3rd International Turkey-Iran Joint Conference on LHC Physics

10 Haziran 2019 Pazartesi - 15 Haziran 2019 Cumartesi

Marmara University Sultanahmet Campus

Özet Defteri

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Visit to Dolmabahce Palace

Dolmabahçe Palace is one of the most resplendent buildings that had hosted the Sultans of the Ottoman Empire between 1856 to 1887. Then later, one of its rooms served to Mustafa Kemal Atatürk, the founder of the Republic of Turkey.
We will have a visit to this glamorous palace is situated between the Golden Horn and Bosphorus.

http://www.millisaraylar.gov.tr/

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Conference dinner

Conference dinner

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The ATLAS RPC system upgrade for the High Luminosity LHC and beyond

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The architecture of the present RPC trigger system in the ATLAS muon barrel was designed according to a reference luminosity of 1034 cm-2 s-1 with a safety factor of 5, with respect to the simulated background rates corresponding to about 300 fb-1 integrated luminosity. HL-LHC will reach a 7.5 times higher luminosity, an expected integrated luminosity of 5000 fb-1 and a total duration extended until at least 2040 largely increasing the original detector performance and longevity demand.
ATLAS approved an RPC upgrade plan, to guarantee the performance required by the physics program based on the addition of 272 new generation RPCs in the inner barrel (BI), to increase the redundancy, the selectivity, and provide almost full acceptance. To match the performance requirements, the new RPCs will have a different structure, materials and a high performance front-end electronics, in SiGe technology. The new BI chambers increase the system selectivity and efficiency and at the same time lowers the performance demand on the legacy RPCs, extending thus their longevity to match the HL-LHC target.
We will illustrate the performance of the new detectors and trigger system, as well as the impact on the ATLAS physics performance.

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Phase-2 Endcap Calorimeter (HGCAL)

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The CMS experiment at CERN will undergo significant improvements to cope with a 5-fold increase in instantaneous luminosity for the High Luminosity LHC (HL-LHC) era. In particular, the endcap calorimetry will suffer from very high radiation levels and unprecedented event pileup. The CMS HGCAL is being designed to replace the existing CMS endcap electromagnetic and hadronic calorimeters. It will be a sampling calorimeter, featuring unprecedented transverse and longitudinal readout and trigger segmentation for both electromagnetic (CE-E) and hadronic (CE-H) compartments. This will facilitate particle-flow calorimetry, where the fine structure of showers can be measured and used to enhance pileup rejection and particle identification, whilst still achieving good energy resolution. The CE-E and a large fraction of CE-H will use hexagonal silicon sensors as active detector material. The lower-radiation environment will be instrumented with scintillator tiles with on-tile SiPM readout. An overview of the HGCAL project will be presented, covering motivation, engineering design, readout and trigger concepts, and performance in beams and in simulation.

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Recent theoretical and experimental progresses in hadron physics

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I will discuss some recent important experimental and theoretical progresses made in the field of both the standard hadrons and exotics. Among these progresses, the developments on the lepton flavour universality violation (LFUV) are of great importance: The experimental data show significant deviations from the SM predictions in some tree-level hadronic transitions. I will also discuss the properties of the hypothetical highly symmetric scalar S-Hexaquark (uuddss), which is considered to be stable, thus a potential candidate for Dark Matter.

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Review of Detector Technologies

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Recent developments in Particle Flow Algorithms and Machine Learning Algorithms gave rise to the idea of high granularity detector systems. With the advances in the development of integrated detector electronics and the accumulated expertise in novel active media, many ideas have already started to be realized. The future implementations are not only limited by the development of novel detectors such as the High Granularity Calorimeter upgrade of CMS and many other imaging calorimeters of the CALICE Collaboration, but also reflect manifest modernizations of the conventional technologies like the Liquid Argon Time Projection Chambers of the DUNE detectors.

This talk will discuss the latest trends in the detector physics and technologies and will explore the extents and limitations in these developments.

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Future collider programs and experiments and related R&Ds

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The presentation introduces projects for future colliders, presenting the status of their current planning, and the main constraints of beam conditions on the associated experiments. The detector concepts proposed for these experiments are then briefly presented, emphasizing the common and specific aspects resulting from performance and operation requirements. Based on these considerations, the main directions for future technology R&D of various systems are discussed, building on the current state of the art in preparation of the HL-LHC upgrades.

