22nd Conference on Flavor Physics and CP Violation (FPCP 2024)

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Chulalongkorn University

Book of Abstracts

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Hadronic cross sections measurement for the muon g-2 calculation

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After more than 60 years since the first measurements, the study of e^+e^- annihilation processes at low energies are still
a great source of information in an energy region where perturbative Quantum Chromodinamyc cannot be used.
The hadronic cross section is also the experimental input for the theoretical
calculation of the hadronic contribution to the anomalous magnetic moment of the muon,
allowing for precise tests of the Standard Model and searches for New Physics effects.

A great improvement on the precision of hadronic cross section measurements has been obtained in the last two decades, thanks to new generation experiments at high-luminosity e^+e^- colliders and novel analysis methods.
We present here the main results obtained for a variety of multi-hadronic final states, including the most recent measurements of the process $e^+e^- \to \pi^+\pi^-$, and discuss the impact of the cross section measurements on the muon $g-2$ calculation.
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Belle II upgrade

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LHCb upgrades

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The LHCb experiment was designed to measure CP-violation in the b-sector and to study rare decays of b- and c-hadrons at the LHC. The excellent performance of the detector during Run 1 and 2 of the LHC enabled LHCb to produce many interesting results. However, the maximum data rate was limited to by a Level-0 hardware trigger to 1.1 MHz and the trigger yield saturated at higher luminosities for hadronic decays. The experiment was upgraded during Long Shutdown 2 of the LHC to be able to operate the detector at higher luminosity and to introduce a trigger-less read-out that can process data from the complete detector at 40MHz. Further upgrades are planned to fully exploit the flavour-physics opportunities of the HL-LHC, and to study additional physics topics that take advantage of the forward acceptance of LHCb. This talk will focus on the status of the current upgrade and give a brief outlook for the LHCb Upgrade 2.

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Current result and plan of neutrino beam experiments

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T2K and NOvA experiments are the two long-baseline experiments currently collecting data to study neutrino oscillations, a quantum mechanical interference phenomenon where the observed neutrino flavor differs from that measured earlier, stemming from neutrino mass and flavor states mixing. The T2K experiment is based in Japan with a peak neutrino energy of ˜0.6GeV and a baseline length of 295km, and the NOvA experiment in the USA with a peak neutrino energy of ˜2GeV across a baseline of 810km. Combining results of these two experiments can give further insight into the observed degeneracies in the oscillation parameter space as they are complementary in detector design and analysis methods. A joint analysis combining the 2020 datasets from both experiments into a unified framework was released earlier this year using detailed likelihoods and consistent statistical treatment. This talk will discuss details about the analysis strategy and presents the first results of the combined constraints on neutrino oscillation parameters.

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Solving the neutrino mass hierarchy problem

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The KM3NeT neutrino telescopes in the Mediterranean Sea: Current status and prospects

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The KM3NeT research infrastructure is building second-generation neutrino telescopes in the depths of the Mediterranean Sea. The KM3NeT/ARCA detector at a depth of 3500 m off the coast of Sicily, Italy, focuses on the detection of high energy (E>TeV) neutrinos from astrophysical sources. The KM3NeT/ORCA detector at a depth of 2500 m off the coast of Toulon, France, is aimed at studying low energy (E>GeV) atmospheric neutrinos for measuring the neutrino mass hierarchy and for gaining insight on fundamental neutrino properties. In this talk, results obtained during the early stages of the detector construction as well as the expected performance of the completed detectors will be presented.

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Neutrino-Nucleon Scattering

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P is for Patipan

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The P in FPCP has a long and interesting history. Here, I argue that P does not stand for Patipan

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Progress of the Super Tau Charm Facility in China

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The Super Tau Charm Facility (STCF), a planned symmetric electron-positron collider in China, aims to facilitate e^+e^- collisions across a center-of-mass energy range of 2 to 7 GeV, targeting a peak luminosity of $0.5\times10^{35}\mathrm{cm}^{-2}\mathrm{s}^{-1}$. With an anticipated annual integrated luminosity exceeding $1\ ab^{-1}$, the STCF is poised to generate vast datasets. These will enable precision measurements of XYZ particles' properties, exploration of new CP violation sources within strange-hyperon and tau-lepton sectors, and accurate Cabibbo angle (θ_c) measurements to test the unitarity of the CKM matrix; search for anomalous decays with sensitivities extending down to the level of SM-model expectations, among other objectives. This talk will cover the STCF's physics goals and outline the latest advancements in the project's R&D.

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Neutrino Program at Fermilab - Enhancing proton beam power and accelerator infrastructure

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The upcoming long baseline neutrino experiments aim to enhance proton beam power to multi-MW scale and utilize large-scale detectors to address the challenge of limited event statistics. The DUNE experiment at LBNF will test the three neutrino flavor paradigm and directly search for CP violation by studying oscillation signatures in the high intensity ν_μ (anti-ν_μ) beam to ν_e (anti-ν_e) measured over a long baseline.
Higher beam power and improved accelerator up-time will enhance neutrino flux for the neutrino program by increasing the number of protons on target. LBNF/DUNE, as well as PIP-II upgrade and Accelerator Complex Evolution (ACE) plan, play a vital role in this effort. The scientific potential of ACE plan extends beyond neutrino physics, encompassing endeavors such as the Muon Collider, Charged Lepton Flavor Violation (CLFV), Dark Sectors, and exploration of neutrinos beyond DUNE.\par
In the era of higher-power accelerator operation, research in target materials and beam instrumentation is crucial for optimizing design modifications.
This abstract discusses Fermilab ACE, the science opportunities it provides, and how Fermilab is pushing the limits of proton beam power and accelerator infrastructure. By tackling neutrino beam challenges and exploring research and development ideas, we are advancing our understanding of fundamental particles and their interactions.

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Recent results from the SND@LHC experiment

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SND@LHC is a compact and stand-alone experiment to perform measurements with neutrinos produced at the LHC in a hitherto unexplored pseudo-rapidity region of 7.2 < ⊠ < 8.6, complementary to all the other experiments at the LHC. The experiment is located 480 m downstream of IP1 in the unused TI18 tunnel. The detector is composed of a hybrid system based on an 800 kg target mass of tungsten plates, interleaved with emulsion and electronic trackers, followed downstream by a calorimeter and a muon system. The configuration allows efficiently distinguishing between all three neutrino flavours, opening a unique opportunity to probe physics of heavy flavour production at the LHC in the region that is not accessible to ATLAS, CMS and LHCb. This region is of particular interest also for future circular colliders and for predictions of very high-energy atmospheric neutrinos. The detector concept is also well suited to searching for Feebly Interacting Particles via signatures of scattering in the detector target. The first phase aims at operating the detector throughout LHC Run 3 to collect a total of 290 fb−1. The experiment has been running successfully during 2022 and 2023 and has published several results. This talk will focus on the experience gained from the first measurements and how this is being used to achieve the physics goals of SND@LHC.

