XII Latin American Symposium on High Energy Physics

Monday 26 November 2018 - Friday 30 November 2018

PUCP

Book of Abstracts

Book of abstracts

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Parallel Talks A / 16

Implications of neutrino generalized interactions in coherent elastic neutrino-nucleus scattering

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In this talk I will discuss the impact of recent COHERENT data on neutrino generalized interactions. I will show that scalar nuclear currents are the most constrained, while vector and tensor still allow for sizable effective couplings. I will discuss as well some implications of vector generalized interactions and will comment on the impact they have in the data fit.

arXiv:

arXiv:1806.07424

Parallel Talks A / 105

Heavy quarks within the electroweak multiplet

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Standard-model elds and their associated electroweak Lagrangian are equivalently expressed in a shared spin basis. The scalar-vector terms are written with scalar-operator components acting on quark-doublet elements, and shown to be parametrization-invariant. Such terms, and the t- and b-quark Yukawa terms are linked by the identification of the common mass-generating Higgs operating upon the other fields. Thus, the customary vector masses are related to the fermions', fixing the t-quark mass m_t with the relation $m_t^2 + m_b^2 = v^2/2$ either for maximal hierarchy, or given the b-quark mass m_b. A sum rule is derived for all quark masses that generalizes this restriction. An interpretation follows that electroweak bosons and heavy quarks belong in a multiplet.

arXiv:1701.01191
To be published, Phys. Rev. D. (2018)

arXiv:

Parallel Talks A / 106

Color dipole approach to diffractive particle production: from Drell-Yan to di-jets final states

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The dipole approach provides all the necessary means for a universal treatment of both inclusive and diffractive reactions. In this presentation, I will classify various sources of diffractive factorisation breakingin hadronic collisions in both diffractive Abelian and non-Abelian radiation as apparent in the dipole picture, as well as give a short overview of the recent advances in treatment of such diffractive production processes as diffractive Drell-Yan and di-jet production.

arXiv:

Parallel Talks A / 4

Extra dimensions' influence on the structure and stability of compact object with a linear equation of state

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The influence of the extra dimension on the static equilibrium configurations and the stability against radial perturbations are analyzed. These studies are investigated by using the stellar structure equations and the radial perturbation equations, both modified for a d-dimensional spacetime. We obtain that the spacetime dimension influences in both structure and stability of an object, whose fluid contained in it follows a linear equation of state, in this case the MIT bag model equation of state is considered. For an interval of central energy densities $\rho_c\,G_d$ and total masses $MG_d/(d-3)$, when the dimension is increased the stars gain more stability. We also show that the value of $\rho_c\,G_d$ used to obtain the maximum value of $MG_d/(d-3)$ is the same used to obtain the zero eigenfrecuency of oscillation, i.e., the peak value of $MG_d/(d-3)$ marks the onset of instability. This indicates that the necessary and sufficient conditions to recognize regions constructed by stable and unstable equilibrium configurations against radial perturbations are respectively $dM/d\rho_c > 0$ and $dM/d\rho_c < 0$.

arXiv:

Parallel Talks A / 10

Polarization signatures from effective interactions of Majorana neutrinos

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We study the capability of angular and polarization observables to disentangle different new physics contributions to the production of heavy sterile Majorana neutrinos in the lepton number violating channels $e^-p \to l_j^+ + 3jets\,(l_j \equiv e, \mu)$ and $e^+e^- \to \tau^+\tau^+ + 4jets$ in electron-proton and electron-positron colliders. This is done investigating the angular and polarization trails of effective operators with distinct Dirac-Lorentz structure contributing to the Majorana neutrino production, which parameterize new physics from a higher energy scale.

arXiv:

1802.07620

Dark Matter searches with the ATLAS Detector

Author: ATLAS Collaboration[None]

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The presence of a non-baryonic dark matter component in the Universe is inferred from the observation of its gravitational interaction. If dark matter interacts weakly with the Standard Model it would be produced at the LHC, escaping the detector and leaving a large missing transverse momentum as their signature. The ATLAS detector has developed a broad and systematic search program for dark matter production in LHC collisions. The results of these searches on the 13 TeV data, their interpretation, and the design and possible evolution of the search program will be presented.

arXiv:

About heavy neutrinos: violation of lepton flavor in neutrinoless decays of leptons

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The fundamental description of nature, beyond the Standard Model (SM), may include heavy neutrinos that mix and thus allow processes in which lepton flavor is not preserved. We investigate the impact of charged currents that couple heavy gauge bosons to heavy neutrinos and SM leptons on neutrinoless lepton-flavor-violating decays of SM leptons into three charged leptons. We implement our expressions for the leading contributions to $Br(l\alpha \rightarrow l\beta\ l\sigma\ l\sigma)$, which hold for either Dirac or Majorana neutrinos, to neutrinoless trilepton decays of the muon and so determine sets of masses of heavy neutrinos and the heavy gauge boson, within GeVs to few TeVs, that are consistent with the upper bounds provided by the SINDRUM Collaboration.

arXiv:

1710.08474v2 [hep-ph]

Deformation of compact objects due to the magnetic field

Authors: Diana Alvear Terrero[1]; Aurora Perez Martinez[1]; Daryel Manreza Paret[2]; Gretel Quintero Angulo[2]; Victoria Hernandez Mederos[1]; Samantha Lopez Perez[3]

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Magnetic fields are present in compact objects affecting its structure. The anisotropy produced by the magnetic field in the pressures suggests the necessity of using structure equations considering the axial symmetry of the magnetized system. In this work, we propose a model that generalizes the Tolman-Oppenheimer-Volkoff equations for the magnetized case and discuss some preliminary results. Our calculations are based on the γ-metrics where the parameter γ relates the deformation with the anisotropy in the pressures.

arXiv:

arXiv:1807.09943v2

Parallel Talks A / 15

Observational tests for Beyond Standard Model Physics: CMB Photon oscillation into Hidden Sector and Axion like Particles.

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We seek to study how the observed spectrum of cosmological photons is modified if a theory that considers new particles is incorporated,
analogues to the usual photons, called Hidden Photons and axion-like particles.

To study these possible modifications, we introduce a model that contains parameters that correspond to the masses and couplings for both new particles. These being free parameters, we seek to find the best adjustment of the spectrum observed with the modifications to the usual black body spectrum and thus obtain regions of exclusion, in which we can observe the possible validity of the extended theory.

Then we need to improve these regions of exclusion, incorporating new interactions in the process of photon oscillation to Hidden Photon and axions, in addition to improving our understanding of the cosmological processes occurring in the evolution of the universe, such as recombination and reionization. [1-2]

As an experimental test, the model is studied from a point of view where the oscillation between particles occurs in an empty environment.
These experiments are of the Aharonov-Bohm type where they study the existence of electric and magnetic fields in the different regions of space, where it can be inferred if there is a presence of new particles. [3]

arXiv:

https://arxiv.org/abs/0901.0014 ; https://arxiv.org/abs/0905.4865 ; https://arxiv.org/abs/1710.08740

Parallel Talks A / 17

Searches for dark matter at CMS

Author: Jose Ruiz[1]

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Searches in CMS for dark matter in final states with invisible particles recoiling against visible states are presented. Various topologies and kinematic variables are explored, including jet substructure as a mean of tagging heavy bosons. The focus of the talk is the recent results obtained using data collected at Run-II of the LHC.

arXiv:

Parallel Talks A / 19

Dark matter production of scalar and vector kind

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The dark matter problem is one of the major subjects of physics these days. The search for hints in the high and low mass range are intense. A quite popular candidate is the axion, a very light hypothetical particle that can only account for the whole dark matter in a window of mass around the μeV. Recently has been found that one way to open up this window is if the axion is coupled to a massless dark photon. In this talk, we would like to review the mechanisms in which axions and dark photons can be independently very good cold dark matter candidates, and also show a model where they can both be produced in the early universe, and therefore have them both as the dark matter.

arXiv:

1201.5902

Parallel Talks A / 35

Recent results in B-physics with the ATLAS detector

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New and recent results from the ATLAS programme of studies in EW physics with open beauty are presented. Particular attention will be given to measurements involving FCNC processes in Bs and Bd mesons decays (that are sensitive to New Physics contributions through corrections to the EW loop amplitudes) and to studies of CP violation in the Bs sector.

The most recent results from ATLAS are presented, including prospects for HL-HLC.

arXiv:

Parallel Talks A / 20

Disentangling atmospheric cascades started by gamma rays from cosmic rays with CORSIKA

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In this work we test a multivariate method to differentiate between particle showers produced by cosmic rays and by gamma rays at TeV energies, using CORSIKA simulations. The aim is to solve the dominant hadron flux background problem when looking for gamma-ray signals measured by different experiments. The results of this work can be applied to the study of Gamma-Ray Bursts (GRBs). GRBs emit very energetic photons, which after interacting in the Earth's atmosphere, produce a large detectable electromagnetic cascade of secondary particles.

We simulate events produced by photons, the signal, and protons, the most abundant cosmic-ray background. We extract several parameters from fitting particle air-shower longitudinal profiles, characterizing the simulated showers. Some of the most important fit parameters are the shower maximum (Xmax), the width of the shower (FWHM), the asymmetry parameter, the maximum number of particles and the shower start. Experiments using fluorescence detectors can measure this longitudinal profile of the shower.