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Observation of single top quark production in association with a Z boson at CMS

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The observation of single top quark production in association with a Z boson and a quark (tZq) will be reported. Events from proton-proton collisions at a center-of-mass energy of 13 TeV containing three charged leptons (either electrons or muons) and at least two jets are analyzed. The data were collected with the CMS detector in 2016 and 2017, and correspond to an integrated luminosity of 77.4 fb^{-1}. The increased integrated luminosity, a multivariate lepton identification, and a redesigned analysis strategy improve significantly the sensitivity of the analysis compared to previous searches for tZq production. The tZq signal is observed with a significance well over five standard deviations. The tZq production cross section is measured with an uncertainty twice as small as achieved by any previous measurement.

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First evidence of single top production in association with a photon in proton-proton collisions at \sqrt{13} TeV

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In this analysis, the first evidence of events consistent with the production of a single top quark in association with a photon is reported. The analysis is based on proton-proton collisions at s√= 13 TeV and recorded by the CMS experiment in 2016, corresponding to an integrated luminosity of 35.9 fb−1. Events are selected by requiring the presence of a muon (μ), a photon (γ), an imbalance in transverse momentum from an undetected neutrino (ν), and at least two jets (j) of which exactly one is identified as associated to the hadronization of a b quark. An excess above the background-only hypothesis is observed, with a significance of 4.4 standard deviations, which is consistent with the SM prediction

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Dark Matter Results from the CMS experiment

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Searches for the production of dark matter are since several years a top priority at the CERN LHC. We present the landscape of dark matter searches at the LHC, and illustrate this with recent searches for dark matter in various final states with the CMS experiment. We focus on searches with invisible particles recoiling against standard model particles, and place this in the broader context of dark sectors, with an outlook towards the future.

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The Central Exclusive Productionat CMS

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The excellent performance of the Compact Muon Solenoid (CMS) experiment at the LHC has made a number of key observations in the exclusive processes and hence probing the Standard Model (SM) in a unique way. This presentation will review recent results on the measurement of Exclusive processes using the data recorded by the CMS detector. Evidence for light-by-light scattering in ultraperipheral PbPb collisions at a center-of-mass energy per nucleon pair of 5.02 TeV is reported. Exclusive ⊠(770)0 photoproduction is measured for the first time in pPb collisions. The exclusive photoproduction of Y(nS) meson states from protons is studied in pPb collisions at a center-of-mass energy of 5.02 TeV. Exclusive pipi production is studied in
proton-proton collisions. Low-mass meson resonances are observed in the invariant mass distribution of pion pairs.

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CutLang: an analysis description language and interpreter for HEP

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Physicists performing LHC data analyses, are required to be well-versed in programming and the particular analysis framework of the associated experiment. The steep learning curve related to these erects a barrier between the data and the physicist who may simply wish to try out an analysis idea.
The abundance of inexpensive, powerful, easy to use computing power leads to a fundamental shift in data analysis. The development of a full-fledged text-based analysis algorithm description language (ADL), incorporating also logic and mathematical expressions, would eliminate all kinds of programming difficulties and errors, consequently allowing the scientist to focus on the goal, but not on the tool. This presentation discusses the guiding principles of such an ADL and gives CutLang as an example. A number of LHC analyses of various complexities will also be shown to illustrate the advantages of a human readable ADL.

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QCD physics with ATLAS and CMS experiments

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The soft and hard QCD processes are analyzed by the ATLAS and CMS experiments using samples of proton-proton collisions collected by the LHC at the center of mass beams energy equal to 7, 8 and 13 TeV. Measurements of jet production rates, jet properties, particle multiplicity and momentum spectra, scaling and correlations are presented. The results are compared to predictions of theoretical models at leading- and next-to-leading orders of QCD. The data are used to measure the strong coupling constant and for PDF constraints.

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New Probes for Axion-like Particles at Hadron Colliders

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Axion-like particles (ALPs) appear from spontaneous global symmetry breaking in many extensions of the Standard Model (SM). In this paper, we find bounds on ALP (a) model parameters at the LHC from the ALP production associated with a photon and a jet ($a+\gamma+j$) as well as single top and top quark pairs ($t+j+a$, $tt^{-}+a$) in a model independent approach. In particular, it is shown that the ALP production associated with a photon plus a jet at the LHC is a promising channel with significant sensitivity to probe the ALP couplings to gluons and electroweak gauge bosons. The prospects are presented at the High Luminosity LHC including a realistic detector simulation and pile up effects. Furthermore, the ALP model is examined through its contributions to the top quark (chromo)magnetic dipole moments. It is shown that the top quark magnetic and chromomagnetic dipole moments enable us to probe the ALP couplings to top quark and gauge bosons at a time. The constraints are complementary to those obtained from direct searches, as they are sensitive to light ALPs.