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First NA62 search for long-lived new physics particle hadronic decays

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The NA62 experiment at CERN, designed to measure the highly-suppressed decay $K^+ \to \pi^+\nu\bar{\nu}$, has the capability to collect data in a beam-dump mode, where 400˜GeV protons are dumped on an absorber. In this configuration, New Physics (NP) particles, including dark photons, dark scalars and

axion-like particles, may be produced and reach a decay volume beginning 80˜m downstream of the absorber. A search for NP particles decaying in flight to hadronic final states is reported, based on a blind analysis of a sample of 1.4×10^{17} protons on dump collected in 2021.

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An Imperative study of the angular observables in $\Lambda_b^0 \to \Lambda_c^+(\to \Lambda\pi^+)\tau\bar{\nu_\tau}$ decay and probing the footprint of new physics

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We have conducted an investigation and prediction of the angular observables in the complete 4-body angular distribution for the decay of $\Lambda_b^0 \to \Lambda_c^+(\to \Lambda\pi^+)\tau\bar{\nu_\tau}$. This analysis takes into account all New Physics (NP) operators in a model-independent manner while analyzing the NP sensitivity of each angular observable with the associated NP operators. We have also provided the shape of the form factor for BGL parametrization, and have updated the SM prediction for angular observables with the LFUV ratio $R(\backslash Lambda\_\{c\})$ which we find consistent with the Lattice. We have constructed for the first time, the CP-violating observable for this decay mode and analyzed it for various NP operators along with other angular observables. Recently, LHCb has measured the Branching Ratio of this for τ mode and provided $R(\backslash Lambda\_\{c\})$ Using these results along with the current HFLAV average of $R(D), R(D*)$, and also LHCb measured value for $F_L(D^*)$, we have performed a χ^2 analysis with one and/or two parameters, one at a time. We found that a scenario $\mathcal{R}][C_{V_2}]$, can explain \text{$R(D^*)$} and \text{$R(\Lambda_c)$} but can't explain \text{$R(D)$} marginally. However, all one-operator scenarios can explain all the observable within 2σ. On the other hand, in a two-parameter scenario, the situation has improved significantly, and \text{$C_{S_1} - C_T$} turns out as a best-fit scenario that can explain all the observable within 1σ. We extensively studied correlations between observables for this charge current decay process in the presence of both one and/or two-operator new physics scenarios.

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Exploring Constraints on Simplified Dark Matter Model Through Flavor and Electroweak Observables

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We have considered a simplified dark matter model featuring a spin-0 mediator that contributes to Flavor Changing Charge Current (FCCC) and Neutral Current (FCNC) processes, as well as electroweak observables at the one-loop level. Through a combined fit incorporating all flavor observables of FCNC, FCCC, and EW observables, we constrain the parameter space. This model adequately describes the anomalous W-boson mass, and we discuss the effects on the parameter space for ΔM_W observed by different experiments. Additionally, our model satisfies relevant dark sector constraints such as relic density and indirect detection bounds. Ultimately, we obtain a tightly constrained parameter space that complies with all relevant flavor, electroweak, and dark sector constraints, while remaining within the scope of ongoing direct detection experiments. These bounds also hold relevance for other phenomenological studies.

Neutrino Physics / 59

Neutrino oscillation with global data analysis

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Results of a global data analysis can constrain the default 3-neutrino mixing scheme given unitarity assumption, based on recent data from the reactor, solar and long-baseline accelerator neutrino oscillation experiments. It is straightforward to extend the analysis towards the non-unitary assumption. Meanwhile, global neutrino data scrutiny serves as a probe of new physics such as whether there exist sterile neutrinos, CPT violations,
and neutrino couplings with light dark matter. Meanwhile, it is promising to check the improvements on these aspects at next-generation neutrino oscillation experiments such as DUNE, T2HK, and JUNO. This talk will cover what we have learned in the past, what we will know with the future efforts and proposals.

Parallel - 4 / 60

Exploring NSI effects in Long-baseline neutrino Experiments

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Neutrino oscillation in the matter could be affected by the sub-dominant, yet unknown, non-standard interactions (NSI). The upcoming long-baseline (LBL) neutrino experiments will be sensitive to these effects and can provide information on the unknown oscillation parameter values. The observed shift in δ_{CP} value observed for NOvA in case of standard model (SM) and NSIs arising simultaneously from two different off-diagonal sectors, $e-\mu$ and $e-\tau$ could be attributed to beyond standard model physics. We extend the study to the upcoming long-baseline experiments: DUNE and T2HK. We derive constraints on the NSI sectors using the combined datasets of NOνA and T2K. Our analysis reveals a significant impact that dual NSIs may have on the sensitivity of standard CP phase δ_{CP} and atmospheric mixing angle θ_{23}. Furthermore, when non-standard interaction from the $e-\mu$ and $e-\tau$ sectors are included, we see significant changes in the CP sensitivity due to the presence of dual NSIs, and also the CP asymmetry exhibits an appreciable difference.

Parallel - 3 / 61

Exotic hadron spectroscopy at LHCb

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Studies of exotic hadrons comprise a natural and privileged playground for a more thorough elucidation of the nature of quantum chromodynamics. In this contest the LHCb experiment, dedicated to study heavy flavor hadrons produced from pp collision at the LHC, plays a vital role, already providing evidence for several exotic hadrons. The talk will deliver an overview of the selected,

latest LHCb on the subject of exotic hadron spectroscopy. It encompasses, in particular, the observations of pentaquarks, tetraquarks and the status of experimental knowledge about the state χc1(3872).

Parallel - 8 / 62

Radiative b-hadron decays at LHCb

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Radiative b-hadron decays are sensitive probes to new physics through the study of branching fractions, angular observables, CP violation parameters, and photon polarization. The LHCb experiment is ideally suited for the analysis of these decays due to the high luminosity of B production, its high trigger efficiency, as well as excellent tracking and particle identification performance. Recent measurements of the b-hadron radiative decays are presented and discussed.

Parallel - 2 / 63

Rare charm decays at LHCb

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Charm measurements allow for testing the Standard Model in a way complementary to measurements in b-quark sector. LHCb experiment, with its large data sample and excellent performance, provides sensitivity approaching the Standard Model predictions for rare charm decays. In this talk, recent LHCb results on rare decays of charm hadrons will be presented.

Rare decays of hadrons and leptons / 64

LHCb measurements of rare electroweak decays of b-hadrons

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In the Standard Model, decays mediated by $b \to sll$ are very suppressed making them sensitive to possible non-SM contributions.