The method to differentiate showers is based on a multivariate analysis using the TMVA package, which improves individual cuts. We use a sample that covers an energy range from 100 GeV to 10 TeV with different spectra to train and test different multivariate methods. We find that the Boosted Decision Trees (BDT) method was the best for distinguishing signal from background. Using tight cuts on the BDT we obtain a 1000 background rejection capability.

arXiv:

Parallel Talks A / 24

Chromomagnetic and chromoelectric dipole moments of the top quark in the fourth-generation THDM

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The chromomagnetic dipole moment (CMDM) and chromoelectric dipole moment (CEDM) of the top quark are calculated at the one-loop level in the framework of the two-Higgs doublet model with four fermion generations (4GTHDM), which is still consistent with experimental data and apart from new scalar bosons (H^0, A^0, and $H^{\pm}$) and quarks (b' and t') predicts new sources of CP violation via the extended 4×4 CKM matrix. Analytical expressions for the CMDM and CEDM of a quark are presented both in terms of Feynman parameter integrals, which are explicitly integrated, and Passarino-Veltman scalar functions, with the main contributions arising from loops carrying the scalar bosons accompanied by the third- and fourth-generation quarks. The current bounds on the parameter space of the 4GTHDM are discussed and a region still consistent with the LHC data on the 125 GeV Higgs boson and the oblique parameters is identified. It is found that the top quark CMDM, which is induced by all the scalar bosons, can reach values of the order of 10^{-2}–10^{-1}. As for the top quark CEDM, it only receives contributions from the charged scalar boson and can reach values of the order of 10^{-20}–10^{-19} ecm for relatively light $m_{H^\pm}$ and heavy $m_{b'}$, with the dominant contribution

arising from the b quark. The CEDM would be the most interesting prediction of this model as it can be larger than the value predicted by the usual THDMs by one order of magnitude.

arXiv:

arXiv:1805.00615

Parallel Talks A / 28

Muon $g-2$ in the 2HDM: updates on maximum results and phenomenology

Authors: Adriano Cherchiglia[1]; Dominik Stoeckinger[2]; Hyejung Stoeckinger-Kim[2]

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In this work, we categorize and discuss the maximum contributions to the muon magnetic moment a_μ as well as to the Yukawa and triple Higgs couplings in the flavour-aligned two-Higgs doublet model (2HDM). We focus on the most promising case of a light pseudoscalar Higgs A with large Yukawa couplings to leptons and quarks. By taking into account experimental constraints from LHC, Higgs and flavour physics, we find maximum possible Yukawa couplings of a light A of around $50 \cdots 100$ (leptons) and $O(0.5)$ (quarks). An overall maximum for a_μ of more than 45×10^{-10} is possible in a very small parameter region around $M_A = 20\,GeV$. For M_A up to $100\,GeV$, the maximum possible value of a_μ is compatible with the currently observed deviation if the A couplings to quarks and leptons are both large, making this scenario promising for LHC searches. We also analyse the subleading bosonic two-loop contributions to a_μ, finding values up to 3×10^{-10}.
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arXiv:

1711.11567

Parallel Talks A / 30

Recent results from SUSY searches with ATLAS

Author: ATLAS Collaboration[None]

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Despite the absence of experimental evidence, weak-scale supersymmetry remains one of the best motivated and studied Standard Model extensions. This talk summarises recent ATLAS results on searches for SUSY, including strong production and electroweak production. Strong limits can be set on gluino and squark (including stop) production with recent data. Several searches explore long-lived scenarios that may be detected through abnormal specific energy loss, appearing or disappearing tracks, displaced vertices, long time-of-flight or late calorimetric energy deposits.

arXiv:

Parallel Talks A / 31

Measurements of the Higgs boson properties at the ATLAS experiment

Author: ATLAS Collaboration[None]

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After the discovery of the Higgs boson in summer 2012, the understanding its properties has been a high priority of the ATLAS physics program. Measurements of Higgs boson properties sensitive to its production processes, decay modes, kinematics, mass, and spin/CP properties based on pp collision data recorded at 13 TeV are presented. The analyses in several decay channels will be described and the results of the combination of different decay channels will be shown.

arXiv:

Parallel Talks A / 32

Searches for non-SM Higgs bosons and for BSM decays of the Higgs boson at the ATLAS experiment

Author: ATLAS Collaboration[None]

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Several theories beyond the Standard Model predict the existence of additional neutral or charged Higgs particles, as well as decays of the Higgs boson that are either forbidden or strongly suppressed in the SM.

Results from selected recent searches for additional Higgs bosons in different production processes and decay modes, and for BSM decays of the 125 GeV-Higgs boson will be presented.

arXiv:

Parallel Talks A / 38

Nambu–Jona-Lasinio Models with Supersymmetry and Phenomenology

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The Nambu–Jona-Lasinio model is the classic model of nonperturbative physics generating an effective Higgs field as dynamical composite giving symmetry breaking and mass generation. We discuss the line of supersymmetric versions of NJL type models we studied in the recent years and their possible phenomenological applications in the setting of the supersymmetric standard model. The nontrivial nature of the notion of supersymmetrization for both the case of spin zero and spin one composites will also be illustrated.

arXiv:

Parallel Talks A / 45

New Physics in Double Higgs production at future e+ e- colliders

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In this work we study the effects of new physics in double Higgs production at future e^+e^- colliders. In particular, we consider the possibility of an enhancement due to the contribution of SM dimension-six effective operators. We perform this study for several benchmarks of energy and integrated luminosity related to several proposed linear colliders such as CLIC, ILC and FCC-ee. We derive expected bounds on the effective field theory coefficients for these different scenarios.

arXiv:

Parallel Talks A / 53

Search for gamma-ray counterparts of newly discovered radio astrophysical sources

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The aim of the present work is to correlate highly energetic, short lived events in the radio wave spectrum, known as Fast Radio Bursts (FRB), and compact radio sources known as Faranoff-Riley 0 (FR-0) with gamma rays using data from the Fermi satellite.
FRB39;s origin is still unknown, although, given their spatial distribution, an extragalactic origin is suspected. Up to date, only one FRB (FRB121102) has been identified due to its repeating nature.
The identification of a gamma ray counterpart for these events would put them as candidates to most energetic observed event, while providing important clues as to their origin.
The Faranoff-Riley classification divides radio sources in Class I (luminosity decreases with distance to the center), Class II (luminosity increases in the lobes) and Class 0 (similar to Class I but with a large deficit of extended radio emission). The study of FR-0s in other wavelengths is crucial to better understand the source39;s engine.
In this work, we model gamma ray fluxes of both FRBs and FR-0s to find a significant correlation. This analysis is made by varying the time windows (in the case of FRBs), the various models used (e.g: power law, log parabola, cutoff, etc) and searching for an optimal set of parameters to maximize the test statistics for the excess flux in gamma rays.

arXiv:

Parallel Talks A / 62

Breaking of CPT due to quantum decoherence tested at DUNE

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We study the feasibility of observing deviations from the CPT symmetry owing to quantum decoherence and in the framework of the neutrino oscillations. Taking into account the open system approach, and considering non-diagonal decoherence matrizes, we study all the cases in which CPT violation (CPTV) terms that could be arising in the neutrino oscillation probabilities. Moreover, and based on the information from the muon neutrino/antineutrino channels, we put on trial all the CPTV cases using the DUNE experiment. For the optimal case, we find 5 σ of confidence for $\Gamma(E/\text{GeV})^n \sim 13.1 \times 10^{-23}\,\text{GeV}, 4.6 \times 10^{-23}\,\text{GeV}\ 2.1 \times 10^{-23}\,\text{GeV}$ y $0.8 \times 10^{-23}\,\text{GeV}$ for $n = -1$, 0, 1 and 2 respectively.

arXiv:

Parallel Talks A / 64

The Latin American Giant Observatory

Author: Luis Otiniano[1]

Co-author: for the LAGO collaboration [2]

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[2] *http://lagoproject.org/, see the full collaboration member list at http://lagoproject.org/collab.html*

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The Latin American Giant Observatory (LAGO) consists of a network of water Cherenkov detectors (WCDs) with the aim of measuring the secondary cosmic rays flux at ground level. It is distributed across 10 countries in Latin America, from Mexico to Antarctica, at several altitudes, from sea level to 5200 m.a.s.l. The decentralized nature of this network has forced the development of a simple and robust detector, as well as an autonomous, synchronized acquisition system, with the capacity to perform on-site analysis.

In this talk we will discuss LAGO's scientific programs: high energy astrophysics, space weather and ground level radiation; also, the LAGO training program, which includes the design, operation and simulation of the detectors. Finally, we present the current state of the detectors network, some results and future prospects.

arXiv:

1703.05337

Parallel Talks A / 72

Particle detection with portable scintillation-based devices

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We built desktop particle detectors based on a design from MIT. We use them for measuring two characteristics of atmospheric muons: their angular distribution at sea level and their attenuation for lead and concrete layers. We also made a comparison between the actual measurements and the expected results from simulations based on Geant4. Finally, we explored the application of the detectors to the measurement of pure beta-sources'activity, allowing for an effective, simple dosimetry and radioactive source recognition method.

arXiv:

Parallel Talks A / 66

Visible neutrino decay and matter effects at future long-base line experiments

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The consequences of introducing matter effects into the neutrino visible decay scheme are studied. To this end, we select two
baselines for which matter effects have to be considered:1300 km (DUNE) and 7650 km(considering an hypothetical
beam aimed towards ANDES). The matter effects are almost unnoticeable for the visible decay contribution DUNE, being sizable at ANDES. We also carry out a realistic analysis taking DUNE as a context, considering ν_μ disappearance and ν_e appearance channels, for both FHC and RHC modes. The sensitivity to the decay constant α_3 can be as low as 2×10^{-6} eV^2 at 90% C.L., depending on the neutrino masses and type of coupling (scalar, pseudo-scalar or both). Lastly, we asses the impact of neutrino decay in the determination of θ_{23} and δ_{CP}, and find that the best-fit value of θ_{23} can move from a true value at the lower octant towards the higher octant.

