The 18th International Workshop on Tau Lepton Physics (TAU2025)

Report of Contributions

https://indico.cern.ch/e/tau2025

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

Observing true tauonium at colliders

The bound state of two tau leptons, called ditauonium or true-tauonium $\mathcal{T}$, is the heaviest and also most compact QED atom, and remains unobserved to date. Its study has several motivations such as precisely extracting properties of the tau lepton, carrying out novel tests of SM and its basic CPT symmetries, and searching for BSM effects impacting the tau lepton. We will first discuss the spectroscopic properties of ditauonium, including energy levels and decay channels. A systematic survey of search strategies at present and future lepton and hadron colliders will then be provided. The spin-triplet state, ortho-ditauonium, can be observed at a future super tau-charm factory (STCF) via $e^+e^- \to \mathcal{T}_1 \to \mu^+\mu^-$, where a threshold scan with monochromatized beams can also provide a very precise extraction of the tau lepton mass with $\mathcal{O}(25\,\text{keV})$ uncertainty. Observing $\text{pp} \to \mathcal{T}_1(\mu^+\mu^-) + X$ is possible at the LHC by identifying its displaced vertex with a good control of the combinatorial dimuon background. The spin-singlet state, para-ditauonium, will be observable in photon-photon collisions at the FCC-ee via $\gamma\gamma \to \mathcal{T}_0 \to \gamma\gamma$.

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Presenter: D'ENTERRIA, David (CERN)

Session Classification: Plenary session

Track Classification: tau properties and SM

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

SND@LHC: First Measurements and Future Prospects

The SND@LHC experiment was designed to perform measurements with neutrinos produced at the LHC within the unexplored pseudo-rapidity range of 7.2 < 𝜂 < 8.6. Located 480 m downstream of IP1 in the unused TI18 tunnel, this compact and stand-alone experiment employs a hybrid detector system consisting of 800 kg of tungsten plates interleaved with emulsion and electronic trackers, complemented by a calorimeter and a muon detection system. This configuration allows for the efficient identification of all three neutrino flavors, thereby opening new
opening a unique opportunity to probe the physics of heavy flavour production at the LHC, particularly in regions inaccessible to existing experiments such as ATLAS, CMS, and LHCb.
Exploring this region is of particular interest for future circular colliders and predictions of very high-energy atmospheric neutrinos. Furthermore, the detector's design is adept at searching for Feebly Interacting Particles through distinctive scattering signatures. Since its initiation in 2022, the SND@LHC experiment has successfully operated during LHC Run 3 and collected 290 fb−1 of data. This presentation will summarize the results obtained thus far, the methodologies employed, and the implications for advancing our understanding of neutrino physics.

Authors: GULER, Murat Ali (Physics Department of Middle East Technical University (TR)); COLL., SND@LHC

Presenter: GULER, Murat Ali (Physics Department of Middle East Technical University (TR))

Session Classification: Plenary session

Track Classification: Neutrino

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

Results from the DsTau (NA65) Experiment

The DsTau (NA65) experiment at CERN is designed to measure the inclusive differential cross-section for Ds meson production, followed by its decay into a tau lepton and tau neutrino, in proton–nucleus interactions. The DsTau detector, employing the nuclear emulsion technique, offers sub-micron spatial resolution, allowing for highly precise detection of short-lived particles such as charmed hadrons. We present the first results from the analysis of data acquired during the 2018 pilot run, focusing on the reconstruction accuracy of proton interaction vertices under high track density conditions. The experimental results on charged particle multiplicities and angular distributions are compared with predictions from several Monte Carlo event generators. The multiplicity distribution in proton–tungsten (p–W) interactions has been tested for the KNO-G scaling, showing approximate agreement. Furthermore, we report the first measurement of the proton interaction length in tungsten. The current status of the Ds
decay search is also discussed, along with preliminary estimates of the differential Ds production cross-section.

Authors: COLLABORATION, DsTau; GORNUSHKIN, Yury

Presenter: GORNUSHKIN, Yury

Session Classification: Plenary session

Track Classification: Neutrino

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

Recent results from LHCb on charged-current decays of b-hadrons

In the SM, the electroweak bosons couple to the three lepton families with the same strength having the only difference in their behaviour due to the difference in mass. The current measurements of the ratios of branching fractions for b-hadrons decaying into final states with different lepton flavours deviate of the order of 3 σ with respect to the Standar Model. This talk presents recent results of lepton flavour universality tests in b→cℓν decays, using hadronic or muonic τ decays, performed at LHCb.
Other results regarding charged-current decays of b-hadrons will also be presented.

Author: VOS, Keri (Nikhef National institute for subatomic physics (NL))

Presenter: VOS, Keri (Nikhef National institute for subatomic physics (NL))

Session Classification: Plenary session

Track Classification: B physics

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

Search for lepton-flavour violating decay $\tau \to \mu\gamma$ at Belle II

The rates of lepton-flavour violation in charged lepton decays are enhanced in many beyond-the-standard-model theories. During the first run of the Belle II experiment 365 fb^{-1} of e^+e^- collision data was collected at a centre-of-mass energy corresponding to the $\Upsilon(4S)$ resonance. This dataset contains around 340 million $e^+e^- \to \tau^+\tau^-$ events with constrained kinematics and low backgrounds, providing an ideal environment to search for a wide variety of lepton-flavour violating (LFV) τ decays. One of the golden channels for τ LFV is $\tau \to \mu\gamma$ and in this talk we present the first search for this decay at Belle II.

Author: ROBERTSON, Steven (IPP / University of Alberta)

Presenter: ROBERTSON, Steven (IPP / University of Alberta)

Session Classification: Plenary session

Track Classification: LFB & BSM

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

Dark sector searches in τ pairs at Belle

The existence and unknown nature of dark matter motivates dark sector searches at accelerators. The Belle experiment has collected samples of e^+e^- collision data containing a huge number of $e^+e^- \to \tau^+\tau^-$ events with constrained kinematics and low backgrounds, enabling several world-leading dark matter searches in the sub-GeV mass region. Using 800 fb^{-1} of data collected at or near the $\Upsilon(4S)$ resonance by the Belle experiment, we search for lepton-flavor violating decays $\tau \to e\alpha$ and $\mu\alpha$, where α is a an undetected spin-0 particle (e.g. an axion-like particle).

