the formation of these extended structures arising from a non-topological soliton configuration known as Q-balls. I will explain in detail the limitations imposed on their sizes and the constraints on underlying parameters, grounded in considerations of gravitational stability and solution viability. Additionally, I will describe their unique gravitational microlensing signatures. Assuming that these astrophysical Q-balls could constitute a minor component of dark matter in the universe, I will establish limits on this fraction using data from gravitational microlensing surveys such as EROS-2, OGLE-IV, HSC-Subaru, and the proposed future survey WFIRST.

Reference publication/preprint

arXiv:2302.11590

Designation

Student

Institution

INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH PUNE

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Presenter: BHANDARI, Lalit Singh (INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH PUNE)

Session Classification: Parallel: BSM + Cosmology

Contribution ID: **60** Type: **Talk**

Next-to-minimal Vectorlike Quark models at the LHC: Bounds and Prospects

Tuesday, 19 December 2023 16:45 (15 minutes)

Non-observation of vectorlike quarks (VLQs) at the LHC motivates us to look for possible gaps in their collider searches. We discuss a scenario where the VLQs decay substantially to a new singlet scalar (or pseudoscalar) that couples dominantly to the VLQs. Such a singlet state can be motivated in various BSM scenarios. The current mass limits on the VLQs ($1.2 - 1.6$ TeV, for various weak representations and decays) relax significantly if the VLQs have such additional decay(s). We present the current bounds on VLQs for this scenario and chart a model-independent roadmap to look for such VLQ decays. We also identify the possible signatures for pair-production searches and present a projection study for some promising channels for the weak-singlet top and bottom partner extensions at the HL-LHC.

Reference publication/preprint

arXiv:2203.13753, arXiv: 2204.09005, arXiv:2212.02442

Designation

Student

Institution

IIIT Hyderabad

Primary author: NEERAJ, Cyrin

Co-authors: Dr BHARDWAJ, Akanksha (University of Glasgow); Mr BARDHAN, Jai (IIIT Hyderabad); BHIDE, Kartik Deepak (Albert Ludwigs Universitaet Freiburg (DE)); MITRA, Subhadip; Dr MANDAL, Tanumoy (IISER Thiruvananthapuram)

Presenter: NEERAJ, Cyrin

Session Classification: Parallel : Collider + BSM

Contribution ID: **61** Type: **Talk**

Quantum Spread Complexity in Neutrino Oscillations

Tuesday, 19 December 2023 14:50 (20 minutes)

Neutrino flavor oscillation is a widely studied physical phenomenon with significant implications for our understanding of particle physics and the search for physics beyond the standard model. Oscillation arises due to the mixing between flavor and mass eigenstates, and their evolution over time. It is a quantum system where flavor transitions are typically studied using probabilistic measures. Neutrinos have also shown potential for quantum information tasks due to their inherent features, such as entanglement and nonlocal correlations. Quantum information theory is a rapidly growing field of research, with various measures of quantum correlations and entanglement tested for their ability to be used for diverse quantum information processing tasks. One such measure, quantum complexity, is increasingly being applied to investigate complex systems in many areas of physics. However, its practical application to physical systems is still limited. In this context, the quantum complexity formalism can be used as an alternative measure to study neutrino oscillations. In particular, quantum spread complexity can reveal additional information about the violation of charge-parity symmetry in the neutrino sector. Our results suggest that complexity favors the maximum violation of charge-parity, which is consistent with recent experimental data.