arXiv:

arXiv:1805.03279 [hep-ph]

Parallel Talks A / 68

Majorana and Pseudo-Dirac Neutrinos at the ILC

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One of the open questions in particle physics is to know the nature of neutrinos, that is, to know if they are Dirac or Majorana particles. One of the most accepted models for the generation of neutrino mass is the Seesaw model, if we also consider an approximate lepton number symmetry, these can be tested in colliders. Here we consider an extension of the standard model, where we add two heavy neutrinos. These Majorana fermions will be considered highly degenerate, this is what we will call Pseudo-Dirac neutrinos. We consider the production of heavy neutrinos at the ILC, where its displaced vertex can be a golden signal. We will connect the splitting of the masses of heavy neutrinos with a forward-backward charge asymmetry and we will show that the constraints in these splittings can be lower than the known bounds.

arXiv:

Parallel Talks A / 69

Constraining sparticles at the LHC in a supersymmetric seesaw scenario

Authors: Joel Jones-Perez[1]; Werner Rudolf Porod[2]

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We study a scenario inspired by natural supersymmetry, where neutrino data is explained within a low-scale seesaw scenario. We extend the MSSM by adding light right-handed neutrinos and their superpartners, the R-sneutrinos, and consider the lightest neutralinos to be higgsino-like.
We consider the possibility of having an R-sneutrino as lightest supersymmetric particle. Assuming that some squarks and gauginos are heavy, we systematically evaluate the bounds on slepton and squark masses due to existing LHC data.

arXiv:

1705.06583

Parallel Talks A / 82

The Astrophobic Axion

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Reliable estimates of the allowed range for axion couplings to photons, nucleons and electrons are of major importance for determining the viable axion mass window as well as to focus experimental axion searches.
We show that in a class of generalized DFSZ axion models with generation dependent Peccei-Quinn charges the axion couplings to nucleons and electrons can be simultaneously suppressed. Astrophysical limits from the SN1987A burst duration and from white dwarf cooling can therefore be relaxed,

and as a consequence for such an astrophobic axion a mass window up to O(0.1) eV remains open. Since the axion-photon coupling remains sizeable, the proposed IAXO helioscope will become crucial to search for axions of this type.
An unavoidable consequence of astrophobia are flavor off-diagonal axion couplings at tree-level, so that experimental limits on flavor-violating processes can also provide a powerful tool to constrain this scenario. The astrophobic axion can be a viable dark matter candidate in the heavy mass window, and can also account for anomalous energy loss in stars.

arXiv:

Parallel Talks B / 86

Traversable wormholes in AdS

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In this talk we review the BTZ type wormhole, the Thermofield Double State (TFD) and the Averaged Null Energy Condition (ANEC) violation which is a prerequisite for all traversable wormholes. Finally we comment on traversable charged rotating wormholes in AdS space.

arXiv:

Parallel Talks B / 2

Spin-2 Portal Dark Matter

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We generalize models invoking a spin-2 particle as a mediator between the dark sector and the Standard Model. We show that a massive spin-2 messenger can efficiently play the role of a portal between the two sectors. The dark matter is then produced via a freeze-in mechanism during the reheating epoch. In a large part of the parameter space, production through the exchange of a massive spin-2 mediator dominates over processes involving a graviton with Planck suppressed couplings. We perform a systematic analysis of such models for different values of the spin-2 mass relative to the maximum and the final temperature attained at reheating.

arXiv:

1803.01866

Parallel Talks B / 3

Traversable wormholes in $f(R, T)$ gravity

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We propose, as a novelty in the literature, the modelling of wormholes within the particular case of the $f(R,T)$ gravity, namely $f(R,T) = R + \lambda T$, with R and T being the Ricci scalar and trace of the energy-momentum tensor, respectively, while α and λ are constants. Although such a functional form application can be found in the literature, those concern to compact astrophysical objects, such that no wormhole analysis has been done so far. The linear geometric and material corrections of this theory make the matter content of the wormhole to remarkably be able to obey the energy conditions.

arXiv:

1802.02465

Parallel Talks B / 6

Pressure distribution of gluons inside the proton using Tsallis entropy within the MIT Bag Model

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The non-extensive Tsallis statistics has been widely used to describe high energy data. This statistics was made as a generalization to Boltzmann statistics in order to benefit long-range-interacting many body Hamiltonian systems [1]. This formalism is based on the entropy S_q, the entropic index q measures the deviation respect to Bolztmann statistics. The success of Tsallis statistics to describe very well many transverse momentum distributions of heavy ion collisions has leaded to guess that there is a connection between the nonextensivity and the physics of the nuclear matter. Therefore, many researches are recently focusing on finding this connection, especially in the deconfinement of nuclear matter. On the other hand, few months ago it was published an article where V. D. Burkert, L. Elouadrhiri and F. X. Girod presented the pressure distribution inside the proton [2]. However, this pressure is only due to quarks, gluons are not considered. For that reason in this work we present a way to obtain the pressure distribution of gluons inside the proton considering the non-extensive Tsallis entropy within the MIT Bag Model as a consequence of the interaction between quarks and gluons. We also present and discuss the consequences of the non-extensivity in the phase diagram and the pressure curve as a function of temperature and the q parameter. While there is a binding pressure of gluons at distances near the centre of the proton, there is a repulsive pressure at greater distances. The quark pressure is slightly more dominant than the gluon pressure at distances near the centre of the proton. However, at greater distances the gluon pressure is more dominant.

[1] C. Tsallis, Introduction to nonextensive statistical mechanics: Approaching a complex world, Springer, New York, (2009).
[2] V. D. Burkert, L. Elouadrhiri and F. X. Girod, The pressure distribution inside the proton, Nature, 557 (2018) 396-399.

arXiv:

Parallel Talks B / 7

Resonant production of dark photons in positron beam dump experiments

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Positrons beam dump experiments have unique features to search for very narrow resonances coupled superweakly to e^+e^- pairs. Due to the continue loss of energy from soft photon bremsstrahlung, in the first few radiation lengths of the dump a positron beam can continuously scan for resonant production of new resonances via e^+ annihilation off an atomic e^- in the target. We explore the foreseeable sensitivity of the Frascati PADME experiment to searching, with this resonance annihilation technique, the 17 MeV dark photon invoked to explain the ^{8}Be anomaly in nuclear transitions.

arXiv:

arXiv:1802.04756

Parallel Talks B / 8

Renormalization and unitarity in higher-order Lorentz violating models

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The breakdown of Lorentz symmetry has been pointed out as a candidate to account for quantum gravity effects. The strong suppression at low energies, has lead to consider the interlink between effective field theory and ultra high precision experiments. To begin with, we motivate such violations within effective field theory and describe how these effective terms are implemented. Recently, higher-order operators have attracted a lot of interest, since one can consider higher energies in the search. We explain why and how these terms can lead to issues on unitarity and renormalization. We show the main ingredients in the formulations to deal with these issues.

arXiv:

1706.01466

Parallel Talks B / 9

Dark Matter from a Vector field in non-trival SU(2)_L Reepresentations

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Co-authors: Alexander Belyaev ; Giacomo Cacciapaglia ; James McKay ; Dixon Marin ; Bastian Díaz ; Felipe Rojas-Abatte

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In this work we present a simple extensions of the Standard Model
that contain, as the only new physics component, a massive spin-one matter field in a non-trivial representation of SU(2)_L. In the first case, we consider a vector field in the adjoint representation. In order
to be consistent with perturbative unitarity, the vector field
must be odd under a Z_2 symmetry. Radiative corrections make
the neutral component of the triplet (Vˆ{0}) slightly lighter than
the charged ones. We show that Vˆ{0} can be the dark matter particle while satisfying all current bounds if it has a mass between 2.8 and 3.8 TeV.
We present the current limit on the model parameter space from highly
complementary experimental constraints including dark matter relic density measurement, dark matter direct and indirect detection searches, LHC data on Higgs couplings to photons and LHC data on disappearing track searches. We also show that the two-dimensional parameter space can be fully covered by disappearing track searches at a future 100 TeV hadron collider, which will probe, in particular, the whole mass range relevant for dark matter, thus giving an opportunity to discover or exclude the model.

In a second mode, we consider a vector field in the fundamental representation of SU(2)_L. In this case we found that the model is more severely constrained.

arXiv:

1808.10464

Parallel Talks B / 11

Temperature Fluctuactions of CMB in Delta Gravity

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Introduction
We have been computing the scalar modes of the temperature fluctuations of the CMB in the context of Delta Gravity (DG) [1,2]. For this purpose we developed the perturbation theory of the equations of motions of this theory and studied the propagation of photons in the extended FRWL background using the hidrodynamical approximation and the sharp transition approximation at the time of last scattering [3].

As in General Relativity (GR), we could split the temperature fluctuation in an early",late" and "ISW" term, which we have probed they are gauge invariant. Then we assumed that all scalar contributions to the fluctuations were dominated by a single mode and we can study the temperature multipole coefficients.

Final calculations are in progress.

The Model
In DG photons follow null geodesics in an effective metric, if we consider a light ray travelling

toward the center of this coordinate system from the direction $\hat{n}$, this ray will have a co-moving radial coordinate r related to t by:

\begin{equation}
0={\bf g}{\mu\nu}dx^{\mu}dx^{\nu}=-(1+\kappa_2 F(t)+E(r\hat{n},t)+\kappa_2 \tilde{E}(r\hat{n},t))dt^2\\+(R^2(t)(1+\kappa_2 F(t))+h{rr}(r\hat{n},t)\kappa_2\tilde{h}_{rr}(r\hat{n},t))dr^2\,,
\end{equation}

where E, $\tilde{E}$, h_{rr} and $\tilde{h}_{rr}$ are perturbations. κ_2 is just a parameter which can be 0 (GR case) or 1 (DG case), and it has no physical meaning because we can always re-scale the fields in the Delta sector.