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Status and Perspectives in SUSY HIGGS Searches

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I will present the status and prospects of SUSY/BSM Higgs search at LHC. The summary will be given for Run I and Run II searches for additional Higgs bosons in ATLAS and CMS collaboration as well as for the searches for the non-Standard Model decays of discovered Higgs boson with mass 125 GeV. Searches for additional Higgs bosons will cover the searches for Higgs bosons with masses both smaller and larger than 125 GeV. The interpretation of the searches will be given in the context of the most presently, popular models as MSSM, NMSSM and 2HDM. The prospects and the guidelines will be given for BSM Higgs boson search program at HL-LHC.

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Mini Space Particle Telescope (MINI-SPT)

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The goal of the Mini Space Particle Telescope (MINI-SPT) is to create a rad-hard, fast, compact, low power, weight and cost, particle detector system compatible with CubeSat standards. Direct measurement of the charged particle energies will be performed in crystal calorimeter. Moreover, time-of-flight with up/down separation, seven dE/dX samplings in silicon pixel and scintillator detectors, and particle tracking will be available. These measurements will allow modeling of highly dynamic events such as solar activity, as well as studying trapped radiation in South Atlantic Anomaly (SAA). In addition, the silicon-pixel detector will provide a real-time warning on space weather conditions hence to activate mitigation techniques for payloads and critical subsystems on host spacecraft. The project will provide a benchmark to use, for the first time in space, the Silicon Photo Multipliers (SIPMs) which are rapidly replacing the classical vacuum photomultipliers. The SIPMs will be tested for two major measurement techniques providing two physical quantities essential for most of the astroparticle physics experiments, calorimetry and time-of-flight.

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Search for large extra dimensions and contact interactions in the dilepton mass spectra from proton-proton collisions at the center of mass energy of 13 TeV

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We present a search for nonresonant excesses in the invariant mass spectra of electron and muon pairs. The results are based on the data from proton-proton collisions at a center-of-mass energy of 13 TeV recorded by the CMS experiment in 2016, corresponding to a total integrated luminosity of 36/fb. No significant deviation from the standard model is observed and limits are set at 95% confidence level on energy scales for large extra dimensions and contact interaction models

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Exotic Hadrons-A Case Study Of X(3872)

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Recent years have been an exciting period for hadronic spectroscopy. Along with discoveries of new single heavy and doubly heavy baryons, many states that do not seem to fit in the conventional quark-anti-quark (for mesons) or three quark (for baryon) pictures have been observed. One of the first candidates for a non-conventional meson was X(3872). Although there are many proposals for its structure, none is established without doubt. In this talk, puzzles presented by X(3872) will be presented along with possible answers to these puzzles. A heavy quark effective theory framework will be presented where X(3872) can be described as a mixture of a charmonium and a molecule. It will be shown that the properties of X(3872) can still be described assuming it to be an almost

pure charmonium or an almost pure molecule. To clarify its nature, more experimental data is necessary.

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Hadronic Resonance Production with ALICE at the LHC

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Because of their short lifetime (τ ~ 10 -23 s), hadronic resonances are very important probes to understand the evolution of the medium and particle production mechanisms in heavy ion collisions. Properties of the resonances such as mass, width and yield may be modified by the medium. These modifications provide information about possible medium effects, for instance suppression of the resonances due to re-scattering processes during the hadronic phase. In addition, comparison of resonance production in different collision systems allows the system size dependence of their production to be studied. In this talk, the main ALICE results on hadronic resonance production in pp, p-Pb, Pb-Pb and Xe-Xe collisions at different colliding energies will be presented.

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CERN-Turkey Industrial Relations

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Journey into CERN membership and progress made since then. Explains the development of ongoing participation of Turkey at CERN from the industrial stand point.

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Measuring the HIGGS Properties at LHC and Beyond

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Many key parameters of the Standard Model are strictly connected to the Higgs boson properties. The precision measurement of these quantities is an important result in itself and would constitute a major physics goal of the CMS experiment at LHC. In addition, any anomaly with respect to the Standard Model predictions would be indirect evidence of new physics and could hint at the energy scale at which new particles or new interactions may appear.
The talk will present the current status of the most important studies in this area and will describe in detail plans and challenges of the next data taking period, Run 3, in preparation for the High Luminosity phase of LHC (HL-LHC). Lastly, the prospects for the measurements of Higgs properties at future linear and circular colliders will be discussed.

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Jet measurements at the LHC

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Jets are the physical manifestations of the quarks and gluons produced in high-energy proton-proton collisions. They are among the most ubiquitous physics objects measured at the LHC, and their production and complex evolution is governed by the proton parton distribution functions (PDFs), the strong coupling constant (αs) and the rules of Quantum Chromodynamics (QCD). Yet they can often be quantitatively understood using perturbative QCD and used to extract information on PDFs and αs.

In this talk, we will review recent jet measurements ranging from inclusive jets, b-jets and dijet azimuthal decorrelations to jet shapes. We review prospects for gluon jet measurements and briefly discuss the importance of jet measurements also for new physics searches (dijet resonance search) and studies of the electroweak vacuum (top quark mass).

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Review of the results and prospects on the higgs boson production associated with top quarks from CMS

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The Higgs boson mass and couplings to the electroweak gauge bosons were measured early after its discovery during LHC Run I. Sensitivity to the Higgs couplings to fermions however has required the large amount of data collected at a center-of-mass energy of 13 TeV during LHC Run II. Recent measurements of the Higgs boson couplings to tau leptons as well as top and bottom quarks mark crucial steps in understanding the mechanism of fermion-mass generation. In this presentation, the latest measurements of the associated production of a Higgs boson and a top quark-antiquark pair ($t\bar{t}H$ production) performed with the CMS experiment will be reviewed. The $t\bar{t}H$ production channel provides a direct probe of the coupling of the Higgs boson to the top quark and is instrumental in testing the Standard Model and constraining various potential new physics models.

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Overview of recent results from observational cosmology

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This talk will review the latest measurements from the presently most precise cosmological probes, namely the cosmic microwave background, distant type Ia supernovae and baryonic acoustic oscillations. The agreement between these data and the ΛCDM model - the standard model of cosmology - will be highlighted. Constraints from these data on inflation and neutrino masses will also be shown. The persistent tension on the Hubble constant between direct measurements and fitted ΛCDM values will be discussed. Finally, the potential of large scale structure measurements beyond baryonic acoustic oscillations will be briefly commented.

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Chaotic Universe Theory

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The Big-Bang has been the most accepted theory in cosmology due to the cosmic microwave background, the cosmic red-shift and the abundance of light elements in the universe. However, this scenario leads to the most important and unsolved problems such as singularity, cosmic coincidence, big crunch, big rip, horizon, oscillation, the emergence of the galaxies, matter distribution and the large-scale organization of the universe. In order to solve these problems, the Chaotic Universe Theory has been proposed by Aydiner in Ref. [1]. This theory is alternative to the Big-Bang theory and it solves these problems of the modern cosmology. At the same time, this model is consistent with experimental results. The related paper is ranked number second among the most widely reading papers in TOP100 in Nature.

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The Plans for Nuclear Reactor Monitoring with Antineutrinos in Turkey

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Nuclear technology is a new era for Turkey. The first nuclear power plant in Turkey will be constructed at Akkuyu, in Mersin Province. It is planned to start operating in 2023. It is also planned to construct additional nuclear power plants in Sinop and İğeada in the near future. Monitoring these nuclear reactors must be one the highest priority issue for nuclear safety in Turkey. In this presentation, different detector designs and simulation results for nuclear reactor monitoring using antineutrino flux measurement will be discussed.

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Loop induced singlet scalar production through the vector like top quark at future lepton colliders

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we explore the signature of a simplified model which includes a new singlet scalar state and a vector like quark at future lepton colliders. In particular, we study the production of the new singlet scalar in association with a photon, which proceeds through loop level diagrams involving vector like top quark partner, at future e−e+ colliders at different center-of-mass energies.

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Trigger Architecture in the CMS Experiment

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In the CMS experiment, events of potential physics interest are selected by the trigger system, which consists of two-level triggers, the Level-1 (L1) Trigger and the High-Level Trigger (HLT).
The L1 Trigger is a hardware trigger that reduces the rate down to 100kHz, while the HLT is a software trigger running in a computer farm that reduces the rate from 100 kHz to about 1 kHz. The HLT runs a streamlined version of the CMS offline event reconstruction. The
online reconstruction of objects, in particular hadronically decaying tau leptons, will be explained, and the performance of tau lepton triggers for Run 2 data taking will be presented.

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The 2020 European Particle Physics Strategy Update - status report

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The European Particle Physics community is in the process of updating its strategy for the future. The process was officially launched by the CERN Council in fall 2018 and is expected to be completed by May 2020. The strategy update is based on inputs received from thematic and national communities and the scientific debate is conducted during an Open Symposium. I will report on the various stages of the strategy update process and in particular on the outcomes of the Open Symposium which recently took place in Granada.