Reference publication/preprint

arXiv:2305.17025 [hep-ph]

Designation

Postdoc

Institution

Centre for Astro-Particle Physics (CAPP), University of Johannesburg

Primary authors: Dr DIXIT, Khushboo (Centre for Astro-Particle Physics, University of Johannesburg); Dr HAQUE, S. Shajidul (University of Cape Town); Prof. RAZZAQUE, Soebur (Centre for Astro-Particle Physics, University of Johannesburg)

Presenter: Dr DIXIT, Khushboo (Centre for Astro-Particle Physics, University of Johannesburg)

Session Classification: Parallel: DM + neutrino

Contribution ID: **63** Type: **Talk**

Probing photon-axion-like particle (ALP) oscillations from the FSRQ QSO B1420+326

Wednesday, 20 December 2023 15:45 (15 minutes)

We investigate the effect of photon-axion-like particle (ALP) oscillations in the gamma-ray spectra of FSRQ B1426+326 measured by Fermi-LAT and MAGIC around the flaring activity in January 2020. We set 95% confidence level (C.L.) upper limit on the photon-ALP coupling constant $g_{a\gamma} < 2 \times 10^{-11}$ GeV^{-1} for ALP masses $m_a \sim 10^{-10} - 10^{-9}$ eV. Assuming the hadronic origin of very-high-energy (VHE) photons, we also estimate the expected neutrino flux and the cumulative flux from QSO B1420+326-like FSRQs at sub-PeV energies. Furthermore, we study the implications of photon-ALP oscillations on the counterpart γ-rays of the sub-PeV neutrinos. Finally, we investigate a viable scenario of invisible neutrino decay to ALPs on the gamma-ray spectra and diffuse γ-ray flux at sub-PeV energies. Interestingly, we find that for the choice of neutrino lifetime $\tau_2/m_2 = 10^3$ s eV^{-1}, the γ-ray flux has a good observational sensitivity towards LHAASO-KM2A.

Reference publication/preprint

arXiv:2310.16634

Designation

Student

Institution

Indian Institute of Technology Jodhpur

Primary author: PANT, Bhanu Prakash (Indian Institute of Technology Jodhpur, India)

Presenter: PANT, Bhanu Prakash (Indian Institute of Technology Jodhpur, India)

Session Classification: Parallel: BSM + Cosmology

Contribution ID: **64** Type: **Talk**

Spinning Primordial Black Holes from First Order Phase Transitions

Wednesday, 20 December 2023 15:30 (15 minutes)

This talk concerns a novel study to obtain the initial spin of the primordial black holes created during a first-order phase transition due to delayed false vacuum decay. Remaining within the parameter space consistent with observational bounds, the abundance and the initial spin of the primordial black holes are expressed as functions of the phase transition parameters. The abundance of the primordial black holes is extremely sensitive to the phase transition parameters. It was also found that the initial spin weakly depends on all parameters except the transition temperature.

Reference publication/preprint

Designation

Student

Institution

IISER Berhampur

Primary authors: BANERJEE, Indra Kumar; DEY, Ujjal Kumar (IISER Berhampur)

Presenter: BANERJEE, Indra Kumar

Session Classification: Parallel: BSM + Cosmology

Contribution ID: **67** Type: **Talk**

The Hunt for Non-Resonant Signals of Axion-Like Particles at the LHC

Tuesday, 19 December 2023 15:30 (15 minutes)

We will discuss an Effective Field Theory which extends the SM by an Axion-Like Particle (ALP) and mainly focus on the interactions of a light ALP to heavy SM particles. The talk is dedicated to the role of the LHC in probing ALP couplings particularly with the Higgs boson and the gauge bosons. We discuss a recent proposal to hunt for ALP signals in the non-resonant regime, i.e. when the ALP is kinematically too light to be on-shell. We use high-energy LHC probes, and examine the Higgs-strahlung process and the production of the diboson and triboson final states. Working in a gauge-invariant framework, upper limits on ALP couplings to the Higgs boson and the electroweak bosons are obtained from the reinterpretation of latest LHC Run II data. The constraints inferred on ALP couplings are very competitive for ALP masses up to 100 GeV. Simple projections for HL-LHC will also be discussed, demonstrating the power of future dedicated analyses at ATLAS and CMS.