Author: ROBERTSON, Steven (IPP / University of Alberta)

Presenter: ROBERTSON, Steven (IPP / University of Alberta)

Session Classification: Plenary session

Track Classification: LFB & BSM

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

Searches for forbidden τ decays at Belle and Belle II

The rates of lepton-flavour, lepton-number, and baryon-number violating τ decays are enhanced in many beyond-the-standard-model theories. The Belle and Belle II experiments have collected samples of e^+e^- collision data containing a huge number of $e^+e^- \to \tau^+\tau^-$ events with constrained kinematics and low backgrounds, providing an ideal environment to search for τ decays forbidden in the Standard Model. We present several world-leading results, including searches for lepton-flavour violating decays $\tau^- \to \ell^- K^0_S$ at Belle and Belle II, and $\tau^- \to e^-\ell^+\ell^-$ at Belle II.

Author: ROBERTSON, Steven (IPP / University of Alberta)

Presenter: ROBERTSON, Steven (IPP / University of Alberta)

Session Classification: Plenary session

Track Classification: LFB & BSM

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

Measurement of CP asymmetry in $\tau \to K^0_S \pi \nu$ at Belle II

More then a decade ago, the BaBar experiment measured a 2.8σ deviation from the Standard Model when searching for CP violation in $\tau^- \to \pi^- K^0_S (\geq 0\pi^0)\nu_\tau$ decays.
Since then, the Tau Physics community has eagerly anticipated a new measurement. The first run of the Belle II experiment collected a 365 fb^{-1} sample of e^+e^- collisions at a centre-of-mass energy corresponding to the $\Upsilon(4S)$ resonance. This dataset contains around 340 million $e^+e^- \to \tau^+\tau^-$ events with excellent K^0_S reconstruction and low backgrounds, providing an ideal environment to measure CP asymmetry in τ decays. In this talk, we present the first search for CP violation in $\tau^- \to \pi^- K^0_S (\geq 0\pi^0)\nu_\tau$ decays at Belle II.

Author: ROBERTSON, Steven (IPP / University of Alberta)

Presenter: ROBERTSON, Steven (IPP / University of Alberta)

Session Classification: Plenary session

Track Classification: tau properties and SM

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

Measurement of the τ lifetime at Belle II

The τ lifetime is a fundamental parameter in the Standard Model, providing an important contribution to the test of lepton-flavour universality. The first run of the Belle II experiment collected a 365 fb^{-1} sample of e^+e^- collisions at a centre-of-mass energy corresponding to the $\Upsilon(4S)$ resonance, delivering around 340 million $e^+e^- \to \tau^+\tau^-$ events. The tiny beam spot size at the interaction point of these collisions, which is unique to the nano-beam scheme of the SuperKEKB accelerator, allows for a novel method for measuring the τ lifetime in the 1x3 prong topology. We present the first results from Belle II using this novel method.

Author: ROBERTSON, Steven (IPP / University of Alberta)

Presenter: ROBERTSON, Steven (IPP / University of Alberta)

Session Classification: Plenary session

Track Classification: tau properties and SM

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

Searches for lepton-flavour violation in meson decays at Belle and Belle II

The Belle and Belle II experiments have collected a $1.1\,\mathrm{ab}^{-1}$ sample of e^+e^- collision data at centre-of-mass energies corresponding to the $\Upsilon(4S)$ resonances. The $\Upsilon(4S)$ resonance decays almost exclusively to $B\bar{B}$ pairs. Using these data, we search for lepton-flavour-violating decays $B \to K^{(*)}\tau\ell$. In addition, we present searches for lepton-flavour-violation in bottomonium decay using samples collected by the Belle detector at centre-of-mass energies corresponding to the $\Upsilon(1S)$ and $\Upsilon(2S)$.

Author: ROBERTSON, Steven (IPP / University of Alberta)

Presenter: ROBERTSON, Steven (IPP / University of Alberta)

Session Classification: Plenary session

Track Classification: B physics

Contribution ID: **15** Type: **Talk**

Model-Independent Signatures of New Physics in the $B \to a_1(1260)\ell^-\bar{\nu}_\ell$ Semileptonic Decay

Recent measurements of B meson decays reveal persistent deviations from Standard Model (SM) predictions, particularly in processes involving $b \to s$ and $b \to c(u)$ quark-level transitions, suggesting potential signals of new physics (NP). Motivated by the capabilities of current and upcoming high-luminosity B factories, we investigate the exclusive decay $B \to a_1(1260)\ell^-\bar{\nu}_\ell$ within a model-independent framework to assess its sensitivity to NP effects. The NP parameters are constrained using the experimentally measured branching fractions of the (semi)leptonic decays $B \to \ell\bar{\nu}$ and $B \to (\pi, \rho, \omega)\ell\bar{\nu}$ (with $\ell = e, \mu, \tau$), which proceed via $b \to u\ell\bar{\nu}$ transitions. We then perform a detailed angular analysis of the $B \to a_1(1260)\ell^-\bar{\nu}_\ell$ channel both within the SM and under various NP scenarios. Furthermore, we present theoretical predictions for several observables, including the branching ratio, forward-backward asymmetry, and indicators of lepton flavor universality violation, thereby highlighting the potential of this decay mode as a probe for physics beyond the Standard Model.

Author: BHATTA, aishwarya

Presenter: BHATTA, aishwarya

Session Classification: Plenary session

Track Classification: B physics

Contribution ID: **16** Type: **Talk**

The Mu2e experiment

The Mu2e experiment will search for coherent neutrinoless conversion of a negative muon into an electron in the field of an aluminium nucleus. Observation of this process would be a signature of Charged Lepton Flavor Violation (CLFV), a Beyond the Standard Model (BSM) process predicted by various theories. Mu2e aims to improve the current limit by four orders of magnitude, reaching a single event sensitivity of 3×10^{-17}, which corresponds to an indirect search at an effective mass scale of 10^4 TeV/c^2. The experiment is wrapping up its construction at Fermilab and is starting its commissioning phase, with plans for data taking in 2027.

Author: BORREL, Léo (California Institute of Technology)

Presenter: BORREL, Léo (California Institute of Technology)

Session Classification: Plenary session

Track Classification: LFB & BSM

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

Charged Lepton Flavour Violation searches at LHCb

Charged Lepton Flavour Violation (cLFV) is strongly suppressed in the Standard Model and therefore represents a sensitive probe for physics beyond it. Recently, the LHCb experiment has performed dedicated searches for cLFV, both in semileptonic b-hadron decays and in purely leptonic tau decays, placing competitive bounds on several decay modes. These results provide relevant constraints on a variety of new physics scenarios. With the larger dataset and upgraded detector available in Run 3, LHCb will be able to further improve the sensitivity to cLFV processes in tau decays, extending the reach in the search for possible signals of new physics.