If we make the approximation of a sharp transition from thermal equilibrium to complete transparency at a moment t_L of last scattering then we get
\begin{equation}
\left(\frac{\Delta T(\hat{n})}{T_0}\right)^S=\left(\frac{\Delta T(\hat{n})}{T_0}\right)^S_{\text{early}}+\left(\frac{\Delta T(\hat{n})}{T_0}\right)^S_{\text{late}}+\left(\frac{\Delta T(\hat{n})}{T_0}\right)^S_{\text{ISW}}\,.
\end{equation}
Each term is gauge invariant under transformations that leave $\mathbf{g}_{i0}$ equal to zero.

The "late" term only affects terms in the multipole expansion of the temperature correlation function with $l = 0$ and $l = 1$, so it can be ignored if from now on we consider only multipole orders $l \geq 2$. Besides, the integrate Sachs-Wolfe effect can also be neglected, because this effect is important only for relatively small values of l, say $l < 20$, where cosmic variance intrudes on measurementes of $C^S_{TT,l}$.

Finally, we are now calculating higher orders of the temperature multipole coefficients for the scalar modes.

arXiv:

Parallel Talks B / 18

Antisymmetric Wilson loops in N = 4 SYM: from exact results to non-planar corrections

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Wilson loops have played a central role in the development of gauge/gravity dualities. We consider the vacuum expectation values of 1/2-BPS circular Wilson loops in N=4 super Yang-Mills theory in the totally antisymmetric representation of the gauge group U(N) or SU(N). Localization and matrix model techniques provide exact, but rather formal, expressions for these expectation values. We extract the leading and sub-leading behavior in a 1/N expansion with fixed 't Hooft coupling starting from these exact results. This is done by exploiting the relation between the generating function of antisymmetric Wilson loops and a finite-dimensional quantum system known as the truncated harmonic oscillator.

arXiv:

1807.04052v2

Parallel Talks B / 34

Searches for Exotic Phenomena in ATLAS

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Many theories beyond the Standard Model predict new phenomena accessible by the LHC. Searches for new physics models are performed using the ATLAS experiment at the LHC. The non-Dark Matter related results reported here use the pp collision data sample collected in 2015 through 2018 by the ATLAS detector at the LHC with a center-of-mass energy of 13 TeV.

arXiv:

Parallel Talks B / 23

η-Deformation of the AdS5×S5 Pure Spinor Superstring

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It is well known that the $AdS_5 \times S^5$ superstring equations of motion either in the Green-Schwarz (GS) or in the pure spinor (PS) formulation can be cast into a zero curvature equation satisfied by a Lax pair.
Recently significant progress has been made in deforming the $AdS_5 \times S^5$ structure of the GS superstring while preserving the integrability and its local symmetries. The η-deformation describes a string moving in a generalized supergravity background, and its main ingredient is a linear operator which solves the modified classical Yang-Baxter equation.
In this work we present an integrable deformation of the $AdS_5 \times S^5$ PS superstring based on homological perturbation theory. The resulting model describes a PS superstring in a η-background. Its equations of motion, Lax connection and BRST symmetry are discussed. We found that the η-deformation of the superstring is produced by the perturbative action of one state in the cohomology of $AdS_5 \times S^5$.

arXiv:

https://arxiv.org/abs/1807.10432v1

Parallel Talks B / 36

Top quark measurements with the ATLAS detector

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The top quark is the heaviest known fundamental particle. As it is the only quark that decays before it hadronizes, it gives us the unique opportunity to probe the properties of bare quarks at the Large Hadron Collider. This talk will present highlights of a few recent precision measurements of the top quark using 13 TeV collision data: top-quark pair and single top production cross sections, including differential distributions and production in association with bosons, will be presented alongside top

quark properties measurements. These measurements, including results using boosted top quarks, probe our understanding of top quark production in the TeV regime. Measurements of the top quark mass are also presented.

arXiv:

Parallel Talks B / 25

Coupling between the Ho\v{r}ava-Lifshitz gravity and electromagnetism

Author: francisco Tello Ortiz[1]

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We analyze the gravity-electromagnetic interaction in a pure Ho\v{r}ava-Lifshitz framework. To do so we formulate the Ho\v{r}ava-Lifshitz gravity in $4+1$ dimensions and perform a Kaluza-Klein reduction to $3+1$ dimensions. We use this reduction as a mathematical procedure to obtain the $3+1$ coupled theory, which at the end is considered as a fundamental, self-consistent, theory. The critical value of the dimensionless coupling constant in the kinetic term of the action is $\lambda = 1/4$. It is the kinetic conformal point for the non-relativistic electromagnetic-gravity interaction. In distinction, the corresponding kinetic conformal value for pure Ho\v{r}ava-Lifshitz gravity in $3+1$ dimensions is $\lambda = 1/3$. We analyze the geometrical structure of the critical and noncritical cases, they correspond to different theories. The physical degrees of freedom propagated by the noncritical theory are the transverse traceless graviton, the transverse gauge vector and two scalar fields. In the critical theory one of the scalars is absent, only the dilaton scalar field is present. The gravity and vector excitations propagate with the same speed, which at low energy can be taken to be the speed of light. The field equations for the gauge vector in the non-relativistic theory have exactly the same form as the relativistic electromagnetic field equations arising from the Kaluza-Klein reduction of General Relativity, and are equal to them for a particular value of one of the coupling constants. The potential in the Hamiltonian is a polynomial of finite degree in the gauge vector and its covariant derivatives.

arXiv:

1807.01629 hep-th

Parallel Talks B / 27

QED process in Very Special Relativity

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The Cohen and Glashow proposal, Very Special Relativity (VSR), explain the existence of a neutrino mass without introducing new particles and leptonic number violation, only reducing the symmetry from Lorentz to a subgroup, SIM(2). The main feature of this model is the existence of a privileged direction, given by a null vector. In this framework we have explored Quantum Electrodynamics in

order to find an observable which we could test the feasibility of this model. We have computed self-energies of photon and electron with new Feynman rules. A calculation in the Coulomb Scattering is presented and we have the same features found in the standard model. In addition, the Photon-Photon Scattering is presented. In the latter case, we have new signals of this null vector, but some problems with the choice of a prescription in the integration are discussed.

arXiv:

Parallel Talks B / 37

Coherent J/ψ photo-production in ultra-peripheral Pb-Pb collisions with ALICE at the LHC

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There are several different predictions for the behaviour of the gluon distribution in nuclei at small Bjorken x and experimental data are needed to choose among them. This is achieved by measuring the cross section of processes specially sensitive to this parton distribution.

The high flux of photons from lead ions at the LHC allows us to study photon-induced reactions in ultra-peripheral collisions (UPC) of Pb-Pb nuclei, in particular of those producing a J/ψ meson exclusively. The study of these collisions, where projectiles do not overlap, provides information about the initial state of nuclei.

The newest ALICE results on vector meson photoproduction are presented. The increased statistics and higher collision energy of $\sqrt{s}$=5.02 TeV in Run 2 allow us to put new constraints on available models.

arXiv:

Parallel Talks B / 40

Investigating diffractive processes in the ALICE experiment at the LHC

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ALICE is unique among experiments at the LHC because of its excellent particle identification capabilities, unmatched tracking performance, low transverse momentum threshold and an extended coverage of twelve units of pseudorapidity to detect the presence of particles produced in the collisions. In particular, the ALICE pseudorapidity range has been updated in the second run of the LHC, due to the addition of two new scintillation stations (AD). The new pseudorapidity regions are: [-7.0, -4.9] and [+5.1, +6.3]. The inclusion of these regions allows ALICE to achieve better sensitivities for studying low mass diffractive processes, in comparison with its previous capabilities. In this talk we review the ALICE diffractive cross section measurements for pp at 7 TeV with data from the first LHC run and the potential for improving these measurements in the second run, taking into account the new AD scintillation stations.

arXiv:

Parallel Talks B / 43

Interplay between multiple parton interactions and color reconnection and their effec ts on forward-backward multiplicity correlations in proton-proton collisions

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we present a study of forward backward multiplicity correlations in proton-proton collisions using PYTHIA event generator, at LHC energies. Detailed analysis is presented splitting data samples into soft and hard QCD processes, as well as, their comparisons of the correlation computed for short and long range pseudorapidity regions. Each region is analyzed taking into account effects on the color reconnection and independently multiple parton interactions. We show that a combination of those effects is required to explain last measurements
on proton-proton data, furthermore, the extraction of the strength of color reconnection and taking events with ranges of the number of multiple partons interactions brings us also the possibility to predict the results to energies not reached in the experiment.

arXiv:

Parallel Talks B / 44

AdS / QCD approach to study Hadron properties in nuclear medium

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We extend a holographic bottom-up model to reproduce in-medium scaling law for hadron masses, and we use it to study electromagnetic form factors and another hadron properties in nucleus. As an example, we consider properties for protons.

arXiv:

Parallel Talks B / 46

Bose-Einstein graviton condensate in a Schwarzschild black hole

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We analyze in detail a previous proposal by Dvali and Gómez that black holes could be treated as consisting
of a Bose-Einstein condensate of gravitons. In order to do so we extend the Einstein-Hilbert action with a
chemical potential-like term, thus placing ourselves in a grand-canonical ensemble. The form and characteristics
of this chemical potential-like piece are discussed in some detail. We argue that the resulting equations of motion
derived from the action could be interpreted as the Gross-Pitaevskii equation describing a graviton Bose-Einstein
condensate trapped by the black hole gravitational field. After this, we proceed to expand the ensuring equations
of motion up to second order around the classical Schwarzschild metric so that some non-linear terms in the metric
fluctuation are kept. Next we search for solutions and, modulo some very plausible assumptions, we find out that
the condensate vanishes outside the horizon but is non-zero in its interior. Inspired by a linearized approximation
around the horizon we are able to find an exact solution for the mean-field wave function describing the graviton
Bose-Einstein condensate in the black hole interior. After this, we can rederive some of the relations involving
the number of gravitons N and the black hole characteristics along the lines suggested by Dvali and Gómez.

arXiv:

gr-qc 1609.01639

Parallel Talks B / 52

Drag Force in QGP via AdS/QCD

Authors: Miguel Angel Martin Contreras[1]; Alfredo Vega[None]

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In this work, we discuss how to develop a model for the drag force using the so-called AdS/QCD soft wall model. The strong medium will be modeled holographically by and AdS-Black hole metric (Schwartzchild and Reissner Nordstrom) in the presence of a static quadratic dilaton. The parton in this approach is given by Chan-Paton charge at the end of an open string living in the background space. Kinematical and dynamical properties of the string will give rise to the dynamic properties of the parton in the strong media.

arXiv:

Parallel Talks B / 60

Equivalent Friedmann Equations in Delta Gravity and a possible explanation to Dark Energy

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From a modified General Relativity model named Delta Gravity (DG), that is based on a new Einstein-Hilbert action based on a new symmetry symbolized as $\tilde{\delta}$, we found two equations with the same structure as the Friedmann Equations. These equations let us establish a relation between the two free parameters of the DG theory, and the "Dark Energy" density, and we can conclude that one of these parameters, L_2, is strictly causing the Accelerating Expansion of the Universe.

These equivalent Friedmann Equations are obtained with a rearrangement of the (DG) motion equations. In this way, a new energy density appears naturally and it can be associated to Dark Energy in the ΛCDM model.

arXiv:

https://arxiv.org/pdf/1704.02888.pdf

Parallel Talks B / 56

Torsional regularization and finite bare charge

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We show that in the presence of the torsion tensor $S^k_{\ ij}$, whose existence is required by the consistency of the conservation law for the total angular momentum of a Dirac particle in curved spacetime with relativistic quantum mechanics, the quantum commutation relation for the four-momentum is given by $[p_i, p_j] = 2i\hbar S^k_{\ ij} p_k$.
We propose that this relation replaces the integration in the momentum space in Feynman diagrams with the summation over the discrete momentum eigenvalues.
We derive a prescription for this summation that agrees with convergent integrals:
$\int \frac{d^4p}{(p^2+\Delta)^s} \to 4\pi U^{s-2} \sum_{l=1}^{\infty} \int_0^{\pi/2} d\phi \frac{\sin^4 \phi \, n^{s-3}}{[\sin \phi + U\Delta n]^s}$,
where $n = \sqrt{l(l+1)}$ and $1/\sqrt{U}$ is a constant on the order of the Planck mass, determined by the Einstein-Cartan theory of gravity.
We show that this prescription regularizes ultraviolet-divergent integrals in loop diagrams.
We extend this prescription to tensor integrals and apply it to vacuum polarization.
We derive a finite, gauge-invariant vacuum polarization tensor and a finite running coupling that agrees with the low-energy limit of the standard quantum electrodynamics.
Including loops from all charged fermions, we find a finite value for the bare electric charge of an electron: $\approx -1.22 \, e$.
Torsional regularization, originating from the noncommutativity of the momentum and spin-torsion coupling, therefore provides a realistic, physical mechanism for eliminating infinities in quantum field theory: quantum electrodynamics with torsion is ultraviolet complete.

arXiv:

1712.09997

Parallel Talks B / 75

Scale-dependent FLRW Cosmology

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In the present work, we investigate the scale-dependence of the FLRW cosmology at the level of the effective action in the presence of a cosmological constant. We promote the classical parameters of the theory, $\{G_0, (\cdots)_0\}$, to scale-dependent couplings, $\{G_k, (\cdots)_k\}$, and then we solve the corresponding effective Einstein's field equations. To close the system of equations we impose the "null energy condition". Furthermore, perfect-fluid like parameters are induced via the scale-dependent gravitational coupling. Finally, to exemplify the effect of the running of the couplings on the properties of the scale-dependent FLRW solution in the underlying theory, we present a few concrete examples.

arXiv:

Parallel Talks B / 76

Glueball masses within an anomalous modified AdS/QCD model

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In this talk we will present how to use the AdS/CFT correspondence to compute analytically the masses of the scalar and higher even spin glueball with P=C=+1 using a single mass equation.
The approach considered here is based on a modified dynamic version of the Softwall Model with anomalous dimension contribution.
Furthermore, from the even glueball masses, we also achieved the Regge trajectory related the pomeron in agreement with other approaches.

arXiv:

arXiv:1611.09817

Parallel Talks B / 79

Newton gauge cosmological perturbations for static spherically symmetric modifications of the de Sitter metric

Authors: Camilo Santa[1]; Antonio Romano[2]

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Static coordinates can be convenient to solve the vacuum Einstein's equations in presence of spherical symmetry, but for cosmological applications comoving coordinates are more suitable to describe an expanding Universe, especially in the framework of cosmological perturbation theory (CPT). Using CPT we develop a method to transform static spherically symmetric (SSS) modifications of the de Sitter solution from static coordinates to the Newton gauge.

We test the method with the Schwarzschild de Sitter (SDS) metric and then derive general expressions for the Bardeen's potentials for a class of SSS metrics obtained by adding to the de Sitter metric a term linear in the mass and proportional to a general function of the radius. Using the gauge invariance of the Bardeen's potentials we then obtain a gauge invariant definition of the turn around radius.

We apply the method to an SSS solution of the Brans-Dicke theory, confirming the results obtained independently by solving the perturbation equations in the Newton gauge. The Bardeen's potentials are then derived for new SSS metrics involving logarithmic, power law and exponential modifications of the de Sitter metric. We also apply the method to SSS metrics which give flat rotation curves, computing the radial energy density profile in comoving coordinates in presence of a cosmological constant.

arXiv:

https://arxiv.org/abs/1611.09223

Parallel Talks B / 83

Two-component dark matter in a new B-L model

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We propose a new extension of the Standard Model by a U(1)B−L gauge symmetry in which the anomalies are canceled by two right-handed neutrinos plus four chiral fermions with fractional B-L charges. Two scalar fields that break the B-L symmetry and give masses to the new fermions are also required. After symmetry breaking, two neutrinos acquire Majorana masses via the seesaw mechanism leaving a massless neutrino in the spectrum. Additionally, the other new fermions arrange themselves into two Dirac particles, both of which are automatically stable and contribute to the observed dark matter density. This model thus realizes in a natural way, without ad hoc discrete symmetries, a two-component dark matter scenario. We analyze in some detail the dark matter phenomenology of this model. The dependence of the relic densities with the parameters of the model is illustrated and the regions consistent with the observed dark matter abundance are identified. Finally, we impose the current limits from LHC and direct detection experiments, and show that the high mass region of this model remains unconstrained.

arXiv:

Parallel Talks B / 84

Gravitational massive stealth fields from deformation method

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We find a large class of scalar field theories in curved spacetime which admit massive configurations with vanishing energy momentum tensor (stealth fields), therefore they do not feedback the gravitational background. We show also that other massive modes contained in these theories possess rescaled energy momentum tensors with respect to the standard (Klein-Gordon) theory, i.e. whose strenght can be smoothed or magnified accoding to the value of a single parameter, equivalent to the mass of the stealth configuration. Our result demonstrates that matter fields may produce non-standard effects in their gravity backgrounds, i.e. different of those expected from general relativity. Talk based in https://arxiv.org/abs/1805.04621

arXiv:

1805.04621

Plenary Talks / 95

ATLAS

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arXiv:

Plenary Talks / 96

Minerva Experiment

arXiv:

Plenary Talks / 97

Dark Matter Theory

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arXiv:

Plenary Talks / 98

WIMPS and beyond - CANCELLED

Corresponding Author: estrada@fnal.gov

I will discuss some of the ongoing experiments for dark matter direct detection, which have a big emphasis on WIMPS. I will also discuss the newly developed experimental techniques that are now

making possible the search for dark matter candidates beyond the wimp, providing a new window into the dark sector.

arXiv:

Plenary Talks / 99

Cosmology

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arXiv:

Plenary Talks / 87

LHCb: results and future perspectives

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A review of recent results of the LHCb experiment will be made, tentatively covering the current status of the so-called weak anomalies in lepton flavor universality and angular analysis of b−> s ll decays, of CP-violation and b- and c-quark spectroscopy, and of low-mass new particle searches. Future perspectives shall also be outlined

arXiv:

Plenary Talks / 88

Lepton Flavour Universality

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I will review Lepton Flavour Universality (LFU), its meaning in the context of the Standard Model, its relation to Lepton Flavour Violation and the implication of its possible failure.
LFU applies to a wide range of processes, at different energy scales, and to a high degree of accuracy. B meson decays mediated by both charged currents and neutral currents have provided hints of violation of LFU. After discussing data and the main theoretical uncertainties involved in the SM interpretation, I will summarize the results of global fits when new physics is invoked. Effective field theories offer a plausible parametrization of these anomalies and allow for a
consistent discussion of the related constraints. As explained in this talk, these include both high-energy collider physics and low-energy processes arising from purely radiative effects.

arXiv:

Plenary Talks / 89

String Theory

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arXiv:

Plenary Talks / 90

Neutrino Theory

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arXiv:

Plenary Talks / 91

Reactor Neutrino Experiments

Corresponding Author: kirktmcdonald@gmail.com

arXiv:

Plenary Talks / 92

DUNE: Science, Status and Perspectives

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We will provide a short introduction to the current status of neutrino knowledge with emphasis on the long-baseline experiments. An extended introduction to the DUNE experiment will follow, addressing the current status of the project, including recent results for its several R&D setups. We will end discussing the overwhelming results DUNE could achieve in general for the neutrino physics.

arXiv:

Plenary Talks / 93

pQCD (and SM physics) at the LHC

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The first years of running of the CERN LHC marked a real milestone in particle physics with the discovery of the long sought Higgs boson. The LHC is delivering a wealth of high-quality data at an increased centre-of-mass energy, which, so far, shows and impressive agreement with the expectation from the Standard Model (SM) without clear evidence for new physics signals.