Reference publication/preprint

Designation

Student

Institution

University of Calcutta

Primary author: BISWAS, Tisa (University of Calcutta)

Presenter: BISWAS, Tisa (University of Calcutta)

Session Classification: Parallel : Collider + BSM

Contribution ID: **68** Type: **not specified**

Inauguration

Monday, 18 December 2023 09:00 (30 minutes)

Session Classification: Plenary

Contribution ID: **69** Type: **Talk**

Bubble-assisted Leptogenesis

Monday, 18 December 2023 09:30 (45 minutes)

In this talk, we discuss leptogenesis occurring at the time of the first order phase transition of U(1)_B-L breaking, dubbed as bubble assisted leptogenesis, in which the strong wash-out can be circumvented due to an efficient departure from equilibrium offered by the relativistic expansion of true phase bubbles. Taking carefully into account all the efficiency factors such as penetration rate, dilution by reheating as well as depletion by annihilation, we find that a successful leptogenesis can be achieved for masses as low as 10ˆ9 GeV even in the usual strong wash-out regime. We also examine the typical gravitational wave signatures possibly observable at terrestrial interferometers.

Institution

Designation

Faculty

Reference publication/preprint

Presenter: CHUN, Eung Jin

Session Classification: Plenary

Contribution ID: **70** Type: **Talk**

Thermal field theory of dark matter and thermal corrections to dark matter annihilation cross sections

Monday, 18 December 2023 10:15 (45 minutes)

Models incorporating moderately heavy dark matter (DM) typically need charged (scalar) fields to establish admissible relic densities. Since the DM freezes out at an early epoch, thermal corrections to the cross sections can be important. Here, we study the IR behaviour at finite temperatures, of dark matter annihilation cross sections, which potentially contains both both linear and sub-leading logarithmic divergences. We prove that the theory is IR-finite to all orders with the divergences cancelling when both absorption and emission of photons from and into the heat bath are taken into account. While 4-point interaction terms are known to be IR finite, their inclusion leads to a neat exponentiation. The finite remainder has then been calculated to NLO in the theory; these corrections can affect the collision term in the Boltzmann equation and in principle alter the dark matter relic density.

Institution

Designation

Faculty

Reference publication/preprint

Presenter: INDUMATHI, D (The Institute of Mathematical Sciences, Chennai)

Session Classification: Plenary

Contribution ID: **71** Type: **not specified**

Is light neutralino thermal DM ruled out in the PMSSM?

Monday, 18 December 2023 11:30 (40 minutes)

We have explored the parameter space for the phenomenological minimal supersymmetric standard model (PMSSM) with specific focus on the region with a light neutralino dark matter (with mass less than half the mass of the Higgs), which is consistent with current collider and astrophysical constraints. We show that the latest results from the LHC searches for sparticles and direct detection constraints from XENON and LUX-ZEPLIN , basically rule out all the region for positive sign of the Higgsino mass parameter mu whereas for the negative sign only a very narrow region with light electro-weakinos is allowed. We further show that it should be possible to explore this region conclusively in the Run-3 of the LHC. We have also studied the impact of a possible light stau on our results

Institution

Designation

Faculty

Reference publication/preprint

Presenter: GODBOLE, Rohini (Centre for Theoretical Studies (CTS))

Session Classification: Plenary

Contribution ID: **72** Type: **not specified**

Diphoton jets to probe light fermiophobic Higgs boson signals at the HL-LHC

Monday, 18 December 2023 12:10 (40 minutes)

We study the phenomenological signatures associated with a light fermiophobic Higgs boson within the type-I two-Higgs-doublet model at the HL-LHC. Our exhaustive parameter scan revealed a captivating mass range between 1 GeV and 10 GeV. This range retains a substantial number of viable parameter points, primarily due to the current experimental difficulties in probing soft decay products of the light fermiophoibic Higgs, two photons. A major obstacle arises as two photons from its decay tend to merge into one jet because of their proximity. This leads to dominating QCD backgrounds. To address this, we utilize EFlow objects within the Delphes framework, identifying a jet containing two photons, termed a diphoton jet. Through our full detector-level simulations across 18 benchmark points, the majority presented signal significances beyond 5 at an integrated luminosity of 3/ab. In challenging scenarios with a heavier charged Higgs boson, our incorporation of machine learning techniques demonstrated a significant enhancement.

Institution

Designation

Faculty

Reference publication/preprint

Presenter: Prof. SONG, Jeonghyeon (Konkuk University)

Session Classification: Plenary

Contribution ID: **73** Type: **Talk**

Neutrino Mass Models: Roadmap for Collider and Cosmology

Monday, 18 December 2023 15:00 (30 minutes)

In this talk, I will discuss different searches for neutrino mass models, particularly emphasizing the updates for LHC and prospect for HL-LHC. Special emphasize will be given on heavy neutral lepton candidates. I will also briefly touch upon the cosmological implications of few of the neutrino mass models.

Institution

Designation

Faculty

Reference publication/preprint

Presenters: Dr MITRA, Manimala (Institute of Physics (IOP)); MITRA, Manimala (Institute of Physics, Bhubaneswar)

Session Classification: Plenary

Contribution ID: **74** Type: **not specified**

Should we consider scalar extensions seriously?

Tuesday, 19 December 2023 09:00 (45 minutes)

I will talk about some extremely interesting results from CMS and ATLAS on the search of new resonances, and show their theoretical implication.

Institution

Designation

Faculty

Reference publication/preprint

Presenters: KUNDU, Anirban; KUNDU, Anirban (Department of Physics, University of Calcutta)

Session Classification: Plenary

Contribution ID: **75** Type: **Talk**

Baryon Asymmetry from a Majorana Fermion Pair Coupled to Quarks

Tuesday, 19 December 2023 09:45 (45 minutes)

We discuss the possibility of generating the observed baryon asymmetry of the Universe by introducing a Majorana fermion coupled to quarks. We discuss decay and scattering processes. We explore the possibility of probing such a scenario using neutron-antineutron oscillation.

Institution

Designation

Faculty

Reference publication/preprint

Presenter: GOPALAKRISHNA, Shrihari (Institute of Mathematical Sciences)

Session Classification: Plenary

Contribution ID: **76** Type: **Talk**

Recent results on BSM searches at LHC

Wednesday, 20 December 2023 11:00 (30 minutes)

Institution

Designation

Reference publication/preprint

Presenter: NAYAK, Aruna (National Institute of Science Education and Research (NISER) (IN))

Session Classification: Plenary

Contribution ID: **77** Type: **Talk**

Some aspects of deep learning frontier in THEP

Tuesday, 19 December 2023 11:30 (30 minutes)

The application of deep learning techniques to theoretical particle physics has recently witnessed explosive growth, opening up exciting new avenues for exploration. The integration of deep learning into theoretical particle physics is still in its early stages, but it holds immense potential for future breakthroughs. As these techniques continue to evolve and become more sophisticated, we can expect even more remarkable discoveries in our quest to understand the fundamental nature of our universe. We would discuss some of the theoretical questions and explore these possibilities in this new paradigm.

Institution

Designation

Reference publication/preprint

Presenter: KONAR, Partha (Physical Research Laboratory, Ahmedabad, Gujarat-380 009, INDIA)

Session Classification: Plenary

Contribution ID: **78** Type: **not specified**

ML-Based Top Taggers: Performance, Uncertainty and Impact of Tower Tracker Data

Tuesday, 19 December 2023 12:00 (30 minutes)

Institution

Designation

Reference publication/preprint

Presenter: GHOSH, Kirtiman (IoP)

Session Classification: Plenary

Contribution ID: **79** Type: **not specified**

Universal See-Saw in Left-Right Symmetric Models

Tuesday, 19 December 2023 12:30 (30 minutes)

Institution

Designation

Reference publication/preprint

Presenter: Dr RAI, Santosh (Harish-Chandra Research Institute)

Session Classification: Plenary

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

Status of the LHC and Standard Model Physics

Wednesday, 20 December 2023 09:45 (45 minutes)

After briefly presenting the status of the LHC project, the talk will cover some of the recent and the most interesting experimental results of standard model physics.