The latest LHCb measurement of the branching fraction ratio of this process between electrons and muons was shown to be consistent with the Standard Model.
However, measurements of branching fraction and angular observables of $b \to s\mu\mu$ have shown an interesting pattern of tensions with the predictions.
This could be due to underestimated hadronic effects or non-SM contributions.
The most recent LHCb measurements as well as future prospects to understand this will be discussed in this talk.

Parallel - 1 / 65

Study of neutrino mass matrices with vanishing trace and one vanishing minor

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In this work we carry out a systematic texture study of the neutrino mass matrix with the ansatzes - (i) one vanishing minor and (ii) the zero sum of the mass eigenvalues with the CP phases (henceforth vanishing trace). There are six possible textures of a neutrino mass matrix with one vanishing minor. The viability of each texture is checked with 3σ values of current neutrino data by drawing scatter plots. In our analysis we are motivated to use the ratio of solar to atmospheric mass-squared differences R_ν for its precise measurement (and also the atmospheric mixing angle θ_{23}) to constrain phenomenologically first the Dirac CP phase δ in the range of $(0^o - 360^o)$ for a given texture with the solutions of the constraint equations. Subsequently we employ this constrained δ to determine the range of completely unknown Majorana CP Phases (α and β) for all the viable textures. We also check the neutrinoless double beta decay rate, $|m_{ee}|$ and the Jarlskog invariant, J_{cp} for the textures. Finally the symmetry realization of all the viable textures under the flavor symmetry group Z_5 via seesaw mechanism is implemented along with the FN mechanism to determine mass hierarchy structure.

Parallel - 1 / 66

Neutrino magnetic moment and inert doublet dark matter in a radiative seesaw scenario

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We illustrate neutrino mass and magnetic moment along with dark matter phenomenology in a Type-III radiative scenario. The Standard Model is enriched with three vector-like fermion triplets and two inert doublets to provide a suitable platform for the above phenomenological aspects. The inert scalars contribute to total relic density of dark matter in the Universe. Neutrino aspects are realized at one-loop with magnetic moment obtained through charged scalars, while neutrino mass gets contribution from charged and neutral scalars. Taking inert scalars up to 2 TeV and triplet fermion in few hundred TeV range, we obtain a common parameter space, compatible with experimental limits associated with both neutrino and dark matter sectors. Finally, we demonstrate that the model is able to provide neutrino magnetic moments in a wide range from $10^{-12}\mu_B$ to $10^{-10}\mu_B$, meeting the bounds of various experiments such as Super-K, TEXONO, Borexino and XENONnT.

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Leptogenesis in a Left-Right Symmetric Model with double seesaw

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We explore the connection between low-scale CP-violating Dirac phase (δ) and high-scale leptogenesis in a Left-Right Symmetric Model (LRSM) with scalar bidoublet and doublets. The fermion sector of the model is extended with one sterile neutrino (S_L) per generation to implement a double seesaw mechanism in the neutral fermion mass matrix. The double seesaw is performed via the implementation of type-I seesaw twice. The first seesaw facilitates the generation of Majorana mass term for heavy right-handed (RH) neutrinos (N_R), and the light neutrino mass becomes linearly dependent on S_L mass in the second. In our framework, we have taken charge conjugation (C) as the discrete left-right (LR) symmetry. This choice assists in deriving the Dirac neutrino mass matrix (M_D) in terms of the light and heavy RH neutrino masses and light neutrino mixing matrix U_{PMNS} (containing δ). We illustrate the viability of unflavored thermal leptogenesis via the decay of RH neutrinos by using the obtained M_D with the masses of RH neutrinos as input parameters. A complete analysis of the Boltzmann equations describing the asymmetry evolution is performed in the unflavored regime, and it is shown that with or without Majorana phases, the CP-violating Dirac phase is sufficient to produce the required asymmetry in the leptonic sector within this framework for a given choice of input parameters. Finally, we comment on the possibility of constraining our model with the current and near-future oscillation experiments, which are aimed at refining the value of δ.

Parallel - 3 / 68

Analysis of Charmed Baryon Weak Decays in the Topological Diagram Approach

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Inspired by the recent BESIII measurement of the decay asymmetry in the decay $\Lambda_c^+ \to \Xi^0 K^+$, we perform a global fit to the experimental data of two-body charmed baryon decays based on the topological diagrammatic approach (TDA) which has the advantage that it is more intuitive, graphic and easier to implement model calculations. The measured branching fractions and decay asymmetries are well accommodated in the TDA except for three modes, in particular, the predicted $calB(\Xi_c^0 \to \Xi^- \pi^+) = (2.83 \pm 0.10)\%$ is larger than its current value. Hence, the TDA is applied successfully to the charmed baryon sector for the first time. The predicted magnitudes of S- and P-wave amplitudes and their phase shifts are presented for measured and yet-observed modes which can be tested in forthcoming experiments.

Parallel - 6 / 69

Precision measurements of B meson decays at ATLAS

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Various precision measurements with B mesons from ATLAS are presented. They include studies of CP violation in $B_s^0 \to J/\psi\phi$ decay, B_c^+ meson decay properties and measurement of B0 meson lifetime, along with average decay width Γ_d and Γ_d/Γ_s ratio.

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B0s ⟶ μ+ μ− effective lifetime measurement in ATLAS

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ATLAS measurement of B0s ⟶ μ+ μ- effective lifetime with 2015-2016 data is presented. This observable, along with the branching fraction of the decay, is sensitive to New physics contributions to the decay amplitude. The measurement result is consistent with the SM.

Parallel - 6 / 71

Heavy-flavour production measurements in ATLAS

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Recent results on open heavy flavour and charmonium production from ATLAS experiment with Run-2 data are presented. This covers the double differential measurements of J/ψ and ψ(2S) production, D mesons and B+ production at √s=13 TeV

Parallel - 3 / 72

Exotic hadron spectroscopy in ATLAS

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Recent results on spectroscopy of exotic hadrons in ATLAS with Run-2 data are presented. Four-muon mass spectrum is studied investigating the structures earlier observed by LHCb experiment, using di-J/ψ and J/ψ+ψ(2S) channels. The latter is also investigated using ψ(2S)⟶ J/ψ(μ+μ−)π+π− decay mode.

Parallel - 4 / 73

DUNE trigger and data acquisition systems

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The Deep Underground Neutrino Experiment (DUNE) is a next-generation long-baseline neutrino experiment currently under construction in the US. The experiment consists of a broadband neutrino beam from Fermilab to the Sanford Underground Research Facility (SURF) in Lead, South Dakota, a high-precision near detector, and a large liquid argon time-projection chamber (LArTPC) far detector. Two prototypes of the DUNE far detector (DUNE-FD) were constructed to assess candidate technologies and methods in advance of the DUNE detector build: Proto-DUNE single-phase horizontal-drift (ProtoDUNE-HD) and ProtoDUNE single-phase vertical-drift (ProtoDUNE-VD). Each prototype cryostat comprises two primary sub-detectors: a single-phase LArTPC and a companion photon detector system.
DUNE has a broad physics program that includes determining the neutrino mass hierarchy, measuring with sufficient precision to discover leptonic CP violation, making precise measurements of the oscillation parameters governing electron neutrino appearance and muon neutrino disappearance, detecting neutrinos from a core-collapse supernova, searching for baryon number violating processes such as nucleon decay and neutron-antineutron oscillation, and searching for other physics beyond the Standard Model.
The Trigger and Data Acquisition (TDAQ) systems are responsible for the acquisition and selection of data produced by the DUNE detectors, as well as for their synchronization and recording. The main challenge for the DUNE-TDAQ lies in the development of effective, resilient software and firmware that optimize the performance of the underlying hardware. The TDAQ is composed of several hardware components. A high-performance Ethernet network interconnects all the elements and allows them to operate as a single, distributed system. At the output of the TDAQ the high-bandwidth Wide Area Network (WAN) allows the transfer of data.

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LFU tests in semileptonic decays at LHCb

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Lepton Flavor Universality (LFU) is a fundamental principle in the Standard Model (SM) of particle physics, stating that the interactions of different generations of leptons with the weak force should be identical. However, experimental observations in the last decade have hinted at potential violations of LFU by comparing the ratios of branching fractions of semileptonic $b \to c\ell\nu$ decays into final states involving τ and light leptons. Besides these ratios of branching fractions, other observables have been proposed in the literature to further test the SM and constrain possible sources of New Physics.This talk presents the most recent results of the LFU tests performed at LHCb. These tests examine the ratio of branching fractions of $B \to D^{(*)}\tau\nu$ and $B \to D^{(*)}\mu\nu$ decays, and the polarization of D^* is analyzed in $B \to D^{(*)}\tau\nu$ decays in two bins of the four-momentum transferred to the $\tau\nu$ pair.

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Possible New Physics on $D_s^+ \to \eta^{(\prime)} l^+ \nu_l$ Decays in Scalar Leptoquark Model

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Recent measurements in flavour changing charged current (FCCC) $b\to c\bar{l}\nu_l$ transitions hint existence of new physics (NP) beyond the standard model (SM). The lepton flavour universality (LFU) ratios $R_{D^{(*)}}$ measured by BaBar, Belle and LHCb have shown around 3.3σ deviation between theory and experiment [1]. These anomalous results connected to the b hadron decays indicate some signal of NP. Hence, a simple question arises in our mind, is there any possibility to find such anomalous results in charm decays? Although, most of the experimental results in the pure leptonic and semileptonic D meson decays agree with the SM predictions, but significant deviations have been observed for branching ratio of $D^+_{(s)}\to\eta^{(\prime)}l^+\nu_l$ decays [2]. Therefore, there are some possibilities for existence of some NP. Several theoretical efforts [3-5] have been done recently to find the NP contribution in D meson decays. In this work, we will investigate $D^+_s\to\eta^{(\prime)}l^+\nu_l$ decays in scalar leptoquark (LQ) model [6,7] to find possible NP footprint. Leptoquarks are the hypothetical beyond SM particles that couple a quark directly to a lepton unlike any particle within the SM and they have both spin zero $(s=0)$ –scalar leptoquarks and one $(s=1)$ –vector leptoquarks, they also carry colour and fractional electric charges. This model is the relics of grand unified theories. In this model for $c\to s\bar{l}_l$ transitions, we will predict the new Yukawa coupling parameters using recent experimental results of branching fraction for the semileptonic D meson decays [2]. Using our predicted new couplings, we will study branching fraction of the above decays. To determine whether this NP model is accepted, a comparison between the SM, the experiment and our model will be conducted. We will be able to better comprehend the existence of NP with the help of the impending measurement of D meson decays in the BESIII and Belle II experiments.

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Region of Interest Filter Optimization for the Deep Underground Neutrino Experiment (DUNE) Data Acquisition system

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The Deep Underground Neutrino Experiment (DUNE) is the next generation neutrino experiment currently under construction. It consists of a broadband neutrino beam at Fermilab, a high precision near detector, and the largest liquid argon time projection chamber far detector ever designed at the Sanford Underground Research Facility (SURF).

The Region of Interest (ROI) filter is designed for DUNE's online Data Acquisition (DAQ) system to address data rate constraints and enable low energy physics in the <10 MeV range. The filter employs zero suppression on the detector signal, and by tuning the readout window and threshold the data rates can be reduced by >90%. Performance of the ROI is analyzed in LArsoft on MARLEY generated low energy MC events propagated through the detector simulation. Notably, the optimized ROI filter enables a lower trigger threshold for readout at ˜5-10 MeV, allowing DUNE to explore low-energy physics, specifically focusing on solar boron 8 neutrinos which are relevant in this energy range. This advancement enhances DUNE's scientific capabilities, opening avenues for detailed analyses of previously inaccessible low-energy neutrino interactions.

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Test abstract

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Test abstract

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Study on Leptogenesis in texture zeros of minimal inverse seesaw

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We study maximal texture zeros of the Dirac matrix in a minimal inverse seesaw ISS (2,3) model with S_4 flavor symmetry. The seesaw model is extended with the addition of 2 Right Handed neutrinos and 3 sterile states in the intermediate-mass range. To make the model more predictive, we have considered the maximum possible texture zeros in Dirac neutrino mass matrix M_D, heavy right-handed (RH) neutrino mass matrix M_R, and sterile mass matrix μ. There are six possible two zero textures of M_D along with maximal zero textures of M_R and μ that yield correct neutrino phenomenology. The decay of the light quasi-Dirac pair present in the model leads to lepton asymmetry. We study Leptogenesis in these six different textures for both normal and inverted ordering.

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Dispersive determination of neutrino mass ordering

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We propose theoretical constraints that fermion masses and mixing angles should respect. These constraints are derived from the dispersion relation obeyed by the box diagrams, which are responsible for the mixing of neutral states, such as the $\mu^- e^+$ and $\mu^+ e^-$ mixing . The only assumption is that the electroweak symmetry of the Standard Model is restored at a high energy scale, which can be achieved in, for example, the composite Higgs model. We argue that the mixing phenomenon disappears, as the electroweak symmetry is restored. This disappearance is then taken as the high-energy input for the dispersion relation, whose solution at low energy, i.e., in the symmetry broken phase,

leads to the aforementioned constraints. These constraints are powerful enough to discriminate the neutrino mass orderings; the neutrino masses in the normal hierarchy, instead of in the inverted hierarchy or quasi-degenerate spectrum, match the observed PMNS matrix elements. The lepton mixing angles larger than the quark ones are explained by means of the inequality $m_2^2/m_3^2 \gg m_s^2/m_b^2$, $m_{2,3}$ being the neutrino masses in the NH and $m_{s,b}$ the quark masses. At last, the solution for the τ^-e^+-τ^+e^- mixing specifies the mixing angle $\theta_{23} \approx 45°$.

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Searching new physics in $c\to ul^+l^-$ decays with non-universal Z' model

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Charm decays have immense potential to probe physics beyond the standard model [1, 2]. The charm sector has shown some interesting phenomena, for instance, $D^0 - \bar{D^0}$ mixing and CP violation [3, 4]. The experimental upper bounds for the branching fractions are constrained at 7.9×10^{-8} for $D^0\to e^+e^-$ [5] and 6.2×10^{-9} for $D^0\to^{+-}$ [6]. Recent results from the LHCb have provided the limit of the branching ratio of lepton flavour violating decays $D^0\to e^{\pm}$ as $B(D^0\to e^{\pm}) < 1.3\times10^{-8}$ [7] at 90% confidence level. The Glashow-Iliopoulos-Maiani mechanism effectively suppresses the flavour changing neutral currents (FCNC) decays involving $\to$ transitions which makes them sensitive to new physics (NP) effects. Among various NP models, the non-universal Z' model is one of the best appreciated NP models. In this model, the rare decays occur at the tree level as they are mediated by a new gauge boson particle, the Z' boson. In this work, we intend to investigate the rare charm decays involving $c\to ul^+l^-$ transition in non-universal Z' model. We estimate the branching fractions of the decays $D\to l^+l^-$, $D\to l^+l^-$, and $D_s\to Kl^+l^-$ in Z' model with the leptonic couplings constrained from $D\to^{+-}$ decays. We expect our study will provide more opportunities to explore NP in the charm sector.

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Recent CP violation and lifetime results from CMS

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Recent results on CP violation in charm and beauty sector, as well as lifetime measurements, by the CMS experiment at the LHC are presented. The analyses are based on 13 TeV pp collision data.

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New Structures in the J/ψ J/ψ Mass Spectrum at CMS

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The speaker will discuss the new structures reported by the CMS collaboration recently. Three structures are found in the J/ψJ/ψ mass spectrum in proton-proton collisions at 13 TeV, and a model with quantum interference among these structures provides a good description of the data. Among them, a new structure with mass around 6.6 GeV is observed with a local significance > 5 sigma. Another structure with even higher significance is consistent with the X(6900) resonance reported by the LHCb experiment and confirmed by the ATLAS experiment. Evidence for another new structure, with a local significance of 4.7 sigma, is found at a mass around 7.1 GeV. Results will also be reported for a model without interference, which does not fit the data as well and shows mass shifts relative to the model with interference.

Rare decays of hadrons and leptons / 84

Searches for rare decays at CMS

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Recent CMS results on rare decays are presented. The results are based on data collected in proton-proton collisions at sqrt(s) = 13 TeV.

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Heavy flavour spectroscopy and properties at CMS

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Recent CMS Experiment results on conventional spectroscopy and production of heavy flavour states in pp collisions at 13 TeV are reported, including the first observation of the Xi_b- —> psi(2S) Xi- decay. We discuss the measured properties of the ground and excited hadron states.

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Observation of double J/ψ production in pPb collisions

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The first observation of the concurrent production of two J/ψ mesons in proton-nucleus collisions will be presented. The analysis is based on a data sample recorded at a nucleon-nucleon center-of-mass energy of 8.16 TeV by the CMS experiment at the CERN LHC corresponding to an integrated luminosity of 174.6 nb^{-1}. The J/ψ mesons are reconstructed in their $\mu^+\mu^-$ decay channel for transverse momenta $p_{\mathrm{T}} > 6.5$ GeV and rapidity $|y| < 2.4$. The measured inclusive fiducial cross section $\sigma(\mathrm{pPb} \to \mathrm{J}/\psi\mathrm{J}/\psi + \mathrm{X})$ will be compared to theoretical perturbative quantum chromodynamics predictions at next-to-leading-order accuracy, including nuclear parton densities effects, for the production of two J/ψ mesons in single- (SPS) and double- (DPS) parton scatterings. The measurement of the double J/ψ cross section in pp collisions at 13 TeV may also be reported.

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Neutrino masses and mixing in an inverse seesaw (2,3) model augmented with S4 modular flavor symmetry

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In our work, we have used modular invariance approach to construct a neutrino mass model in the framework of the inverse seesaw(2,3) mechanism with modular S4 flavor symmetry. The use of modular invariance requires less number of flavon fields which increases the predictability of the

model. The phenomenological study of the neutrino mass matrix is carried out using the current 3σ ranges of neutrino oscillation data to test the compatibility of the model with experiments. Again the use of inverse seesaw mechanism allows the right-handed neutrinos to have masses in the TeV scale which may be feasible at the current collider experiments.

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Analysis of the semileptonic $B_c \to D_s^{(*)}(\mu^+\mu^-, \nu_\mu\bar{\nu}_\mu)$ decay modes in the effective field theory approach

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We study the exclusive semileptonic $B_c \to D_s^{(*)}(\mu^+\mu^-, \nu\bar{\nu})$ decay modes mediated by $b \to s$ quark level transitions in the Effective field theory formalism. There are discrepancies between the experimental measurements and the Standard Model predictions in various observables associated with the $B \to (K, K^*, \phi)\ell\ell$ processes. On the other hand, a very recent measurement of the branching ratio of the $B \to K\nu_\ell\bar{\nu}_\ell$ process observed by Belle - II Collaboration indicates a 2.8σ deviation above the Standard model prediction. We constraint the parameter space in the language of new physics couplings and then analyse the observables such as the branching ratio, forward-backwards asymmetry, lepton polarisation asymmetry, etc. In addition, we test the lepton non-universality observable associated with the $B_c \to D_s^{(*)}\mu^+\mu^-$ process. Being not yet observed in the experiment, we provide the predictions and comment on the observables of the $B_c \to D_s^{(*)}(\mu^+\mu^-, \nu_\mu\bar{\nu}_\mu)$ process in the SM, and in the new physics as well.

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New physics prospects in semileptonic $\Lambda_b \to \Lambda_c^*$ decays

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Observations of flavor anomalies in the b-sector, particularly the deviations in the measurements of the lepton flavor universality ratios in the $b \to c\tau\nu_\tau$ transitions from the standard model (SM) predictions, suggest the existence of possible new physics beyond the SM. In the pursuit of new physics in similar decays involving $b \to c\ell\nu_\ell$ transitions, we scrutinize the decay modes $\Lambda_b \to \Lambda_c^*(2595, 2625)\tau^-\bar{\nu}_\tau$ beyond the SM. In particular, we examine the impact of the presence of leptoquarks in these decay modes, within the framework of the vector leptoquark U_1 model. We employ form factors obtained from lattice QCD (LQCD) calculations to predict various q^2-dependent observables. Some of these observables include the differential branching fraction, the ratio of branching fractions and the forward-backward asymmetry of the charged lepton. The new couplings are constrained using current $b \to c\ell\nu_\ell$ experimental data.

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Exploring $b \to c\tau\nu$ mediated baryonic decay modes in SMEFT framework

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Motivated by the interplay between the LEFT and SMEFT operators at the electroweak scale, we study the interrelation among the transitions $b \to c\ell\nu_\ell$, $b \to s\nu_\ell\nu_\ell$ and $b \to s\ell\ell$ ($\ell = e, \mu, \tau$). We explore this correlation within the context of six - SMEFT operators: $\mathcal{Q}_{\ell q}^{(3)}$, $\mathcal{Q}_{\ell edq}$, $\mathcal{Q}_{\ell equ}^{(1)}$, $\mathcal{Q}_{\ell equ}^{(3)}$, $\mathcal{Q}_{\phi q}^{(3)}$ and $\mathcal{Q}_{\ell q}^{(1)}$.
We constrain the new physics parameter space through a comprehensive global fit incorporating the observables: R_D, R_{D^*}, $P_\tau(D)$, $P_\tau(D^*)$, $F_L(D^*)$, $\mathcal{B}(B_0 \to K^*\nu\nu)$, $\mathcal{B}(B \to K^+\nu\nu)$, $\mathcal{B}(B \to K^+\tau^+\tau^-)$ and $\mathcal{B}(B_s \to \tau^+\tau^-)$. We then investigate the sensitivity of new physics in the semileptonic decay modes of b-baryons, specifically $\Xi_b \to \Xi_c\tau^-\bar{\nu}_\tau$ and $\Sigma_b \to \Sigma_c^{(*)}\tau^-\bar{\nu}_\tau$. We also provide the predictions of several observables such as the branching ratio, forward-backward asymmetry, longitudinal polarisation asymmetry, convexity parameter, and the lepton flavor non-universality observable of $\Xi_b \to \Xi_c\tau^-\bar{\nu}_\tau$ and $\Sigma_b \to \Sigma_c^{(*)}\tau^-\bar{\nu}_\tau$ processes.

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Exploring Flavor Anomalies and Dark Matter in $U(1)_{L_e-L_\mu}$ model with a scalar leptoquark

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We explore $U(1)_{L_e-L_\mu}$ gauge extension of the Standard model with particle content enlarged by three neutral fermions, of which the lightest one contributes to dark matter content of the Universe. The scalar sector is enriched with a $\tilde{R}_2$ scalar leptoquark doublet to investigate flavor anomalies in B-meson sector, an additional inert scalar doublet to realize neutrino mass at one loop and a scalar singlet to spontaneously break the new $U(1)$. We discuss dark matter relic density and direct detection cross section in scalar and gauge portals. New physics contribution for $b \to s$ transition comes from penguin diagrams with Z', leptquark and new fermions. We analyze the constraints on the model parameters from the established observables such as P_5', Br($B_s \to \phi, K^{(*)}\mu\mu$), and Br($B_s \to \mu\mu$) processes. Utilizing the permissible parameter space consistent with both flavor and dark sectors, we discuss the impact on various observables such as branching ratio, forward-backward asymmetry, polarisation asymmetry and also lepton non-universality of $\Lambda_b \to \Lambda^*(1520)(\to pK)\ell\ell$ decay channel.

Neutrino Physics / 92

Neutrino mass experiments: current and future

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Nearly 70 years since the neutrino was discovered, and 25 years since discovery of neutrino oscillations established its non-zero mass, the absolute neutrino-mass scale remains unknown. Due to its unique characteristics, determining this neutrino property requires new measurement techniques to be developed. Currently, there are four measurement approaches: using cosmological models, inference from time-of-arrival from supernovae, through observation of neutrinoless double beta decay, and the kinematics of weak decay processes.
I will review the theoretical basis underlying neutrino mass measurement and present key experiments in this field. I will highlight the current best upper limits, how neutrino mass experiments are complementary to other neutrino property searches, and summarize the challenges that lie ahead of the neutrino mass community.

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Measurements of lepton-flavour universality in semileptonic B decays at Belle and Belle II

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The Belle and Belle II experiments have collected a 1.1 ab^{-1} sample of $e^+e^- \to B\bar{B}$ collisions at the $\Upsilon(4S)$ resonance. These data, with low particle multiplicity, constrained initial state kinematics and excellent lepton identification, are an ideal environment to study lepton-flavour universality in semileptonic decays of the B meson. We present results on the ratios of semitauonic decay rates to semileptonic decays with light leptons, in both exclusive and inclusive B decays. We also present measurements of angular observables that test universality between electrons and muons.

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Measurements of electroweak and radiative penguin B decays at Belle and Belle II

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The Belle and Belle II experiments have collected a 1.1 ab^{-1} sample of $e^+e^- \to B\bar{B}$ collisions at the $\Upsilon(4S)$ resonance. These data, with low particle multiplicity and constrained initial state kinematics, are an ideal environment to search for rare B meson decays proceeding via electroweak and radiative penguin processes. Results include those of the decay $B^+ \to K^+\nu\bar{\nu}$ using an inclusive tagging technique. We also present results on radiative decays $B^0 \to \gamma\gamma$, $B \to \rho\gamma$ and $B \to K^*\gamma$. CP and

isospin asymmetries are presented for the latter two decays. We also present results from decays related to $b \to s\ell^+\ell^-$ and $b \to d\ell^+\ell^-$ transitions, where ℓ is an electron or muon.

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Measurements of hadronic B decay rates at Belle and Belle II

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The Belle and Belle II experiments have collected a 1.1 ab^{-1} sample of $e^+e^- \to B\bar{B}$ collisions at the $\Upsilon(4S)$ resonance. The study of hadronic B decays in these data allows the precise measurement of absolute branching fractions and angular distributions of the decay products. These measurements provide tests of QCD and allow the generation of more realistic simulation samples. We present measurements of the decays $B^- \to D^0\rho^-$, $\bar{B}^0 \to D^+\pi^-\pi^0$, $B \to DK^*K$ and $\bar{B}^0 \to \omega\omega$.

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Charm results at Belle and Belle II

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The Belle and Belle II experiments have collected a $1.4\ \text{ab}^{-1}$ sample of e^+e^- collision data at centre-of-mass energies near the $\Upsilon(nS)$ resonances. These samples contain a large number of $e^+e^- \to c\bar{c}$ events that produce charmed mesons. Direct CP violation is searched for in $D^0 \to K^0_S K^0_S$ decays and D-meson decays to a four-body final state. For the four-body decays, asymmetries in the distributions of triple and quadruple moments probe for CP violation.
We present searches for rare flavour-changing neutral current $c \to u\ell^+\ell^-$ processes in several decay modes. Further, we study several decays of the Λ_c and Ξ_c to determine branching fractions, as well as CP asymmetries in singly Cabibbo-suppressed decays.

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Precision measurements of τ lepton decays at Belle II

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The Belle II experiment has collected a 424fb^{-1} sample of e^+e^- collision data at center-of-mass energies near the resonances $\Upsilon(nS)$. This sample contains 389 million $e^+e^- \to \tau^+\tau^-$ events, which we use for precision tests of the standard model. In this talk, we focused on the measurements of

the tau-lepton mass and
tests of Lepton Flavor Universality (LFU) between electrons and muons.

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Searches for dark sector particles at Belle and Belle II

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The Belle and Belle II experiment have collected samples of e^+e^- collision data at centre-of-mass energies near the $\Upsilon(nS)$ resonances. These data have constrained kinematics and low multiplicity, which allow searches for dark sector particles in the mass range from a few MeV to 10 GeV. Latest results are presented.

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Exploring type-I seesaw under S_3 modular symmetry

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This work's novelty lies in using the simplest group i.e. $\Gamma_2 \cong S_3$ modular symmetry implemented on the canonical seesaw to explain neutrino phenomenology. Here, we construct and classify models based on the doublet and singlet representations of supermultiplets under S_3 discrete symmetry along with their respective modular weights, allowing a mass matrix for the neutrino sector with minimal use of free parameters. These modular symmetries become advantageous in avoiding the requirements of multiple flavon fields and the intricacies of vacuum alignments. In this way, we endeavor to clarify the effect and significance of modular S_3 symmetry, which is considered in explaining the neutrino phenomenology viable with the current observations. Additionally, we also shed some light on the neutrinoless double beta decay.

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Asymmetric Self-interacting Dark matter via Dirac Leptogenesis

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The nature of neutrinos, whether Dirac or Majorana, is hitherto not known. Assuming that the neutrinos are Dirac, which needs $B-L$ to be an exact symmetry, we attempt to explain the observed proportionality between the relic densities of dark matter (DM) and baryonic matter in the present Universe *i.e.*, $\Omega_{\rm DM} \approx 5\,\Omega_{\rm B}$. We extend the Standard Model (SM) by introducing heavy scalar doublets $X_i, i = 1, 2$ and η, two singlet scalars Φ and Φ', a vector-like Dirac fermion χ representing the DM and three right-handed neutrinos $\nu_{R_i}, i = 1, 2, 3$. Assuming $B-L$ is an exact symmetry of the early Universe, the CP-violating out-of-equilibrium decay of heavy scalar doublets: $X_i, i = 1, 2$ to the SM lepton doublet L and the right-handed neutrino ν_R, generate equal and opposite $B-L$ asymmetry among left (ν_L) and right (ν_R)-handed neutrinos. We ensure that $\nu_L - \nu_R$ equilibration does not occur until below the electroweak (EW) phase transition during which a part of the lepton asymmetry gets converted to dark matter asymmetry through a dimension eight operator, which conserves $B-L$ symmetry and remains in thermal equilibrium above sphaleron decoupling temperature. A part of the remaining $B-L$ asymmetry then gets converted to a net B-asymmetry through EW-sphalerons which are active at a temperature above 100 GeV. To alleviate the small-scale anomalies of ΛCDM, we assume the DM (χ) to be self-interacting via a light mediator Φ, which not only depletes the symmetric component of the DM, but also paves a way to detect the DM at terrestrial laboratories through $\Phi - H$ mixing, where H is the SM Higgs doublet.

Neutrino Physics / **101**

Future neutrino physics with Hyper-Kamiokande

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Hyper-Kamiokande, the next-generation neutrino observatory in Japan, evolves from its predecessors, Kamiokande and Super-Kamiokande, with a significant upgrade to a 260-kton water Cherenkov detector equipped with 20,000 PMTs. Hyper-Kamiokande will host an extremely rich and broad physics program, covering areas from neutrino astrophysics to nucleon decay searches and precision neutrino oscillation measurements. Positioned as the far detector for the JPARC neutrino beam, with a baseline of 295 km, and utilizing near detectors such as the upgraded ND280 detector and INGRID currently used by the T2K experiment, Hyper-Kamiokande will have excellent sensitivity to CP violation signatures in neutrino oscillations. Set to be completed in 2027, this presentation will summarize Hyper-Kamiokande's status and physics program, with an emphasis on its CP violation searches.

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Role of Right-handed Neutrinos in $B_c^+ \to B_s \bar{\mu} \nu$

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We perform a model-independent study of $c \to s\mu\nu$ mediated transitions to analyze the new physics effects in the presence of right-handed neutrinos. We have adopted the effective field theory approach and write the low-energy effective Hamiltonian including all possible dimension-six operators. The Wilson coefficients introduced through low energy effective Hamiltonian encode all NP that can enter in $c \to s$ transition at the dimension-six operator level. These Wilson coefficients are determined through a χ^2 fit by using the Miniut package to available experimental data of leptonic $D_s^+ \to \bar{\mu}\nu$ and semileptonic decays $D^0 \to K^-\bar{\mu}\nu$, $D^+ \to \bar{K^0}\bar{\mu}\nu$ and $D^0 \to K^{*-}\bar{\mu}\nu$, $D^+ \to \bar{K^{*0}}\bar{\mu}\nu$, $D_s^+ \to \phi\bar{\mu}\nu$. The differential decay width of $B_c^+ \to B_s\bar{\mu}\nu$ is derived to investigate the role of right-handed neutrinos in the search for new physics through the three-body decay process. We also make the predictions of q^2 spectra for the mode $B_c^+ \to B_s\bar{\mu}\nu$ to inspect the effect of the allowed new physics in $c \to s$ sector through right-handed neutrinos to motivate the future measurements.

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Lepton flavour violating Σ_b⟶Σl_1 l_2 decays in Zˆ'model

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Inspired by the various LHCb results of lepton flavour violation on b⟶s transition we will study the lepton flavour violating b⟶l1l2 decays in terms of transversity amplitudes in non-universal Z' model. These LFV
processes are extremely suppressed in the Standard Model (SM) because the expected levels at the SM lie far below current experimental sensitivities. In particular the branching fractions of B0⟶±⊠ and Bs⟶±⊠ decays are obtained in SM of order 10ˆ-54 [1] whereas experimentally they are constrained at the order of 10ˆ-5 by BaBar and LHCb with 90% and 95% confidence level respectively [2, 3]. There are several theoretical models proposed to explain various popular anomalies of b hadron sector. It can be said that the models that generate LFU violation also can generate LFV processes. Various lepton flavour violating decays, such as tau⟶3 mu, mu⟶3e and radiative decays ⟶e etc are studied in different NP models [4, 5] though there are no direct experimental evidence of these decays but their experimental bounds exist. In this work we will study the differential branching fractions of LFV decays b⟶l1l2 induced by the quark level transition b⟶sl1l2 in Z'model where l1 and l2 are charged leptons of different flavours.
We will constrain the NP couplings using several experimental upper limits. It is expected that the study of the decay would be very interesting and that might emboss the footprints of NP more aesthetically.
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Parallel - 7 / 105

ESSnuSB and the precise measurement of leptonic CP violation at the second neutrino oscillation maximum

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The ESSnuSB project aims to measure the leptonic CP violation at the second neutrino oscillation maximum using an intense neutrino beam produced by the powerful ESS proton linear accelerator in Sweden. This next-to-next generation long baseline neutrino oscillation experiment has a potential to start the precision era in the field of the leptonic CP violation measurement. Indeed, the reduced impact of systematic errors on sensitivity at the second maximum allows for a very precise measurement of the CP violating parameter. In this talk we will show the expected performances of ESSnuSB on delta_CP determination and describe in details the advantages to search for neutrino oscillation at their second maximum. Furthermore, we will summarize the other rich physics potentials of this experiment and of its extension phase, the ESSnuSBplus project.

Exotic quarkonium-like states / **106**

Theoretical interpretations of exotic hadrons

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In the naive quark model, baryons and mesons are bound states of three quarks and quark-antiquark pair, respectively. However, Exotic hadrons such as tetraquark ($q^2\overline{q}^2$), pentaquark ($q^4\overline{q}$), hexaquark ($q^3\overline{q}^3$), and even quark-gluon hydrid (q^3G) and glueball are not forbidden in the framework of QCD. Some exotic hadron states may possess quantum numbers which are not accessible by the traditional $q\overline{q}$ and q^3 hadron states. In this talk we will summarize all potential exotic hadrons, particularly the recently observed Charmonium-like X, Y, and Z tetraquark particles and P_c pentaquark states.

The nature of any exotic hadron still remains an open question with diverged interpretations. Among various theoretical pictures, constituent quark models, chiral perturbation theory, effective field theories, dynamical models like triangle singularity, Lattice QCD, and QCD sum rules have been proposed to explain the quantum numbers, decay patterns, mass spectrum and internal structures of the exotic hadrons. For the Charmonium-like X, Y, and Z tetraquark particles and P_c pentaquark states, the compact multi-quark picture and hadronic molecular picture are the widely accepted interpretations. We will brief all the popular theoretical models.

%Group theory approach is a very tool for constructing the multiquark system,
A special attention will be paid on tetraquark and pentaquark states, showing how the wave functions of light and heavy tetraquark and pentaquark states may be systematically constructed in the language of group theory. As an example, we will briefly introduce a constituent quark model applied to derive the mass spectrum and strong decay widths of pentaquarks, considering the coupling between the $\Sigma_c^{(*)}\bar{D}^{(*)}$ molecular states and the $q^3c\bar{c}$ compact pentaquark states.

Finally we propose that the isospin-1/2 narrow resonance $N^+(1685)$ could be the lowest compact pentaquark state, based on our recent work.

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Quantum decoherence and CP violation at Protvino to ORCA

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In this work, we study the impact of the environmental decoherence at Protvino to ORCA (P2O) experiment which has a substantial baseline of 2595 kilometres. We simulate this experiment assuming different phenomenological models and by considering energy dependency of decoherence parameter, $\Gamma \propto E_\nu^n$ ($n = 0, \pm 1, \pm 2$). We estimate the sensitivity of P2O experiment to obtain the upper bounds on Γ parameters in each of these cases. Additionally, we use these bounds to illustrate the effect of environmental decoherence on mass hierarchy (MH) and CP violation sensitivity of this experiment.

We have noted that P2O poses the strong bound on $\Gamma \leq 1.89 \times 10^{-24}\ GeV$ (90% CL) for the case of $n = 0$. Moreover, we observed that while the MH sensitivity has not changed significantly in all the cases, CP violation sensitivity increased above the standard case for all true values of δ_{CP}.

CP violation in hadrons and leptons, EDMs / 108

CP violation in B and D decays at LHC

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Studies of CP-parity violation (CPV) in heavy flavours allow measurements of important theory parameters and searches for effects deviating from the Standard Model predictions. The talk features new results of CPV studies at the LHC. Following the observation of CPV in a charm decay by the LHCb experiment, new studies of CPV in charm decays are reported. In B sector, new measurements of the Cabibbo-Kobayashi-Maskawa angles beta and gamma are discussed.

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Opening Ceremony

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Highly suppressed (Rare) b-quark processes

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Highly suppressed (Rare) b-quark processes provide an excellent probe into heavy New Physics (NP) scenarios in conjunction with stringent tests of the Standard Model (SM). Rare decays of the form $b \to s\nu\bar{\nu}$ appear in the $\Lambda_b \to \Lambda\nu\bar{n}u$ channel, that has not yet been observed, but is a promising avenue of exploration at future e^+e^- colliders, given the current status of b-quark anomalies. We provide an analysis of such decays in the SMEFT framework, accounting for the missing energy final

states. Experimental deviations from the SM predictions connote the possible footprints of heavy NP events or dark sector final states that masquerade as undetectable neutrinos. To further probe the chiral structures of BSM contributions, we calculate a decay rate for polarized initial states, forming predictions of spin-angular correlations.

Rare decays of hadrons and leptons / **111**

Exotic hadron spectroscopy and B0s-> mumu lifetime measurement in ATLAS

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Overview and recent results on spectroscopy of exotic hadrons in ATLAS with Run-2 data are presented. Four-muon mass spectrum is studied, investigating the structures earlier observed by LHCb experiment in di-J/ψ channel, using di-J/ψ and $J/\psi + \psi(2S)$ final states. Search for exotic resonances is also performed in $\Upsilon(1S) + 2\mu$ final state. ATLAS measurement of $B_s^0 \to \mu^+\mu^-$ effective lifetime with 2015-2016 data is also presented. This observable, along with the branching fraction of the decay, is sensitive to New physics contributions to the decay amplitude. The measurement result is consistent with the SM.

FPCP IAC Meeting / **112**

FPCP IAC Meeting

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Topic: FPCP IAC Meeting
Time: May 28, 2024 12:30 PM Bangkok

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