IRN Terascale @ IP2I Lyon

Report of Contributions

https://indico.in2p3.fr/e/33701

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

Welcome

Wednesday 13 November 2024 13:45 (5 minutes)

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

In memoriam Ulrich Ellwanger

Wednesday 13 November 2024 13:50 (40 minutes)

Presenters: TEIXEIRA, Ana Margarida (LPC Clermont); Dr HUGONIE, Cyril (LUPM); ORLOFF, Jean (LPC Clermont, Univ. Blaise Pascal)

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

SMC meeting

Thursday 14 November 2024 17:45 (30 minutes)

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

Search for Long Lived Particles at CMS

Thursday 14 November 2024 14:25 (25 minutes)

Depending on the length of the talk and the preference of the session conveners, the presentation could either focus on the search for heavy stable charged particles at CMS (work performed at IPHC) or cover a broader panel of LLP searches at CMS, associated to different experimental signatures in the detector.

Primary author: COLLARD, Caroline (IPHC (Strasbourg))

Presenter: COLLARD, Caroline (IPHC (Strasbourg))

Session Classification: BSM

Track Classification: BSM

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

First axion and dark photon dark matter searches with MADMAX

The MAgnetized Disk and Mirror Axion eXperiment (MADMAX) is a future experiment aiming to detect dark matter axions from the galactic halo by resonant conversion to photons in a strong magnetic field. It uses a novel concept based on a stack of dielectric disks, called booster,to enhance the axion-photon conversion probability over a significant mass range. In its final version MADMAX can scan the uncharted QCD axion mass range around 100 μeV, favoured by post-inflationary theories. Several smaller scale prototypes have been tested these two last years allowing to validate the new dielectric haloscope concept and perform first axion and dark photon dark matter searches.

Primary author: PRALAVORIO, Pascal (CPPM, Aix-Marseille Université, CNRS/IN2P3)

Presenter: PRALAVORIO, Pascal (CPPM, Aix-Marseille Université, CNRS/IN2P3)

Track Classification: Dark Universe

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

MicrOMEGAs 6: new developments and physics applications

Thursday 14 November 2024 09:00 (20 minutes)

MicrOMEGAs is a computer program to compute different dark matter observables. In this talk we will present some new features of its latest release, version 6, and discuss some of their physics applications.

Primary author: GOUDELIS, Andreas (LPC - Clermont Ferrand)

Presenter: GOUDELIS, Andreas (LPC - Clermont Ferrand)

Session Classification: Methods and Tools

Track Classification: Methods and Tools

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

SModelS v3: Going Beyond Z2 Topologies

Thursday 14 November 2024 09:25 (20 minutes)

SModelS is a public tool for fast reinterpretation of LHC searches for new physics based on a large database of simplified model results. While previous versions were limited to models with a Z2-type symmetry, version 3 can now handle arbitrary signal topologies. To this end, the tool was fully restructured and now relies on a graph-based description of simplified model topologies. In this talk, I will discuss the main conceptual changes and novel features of SModelS v3.

Primary authors: LESSA, Andre; RAMOS, Camila; ALTAKACH, Mohammad Mahdi; KRAML, Sabine; NARASIMHA, Sahana; PASCAL, Timothée; WALTENBERGER, Wolfgang; VILLAMIZAR, Yoxara

Presenter: ALTAKACH, Mohammad Mahdi

Session Classification: Methods and Tools

Track Classification: Methods and Tools

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

Latest Results from the XENONnT Dark Matter Experiment

The XENONnT project is located in the Gran Sasso laboratory in Italy. Its main goal is the direct detection of dark matter, particularly Weakly Interacting Massive Particles (WIMPs). It uses a dual-phase liquid xenon time projection chamber (TPC) to identify particle interactions. When a particle interacts with the target mass, light (S1 signal) and charge (S2 signal) are produced. The experiment is protected by natural shielding, situated under 3600 meters of rock, and has an active system to reduce background noise. The dense liquid xenon also provides effective self-shielding, allowing the definition of a central fiducial volume with minimal background noise.

Recently, XENONnT achieved a major breakthrough by observing solar neutrinos from ^{8}B via coherent elastic neutrino-nucleus scattering (CEvNS). This is a significant milestone, as it marks the first direct detection of nuclear recoils caused by solar neutrinos using a dark matter detector. The detection was made with a statistical significance of 2.73σ, confirming the observation. This CEvNS measurement presents a new opportunity for neutrino studies and paves the way for future analyses that may lead to further exciting discoveries. XENONnT continues to collect and analyze more data, raising the potential for new advances in rare interaction searches.