In general, the key word for indirect physics searches for the next years will be precision, since new physics could manifest itself through small deviations from SM behavior. In this talk I will present the state of the art theoretical (QCD and SM) toolkit for precision physics at the LHC.

arXiv:

Plenary Talks / 94

CMS

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arXiv:

Plenary Talks / 100

Some Recent Developments in Astroparticle Theory and Phenomenology

Corresponding Author: guenter.sigl@desy.de

I will review two recent developments in astroparticle theory and phenomenology that are not meant to be exhaustive in any way, but are connected to some of the particle physics covered in this conference.

First, cosmic rays have been observed up to macroscopic energies of about 50 Joules, presumably in one elementary particle. The existence of such particles pose formidable challenges and exciting prospects at the same time: Their origin and sources have not been identified yet, but they already allow to test physics at center of mass energies unattained in the laboratory, albeit in a rather indirect way. We will give an overview over possible sources and
acceleration mechanisms, issues related to cosmic ray mass composition and hadronic interaction models, and the role of secondary gamma-rays and neutrinos produced in primary cosmic ray interactions.

Second, axion-like particles, partly motivated by the strong CP problem, have recently gained attention as dark matter candidates and are searched for by shining light through a wall experiments and so called haloscopes and helioscopes based
on their two-photon couplings. They also provide interesting open theoretical problems ranging from their production in the early Universe to the large scale dark matter distribution, down to "axion stars", they would give rise to. Some of these aspects
will be reviewed.

arXiv:

Plenary Talks / 101

IceCube Experiment

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arXiv:

Plenary Talks / 102

ANDES Lab

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arXiv:

Plenary Talks / 103

LIGO

arXiv:

Plenary Talks / 104

Beyond the Standard Model

Corresponding Author: carena@fnal.gov

arXiv:

Plenary Talks / 107

Cosmology of String Moduli and the Swampland Conjecture

Corresponding Author: director@ictp.it

arXiv:

Plenary Talks / 13

ALICE: recent results and future perspectives

Author: Edmundo Garcia-Solis[1]

[1] *Chicago State University (US)*

Corresponding Author: edmundo.garcia@cern.ch

ALICE is an experiment designed to study the physics of strongly interacting matter and the quark-gluon plasma (QGP) in nucleus-nucleus collisions at the CERN's LHC. During the Run1 and Run 2 data taking (2010-2018), ALICE has collected valuable data for proton-proton, proton-lead, lead-lead and Xenon-Xenon collisions at different energies. In the presentation, we will summarize the main results towards understanding the high temperature and high energy density matter formed in these collisions, covering observables from the soft sector (bulk particle production and correlations), hard probes (charmed hadrons and jets) and signatures of possible collective effects in pp and p-Pb collisions with high multiplicity. The ALICE collaboration is currently preparing the upgrade of the experiment for Run 3, we will present the planned upgrades together with the future physics outlook.

arXiv:

Poster Session / 85

Higgs and Z' portals in the Dark Matter indirect detection

Corresponding Author: josehalim@gmail.com

In this work we study the contributions to the Dark Matter indirect detection which arising from additional neutral scalar and neutral gauge vector boson. The Dark Matter candidate is assumed to be an extra singlet scalar field. We find interesting scenarios for the additional contributions to the Dark Matter indirect observation.

arXiv:

Poster Session / 108

Phenomenology of Vector-like Heavy Fermions at High Energy Colliders

Despite the success of the SM when compared with experiment related to the electroweak and strong interactions. we have quite important reasons to believe that the SM is not complete. The SM does not provide a satisfactory explanation to the hierarchy problem. Many extensions of the Standard Model that solve the hierarchy problem result in new particles. We will study the phenomenology of vector-like fermions resulting in theories where the Higgs boson is typically a pseudo-Nambu-Goldstone boson. In these theories we study the case where a heavy fermion will be heavier than a heavy gluon, and then the channel of a heavy fermion decaying into a color octet is considered. We study this phenomenology at high energy colliders, both the LHC as well as future machines.

arXiv:

Poster Session / 21

Distributed acquisition logic for extended detector systems

Author: Adrián Pablo José Sedoski Croce[1]

Co-authors: Esteban Mocskos [2]; Rodrigo Castro [2]; Alejandro Almela [1]; Diego Melo [1]; Matías Rolf Hampel [1]; Alan Fuster [1]

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The Pierre Auger Observatory is designed to study cosmic ray showers at the highest energy using a hybrid approach by combining complementary detection techniques to study the same phenomena. One of these detectors is the Surface Detector Array, a regular array of 1660 water Cherenkov detectors distributed in an area of ˜3000 km^2.

The surface detector has a centralized, hierarchical event trigger mechanism by which all stations send timing information to a dedicated computer system programmed to search for spatial and temporal coincidences, sending data requests to a relatively broad cluster of stations when one such coincidence is found.

This work proposes an alternative event trigger system in which each station searches for the candidate shower trigger condition, and presents the progress on simulations, using the OMNeT++ network simulator, to verify that i) the proposed event trigger system can detect events using the same criteria currently applied in Auger, and ii) to study the minimum hardware requirements for a possible implementation.

arXiv:

Poster Session / 22

Magnetized BEC stars at finite temperature

Author: Lismary de la Caridad Suárez González[1]

Co-authors: Aurora Perez Martinez [2]; Gretel Quintero Angulo [3]

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We study magnetic field and temperature effects on the Equations of State (EoS) and the structure of a compact object composed by a gas of interacting spin one bosons formed up by the pairing of two neutrons. We have considered independently that particle-magnetic field and particle-particle interactions. The magnetic field provokes anisotropic equation of the state so it is not valid any more Tolman–Oppenheimer–Volkoff (TOV) equation for to obtain mass and radius relation. So, we have used the recently found γ-structure equations that describe axially symmetric objects provided they are spheroidal and have obtained some results related to the deformation of the object due to the presence of the magnetic field.

arXiv:

D. A. Terrero, V. H. Mederos, S. L. P´erez, D. M. Paret, A. P´erez Mart´ınez and G. Q. Angulo, arXiv:1807.09943 [astro-ph.HE].

Poster Session / 26

Search for Vector-Like Fermions using missing transverse momentum and muons in a final state of pp-collisions in the HL-LHC and Phase-II CMS experiment

Author: Diego Alberto Baron Moreno[1]

Co-authors: Nelson Vanegas Arbelaez [2]; Jose Ruiz [2]

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In this poster I will present the simulation of a signal that could be found in the High Luminosity Large Hadron Collider. The signal represents a candidate for dark matter (DM) , based on models with extra partciles from the known standard model particles, an extra vector-like fermion doublet and a scalar DM candidate. The signal is thought to be consistent with photon excesses coming from galaxy centers. The signature studied consists of one or two muons plus missing transverse momentum. With this criteria if no new physics is found, the existence of heavy fermion masses F above 130 GeV are excluded, assuming a difference in mass of $\Delta M(F, DM) = 20$ GeV and a branching ratio $BR(F \to \mu\chi) = 100\%$. Also, more area of parameter space can be excluded complementing Fermi-LAT and High Energy Stereoscopic System (HESS) experiments for gamma rays.

arXiv:

Poster Session / 29

Coexisting vacua in the CP conserving 2HDM: an one-loop study

Authors: Adriano Cherchiglia[1]; Celso Nishi[2]

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The Two-Higgs-Doublet model (2HDM) is a simple and viable extension of the Standard Model with a scalar potential complex enough that two minima may coexist. In this contribution we investigate if the procedure to identify our vacuum as the global minimum by tree-level formulas carries over to the one-loop corrected potential. In the CP-conserving case, we identify two distinct types of coexisting minima the regular ones (moderate $\tan\beta$) and the non-regular ones (small or large $\tan\beta$) and conclude that the tree level expectation fails only for the non-regular type of coexisting minima. For the regular type, the sign of the soft-breaking term already precisely indicates which minima is the global one, even at one-loop.

arXiv:

1707.04595

Poster Session / 41

An overview on B anomalies

Author: jonathan cardozo[1]

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In this work we present a review of the anomalies generated by the transition $b \to cl\nu$, where $l = e, \mu, \tau$. Specifically anomalies $R(D)$, $R(D^*)$, $R(J/\psi)$ are studied, including all possible four-Fermi operators in the effective Lagrangian that induce new physics to these ratios.

arXiv:

https://arxiv.org/abs/1212.1878

Poster Session / 42

Developing of a muon tomography system for the study of geological objects

Authors: César M. Castromonte F.[1]; Carlos J. Solano S.[1]; Jorge E. Samanés C.[2]; Luis J. Otiniano O.[2]; Gerald F. Salazar Q.[1]

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This work describes the initial steps to develop and build a muon scattering tomography system to investigate the space and time changes in the internal density distribution inside geological structures. As a start, a very detailed simulation chain to calculate the cosmic ray background flux is being developed in order to estimate the most convenient places and the exposure time of the muon detector to study a small mountain near the National University of Engineering. This project is a combined effort between the National Aerospace Research and Development Commission (CONIDA) and the National University of Engineering (UNI). Although this technology is not novel, this is the first time a project like this will be developed in the country.

arXiv:

Poster Session / 50

Photon trigger efficiency of the ATLAS detector in Run-2

Authors: Gonzalo Enrique Orellana[1]; On behalf of the ATLAS Collaboration[None]

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The production and efficient detection of photons in the ATLAS detector, plays an important role in the different analysis that takes place in the collaboration. Including both studies of the SM process and searches for new physics.