Author: VOS, Keri (Nikhef National institute for subatomic physics (NL))

Presenter: VOS, Keri (Nikhef National institute for subatomic physics (NL))

Session Classification: Plenary session

Track Classification: LFB & BSM

Contribution ID: **18** Type: **Talk**

Searches for new phenomena in final states with taus using the ATLAS detector: using standard reconstruction and identification techniques

Many theories beyond the Standard Model predict new phenomena, such as leptoquarks, vector like leptons, supersymmetry, new scalars or heavy leptons, in final states with isolated taus reconstructed using standard techniques. Searches for new physics with such signatures, produced either resonantly or non-resonantly, are performed using the ATLAS experiment at the LHC. The most recent results will be reported.

Author: VIVARELLI, Iacopo (Universita e INFN, Bologna (IT))

Presenter: VIVARELLI, Iacopo (Universita e INFN, Bologna (IT))

Session Classification: Plenary session

Track Classification: LHC

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

Searches for new phenomena in final states with taus using the ATLAS detector: using new advanced reconstruction and identification techniques

Many extensions of the Standard Model predict new phenomena like beyond-the-Standard-Model couplings to the Higgs boson, charged Higgs, Heavy neutral lepton, supersymmetry, among others. In this talk, the latest searches latest from the ATLAS experiment will be reported, with emphasis on the final states using special tau reconstruction techniques like merged or boosted tau topologies as well as displaced tau leptons.

Author: VIVARELLI, Iacopo (Universita e INFN, Bologna (IT))

Presenter: VIVARELLI, Iacopo (Universita e INFN, Bologna (IT))

Session Classification: Plenary session

Track Classification: LHC

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

Looking forward to B+⟶τν and Bc⟶τν

In this talk we present the outcome of a stand-alone feasibility study using RapidSim simulation software that demonstrates that the Large Hadron Collider beauty (LHCb) experiment will be capable of observing the decays $B^+ \to \tau^+\nu_\tau$ and $B_c^+ \to \tau^+\nu_\tau$ using the data that is being collecting during Run 3 of the LHC. Our proposed analysis exploits the small distance of only 5.1 millimetres between the sensing elements of LHCb's innermost silicon pixel detector, the VELO, and the LHC' s proton beams to identify direct pixel hits in the VELO that can be associated with the charged B^+, B_c^+ or τ^+ particles. By exploiting this extra information, the limitations due to the missing momentum and vertex information, which were up to now considered a showstopper, will be significantly reduced. This provides enough statistical power to pursue the measurements of these two decay channels at the Large Hadron Collider. In particular for the decay $B_c^+ \to \tau^+\nu_\tau$, which has been identified by the high energy physics community as a key objective for experiments at the planned next-generation particle accelerators, this means we do not need to wait for the 2030s or beyond to get first experimental constraints.

Authors: MARTINEZ GOMEZ, Daniel Guillermo (University of Groningen (NL)); DE BRUYN, Kristof Antoon M (University of Groningen); VAN VEGHEL, Maarten (Nikhef National institute for subatomic physics (NL)); GALATI, Maria Domenica (Van Swinderen Institute, University of Groningen); MULDER, Mick (University of Groningen (NL))

Presenter: GALATI, Maria Domenica (Van Swinderen Institute, University of Groningen)

Session Classification: Plenary session

Track Classification: B physics

Contribution ID: **21** Type: **Talk**

Tau Physics at STCF

The super tau-charm facility proposed in China, is suppose to produce 3.5 billion tau pairs per year in the energy region of 4 to 5 GeV. Besides, the STCF covers the threshold of tau pairs. Based on thses samples, general topics are proposed at STCF, e.g., cLFV processes, $|V_{us}|$ measurements, alpha_s and tau mass measurements. Novel topics are proposed at well, e.g., tau atoms. In this topic, we will briefly introduce the current simulations and sensitivities on tau physics that can be achieved at STCF, and most importantly, would like to hear the suggestions
from the experts about the tau physics at STCF.

Author: Prof. YAN, Wenbiao (University of Science and Technology of China)

Co-author: HU, Qipeng (University of Science and Technology of China (CN))

Presenter: Prof. YAN, Wenbiao (University of Science and Technology of China)

Session Classification: Plenary session

Track Classification: Future experiments

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

Measurement of electromagnetic transition form factors in two-photon collisions at BESIII

Electromagnetic transition form factors of light mesons are important inputs to the calculations of the hadronic light-by-light scattering contribution to the Standard Model prediction of the anomalous magnetic moment of the muon. However, data in the relevant regions of momentum transfer are scarce. The BESIII experiment at the e^+e^- collider BEPCII has collected the world's largest data sets in the τ-charm energy region, including, but not limited to more than $20\,\mathrm{fb}^{-1}$ of data at a center-of-mass energy of 3.773 GeV/c^2. The data are analyzed for two-photon collisions in events of the type $e^+e^- \to e^+e^-P$, with $P = \pi^0, \eta^{(\prime)}, f_1(1285), \pi^0\pi^0$, and $\pi^+\pi^-$. The aim is to study the momentum dependence of the respective space-like electromagnetic transition form factors. In this presentation we discuss recent results and prospects of ongoing analyses.

Author: REDMER, Christoph

Presenter: REDMER, Christoph

Session Classification: Plenary session

Track Classification: g-2

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

Update on the status of COMET experiment

Experiments on neutrino oscillations have demonstrated that lepton flavor can be violated for neutral leptons. However, no charged lepton flavor violation (cLFV) has yet been observed. The COMET experiment [1] aims to detect cLFV through a process involving new physics: the coherent, neutrinoless conversion of a muon bound to a nucleus into an electron (μ^- + N(Z,A) $\longrightarrow$ e^- + N(Z,A)). The experiment aims for a single-event sensitivity of 10^{-17} over two phases, which would be a four-order-of-magnitude improvement over the current limit (SINDRUM-II, 2006)[2]. COMET will begin with a low-intensity beam at J-PARC in 2026. This talk will present an update on the status of the COMET beam line, magnets, detectors, data acquisition system, and schedule.

[1] The COMET Collaboration. COMET Phase-I technical design report. Prog. Theor. Exp. Phys., 033C01:102 pages, 2020. DOI: https://doi.org/10.1093/ptep/ptz125.
[2] The SINDRUM II Collaboration. A search for μ − e conversion in muonic gold. Eur. Phys. J. C, 47:337–346, 2006. DOI: https://doi.org/10.1140/epjc/s2006-02582-x.

Author: CLOUVEL, Thomas

Co-author: THE COMET COLLABORATION

Presenter: CLOUVEL, Thomas

Session Classification: Plenary session

Track Classification: LFB & BSM

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

Tau-philic light new physics at Belle-II

New physics scenarios addressing the flavor puzzle generally predict dominant interactions with fermions of the third generation. In this talk, I will discuss the prospects for probing light particles beyond the standard model —such as light vectors, scalars and axion-like particles —which possess dominant couplings to the tau lepton. In particular, I will focus on the possibility to investigate these scenarios at Belle-II. I will highlight the complementarity in direct searches, such as the $e^+e^- \to \tau^+\tau^-\gamma\,\gamma, \tau^+\tau^-\gamma$, $3\,\gamma$, mono-γ processes, and indirect probes, such as the impact of these new physics candidates on the τ anomalous magnetic and electric dipole moments. The correlated effects in these searches can offer uniques hints at the underlying new physics dynamics and point at viable strategies that can be adopted to discriminate between different scenarios.

Author: LEVATI, Gabriele

Presenter: LEVATI, Gabriele

Session Classification: Plenary session

Track Classification: LFB & BSM

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

Update on alpha_s from hadronic tau decays, including the Belle $\tau \to \pi^- \pi^0 \nu_\tau$ data

The extraction of the QCD coupling, α_s, from hadronic tau decays relies on experimental determinations of the relevant inclusive spectral functions. In this work, we produce a new inclusive vector-isovector spectral function combining information from several experiments. We obtain contributions from the dominant decay modes, $\pi^-\pi^0$, $2\pi^-\pi^+\pi^0$, and $\pi^-3\pi^0$, adding to the ALEPH and OPAL data used in our previous analyses, for the first time in this update, the high-statistics Belle $\tau \to \pi^-\pi^0\nu_\tau$ results. Smaller contributions from other higher-threshold modes are obtained using BaBar data for $\tau \to K^-K^0\nu_\tau$ and $e^+e^- \to \text{hadrons}$ cross section input, related to the corresponding τ distributions by CVC, for other modes. This allows us to construct a new complete vector-isovector spectral function that relies solely on experimental data, without the need of Monte-Carlo inputs. This is then used to perform a new α_s determination, employing our previously developed strategy based on finite energy sum rules. We find, at the Z-mass scale, $\alpha_s(m_Z^2) = 0.1159(14)$. The lower central value and larger error, compared with the result of our previous works, are mainly due to updated HFLAV branching-fractions inputs. The impact of Belle data for the dominant 2π channel and the inclusion of the CLEO spectrum in the analysis are also discussed.

Author: MORETHES MANSUR, Lucas

Co-authors: EIBEN, Aaron; BOITO, Diogo (University of Sao Paulo); MALTMAN, Kim; GOLTERMAN, Maarten; PERIS, Santi

Presenter: MORETHES MANSUR, Lucas

Session Classification: Plenary session

Track Classification: tau properties and SM

Contribution ID: **26** Type: **Talk**

Beyond Form Factors: Precise Angular Tests in Hadronic τ Decays

Semileptonic τ decays mainly proceed via interactions between charged lepton and quark currents. The hadronization of the quark current is intrinsically nonperturbative and generally cannot be addressed analytically. In this work, we propose using symmetry arguments alone to construct clean angular observables, which, within the Standard Model and in the absence of long-distance electromagnetic corrections, remain form-factor independent. These predictions can be experimentally tested, and any observed deviation could signal either effects of physics beyond the Standard Model or provide a clean benchmark for long-distance electromagnetic corrections. We also explore a first estimate of the expected impact from both sources on these observables.

Authors: RODRÍGUEZ SÁNCHEZ, Antonio (IFIC); ESTRADA GONZÁLEZ, Emilio José (Cinvestav, México); ROIG GARCÉS, Pablo; PAZ, Sergio (IFIC)

Presenter: RODRÍGUEZ SÁNCHEZ, Antonio (IFIC)

Session Classification: Plenary session

Track Classification: tau properties and SM

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

Generalized structure functions in semileptonic tau decays

In case there are tensor interactions beyond the SM in the low-energy EFT Lagrangian, their interference with the SM V-A currents yields a contribution for tau decays into three or more mesons [as we noted in Phys.Rev.D 106 (2022) 9, 096016] that cannot be included in the famous structure functions introduced by Kühn and Mirkes (KM) in their seminal 1992 paper [Z.Phys.C 56 (1992) 661-672]. We perform this generalization here, highlighting again the importance of measuring the (generalized) KM spectral functions (instead of e. g. doing a partial-wave analysis), as being model-independent and capturing the most information from the data. This can be particularly relevant for CPV studies with at least three mesons in the final state of the tau decay.

Authors: RODRÍGUEZ SÁNCHEZ, Antonio (IFIC); LÓPEZ AGUILAR, Daniel (Cinvestav); ROIG GARCÉS, Pablo

Presenter: ROIG GARCÉS, Pablo

Session Classification: Plenary session

Track Classification: tau properties and SM

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

New precise measurement of e+e- to pi+pi- with BABAR for muon g-2 prediction

A measurement of the key cross section e+e- to pi+pi- for hadronic vacuum polarization (HVP)is presented with the full BABAR statistics using a new method not relying on particle ID to separate pions ans muons, therefore independent from the 2009 analysis. This result should play an important role to clarify the presently rather confused situation where large discrepancies are observed between the extreme results from KLOE and CMD-3, preventing an average of e+e- to pi+pi- cross sections to compute the HVP contribution to the muon g-2.

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Presenter: Dr POLAT, Léonard (LPNHE-Paris/IJClab-Orsay)

Session Classification: Plenary session

Track Classification: g-2

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

Data-based evaluation of isospin-breaking to tau 2pi spectral functions for muon g-2 prediction

Tau data, especially the 2-pion spectral function, can be used to compute the HVP contribution to the SM muon g-2 prediction after correcting for isospin violations between tau and e+e-. These corrections are usually computed theoretically with uncertainties sometimes difficult to establish. We present here a data-based evaluation of the most critical correction to the charged-current pion form factor available in tau decays. The result leads to a very competitive estimate of the HVP contribution.

Author: Dr ZHANG, Zhiqing (IJClab-Orsay)

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Presenter: Dr ZHANG, Zhiqing (IJClab-Orsay)

Session Classification: Plenary session

Track Classification: g-2

Contribution ID: **30** Type: **Talk**

Advancing Precision Calculations of the Tau Lepton's Magnetic and Electric Dipole Moments

Despite being a highly sensitive probe for physics beyond the Standard Model (BSM), the anomalous magnetic moment of the tau lepton a_τ remains significantly less explored than those of other leptons. This talk presents a promising path to measure a_τ with a precision of 10^-5, a level crucial for imposing meaningful constraints on BSM theories. Achieving this precision necessitates advancing the cross-section calculations for the process $e^+e^- \to \tau^+\tau^-$ to two-loop accuracy. Recognizing the immense challenges in measuring the full cross section at such precision, we shift our focus to exploiting specific asymmetries accessible via polarized electron beams. Concurrently, these techniques can be applied to probe the tau's electric dipole moment d_τ, with the potential to enhance sensitivity down to $10^{-20} e\,\mathrm{cm}$. We will present first next-to-leading order results [1] implemented using the Monte Carlo integrator McMule, incorporating kinematical cuts. Furthermore, we map out the path towards next-to-next-to-leading order while addressing the attendant challenges.

[1] J. Gogniat, M. Hoferichter and Y. Ulrich, arXiv:2505.09678 [hep-ph].

Authors: GOGNIAT, Joël (University of Bern); HOFERICHTER, Martin (University of Bern); ULRICH, Yannick (University of Liverpool)

Presenter: GOGNIAT, Joël (University of Bern)

Session Classification: Plenary session

Track Classification: g-2

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

Status and prospects of the Hyper-Kamiokande Experiment

Water Cherenkov detectors have demonstrated exceptional sensitivity in neutrino observation over the years. The Hyper-Kamiokande (Hyper-K), the third generation of underground detectors in Japan, represents a significant advancement in both sensitivity and scalability. Hyper-K will act as the far detector for a long-baseline neutrino oscillation experiment using the upgraded 1.3 MW J-PARC muon neutrino/antineutrino beam. In addition, it will be capable of observing proton decays, atmospheric neutrinos, and neutrinos from astronomical sources. Hyper-K features a cylindrical tank measuring 71 meters in depth and 68 meters in diameter. Its fiducial volume, holding a mass of 186 kilotons, will be equipped with an array of 20,000 photomultiplier tubes (20-inch PMTs) alongside 800 multi-PMT modules (each housing nineteen 3-inch PMTs). Excavation and tests of the detector are currently undergoing, and the beginning of its operation is scheduled for 2028. Along this talk, the research program and recent developments of the Hyper-K experiment will be presented.

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Presenter: ALMAZAN, Helena (Donostia International Physics Center (DIPC) (ES))

Session Classification: Plenary session

Track Classification: Neutrino

Contribution ID: **32** Type: **Talk**

New understanding of the different strategies for extracting α_s from non-strange hadronic τ decay data

We discuss recent results leading to a new understanding of one of the two main approaches to determining α_s from finite-energy sum rule analyses of non-strange hadronic τ decay data. This approach involves fits to sets of differently weighted spectral integrals with a single common upper endpoint, $s = s_0$, in which several in-principle-present, higher-dimension condensate contributions are unavoidably neglected. We show that, contrary to current understanding, α_s in this approach is obtained from a purely perturbative analysis of a smaller subset of FESRs, with the retained lower-dimension condensates, C_D, playing no role whatsoever in this determination. Results for the retained C_D are, moreover, shown to be produced by redundant, one-spectral-integral-in, one-fit-parameter-outmatchings susceptible to generically large theoretical systematic uncertainties. Internal self-consistency checks in the restricted subspace of the FESRs responsible for determining α_s are shown to reveal discrepancies comparable in size to currently quoted errors. The utility of alternate analyses employing, not just multiple weights, but also multiple s_0, in dealing with these issues is highlighted. We also discuss the relative roles of theory-side non-perturbative condensate and duality violating contributions, as well as further improvements to the analyses and internal self-consistency tests improved experimental results for the two 4π distributions would make possible.

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Co-authors: BOITO, Diogo; GOLTERMAN, maarten; PERIS, Santiago

Presenter: MALTMAN, Kim (York University (Canada))

Session Classification: Plenary session

Track Classification: tau properties and SM

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

Averages of tau branching fractions and combined tau lepton-flavour-violating branching fractions limits by HFLAV

In the Tau section of the HFLAV 2023 report (arXiv:2411.18639 [hep-ex]) we present an improved global fit of the tau branching fractions and new combinations of tau lepton-flavour-violating (LFV) upper limits. The branching fraction fit includes recent measurements and furthermore since this report features nuisance fit parameters. The HFLAV fit is now identical to the fit that HFLAV uses, with the unitarity constraint, to provide the Tau fit results for the PDG. The lepton flavour universality tests and the $|V_{us}|$ calculations with tau measurements are updated. A new lattice QCD calculation is used to update $|V_{us}|$ using the inclusive branching fraction to strange final states. A new method is used to combine the LFV limits, by averaging the corresponding raw branching fraction measurements and computing limits using the averaged branching fraction.

Author: LUSIANI, Alberto (Scuola Normale Superiore and INFN, sezione di Pisa)

Presenter: LUSIANI, Alberto (Scuola Normale Superiore and INFN, sezione di Pisa)

Session Classification: Plenary session

Track Classification: tau properties and SM

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

Estimated precision at FCC-ee on measurements of tau properties, lepton universality and searches for lepton flavour violation

We estimate the precision at FCC-ee on the measurements of the tau mass, lifetime, leptonic branching fractions, and on the searches for lepton-flavour-violating branching fractions $\tau \to \mu\gamma$ and $\tau \to 3\mu$. We compute the estimated precision on the lepton flavour universality tests, considering the 2nd-order QED radiative corrections and estimating the radiative corrections uncertainties.

Author: LUSIANI, Alberto (Scuola Normale Superiore and INFN, sezione di Pisa)

Presenter: LUSIANI, Alberto (Scuola Normale Superiore and INFN, sezione di Pisa)

Session Classification: Plenary session

Track Classification: Future experiments

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

Searches for new physics by probing Lepton Flavor Violation and Universality in Heavy Flavour Tau Decays at CMS

This contribution presents recent results from the CMS experiment at the LHC on searches for Lepton Flavor Violation (LFV) and Lepton Flavor Universality (LFU) violation in heavy flavour decays involving tau leptons. The tau acts as a powerful probe for physics beyond the Standard Model (BSM), particularly in the low transverse momentum (p_T) regime typical of B hadron decays. We report on a search for charged LFV via the decay \tau \to 3\mu, as well as on tests of LFU in the rare decay B_c \to J/\psi \tau \nu.

Author: GOERLACH, Ulrich (Centre National de la Recherche Scientifique (FR))

Presenter: GOERLACH, Ulrich (Centre National de la Recherche Scientifique (FR))

Session Classification: Plenary session

Track Classification: LHC

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

Recent advancements in the tau reconstruction and identification techniques in CMS

The High-Luminosity LHC (HL-LHC) will pose significant challenges for the reliable and accurate reconstruction and identification of physics objects in the High-Level Trigger (HLT) of the CMS experiment, particularly in the presence of up to 200 simultaneous proton-proton interactions per event. The upgraded CMS detector will feature the High-Granularity Calorimeter (HGCAL), offering unprecedented capabilities for real-time imaging of calorimetric showers. To fully exploit this potential, a dedicated reconstruction framework, The Iterative CLustering (TICL), is currently developed within the CMS collaboration. In this work, we present the application of a transformer-based neural network, ParticleTransformer, to identify hadronic tau decays in the Phase-2 HLT. This approach aims to enhance both the efficiency and purity of the tau selection, benefiting precision measurements of the Standard Model as well as searches for new physics. We further discuss the reconstruction quality of the tau decay products within the TICL framework, which serve as inputs to the network.

Author: GOERLACH, Ulrich (Centre National de la Recherche Scientifique (FR))

Presenter: GOERLACH, Ulrich (Centre National de la Recherche Scientifique (FR))

Session Classification: Plenary session

Track Classification: LHC

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

Constraining new scalar interactions with the rare $\tau \to \eta\pi\nu$ decay

The sensitivity of the rare eta-pion decay channel of the tau lepton to new physics (NP) is investigated in the framework of models that contain scalar interactions. The different sources of isospin breaking are included in the Standard Model contributions. Using the current upper limits on the branching ratio of this rare decay, combined with precise measurements of other allowed semileptonic decays of taus, allow us to set constraints on the parameter space that characterizes the new physics contributions. Although these constraints are competitive with other direct and indirect searches of NP, a future measurement of this rare decay channel and a better understanding of the scalar form factor can provide the strongest constraints on the specific models under consideration

Author: Mr PORTILLO SANCHEZ, Diego (Cinvestav)

Co-author: LOPEZ CASTRO, Gabriel

Presenter: Mr PORTILLO SANCHEZ, Diego (Cinvestav)

Session Classification: Plenary session

Track Classification: LFB & BSM

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

Constraints on SU(2)_L-preserving NSI from τ decays

Neutrino non-standard interactions (NSI) have been studied in a variety of contexts and suggested as a possible mechanism for resolving certain unexpected results in oscillation experiments. NSI may be generated in various ways and take a variety of forms. We focus on flavor-changing neutral current NSIs involving tau neutrinos. In simple scenarios in which these are generated by dimension-six effective operators, it is often the case that flavor-violating interactions of charged leptons are also generated; the strengths of these interactions are then related by SU(2)_L symmetry. We investigate for this subset of NSI the restrictions which can be obtained by utilizing the stringent experimental limits on charged lepton flavor-violating tau decays, finding that the quark contributions to these operators are often constrained to be on the order of 10ˆ-3.

Author: PAZ CASTRO, Santiago (Universitat de València)

Co-authors: PASSEMAR, Emilie; MCNULTY, William

Presenter: PAZ CASTRO, Santiago (Universitat de València)

Session Classification: Plenary session

Track Classification: Neutrino

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

Simulation of tau decays, ambiguities and anomalous couplings effects.

Present day high statistic tau lepton experimental samples, require continuous revision of simulation precision. This is especially important for multi-dimensional signatures. That is in partiucular important in context of anomalous couplings.

Also, because evolution of software environments, completion of programs migration to C++ as well as study of new effects become of ever greater importance. That is equally the case of tau decays themselves as of production. In all cases, past estimations of systematic ambiguities may turn out to be insufficient.

Author: WAS, Zbigniew Andrzej (Polish Academy of Sciences (PL))

Presenter: WAS, Zbigniew Andrzej (Polish Academy of Sciences (PL))

Session Classification: Plenary session

Track Classification: tau properties and SM

Contribution ID: **41** Type: **Talk**

Towards a dispersive calculation of isospin-breaking corrections for τ data

The hadronic τ decay, $\tau \to \pi\pi^0\nu_\tau$, provides an independent way to compute the HVP contribution to the muon $g-2$ Standard Model (SM) prediction, provided one is able to reliably evaluate the relevant isospin breaking (IB) corrections. I will present a dispersive approach to the evaluation of the IB corrections relating $\tau \to \pi\pi^0\nu_\tau$ to $e^+e^- \to \pi^+\pi^-$, with the goal of providing an alternative way to calculate the 2π HVP contribution to the muon $g-2$. Results for the long-range corrections usually denoted by $G_{EM}(t)$ will be presented, as well as a roadmap towards a full dispersive evaluation of the required IB correction.

Author: COTTINI, Martina (University of Bern)

Presenter: COTTINI, Martina (University of Bern)

Session Classification: Plenary session

Track Classification: g-2

Contribution ID: **42** Type: **Talk**

Sensitivity to Charged Lepton Flavor Violation via e⟶τTransitions in the Leptoquark Framework at the Electron-Ion Collider

The Electron-Ion Collider (EIC), with its state-of-the-art electron-Proton/Ion Collider (ePIC) detector, offers a unique opportunity to probe the structure of matter and search for new physics beyond the Standard Model (BSM). A particularly intriguing BSM scenario involves leptoquarks (LQ), hypothetical particles that couple quarks and leptons and can mediate rare charge-induced lepton flavor violating (CLFV) processes. In this study, we focus on the CLFV transition $e \to \tau$, which is predicted in several LQ models. This process yields a distinctive experimental signature at the EIC, especially when the τ lepton decays hadronically into three charged pions, a clean but rare decay mode. However, identifying this signature is challenging due to background processes such as Charged Current (CC) and Neutral Current (NC) Deep Inelastic Scattering (DIS), as well as Semi-Inclusive (SI) DIS, all of which can mimic the hadronic activity of τ decays. To isolate the signal, we employ realistic detector simulations and optimize selection criteria using Boosted Decision Trees (BDT) as part of a multivariate analysis. Assuming an integrated luminosity of $100\ \mathrm{fb}^{-1}$ at the highest available center-of-mass energy configuration of $\sqrt{s} = 141\ \mathrm{GeV}$ (achieved with 18 GeV electron and 275 GeV proton beams), the EIC will significantly improve the current bounds in LQ-mediated $e \to \tau$ transitions, surpassing the previous limits set by HERA. In this talk, I will present our study of the CLFV process $e \to \tau$ and the sensitivity to leptoquarks, highlighting the EIC's potential for new physics beyond the Standard Model.

Author: QUNI, BARDH (PhD Student)

Presenter: QUNI, BARDH (PhD Student)

Session Classification: Plenary session

Track Classification: Future experiments

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

Search for new resonances and di-Higgs production in channels involving taus

The CMS Collaboration reports on searches for new resonances decaying to final states with tau leptons, using data collected at the LHC. The talk will cover multiple final states with hadronic and leptonic tau decays, covering a wide mass range.
The H->tau tau decay mode has a relatively high BR and good S/B ratio when considering advanced techniques to reconstruct and identify tau leptons in all possible decay modes. This enables the search of rare process, as non-resonant di-Higgs production, where one of the Higgs boson decays to ditaus. Possible channels involve H->gamma gamma, H->bb, associated with the H->tau tau decay. This presentation will also cover both the resonant and non-resonant HH decays, involving tau decays, using CMS data.

Author: GOERLACH, Ulrich (Centre National de la Recherche Scientifique (FR))

Presenter: GOERLACH, Ulrich (Centre National de la Recherche Scientifique (FR))

Session Classification: Plenary session

Track Classification: LHC

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

Constraints on Lorentz and CPT violation from muon-electron conversion

Charged lepton flavor violation is a popular target in searches for new physics. We demonstrate how the search for violations of an accidental symmetry of the Standard Model can also be connected to the search for violations of more fundamental symmetries. Working in the Standard Model Extension, a Lorentz- and CPT-violating effective field theory, we investigate the conversion of a muon to an electron in an atomic environment. A subset of the contributing operators are uniquely constrained by this channel, and their bounds (coming from the SINDRUM II experiment) are the first such reported. We further provide sensitivity estimates for the upcoming searches by the Mu2e and COMET experiments. We also discuss the experimental signature which would indicate Lorentz violation and a method which could provide greater sensitivity in future analyses and help to distinguish between the contributions of different operators.

Author: MCNULTY, William (Indiana University)

Co-authors: PASSEMAR, Emilie (Indiana University / IFIC Universitat de València); SHERRILL, Nathaniel (Leibniz Universität Hannover); KOSTELECKÝ, V. Alan (Indiana University)

Presenter: MCNULTY, William (Indiana University)

Session Classification: Plenary session

Track Classification: LFB & BSM

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

First detection of tau neutrinos with KM3NeT/ORCA6

The tau neutrino is one of the least well studied particles in the Standard Model, with an overall measured statistics of about 2000 events. KM3NeT/ORCA is a water Cherenkov detector currently under construction in the Mediterranean Sea that aims to determine the neutrino mass ordering. It is optimised for the detection of atmospheric neutrinos in the 1-100 GeV range. While the atmospheric neutrino flux at these energies is initially only composed of electron and muon neutrinos, there is a considerable flux of tau neutrinos at the Earth due to oscillations. KM3NeT/ORCA is sensitive to this flux and can detect tau neutrinos. The presentation highlights the first detection of tau neutrinos with KM3NeT/ORCA6, a preliminary detector configuration, which corresponds to about 5% of the final detector.

Author: GEISSELBRECHT, Nicole (ECAP)

Presenter: GEISSELBRECHT, Nicole (ECAP)

Session Classification: Plenary session

Track Classification: Neutrino

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

Measurement of $R(D)$ and $R(D^*)$ using semileptonic B tags and leptonic τ decays

We report a measurement of $R(D) = B(B \to D\tau\bar{\nu}_\tau)/B(B \to D\ell\bar{\nu}_\ell)$ and $R(D^*) = B(B \to D^*\tau\bar{\nu}_\tau)/B(B \to D^*\ell\bar{\nu}_\ell)$, where ℓ refers to either an electron or muon. The dataset consists of 426 fb^{-1} collected at the $\Upsilon(4S)$ resonance by the BABAR detector at the PEP-II asymmetric storage ring collider. We select samples by reconstructing tag-side B mesons in semileptonic decays and signal-side τ in a purely leptonic decay.

Author: BABAR COLLABORATION

Co-author: PORTER, Frank

Presenter: BABAR COLLABORATION

Session Classification: Plenary session

Track Classification: B physics

Contribution ID: **47** Type: **Talk**

The Cabibbo angle from inclusive τ decays

The inclusive hadronic decays of the τ lepton provide an alternative avenue for determining the CKM matrix elements V_{ud} and V_{us}. In this talk, I will present recent results from the ETM Collaboration for the inclusive hadronic τ decay rate, obtained in $N_f = 2 + 1 + 1$ QCD using the novel HLT method. This approach circumvents the well-known inverse Laplace transform problem that hinders this calculation, allowing to obtain first-principles results without relying on the operator-product expansion (OPE) or perturbative QCD. Except for isospin-breaking (IB) effects, all systematic uncertainties are under control. In the $\bar{u}s$ channel we obtain $|V_{us}|_{\tau-\mathrm{latt}-\mathrm{incl}} = 0.2189(7)_{\mathrm{th}}(18)_{\mathrm{exp}}$, which reveals a 3σ tension with purely hadronic determinations of $|V_{us}|$. Since this tension can no longer be attributed to the OPE approximation, it prompts a closer examination of experimental uncertainties and highlights the importance of determining IB corrections from first principles. I will briefly present an update on the ongoing status of our calculation of these corrections.

Author: GAGLIARDI, Giuseppe

Presenter: GAGLIARDI, Giuseppe

Session Classification: Plenary session

Track Classification: tau properties and SM

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

a_muˆ{HVP,LO} using tau data

We revisit the isospin-breaking corrections relating the e+e- hadronic cross section and the tau decay spectral function, focusing on the dipion channel, that gives the dominant contribution to the hadronic vacuum polarization piece of the muon g-2. We test different types of electromagnetic and weak form factors and show that both, the Gounaris-Sakurai and a dispersive-based approach, describe accurately τ lepton and e+e- data (less when KLOE measurements are included in the fits) and comply reasonably well with analyticity constraints. From these results we obtain the isospin-breaking contribution to the conserved vector current (CVC) prediction of the BR($\tau\to\pi\pi\nu\tau$) and to the 2π hadronic vacuum polarization (HVP) contribution to the muon g-2, in agreement with previous determinations and with similar precision. Our results abound in the utility of using tau data-based results in the updated data-driven prediction of the muon g-2 in the Standard Model.

Authors: MIRANDA, Alejandro (IFAE); LOPEZ CASTRO, Gabriel; ROIG GARCÉS, Pablo

Presenter: LOPEZ CASTRO, Gabriel

Session Classification: Plenary session

Track Classification: g-2

Contribution ID: **49** Type: **Talk**

Status of the MUonE experiment and preliminary results from the 2025 run

The MUonE experiment at CERN aims to provide an independent measurement of the leading-order hadronic contribution to the muon g-2 (a_μ^{HVP}), complementary to the existing ones. The innovative approach proposed by MUonE is based on the measurement of the hadronic contribution to the running of the QED coupling, which can be extracted from a precise measurement of the shape of the differential cross section of the $\mu-e$ elastic scattering.
The experiment is carried out at the M2 beam line at CERN, where a 160 GeV muon beam is scattered off the atomic electrons of a low-Z target. The M2 beam line provides the necessary intensity needed to reach the statistical goal in few years of data taking. The experimental challenge relies in the precise control of the systematic effects. A first run with a minimal prototype detector was carried out in 2023, while a pilot run including a reduced setup of the full detector components is ongoing in Summer 2025. The status of the experiment will be presented, along with first preliminary results from the 2025 run and the future plans.

Author: PILATO, Riccardo (University of Liverpool (GB))

Presenter: PILATO, Riccardo (University of Liverpool (GB))

Session Classification: Plenary session

Track Classification: g-2

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

Search for b→sττ decays at the LHCb experiment

Several discrepant measurements have been observed by LHCb and other experiments in b→cτν decays over the past few years. If these are due to new physics beyond the Standard Model, several models suggest an associated large enhancement in the branching fractions of b→sττ decays. Such decays have not been observed yet, and the existing upper limits which have been set are several orders of magnitude above the Standard Model expectations. This talk presents recent results on b→sττ decays, performed at LHCb

Author: VOS, Keri (Nikhef National institute for subatomic physics (NL))

Presenter: VOS, Keri (Nikhef National institute for subatomic physics (NL))

Session Classification: Plenary session

Track Classification: B physics

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

Chiral Belle Status: R&D on Upgrading SuperKEKB with Polarized Electron Beams

Upgrading the SuperKEKB e+e− collider with polarized electron beams, the Chiral Belle project, provides new and unique opportunities for searches for new physics via precision electroweak and other measurements, including measurements involving the tau lepton.
These include measurements the neutral current vector couplings via left-right asymmetry (ALR) measurements in annihilations to pairs of electrons, muons, taus, charm and b- quarks. These will provide measurements with precisions matching or exceeding current world averages precisions the Z0-pole, but at 10GeV and thereby providing unique probes the running of the weak mixing angle from diVerent fermions and with high precision. Chiral Belle will also provide the highest precision measurements of neutral current universality ratios, precision measurements of tau lepton properties, including the tau magnetic moment and Michel parameters. This presentation review developments on the physics potential and then report on developments related to provision of the polarized source and preparatory R&D initiatives

Author: Prof. RONEY, Michael (University of Victoria)

Presenter: Prof. RONEY, Michael (University of Victoria)

Session Classification: Plenary session

Track Classification: Future experiments

Contribution ID: **53** Type: **Talk**

Strategy to measure tau □ –2 via photon fusion in LHC proton collisions

https://journals.aps.org/prd/abstract/10.1103/PhysRevD.110.092016

Author: Dr CLAWSON, Savannah

Presenter: Dr CLAWSON, Savannah

Session Classification: Plenary session

Track Classification: g-2

Contribution ID: **54** Type: **Talk**

Overview of Tau physics

Monday 20 October 2025 09:10 (40 minutes)

Presenter: PASSEMAR, Emilie

Session Classification: Plenary session

Track Classification: General

Contribution ID: **55** Type: **not specified**

Interplay between B and tau physics

Presenter: CORNELLA, Claudia

Session Classification: Plenary session

Track Classification: B physics

Contribution ID: **56** Type: **Talk**

Status of Jparc experiments

Presenter: ZHANG, Ce (University of Liverpool)

Session Classification: Plenary session

Track Classification: Future experiments

Contribution ID: **57** Type: **not specified**

Summary and prospects for tau leptons

Presenter: ZANI, Laura

Session Classification: Plenary session

Track Classification: General

Contribution ID: **58** Type: **Talk**

Summary and prospects for neutrinos

Presenter: COELHO, Joao (CNRS / APC - Paris)

Session Classification: Plenary session

Track Classification: General

Contribution ID: **59** Type: **not specified**

Muon g-2 overview

Presenter: GÉRARDIN, Antoine (CPT Marseille)

Session Classification: Plenary session

Track Classification: g-2

Contribution ID: **60** Type: **not specified**

Welcome

Monday 20 October 2025 09:00 (10 minutes)

Session Classification: Plenary session

Track Classification: General

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

Measurement of tau-lepton anomalous magnetic moment with the ATLAS Detector

Measurements of the anomalous magnetic moment of charged leptons (electrons, muons, and leptons) are cornerstone tests of the Standard Model with unique sensitivity to beyond-the-SM phenomena. The probe of anomalous magnetic moment (a) is of great difficulties due to the short lifetime of -lepton, and is therefore of great interest to pursue its precision at modern colliders. This talk addresses the measurement of a based on the newly observed process in lead-lead collisions at the ATLAS experiment. Benefiting from this novel approach, a very competitive measurement of a has been achieved. Key ingredients of the measurement as well as future prospects will be also discussed.

Author: VIVARELLI, Iacopo (Universita e INFN, Bologna (IT))

Presenter: VIVARELLI, Iacopo (Universita e INFN, Bologna (IT))

Session Classification: Plenary session

Track Classification: LHC

Contribution ID: **62** Type: **Talk**

Tau-lepton pair production via di-photon fusion in ultra-peripheral heavy-ion collisions at the ATLAS detector

In ultra-relativistic heavy-ion collisions, high rates of $\gamma\gamma$ processes occur through the interaction of the large electromagnetic fields of the heavy nuclei. For large impact parameters between the nuclei, i.e. interaction distances larger than the nuclei's radii, the di-photon interaction can be the only one taking place, leading to very clean signatures in the detector. One of the possible signatures in these ultra-peripheral collisions (UPCs) is the production of a τ-lepton pair. The outgoing τ-leptons are back-to-back in the transverse plane, which allows a precise and efficient identification. Processes beyond the Standard Model (BSM) can influence the production cross sections for this process, through modifications of the $\gamma\tau\tau$-vertex, allowing to probe for and constrain their existence. This talk presents the most recent measurement of di-τ production in UPC-events at a centre-of-mass energy of 5.02 TeV, performed using data from the second running period (Run 2) of the Large Hadron Collider (LHC) and recorded with the ATLAS detector. Using final states where one of the τ-leptons decays involving a muon, fiducial differential cross sections for $\gamma\gamma \to \tau\tau$ production are measured for the first time and compared to currently most advanced theory predictions. Constraints on the electromagnetic moments of the τ-lepton which influence the $\gamma\tau\tau$ vertex contained in $\gamma\gamma \to \tau\tau$ production are extracted and the implications on BSM contributions discussed.

Author: VIVARELLI, Iacopo (Universita e INFN, Bologna (IT))

Presenter: VIVARELLI, Iacopo (Universita e INFN, Bologna (IT))

Session Classification: Plenary session

Track Classification: LHC