Primary author: Mr RAVINDRAN, Ananthakrishnan (SUBATECH, IMT Atlantique & The University of Melbourne)

Presenter: Mr RAVINDRAN, Ananthakrishnan (SUBATECH, IMT Atlantique & The University of Melbourne)

Track Classification: Dark Universe

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

Hyperiso: A general BSM calculator for flavour observables

Thursday 14 November 2024 09:50 (15 minutes)

Hyperiso is a refactored and expanded version of the flavour code SuperIso allowing for efficient calculations of flavour observables. While SuperIso was dedicated to SM, THDM and several SUSY models, Hyperiso now implements a transparent interface with MARTY (a public tool to perform analytical QFT calculations) to extend SuperIso's observable calculation routines to generic BSM scenarii. In this talk, we will present the main structural changes and new features of the MARTY–Hyperiso pipeline.

Primary authors: MAHMOUDI, Nazila (Lyon University); FARDEAU, Niels; REYMERMIER, Théo (IP2I Lyon + LPSC)

Presenters: FARDEAU, Niels; REYMERMIER, Théo (IP2I Lyon + LPSC)

Session Classification: Methods and Tools

Track Classification: Methods and Tools

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

Machine Learning the likelihoods

Thursday 14 November 2024 10:10 (15 minutes)

In recent years, the ATLAS collaboration has released full statistical models for some of their analyses, allowing for precise reinterpretation of experimental limits. These models incorporate numerous nuisance parameters and correlations between signal bins, but their complexity often results in prolonged computation times. This project seeks to develop a method for efficient yet accurate reinterpretation of experimental results in phenomenological studies. We are training Deep Neural Networks (DNNs) to act as surrogates for full statistical models by performing likelihood interpolation. This approach significantly reduces computation times, often by several orders of magnitude, while preserving a high level of accuracy.

In my talk, I will present the project and highlight recent progress, including the creation of a framework that uses Markov Chain Monte Carlo (MCMC) techniques to generate data, the training of Neural Networks to interpolate likelihoods, and the validation of these models on real-world analyses.The long-term objective is to develop a publicly accessible and maintainable database of trained machine learning models, which can be integrated into various reinterpretation tools, offering a valuable resource for the particle physics community.

Primary author: MASELEK, Rafal (LPSC (Grenoble))

Presenter: MASELEK, Rafal (LPSC (Grenoble))

Session Classification: Methods and Tools

Track Classification: Methods and Tools

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

Leptophilic Z' at the FCC-ee

Thursday 14 November 2024 12:10 (20 minutes)

We present the detection prospects of new Standard Model (SM)-neutral vector bosons (Z_l) that couple exclusively to leptons at the Future Circular Collider in the electron-positron stage (FCC-ee). We focus our search on Z' production with a radiated photon, and show that FCC-ee can significantly extend the unprobed parameter space for this class of models in the kinematically allowed mass range and outdo other proposed future lepton colliders. Furthermore, we look at the possibility of improving our bounds by studying the sensitivity dependence on detector parameters.

Primary author: PATTNAIK, Baibhab (IFIC (CSIC-University of Valencia) and LPC)

Presenter: PATTNAIK, Baibhab (IFIC (CSIC-University of Valencia) and LPC)

Session Classification: BSM

Track Classification: BSM

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

New LCSR B->K Form Factors determination

Thursday 14 November 2024 14:50 (20 minutes)

Deviations from the Standard Model have long been observed in semileptonic B-meson decays, notably $b \to s\ell\ell$ transitions, triggering speculations on potential New Physics effects in this sector. Following recent updates of $R_{K^{(*)}}$ and $BR(B_{(s)} \to)$, and the first measurement of R_ϕ by the LHCb collaboration, the sole remaining significant deviations from the SM in flavour-changing neutral currents B-decays now lie in the branching ratios of decays involving b ⟶ sμμ and in the angular observable P'5.

However, unlike $R_{K^{(*)}}$, R_ϕ, and $BR(B_{(s)} \to)$, predicting $BR(B_s \to M)$ (with $M = K^{(*)}, , ...$) is challenging due to significant non-perturbative QCD effects, which introduce up to 30% theoretical uncertainty—often comparable to experimental errors—hampering the potential of these observables for discovery

We undertake a new calculation of local $B \to K$ form factors using Light-Cone Sum Rules, proposing an alternative method and reassessing the systematic error associated to semi-global quark-hadron duality. These form factor predictions are then used to compute relevant observables and perform fits of NP scenarios.

Primary author: MONCEAUX, Yann (IP2I (Lyon))

Co-authors: CARVUNIS, Alexandre (LAPTh); MAHMOUDI, Nazila (Lyon University)

Presenter: MONCEAUX, Yann (IP2I (Lyon))

Session Classification: BSM

Track Classification: BSM

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

Linear Collider Facility - Introduction and Higgs programme below the ttbar threshold

Friday 15 November 2024 11:35 (15 minutes)

The physics programme of linear e+e- colliders spans from the Z-Pole deep into the TeV range. Therefore, all Standard Model particles and their interactions are covered by the scientific programme of linear colliders. Beam polarisation allows for testing all aspects of the electroweak and the Higgs sector. New physics would lead to unique patterns of deviations from the Standard Model predictions. Examples are the set of couplings of Standard Model particles to the Higgs boson. At a centre of mass energy of 250 GeV coupling precisions of the order of 1% and better are achievable. This precision would confirm deviations from the standard model and allow for pinning down a concrete model. The contributions will show examples for these studies carried out in French groups.

Primary authors: LAKTINEH, Imad ({UNIV CLAUDE BERNARD}UMR5822); POESCHL, Roman (LAL Orsay); LAKTINEH, imad (in2p3-ucbl)

Presenter: LAKTINEH, imad (in2p3-ucbl)

Session Classification: Higgs and Electroweak

Track Classification: Higgs

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

Linear Collider Facility - Physics about ttbar threshold and outlook

Friday 15 November 2024 11:55 (15 minutes)

At energies above 500 GeV processes such as di-Higgs production or associated top-Higgs production open up. Both processes will profit from the clean environment of e+e- collisions that will allow for a direct measurement of the Higgs self-coupling and an unambiguous determination of the CP properties of the Higgs boson.
The Higgs particle is intimately coupled to the top quark. Therefore, the full top programme can be considered as equally important to that of the Higgs. In the past years French groups made leading contributions to this topic. The top quark programme will cover a precise determination of the top quark mass as well as of the electroweak top quark couplings to the percent precision. Deviations from the Standard Model prediction would allow for interpretations in the frame of models with (warped) extra dimensions or (equivalent) models in which the Higgs and the top are composite. These measurements will be complemented by the determination of electroweak couplings of lighter Standard Model fermions in the per-mille range that in itself bears a considerable discovery potential. Finally, it will be also outlined how the energy reach of linear colliders is capable to complement discoveries that might be made in the upcoming HL-LHC phase.
The most mature proposal for a linear collider is the International Linear Collider ILC based on superconducting radio frequency (SCRF) cavities. Therefore, the physics potential will be mainly illustrated by recent results obtained in detailed simulation studies using the detector concepts ILD and SiD. These results are complemented by results obtained in studies for CLIC and where available for other linear collider variants. Recently, all variants are federated under the roof of the LCVision project that will allow for elaborating a coherent plan for the initial stage of a Linear Collider Facility and for the upgrades to higher energies.

Primary authors: LAKTINEH, Imad ({UNIV CLAUDE BERNARD}UMR5822); POESCHL, Roman (LAL Orsay); LAKTINEH, imad (in2p3-ucbl)

Presenter: POESCHL, Roman (LAL Orsay)

Session Classification: Higgs and Electroweak

Track Classification: Higgs

Contribution ID: **16** Type: **not specified**

First-order phase transitions from a broken horizontal SU(2) gauge symmetry

Thursday 14 November 2024 15:10 (20 minutes)

Under certain conditions, a first-order phase transition during early-universe symmetry breaking can generate observable signals in the stochastic gravitational-wave (GW) background. Since the Standard Model (SM) predicts a cross-over phase transition, detectable signals are expected to arise from beyond the SM frameworks, traditionally testable only at colliders. Motivated by this complementarity between collider experiments and GW observatories, we consider the breaking of a new non-abelian SU(2) gauge symmetry corresponding to a horizontal flavour gauge group embedded in the SM flavour structure. For such a model, the new gauge symmetry is broken far above the electroweak scale and constraints are dominated by "flavour-transfer"operators rather than flavour-changing currents. We calculate the finite-temperature corrections to the effective potential and determine the critical temperature for the phase transition. We compare two of the thermal resummation techniques favoured in the literature and examine the parameters for which the phase transition is strongly first-order.

Primary authors: CORNELL, Alan (University of Johannesburg); DEANDREA, Aldo (IP2I - Université Lyon 1); CHRYSOSTOMOU, Anna (LPTHE); DARMÉ, Luc (IP2I - Université Lyon 1)

Presenter: CHRYSOSTOMOU, Anna (LPTHE)

Session Classification: BSM

Track Classification: BSM

Contribution ID: **17** Type: **not specified**

Analyses surrogates and how to build them

Thursday 14 November 2024 11:00 (20 minutes)

I will present the reinterpretation of the CalRatio + X ATLAS analysis (arXiv:2407.09183), focusing on neutral long-lived particles decaying within the ATLAS hadronic calorimeter. The reinterpretation involves a Boosted Decision Tree (BDT) trained on truth-level variables to estimate the probability of events within the ABCD plane and assess the sensitivity of the analysis. The BDT weights, along with a Python code example, are available on HEPData to ensure reproducibility. Additionally, I will discuss how this method can be extended to other analyses, providing guidance for broader applications.

Presenter: HADDAD, Abdelhamid (LPCA)

Session Classification: Methods and Tools

Contribution ID: **18** Type: **not specified**

MadNIS

Thursday 14 November 2024 11:25 (20 minutes)

Theory predictions for the LHC require precise numerical phase-space integration and generation of unweighted events. We combine machine-learned multi-channel weights with a normalizing flow for importance sampling to improve classical methods for numerical integration. By integrating buffered training for potentially expensive integrands, VEGAS initialization, symmetry-aware channels, and stratified training, we elevate the performance in both efficiency and accuracy. Further, we show how differential programming techniques can boost the performance of current and planned MadGraph implementations. We empirically validate these enhancements through rigorous tests on diverse LHC processes.

Presenter: HEIMEL, Theo (Heidelberg)

Session Classification: Methods and Tools

Contribution ID: **19** Type: **not specified**

Some non-axion solutions to the strong CP problem and their phenomenology

Thursday 14 November 2024 11:50 (20 minutes)

While axions (which are very well-motivated) heavily dominate the amount of work currently done regarding the strong CP problem, alternatives ought to be systematically investigated, in order to assess what the strong CP problem really entails (and potentially update our theoretical biases). In this context, I will talk about solutions that rely on spontaneously broken spacetime symmetries, and various UV structures, such as copies of the Standard Model's fields and interactions, or appropriately designed extended Higgs sectors. If time allows, I will talk about their collider, flavor and early universe phenomenology.

Presenter: BONNEFOY, Quentin (Université de Strasbourg & IPHC, CNRS)

Session Classification: BSM

Contribution ID: **20** Type: **not specified**

Quantum Tops: Quantum Information Meets High Energy Physics

Thursday 14 November 2024 14:00 (25 minutes)

The Standard Model of particle physics is a quantum field theory, based on quantum mechanics and special relativity. Therefore, it allows us to test fundamental properties of quantum mechanics. Top-quark pairs, which are generated at the LHC, are a unique high-energy system since their spin correlations can be measured. Thus, it is possible to study fundamental aspects of quantum mechanics such as entanglement and Bell non-locality using top-quark pairs, represented as two qubits. The environment provided by the LHC makes these studies especially attractive: the qubits are entangled through exotic interactions and are genuinely relativistic, at energies which are many orders of magnitude above conventional condensed-matter and optical experiments. In addition to the fundamental and interdisciplinary nature of these studies, quantum information observables can be used to develop new strategies to search for physics beyond the Standard Model. I will discuss the theoretical background, the first measurements of entanglement between top-quark pairs by the ATLAS and CMS collaborations, and the future prospect of the field.

Presenter: AFIK, Yoav (Enrico Fermi Institute, University of Chicago)

Session Classification: BSM

Contribution ID: **21** Type: **not specified**

Muon colliders

Wednesday 13 November 2024 14:35 (15 minutes)

Presenters: BALLI, Fabrice (CEA Saclay); BALLI, Fabrice (CEA Saclay)

Session Classification: Session on the European Strategy for Particle Physics Update 2025

Contribution ID: **22** Type: **not specified**

ECFA summary

Wednesday 13 November 2024 14:55 (20 minutes)

Presenter: ZERWAS, Dirk (DMLab and IJCLab)

Session Classification: Session on the European Strategy for Particle Physics Update 2025

Contribution ID: **23** Type: **not specified**

ECFA theory overview

Wednesday 13 November 2024 15:20 (20 minutes)

Presenter: MUEHLLEITNER, Margarete (ITP Karlsruhe)

Session Classification: Session on the European Strategy for Particle Physics Update 2025

Contribution ID: **24** Type: **not specified**

Perspectives on computing challenges

Wednesday 13 November 2024 15:45 (15 minutes)

Presenter: CRÉPÉ-RENAUDIN, Sabine (IN2P3)

Session Classification: Session on the European Strategy for Particle Physics Update 2025

Contribution ID: **25** Type: **not specified**

Early career researcher ECFA summary

Wednesday 13 November 2024 16:25 (10 minutes)

Presenter: D'ERAMO, Louis (LPCA - Clermont)

Session Classification: Session on the European Strategy for Particle Physics Update 2025

Contribution ID: **26** Type: **not specified**

Sustainability issues

Wednesday 13 November 2024 16:05 (15 minutes)

Presenter: CALVET, Samuel (LPC)

Session Classification: Session on the European Strategy for Particle Physics Update 2025

Contribution ID: **27** Type: **not specified**

Discussion

Wednesday 13 November 2024 17:00 (1h 30m)

Session Classification: Session on the European Strategy for Particle Physics Update 2025

Contribution ID: **28** Type: **not specified**

Latest Results from the XENONnT Dark Matter Experiment

Thursday 14 November 2024 16:15 (30 minutes)

Presenter: RAVINDRAN, Ananthakrishnan

Session Classification: Dark Universe

Contribution ID: **29** Type: **not specified**

First axion and dark photon dark matter searches with MADMAX

Thursday 14 November 2024 16:45 (30 minutes)

Presenter: DABHI, Vijay (CPPM, Marseille)

Session Classification: Dark Universe

Contribution ID: **30** Type: **not specified**

DarkSide-20k sensitivity to light dark matter particles

Thursday 14 November 2024 17:15 (30 minutes)

Presenter: PRALAVORIO, Pascal (CPPM, Aix-Marseille Université, CNRS/IN2P3)

Session Classification: Dark Universe

Contribution ID: **31** Type: **not specified**

Famous last words

Friday 15 November 2024 12:15 (10 minutes)

Contribution ID: **32** Type: **not specified**

Introduction

Friday 15 November 2024 09:30 (5 minutes)

Presenters: OCHANDO, Christophe (LLR); KOLETSOU, Iro (LAPP); D'ERAMO, Louis (LPCA - Clermont); SLAVICH, Pietro (LPTHE Paris)

Session Classification: Higgs and Electroweak

Contribution ID: **33** Type: **not specified**

Studies of the energy dependence of diboson polarization fractions and the Radiation Amplitude Zero effect in WZ production with the ATLAS detector

Friday 15 November 2024 09:35 (15 minutes)

Presenter: MANJARRES RAMOS, Joany (L2I Toulouse, UT3, CNRS/IN2P3)

Session Classification: Higgs and Electroweak

Contribution ID: **34** Type: **not specified**

Heavy Higgs search in the 4l final state with CMS

Friday 15 November 2024 09:55 (15 minutes)

Presenter: Mr LIU, Geliang (Ecole polytechnique)

Session Classification: Higgs and Electroweak

Contribution ID: **35** Type: **not specified**

HH searches at the HL-LHC in the bb□□ final state with ATLAS

Friday 15 November 2024 10:45 (15 minutes)

Presenters: FUJIMOTO, Minori (CPPM, Aix-Marseille Université, CNRS/IN2P3); FUJIMOTO, Minori

Session Classification: Higgs and Electroweak

Track Classification: Higgs

Contribution ID: **36** Type: **not specified**

Higgs physics opportunities at the FCC

Friday 15 November 2024 11:05 (20 minutes)

Presenter: MARCHIORI, Giovanni (APC Paris)

Session Classification: Higgs and Electroweak

Track Classification: Higgs

Contribution ID: **38** Type: **not specified**

Introduction

Wednesday 13 November 2024 14:30 (5 minutes)

Presenter: VACAVANT, Laurent (IN2P3)

Session Classification: Session on the European Strategy for Particle Physics Update 2025

Contribution ID: **39** Type: **not specified**

Dîner au Café des fédérations

Thursday 14 November 2024 20:00 (2 hours)

Contribution ID: **40** Type: **not specified**

In memoriam: Rohini Godbole

Thursday 14 November 2024 15:30 (15 minutes)