For the photon detection is essential a trigger system that allows a proper signal event selection, and also works for calibration, efficiency and identification measurements. This poster presents a measurement of the efficiency of the photon trigger in the ATLAS detector, using bootstrap techniques and the radiative decay of the Z boson. The data used here correspond to the Run-2 of the LHC, during 2015-2017.

arXiv:

Poster Session / 47

On the Propagation of Gravitational Waves in an Expanding Universe

Authors: Mauricio Gamonal San Martín[1]; Jorge Alfaro[2]

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Abstract
In [1,2], the influence of the cosmological constant in the propagation and measurement of Gravitational Waves (GW) was analyzed. In [3], a similar influence produced by non-relativistic matter was obtained. Thus, in this work we have generalized the effect for the case of an arbitrary perfect fluid, with equation of state $p = \omega_i \rho$, as the Universe background and used this for ΛCDM model, developing a numerical analysis that shows a potential usefulness of the results through Pulsar Timing Array future observations.

Results
From the linearization of the transformation between comoving coordinates of a cosmological observer and the coordinates that emerge from the GW source, the perturbation of the spacetime metric for ΛCDM model becomes

$$\mathrm{h}_{\mu\nu}^{GW} = \frac{1}{R}\left(1 - R\sqrt{\frac{\Lambda + \kappa\rho_{d0} + \kappa\rho_{r0}}{3}}\right)\left(E_{\mu\nu}\cos[w_{eff}T - k_{eff}R] + D_{\mu\nu}\sin[w_{eff}T - k_{eff}R]\right)$$

where ρ_{r0} is the energy density of radiation, ρ_{d0} is the density of non−relativistic matter and

$$\mathrm{w}_{eff} = \Omega\left(1 - R\sqrt{\frac{\Lambda + \kappa\rho_{d0} + \kappa\rho_{r0}}{3}}\right) \quad k_{eff} = \left(1 - \frac{R}{2}\sqrt{\frac{\Lambda + \kappa\rho_{d0} + \kappa\rho_{r0}}{3}}\right)$$

In [2] it is explained how the perturbation in space-time due to a pass of Gravitational Waves affect the arrival time of a light beam coming from a nearby pulsar. In this research, we considered two models: A very simplified one-pulsar configuration and a realistic model with a set of pulsar randomly distributed. The following figure shows the first simplified model,

![][4]

The figure shows that cosmological components can be perceived by a timing residual of a nearby pulsar emission due to a pass of Gravitational Waves.

In the realistic model, we simulated the statistical significance of the measurement of the peak observed in the simplified model. We used the data from ATNF pulsar catalogue, obtaining the following figure

![][5]

These results show that it is potentially possible to differentiate the Minkowski spacetime and the ΛCDM spacetime (and its cosmological components) through observations of timing residuals in PTA projects.

References

[1] J. Bernabeu, D. Espriu and D. Puigdomenech, Phys. Rev. D **84**, 069904 (2011).

[2] D. Espriu and D. Puigdomenech, Astrophys. J. **764**, 163 (2013).

[3] J. Alfaro, D. Espriu and L. Gabbanelli. (2017) https://arxiv.org/abs/1711.08315

arXiv:

https://arxiv.org/abs/1711.08315

Poster Session / 48

Spontaneous Breaking of Supersymmetry in the Wess-Zumino Model

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Exact unbroken supersymmetry implies that particles and their superpartners would have the same mass and therefore it should be able to recreate them in high energy particle accelerators. However, the lack of evidence for the existence of this superpartners suggests that if nature is, in fact, supersymmetric it must be spontaneously broken so the superpartners become much heavier than their corresponding particles. In this poster, the conditions for spontaneous breaking of supersymmetry is discussed in the Wess-Zumino model.

arXiv:

Poster Session / 49

Earthquake Studies Using a LAGO Detector in Ecuador

Authors: Edgar Fernando Carrera Jarrin[1]; Ricardo Escobar[2]; Felipe Mateo Navarro Cordero[None]; Dennis Cazar Ramirez[1]; Mario Audelo[3]

Co-author: The LAGO Collaboration

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Several studies have suggested the possibility of an interrelation between the occurrence of earthquakes and local disturbances in the geomagnetic field that could translate into an influence on the local cosmic ray flux at ground level. On April 16, 2016, Ecuador suffered one of the strongest earthquakes in its history. One of the Latin American Giant Observatory (LAGO) water Cherenkov detectors (WCD), located in the city of Riobamba-Ecuador, was monitoring the cosmic ray flux before, during and after this seismic event. In this work, we revisit the idea, already explored by other

LAGO groups, of using the data acquired by LAGO WCDs to study the interrelation between seismic phenomena and the geomagnetic field modulation of the flux of atmospheric muons originated in extensive air showers. To do this, after noise removal, an implementation of the moving windows average (MWA) algorithm and a Fast Fourier Transform analysis were used to search for noticeable flux variations. No significant change was found around the time of the earthquake, but the analysis method was put in place and can be used for future, similar studies.

arXiv:

https://arxiv.org/abs/1207.4823

Poster Session / **51**

Decays $A \to Z\gamma\gamma$ and $\phi \to Z\gamma\gamma$ ($\phi = h, H$) in two-Higgs doublet models

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The one-loop contributions to the decays of the CP-odd and CP-even scalar bosons $A \to Z\gamma\gamma$ and $\phi \to Z\gamma\gamma$ ($\phi = h, H$) are calculated within the framework of CP-conserving THDMs, where they are induced by box and reducible Feynman diagrams. The behavior of the corresponding branching ratios are then analyzed within the type-II THDM in a region of the parameter space around the alignment limit and still consistent with experimental data. It is found that the $A \to Z\gamma\gamma$ branching ratio is only relevant when $m_A > m_H + m_Z$, but it is negligible otherwise. For $m_A > 600$ GeV and $t_\beta \simeq O(1)$, $BR(A \to Z\gamma\gamma)$ can reach values of the order of 10^{-5}, but it decreases by about one order of magnitude as t_β increases up to 10. A similar behavior is followed by the $H \to Z\gamma\gamma$ decay, which only has a non-negligible branching ratio when $m_H > m_A + m_Z$ and can reach the level of 10^{-4} for $m_H > 600$ GeV and $t_\beta \simeq O(1)$. Since the properties of the h scalar boson are nearly identical to the SM Higgs boson, the $h \to Z\gamma\gamma$ branching ratio does not deviates significantly from the SM prediction, where it is negligibly small, of the order of 10^{-9}. This result is in agreement with previous calculations.

arXiv:

arXiv:1802.01222v2 [hep-ph]

Poster Session / **55**

New anisotropic solution of Einstein's equations

Authors: Pablo León[1]; Camilo Las Heras[1]

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The aim of this work was to obtain new analitical solutions for Einstein equations in the anisotropical domain. This was done via the minimal geometric deformation (MGD) approach, which is a simple

and systematical method that allow us to decouple the Einstein equations. It requires a perfect fluid known solution that we will choose to be Finch-Skeas(FS) solution. Two different constraints were applied, and in each case we found an interval of values for the free parameters, where necesarly other physical solutions shall live.

arXiv:

arXiv:1804.06874v3 [gr-qc]

Poster Session / 57

Search for composition-weighted correlations between UHECR events from the Pierre Auger Observatory and the Telescope Array with astrophysical gamma ray-sources

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We present a study connecting ultra-high energy cosmic rays (UHECR) events with gamma-ray astrophysical sources. We use UHECR data with energies greater than 80 EeV detected by the Pierre Auger Observatory and the Telescope Array. UHECR from extragalactic sources are likely made by protons and also light nuclei, as helium, and heavier nuclei. We consider several random mass compositions based on data. Deflection caused by galactic and extragalactic magnetic fields are taken into account, as well as a maximun distance given by the GZK cut-off for all possible different compositions. Gamma-ray sources are selected from different catalogues (TEVCAT, 2WHPS, 3FGL) taking into account the distance, type and flux. We include different astrophysical type of sources looking for statistical significant correlations with UHECR after trial corrections.

arXiv:

Poster Session / 59

Charged rotating BTZ geometry

Authors: Cristian Rivera[None]; Teofilo Vargas[1]

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We review the topological (2+1) black hole solution proposed by Bañados, Teitelboim and Zanelli (BTZ) for the rotating and charged case, emphasizing the wormhole solution of the above BTZ configuration. Recent work in holography and entanglement related with implementations of quantum teleportation protocols in the ER=EPR context and in more general cases showed that a further study of the BTZ geometry and the associated wormhole solutions are necessary.

arXiv:

https://arxiv.org/abs/1608.05687

Poster Session / 61

An alternative explanation to accelerating Universe without Λ in concordance with the last H_0 measured value

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We perform an MCMC analysis with the most updated SN-Ia catalog using an alternative cosmological model named Delta Gravity. This model is based on a new Einstein-Hilbert action based on a new symmetry symbolized as $\tilde{\delta}$. This theory predicts an accelerating Universe without the need to introduce a Λ by hand in the equations.