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The long way from the discovery of the W, Z bosons to the Higgs boson... and what next

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The talk will briefly review the key steps in establishing the Standard Model, in particular, the discovery of the W and Z in the UA1 experiment bosons, how we launched the LHC and the main steps in designing the CMS detector, largely on basis of the experience with UA1. Then I briefly review the discovery of the Higgs boson, the present day status of Higgs studies and few related salient physics results relevant to the near future surveys and possible longer-term projects.

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Ion Problem in Gaseous Detectors and Ongoing Ion Characterisation Studies

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In particular, ions affect the signal received from the detector by disrupting the electrical field configuration in some types of gas detectors (such as TPC's, Micromegas, Drift tubes). For this reason, scientists have tried various methods to eliminate these effects of ions, but it can not be said that any success yet. In recent years, our studies have shown that; we must characterize their transfer properties and the chemical processes that occur while drifting in the detector volume before actually attempting to develop methods to eliminate the ionic effect. Our studies have clearly shown that primary ions are forming ionic clusters in the nano-seconds. In addition to this fact, it is very important to determine the size of these cluster ions in order to characterize their effects on the signal. In addition to some of the theoretical calculations that we have done before, this talk includes an original experimental setup which we developed to measure the dimensions of the cluster ions by placing the detector (PMT) in the detector (GEM) and pre-results of the work.

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Searches for Long-Lived Particles at the LHC: Future Perspectives

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The absence of any significant signal for Physics Beyond the Standard Model from the experiments at the LHC so far has led to expanding the search space for new exotic particles and effects. One direction that has recently drawn increased attention is the search for new long-lived particles, such as monopoles, dark photons, weakly interacting neutral particles, heavy stable charge particles and so on. Present LHC experiments have some coverage for such particles but are not be able to cover all the possible phase space. New small-scale experiments are proposed to complement these searches at the LHC, such as MilliQan, Faser, Mathusla, Codex-b, Al3x, in a similar fashion as the already running MoEDAL monopole search experiment. This talk will introduce these recent ideas and physics search targets of these new experimental proposals.

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SHiP Experiment: Search for New Physics at the High Intensity Frontier

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A new general purpose fixed target experiment is proposed at the CERN SPS accelerator which is aimed to search for hidden particles beyond the Standard Model and make measurements with tau neutrinos. The experiment will use decays of charm and beauty mesons to search for Heavy Neutral Leptons (HNLs), also known as "sterile neutrinos", which are sub-electroweak region particles introduced by the neutrino minimal Standard Model (νMSM). The existence of these particles would allow to explain neutrino masses, dark matter (with keV scale sterile neutrino forming dark matter) and the baryon asymmetry of the universe. We report results of the test exposure conducted at CERN and present the SHiP sensitivity to new physics beyond the Standard Model .

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Measurement of the top quark polarization and ttBar spin correlations using dilepton final states in proton-proton collisions at √s = 13 TeV

Measurements of the top quark polarization and top quark pair ($t\bar{t}$) spin correlations are discussed in this talk. Events containing two leptons produced in proton-proton collisions at a center-of-mass energy of $s\sqrt{}$= 13 TeV are going to be presented including a set of parton-level normalized differential cross sections, sensitive to each of the independent coefficients of the spin-dependent parts of the $t\bar{t}$ production density matrix. The data were analyzed by the CMS experiment at the CERN LHC in 2016 and correspond to an integrated luminosity of 35.9 fb−1 for the first time. The measured distributions and extracted coefficients are compared with standard model predictions from Monte Carlo simulations with next-to-leading-order (NLO) accuracy in quantum chromodynamics (QCD) and from NLO QCD calculations including weak and
mixed QCD-weak corrections. All measurements are found to be consistent with the expectations of the standard model.

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A study of Quartz Cherenkov Detectors in the Forward Region of CMS at LHC

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Abstract
In forward regions of high energy colliders (e.g. LHC), near the direction of the beams, the detectors need to have excellent resolving times, high-rate readout and resistance to radiation. Among various detector schemes proposed for these applications, combinations of Cherenkov radiators (like quartz, sapphire, etc.) with fast photodetectors (PMT, MCP, SiPM, etc) have been considered. Quartz-based calorimeters are already employed at CMS in the forward direction. For single particle detection, quartz bar arrays (QUARTIC) have been proposed. We report here on results obtained with an operating prototype of these detectors, installed near the LHC beam pipe close to the CMS experiment at CERN LHC during a period of 13 TeV pp collisions in 2018.