Institution

Designation

Reference publication/preprint

Presenter: MAZUMDAR, Kajari (Tata Inst. of Fundamental Research (IN))

Session Classification: Plenary

Contribution ID: **81** Type: **not specified**

Constraints on doublet left-right symmetric model from Higgs data

Wednesday, 20 December 2023 11:30 (30 minutes)

We study the constraints on the doublet left-right symmetric model coming from the Higgs data. The SU(2)L symmetry of this model is broken by three vacuum expectation values, k1, k2 and vL. Most model builders assume that vL and k2 are negligibly small compared to k1. We test whether this assumption is valid in light of the measurement of Higgs boson coupling to gauge bosons and third generation quarks and the lower limits on heavy neutral scalar masses. We find that the data, especially the coupling of light higgs to b-quarks and the lower limit on heavy neutral scalar, strongly disfavour very small values of vL and k2 relative to k1. In fact, the data prefers vL to be of the order of k1.

Institution

Designation

Reference publication/preprint

Presenter: UMASANKAR, Sankagiri (IIT Bombay)

Session Classification: Plenary

Contribution ID: **82** Type: **not specified**

Connecting Dark Matter with flavor puzzle

Wednesday, 20 December 2023 12:00 (30 minutes)

In this talk, I will discuss an extension of the Standard Model (SM) with a complex scalar field, known as'flavon', based on the Froggatt-Nielsen mechanism. In an effective theory approach, the SM fermion masses and mixing patterns are generated in orders of the parameter related to the vacuum expectation value of the flavon field and the cut-off of the effective theory. By introducing right-handed neutrinos, we study the viability of the lightest right-handed neutrino as a dark matter candidate, where the same flavon field acts as a mediator between the dark and the SM sectors.

Institution

Designation

Reference publication/preprint

Presenters: MANDAL, Rusa (Siegen University); MANDAL, Rusa

Session Classification: Plenary

Contribution ID: **83** Type: **Talk**

Nonlocal Cosmologies from the Chiral/conformal Anomaly Effective Action and Einstein-Gauss Bonnet

Wednesday, 20 December 2023 12:30 (30 minutes)

Assuming a conformal phase of the early universe, we discuss the conformal backreaction, by studying the anomaly effective action around flat space and, in parallel, the anomaly induced actions (Fradkin Vilkovisly and Riegert's actions) in curved space. Gravity is treated classically. Anomalies included take the form both of conformal (parity-even) and of chiral (parity odd) contributions. Crucial, in these derivations, is the possibility of solving the conformal Ward identities using CFT methods in momentum space for correlators of many-gravitons. We show how the identities allow to reconstruct the action in a consistent way up to 4-point functions perturbatively. The method defines a powerful way to patch flat and curved spacetime derivations. In this framework dark energy is attributed to the trace anomaly.

Institution

Designation

Reference publication/preprint

Presenter: CORIANO, Claudio (Unknown)

Session Classification: Plenary

Contribution ID: **84** Type: **not specified**

Closing Remarks

Wednesday, 20 December 2023 17:30 (30 minutes)

Session Classification: Plenary

Contribution ID: **85** Type: **not specified**

Classically Conformal U(1) (B-L) model: Lessons from the Collider and Cosmology

Tuesday, 19 December 2023 17:45 (15 minutes)

Institution

Designation

Reference publication/preprint

Presenter: NIYOGI, Saurabh (Harish-Chandra Research Institute)

Session Classification: Parallel: DM + neutrino