The equations of motion that describe the expansion of the universe depend on two free parameters: L_2 and C that are found by the MCMC simulation. Using these parameters we predicted cosmological parameters such as the Hubble Constant H_0, the age of the universe and the deceleration parameter q_0.

The most significant result is that Delta Gravity predicts that H_0 is 74.47 ± 1.63 km/(s Mpc). This value is in concordance with the last measurement of the H_0 local value, 73.83 ± 1.48 km/(s Mpc) (Riess 2018). This result is very important because could be an explanation to the H_0 tension today.

arXiv:

https://arxiv.org/pdf/1704.02888.pdf

Poster Session / 63

Replica Trick and Entanglement Entropy

Author: Fernando Temoche Hurtado[1]

Co-author: Teófilo Vargas Auccalla [1]

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The present work is focused on the implementation of path integral formalism for the calculation of entanglement entropy (EE) in quantum field theories (QFT's). First we introduce the alternative definition of EE, $S(A)$, in terms of R\'enyi entropy, $S_n(A)$. Then, we implement the reduced density matrix ρ_A as an euclidean path integral. Inmediately after that, we consider the case of massive scalar field and compute EE across a hyperplane in Minkowski spacetime.

Having obtained that result, we will comment on the divergence structure of it, essential to understand the role of EE as a source of universal information of our theory.

arXiv:

Nishioka, T. (2018). Entanglement entropy: holography and renormal- ization group.. arXiv preprint arXiv:1801.10352.

Poster Session / 65

Linking LFV Higgs decays $h \rightarrow l_i l_j$ with CP violation in multi-scalar models

Authors: O. Félix-Beltrán[1]; L. Díaz-Cruz[2]; E. Barradas-Guevara[2]; U. J. Saldaña-Salazar[2]

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The study of LFV decays of the Higgs boson, $h \rightarrow \ell_i \ell_j$, has become an active research subject both from the experimental and theoretical points of view. Such decays vanish within the SM and are highly suppressed in several theoretical extensions. Due to its relevance and relative simplicity to reconstruct the signal at future colliders, it is an important tool to probe SM extensions where it could reach detectable levels. Here we identify a mechanism that allows to induce large LFV Higgs interactions, by linking it with the appearance of CP violation in the scalar flavon sector, within the context of general multi-Higgs models. We then focus on the simplest model of this type to study its phenomenology, whose scalar sector consists of a Higgs doublet and a Froggatt–Nielsen (FN) (complex) singlet. Constraints on the parameters of the model are derived from low-energy observables and LHC Higgs data, which are then applied to predicted the rate for the decay $h \rightarrow \tau\mu$. Overall, branching ratios for $h \rightarrow \tau\mu$ of the order 10^{-3} are obtained within this approach, that are consistent with all known constraints.

arXiv:

arXiv:1706.00054 [hep-ph]

Poster Session / 67

An updated version of the electroweak right-handed neutrinos and new Higgs signals at LHC

Authors: Enrique Barradas Guevara[1]; J. Lorenzo Diaz Cruz[1]; Olga Guadalupe Félix Beltrán[2]; Félix González Canales[2]; Alfonso Rosado Sánchez[3]; Moises Zeleny Mora[1]

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We explore the Higgs sector phenomenology in the standard model extension including one complex singlet Higgs field (SM+1CS), which implies massness right-handed neutrinos ($\sim O(M_{Z_0})$).
All scales arise from spontaneous symmetry breaking (SSB). The scalar spectrum includes two neutral CP-even states (h and H, with $m_h < m_H$) and a neutral CP-odd state (σ) that can be identified as a pseudo-Majoron. The Higgs potential parameters are constrained using a perturbativity criteria, which amounts to solve the corresponding RGE. The relevant Higgs BR's are discussed, focus on the detection of the invisible Higgs signal at the LHC.

arXiv:

1007.2134

Poster Session / 70

Approximated three-flavor neutrino oscillation probabilities in matter for a generic decoherence matrix

Authors: Juan Carlos Carrasco Martínez[1]; Alberto Martín Gago Medina[1]

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The quantum decoherence phenomena has been largely studied as a sub-leading effect within the neutrino oscillation framework. From the analytical point of view, two-flavor neutrino oscillation probabilities in matter have been derived for a generic decoherence matrix. The aim of this work is, assuming a generic decoherence matrix (i.e. with off-diagonal elements non - zero) to develop analytical approximated neutrino oscillation probabilities formulae for a three-flavor scenario in constant density matter, taking $\alpha = \Delta m_{12}^2 / \Delta m_{13}^2$ and θ_{13} as small parameters . Finally, using these formulae we take a brief look of its phenomenological consequences.

arXiv:

Poster Session / 73

General Theory of Relativity under the Monad Formalism and its comparison with the ADM approach

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The present work exposes the Monad Formalism, which allows to characterize the frames of reference by tensor magnitudes, called physical-geometric tensors, and their relations with the metric tensor of space-time in the General Theory of Relativity (GTR). The invariances of the Monad Formalism are analyzed and the 3 + 1 foliation of the space-time is developed, which allows the Hamiltonian formulation of the GTR. This formulation is compared to the ADM formalism.

arXiv:

Poster Session / 74

Research on flavor changing neutral currents beyond the Standard Model

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Models beyond the standard model with extra scalars have been highly motived by the discobery of the Higgs boson. The two Higgs doublet model type III considers the most general case for the scalar potential, allowing mixing between neutral CP-even and CP-odd scalars fields. This work presents the results of the study on the t -> c gamma, t -> c Z, and t -> c h_1 decays, where h_1 is the Standard Model Higgs boson. The neutral flavor changing is generated by top-charm-Higgs coupling given by the Yukawa matrix.

arXiv:

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ADS BLACK-HOLE SOLUTIONS IN EINSTEIN-GAUSS-BONNET HIGHER ORDER DERIVATIVE GRAVITY

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In recent years, black holes solutions in Anti-de Sitter (AdS) spaces have attracted a great deal of attention. This is partly due to the success of AdS/CFT correspondence, which has the holographic entanglement entropy (EE) proposed by Ryu and Takayanagi as one of its most important applications

This is why, as the first part of a project that intends to study EE in higher order derivative theories of gravity, we will analyze black hole solutions in Einstein's theory with a Gauss-Bonnet term and a negative cosmological constant that constitutes one of the most accessible theories of higher order derivatives.

arXiv:

Sun, Y., Xu, H., & Zhao, L. (2016). Thermodynamics and holographic entanglement entropy for spherical black holes in 5D Gauss-Bonnet gravity. Journal of High Energy Physics, 2016(9), 60.

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Study of Higgs potential in an abelian extension of the Standard Model

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An extension of the Standard Model of elementary particles (SM) is studied to explain the mass hierarchy of fermions. This extension is based on the assumption of a new non-universal abelian U (1) 'interaction, which introduces extra fermions for the cancellation of chiral anomalies. As a consequence, an extended scalar sector is necessary to use, which consists of three doublets and one Higgs singles. In the case of doublets, their gaps have a hierarchy in their values to hundreds of GeV, units of GeV and hundreds of MeV, in order to satisfactorily describe the mass scales of the fermions. On the other hand, the singles break the non-universal symmetry and give mass to the extra fermions and bosons.

In this poster is calculated with the Higgs potential more general than can be constructed With 3 Higgs doublets and one Scalar singles invariant under this new non-universal symmetry and minimizing the potential the mass matrices and the self mass states with their respective rotation matrices for the charged bosons, the CP-pairs and CP-odd bosons. Diagonalizing the matrices we obtain the three Goldstone bosons of the SM and an extra one that would be associated with the new gauge boson, a lightweight Higgs boson was obtained in the order of the electroweak vacuum expectation value, so it is interpreted as the Higgs boson of 125 GeV and also was obtained new scalar bosons whose masses are at the TeV scales.

arXiv:

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Software algorithm implementation on geometric efficiency calibration for gamma spectrometry with scintillation detector using numerical methods

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Gamma spectrometry (γ) is used to detect photons with different energies, which characterize the different elements of radioactive samples. For this process there are several types of detectors applied to various types of sources. The present study focuses on obtaining a geometric efficiency calibration software, which will be used to introduce experimental characteristics, such as source radius, distance, among others. This way, a calibration curve can be obtained with alternative numerical methods to Monte Carlo, thus reducing the memory expenditure in Python, for cylindrical scintillation detectors and to be able to use it in future research. In this paper, geometric efficiency was calculated for punctual sources and disks, which were compared with experimental data to demonstrate what this software would do in the future.

arXiv:

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Simulation of the response and calibration of a Water Cherenkov Detector using Geant4

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Water Cherenkov Detectors (WCDs) are widely used for the study of the secondary cosmic rays flux at ground level and other high energy particles. Their performance is based on the emission of Cherenkov radiation in the active volume of the detector. This kind of radiation is emmited whenever a charged particle travels faster than the speed of light inside the medium. LAGO (Latin American Giant Observatory) is an array of WCDs deployed in a wide range of latitudes, from Mexico to the Antarctica; and at different altitudes, from the sea level to above 5200 m.a.s.l. This work presents a GEANT4 simulation of the response of WCDs to the secondary flux of cosmics rays at

ground level, the flux is obtained from a detailed CORSIKA simulations. We use this results to test a semi-analytical method to reconstruct the Vertical Muon Event spectrum, in order to calibrate the detectors response. Finally, we reanalyze old data to probe the new calibration method capability against the current calibration method used in the collaboration.

arXiv: