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Book of Abstracts

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Stationary Worldline Power Distributions

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A stationary worldline is one of the most simple non-trivial motions in physics. Point charges moving along these trajectories emit constant radiative power. The angular distribution of this power is found for all stationary worldlines including those with torsion and hypertorsion.

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Holographic description of the Quark Gluon Plasma using AdS/QCD

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In this talk, we will describe a toy model to approach the QGP phenomenology based on the so-called AdS/QCD Soft Wall Model, defined by the presence of static quadratic dilaton in the background. We will focus on the photon emission analyzed from the Schrödinger-like holographic potentials and, the drag force calculated from open strings propagating in the AdS-black-hole (Schwartzchild and Reissner-Nordstrom) geometries.

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A study of RIvet for the analysis of simulated events in particle physics

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The Rivet toolkit is introduced as an useful package for the analysis of simulated events in particle physics and its direct comparison with experimental data. A special emphasis is made on the Monte Carlo algorithms for the generation of events and their extension to NLO in perturbation theory. A simulation for the production of b-flavoured hadrons is made for proton-proton collisions at a center of mass energy of $\sqrt{s} = 7TeV$ using an implementation of the MC@NLO scheme for the matching of parton showers with NLO matrix element calculations.

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Full phenomenological consistency of the singlet-triplet scotogenic model

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We perform a complete analysis of the consistency of the singlet-triplet scotogenic model that focus in explain the dark matter (DM) and the neutrino masses of the stadard model to one-loop. We aisle the parameter space that is in agreement with the relic density of DM reported by the Plank satellite and the recent fits to the neutrino parameters. Even more, we aisle the parameter space that is also in agreement with direct-indirect detection experiments as XENON1T and Fermi-LAT, with searches of signals at the LHC in the context of supersymmetry and with processes of lepton flavor violation. We computed for the first time the DM annihilation into two photons and the spin-dependent cross-section in this model. We studied those two process at one-loop in detail. In the end, we realized that this model is able to fulfill all its theoretical constraints and the current experimental bounds, staying alive to future searches of DM signals.

1

Resonances + Top partners + Dark Matter

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Top partners and vector/scalar resonances are coupled in a interplaying Composite Higgs framework. The entailed phenomenology is analysed via resonances decay channels and top partners

production mechanisms. Recent LHC searches for vector-like quarks production in pp-collisions at 13 TeV have been imposed to exclude regions of the underlying parameter spaces. Furthermore, the WIMP-nucleon scattering cross section in a simple dark matter model and its constraints from the latest direct detection experiment are treated at the loop level. The involved dark matter-mediator masses are constrained by the Xenon1T limit and the neutrino floor. The current direct detection bounds are eluded by invoking the top partners, whose scale mass aids us in properly suppressing the WIMP-nucleon cross section.

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Charmed baryon spectroscopy with D0p and D+p final states at LHCb experiment

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We study several Dp+c.c. and $\bar{D}p$+c.c. prompt systems, inclusively produced from pp collisions at the LHCb experiment, in order to perform singly charmed hadronspectroscopy studies.

2

Search for decays of the Higgs Boson into Muons In p-p Collisions with the CMS Detector

Authors: Luisa Fernanda Chaparro Sierra[None]; Adrian Perieanu[None]; Juan Carlos Sanabria Arenas[None]

A search for events in which the recently discovered Higgs boson decays into a pair of muons is presented. The search was performed using the data collected by the CMS experiment at CERN during Run 2 of the LHC. The data comes from p-p collisions at √s=13 TeV, corresponding to an integrated luminosity of 35.9 fb-1.

In the Standard Model(SM) once the mass of the Higgs boson is known, all its couplings get fixed, including the coupling to muons. Any significant deviations in the experimental results from the values expected from the SM predictions could indicate the onset of new physics. Therefore, it is very important to measure all possible decay channel parameters. The H→μ+μ- is the only channel where the Higgs boson couples to the second generation of fermions that could be measured during Run 2 of the LHC. The Higgs coupling to fermions is proportional to the mass of the particles, and since the muons
are very light, any measurement in this channel provides valuable information about the Higgs Yukawa coupling to fermions.

The small branching ratio of the H→μ+μ- decay (2.4 x 10-4) indicates that with the statistics collected by CMS during the Run 2, the expected number of events is also small. Therefore, any improvement in the event selection should be included in the analysis. I have focused in recovering events in which the final-state muons might have radiated photons (final-state radiation, FSR) and in correcting the resulting invariant mass distribution. Two techniques were implemented: a cut-based analysis and a multivariate analysis. A study of the impact of the FSR photon recovery in the Higgs mass reconstruction is presented.

3

Heavy neutrino searches at the LHC with displaced vertices

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For Majorana neutrino masses the lowest dimensional operator possible is the Weinberg operator at d = 5. Here we discuss the possibility that neutrino masses originate from higher dimensional operators. Specifically, we consider all tree-level decompositions of the d = 9, d = 11 and d = 13 neutrino mass operators. Despite the large number of possible models, we found only very few genuine neutrino mass models: At d = (9, 11, 13) we find only (2,2,2) genuine diagrams and a total of (2,2,6) models. Here, a model is considered genuine at level d if it automatically forbids lower order neutrino masses without the use of additional symmetries.
We also analyse systematically all possible genuine 1-loop dimension 7 neutrino mass models and discuss 2 examples in detail.

4

A Rigorous Formalism to Study the Ultra High Energy Cosmic Ray Particles including Neutrinos Detected by ANITA Experiment at Antarctica

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Within the last 30 years, the sub-field of ultra-high energy cosmic ray (UHECR) astronomy has emerged as a vibrant experimental and theoretical sub-field within the larger field of particle astrophysics, comprising studies of both charged and neutral particles at energies greater than 1 EeV. The physics interest in UHECR lies in understanding the nature of the cosmic accelerators capable of producing such enormously energetic particles at energies millions to billions of times higher than what we are capable of producing in terrestrial accelerators, the details of the interaction of UHECR with the cosmic ray background, correlations in the arrival directions of UHECR with exotic objects such as neutron stars, gamma-ray bursts (GRB), and active galactic nuclei (AGN), and testing the Standard Model of particle physics at the ultra high energy frontier. The **NASA-sponsored Antarctic Impulsive Transient Antenna (ANITA)** project has the goal of detecting ultra high energy neutrinos of energies above 1 EeV. Ultra high energy neutrinos provide a new window to the Universe since they can propagate in intergalactic medium without attenuation, i.e. they do not suffer from the GZK cutoff.
ANITA is a balloon-borne suite of 48 high precision radio receivers designed to register radio frequency (50-1000 MHz) signals produced by UHECR, synoptically observing an area of ice of order 15,00000 km^2. Although originally purposed for detection of neutrinos, the ANITA-1 mission (2006) unexpectedly observed 14 extremely high-energy radio-frequency signals with a nonneutrino-like radio wave signal polarization (horizontal [HPol] vs. vertical [VPol]) which traced back to the Antarctic surface beneath the balloon. After considerable work, it was demonstrated that these events were the result of collisions of down-coming protons corresponding to energies 10,000,000 times greater than the energy of particles accelerated in the Large Hadron Collider in Geneva, Switzerland. The radio frequency signals produced in the collision of UHECR particles with atmospheric molecules are explained as the combined result of the Askaryan effect resulting from the net charge excess acquired by the shower as it descends through the atmosphere, plus the geomagnetic signal resulting from separation of different charged species due to the Earth's magnetic field. These signals subsequently get reflected off the Antarctic surface and back up to the ANITA detector at an altitude of about 38 Km. An upcoming ultra high energy neutrino produces coherent radio emission after collision with ice nuclei and the refracted radio wave from the ice-air interface is also detected

by ANITA. We developed a reliable theoretical framework based on the Weyl formalism to model the reflection and refraction properties of these radio pulses on Antarctic ice surface, incorporating curvature of Earth as well as the surface roughness. The incident pulses are first decomposed into their Fourier components, each of which are monochromatic spherical waves. The propagation distance turns out to be very large in comparison to the wavelength. However, despite the large propagation distance, it is not a good approximation to assume these reflected waves to be plane waves. The reflection of each of these spherical waves can be handled by decomposing them into plane waves and then using the standard Fresnel formalism for each plane wave. This is called the Weyl formalism in literature. The resulting integral over all the plane waves shows very rapid fluctuations and hence is computationally intensive. These results are described in our paper **Antarctic Surface Reflectivity Calculations and Measurement from the ANITA-4 and HiCal-2 Experiments, (arXiv:1801.08909,(2018))**. We have worked on calibration of the detector by using HiCal (High-altitude Calibration) I and II. HiCal consist of a calibrated radio-frequency transmitter source flying on a balloon, several hundred km away from the ANITA payload. The main goal of HiCal experiment is to directly measure the local surface reflectivity by sending radio pulses towards ANITA both directly, and also via surface reflection. Taking the ratio of direct and reflected field, one can directly measure the local surface albedo. The earlier treatment of the reflected pulses used the standard Kirchoff integral formalism which is reasonable but not rigorous. Our first application of the Weyl formalism was based on the assumption that a plane wave after getting reflected at the spherical ice surface remains a plane wave. This assumption is reasonable since the radius of Earth is much larger than the wavelength of the wave. However direct comparison with experimental data revealed that it fails for small elevation angles (i.e. angle with respect to ground). We have now solved this problem by assuming that the reflected wave is a plane wave only over a small neighbourhood of the wave vector pointing towards the detector. We term this procedure as local plane wave approximation. This provides a theoretically rigorous treatment of this problem without relying on any uncontrolled approximations. We also studied more realistic surface roughness models to incorporate the surface roughness properties of the ice-air interface into our formalism. We found that our results are in very good agreement with the ANITA-HiCal data. Our model is the first complete theoretical model that can be applied rigorously to radio pulses generated by UHECR particles including neutrinos. We have calculated the H-Pol and V-Pol field strengths assuming that the pulses are generated by a horizontal dipole radiator, applicable to the HiCal experimental case. ANITA -1 has detected two strange events, dominantly H-Pol, with polarity consistent with direct cosmic ray event. However their arrival directions are such that they must either originate from inside the ice or the radio pulse be reflected. Both of these possibilities are inconsistent with standard expectations. We seek to understand these mystery events using our formalism based on the local plane wave approximation. We start with the incident wave as dominantly H-Pol and expect that the reflected wave will be 180 degrees out of phase with the incident wave. Any deviation from this behaviour might provide an explanation for the observed mystery events. This has the potential to lead to a breakthrough discovery of new physics.

5

Status of the NEXT-White neutrinoless double beta decay experiment

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The \textit{Neutrino Experiment with a Xenon TPC} (NEXT-100) is a detector scheduled to start searching for $\beta\beta 0\nu$ decays in ^{136}Xe in 2020 at the Laboratorio Subterráneo de Canfranc (LSC), in Spain. The concept of a high pressure xenon gas time projection chamber with electroluminescent amplification (EL HPGXe TPC) offers an excellent energy resolution ($0.5-0.7\%$ FWHM at the $Q_{\beta\beta}$). The NEXT collaboration is currently operating a first phase of the NEXT-100 experiment at the LSC, called NEXT White(NEW). This detector is the largest high pressure xenon gas TPC using electroluminescent amplification in the world. The NEW detector is able to measure the energy of the event using a plane of photomultipliers located behind a transparent cathode. It is also equipped with a plane of silicon photomultipliers located behind the anode, which can be used to reconstruct the trajectories of the charged tracks in the dense TPC. The NEW detector is a scale of 1:2 in size of the NEXT-100 detector and uses the same materials and photosensors. It will be used to perform a characterization of the $0\nu\beta\beta$ backgrounds and a measurement of the standard two-neutrino double beta decay rate. In this talk an overview of the NEW detector and some recent results using calibration data are presented.

6

ρ mesons in the large N_f

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We reconsider the old attempts to describe effectively the interactions of light vectorial resonances as Yang-Mills fields of a hidden local symmetry. Coupling the vectors to pions and other light pseudoscalars in the framework of the large N_f limit (N_f being the number of isospin flavors) we calculate corrections to the pion form factors and pion-pion scattering amplitudes in energy regimes above the typical chiral scale allowed by chiral models involving only pions and photons. We reproduce the ρ dominance of the pion electromagnetic form factor and other phenomenological relations of low energy meson physics in the simple scheme of hidden local symmetries plus large N_f.

7

Search for supersymmetry with a compressed mass spectrum in the vector boson fusion topology with 1-lepton and 0-lepton final states in proton-proton collisions at √s = 13 TeV

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A search for supersymmetric particles produced in the vector-boson fusion topology is presented. The search targets final states with one or zero leptons, large missing transverse momentum (transverse missing momentum), and two jets with a large separation in rapidity. The data sample corresponds to an integrated luminosity of 35.9 /fb of proton-proton collisions at √s = 13 TeV collected with the CMS detector during 2016 at the CERN LHC.

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An upper limit on a variation of the fine-structure constant from an analysis of the Mg II line towards quasar J110325-264515

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We report a new limit on the space-time variation in the fine-structure constant (α= eˆ2/(4πε_0 ℏc)) obtained from analysis of the Mg II line from quasar J110325-264515 at z_abs=1.8389. We find Δα/α=(-0.155±0.728)× 〖10〗ˆ(-6) by a comparison of quasar spectra of Mg II with spectra used in a laboratory.

The result obtained in this work is used to suggest further improvement in observational technique which would lead to a tighter constraint on a variation of the fine-structure constant.

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AdS/QCD Modified Soft Wall Model and Light Meson Spectra

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We analyze here the mass spectrum of light vector and scalar mesons applying a novel approach where a modified soft wall model that includes a UV-cutoff at a finite z-position in the AdS space is used, thus introducing an extra energy scale. For this model, we found that the masses for the scalar and vector spectra are well fitted within $\delta_{RMS} = 7.64\%$ for these states, with non-linear trajectories given by two common parameters, the UV locus z_0 and the quadratic dilaton profile slope κ. We also conclude that in this model, the $f_0(500)$ scalar resonance cannot be fitted holographycally as a $q\overline{q}$ state since we cannot find a trajectory that include this pole. This result is in agreement with the most recent phenomenological and theoretical methods.

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CP sensitivity Dalitz plot analisis of the decay B0 -> KsKK

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I study the weak three-body decay B0 -> KsKK generated at the LHCb experiment (Large Hadron Collider beauty) in the LHC (Large Hadron Collider) at CERN (Conseil Européen pour la Recherche Nucléaire). Validating the current results from run 1 (2010-2012) and run 2 (2015-2017) and studying the expected results from run 3 (2019-2022). The simulation of the experimental conditions for run 3 like the tagging (flavour of the B0), the detector efficiency and the number of expected events will determine the sensitivity of the mass phase space (Dalitz plot) to the isobar amplitudes for the many resonance modes in the three-body decay, expecting to determine the CP-violating asymmetries of the flavour specific modes.

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Fases y Ángulos de Mezcla en Matrices Unitarias

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La generación de masas en el modelo electrodébil SU(2)xU(1) para los sectores de quarks y leptones involucran matrices de mezcla unitarias para la diagonalización de estados de sabor a estados de masa. Se estudio de distintas formas como parametrizar estas matrices y estudiar como pueden ser absorbidos estos campos fermionicos para encontrar el menor número de parámetros físicos observables. Por último se estudio la oscilación de neutrinos con esto mostrar como se evidencia de forma experimental la existencia de una matriz de mezcla en el caso leptónico, la cual no puede ser descrita bajo el formalismo del modelo estándar.

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Spin Correlations in Dark Matter Production in Association with Top Quarks at Hadron Colliders

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We study possible top quark spin correlation effects in Dark Matter (DM) production in association with top quarks at the LHC. Final states and their kinematic properties are studied in detail at the 14 TeV LHC. We show some preliminary results of angular correlations and distributions of the top quarks which may allow us to explore the DM interactions.

16

Fermion mass hierarchy from nonuniversal abelian extensions of the Standard Model

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A nonuniversal abelian extension $\mathrm{U}(1)_X$ free from chiral anomalies is introduced into the Standard Model (SM), in order to evaluate its suitability in addressing the fermion mass hierarchy (FMH) by using seesaw mechanisms (SSM). In order to break the electroweak symmetry, three Higgs doublets are introduced, which give mass at tree-level to the top and bottom quarks, and the muon lepton. With an electroweak singlet scalar field, the $U(1)_X$ symmetry is broken and the exotic particles acquire masses. The light particles in the SM obtain their masses via SSM and Yukawa couplings differences. Active neutrino masses are generated through inverse seesaw mechanisms (ISM). Additionally, the algebraic expressions for the mixing angles for quarks and leptons are also shown.

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Inclusive Displaced Vertex Searches for Heavy Neutral Leptons at the LHC

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The inclusion of heavy neutral leptons to the Standard Model particle content could provide solutions to many open questions in particle physics and cosmology. The modification of the charged and neutral currents from active-sterile mixing of neutral leptons can provide novel signatures in Standard Model processes. We revisit the displaced vertex signature that could occur in collisions at the LHC via the decay of heavy neutral leptons with masses of a few GeV emphasizing the implications of flavor, kinematics, inclusive production and number of these extra neutral fermions. We study in particular the implication on the parameter space sensitivity when all mixings to active flavors are taken into account. We also discuss alternative cases where the new particles are produced in a boosted regime.

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Production of a light top-squark pair in association with a light non-standard Higgs boson within the NMSSM at the 13 TeV LHC and a 33 TeV proton collider

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We study the potential of the LHC accelerator, and a future 33 TeV proton collider, to observe the production of a light top squark pair in association with the lightest Higgs boson ($\tilde{t}_1\tilde{t}_1^*h_1$), as predicted by the Next-to-Minimal Supersymmetric Standard Model (NMSSM). We scan randomly about ten million points of the NMSSM parameter space, allowing all possible decays of the lightest top squark and lightest Higgs boson, with no assumptions about their decay rates, except for known physical constraints such as perturbative bounds, dark matter relic density consistent with recent Planck experiment measurements, Higgs mass bounds on the next to lightest Higgs boson, h_2, assuming it is consistent with LHC measurements for the Standard Model Higgs boson, LEP bounds for the chargino mass and Z invisible width, experimental bounds on B meson rare decays and some LHC experimental bounds on SUSY particle spectra different to the particles involved in our study. We find that for low mass top-squark, the dominating decay mode is $\tilde{t}_1 \to b\tilde{\chi}_1^\pm$ with $\tilde{\chi}_1^\pm \to W^\pm\tilde{\chi}_1^0$. We use three bench mark points with the highest cross sections, which naturally fall within the compressed spectra of the top squark, and make a phenomenological analysis to determine the optimal event selection that maximizes the signal significance over backgrounds. We focus on the leptonic decays of both W's and the decay of lightest Higgs boson into b-quarks ($h_1 \to b\bar{b}$). Our results show that the high luminosity LHC will have limitations to observe the studied signal and only a proton collider with higher energy will be able to observe the SUSY scenario studied with more than three standard deviations over background.

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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≡e,μ) and $e^{+}e^{-}{\to}^{++}+4jets$ 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.

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The implementation of the Type I seesaw mechanism for neutrino masses in the context of left-right theories

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The implementation of the Type I seesaw mechanism for neutrino masses in the context of left-right theories where parity is spontaneously broken is investigated. We propose a simple left-right symmetric theory where neutrino masses are generated through of seesaw mechanism Type I. We study the left-right symmetric model, which has a totally real Lagrangian density of Yukawa, to avoid explicit complex phases, and a sector of scalar bosons with interesting and important properties: i) the presence of two complex phases originated in the spontaneous rupture of the symmetry; ii) a wide variety of neutral, charged, double charged scalar bosons and iii) the possibility of explaining the origin of the very small mass of the left neutrinos. In the same way, the model allows to explain in a natural way not only the origin of the CP violation but also the origin of the parity violation (P), and in addition it provides a physical meaning to the quantum number of hypercharge (Y), identifying it with the difference between baryonic and leptonic number (B-L).

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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.

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STUDY OF THE CASIMIR EFFECT IN SCALAR, ELECTROMAGNETIC AND SPINOR FIELD THEORY.

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We study the Casimir Effect as a product of continue fluctuations on the vacuum space between a system of two parallel conducting plates that confine different types of fields as scalar, electromagnetic and spinor field analyzing each one of them at zero and finite temperature and finding, at calculate the vacuum energy, that always exists an attractive force, that in each cases is different, between the plates when they are separated an small distance, taking into account relativistic effects for an scalar field and considering a massless fermionic field.

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Study of the properties of dark matter through the fermionic dispersion relations in a thermal medium at finite temperature

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By not knowing the nature of the particles that make up dark matter, it is inferred that it acts forming a plasma or "dark thermal medium" that fills the space (intergalactic region), interacting to a greater or lesser degree with particles of ordinary matter (standard model particles) that are immersed in it.

In the work I'm developing, I analyze the properties of the SM fermions that can be modified by this interaction and, assuming that the DM acts in a similar way to a plasma at finite temperature and density, it is proposed a model for the dark sector composed by an $SU(N_D)$ gauge theory, and considering that the effects of the dark medium must disappear at very large momenta, this theory is used to study the changes in the SM fermionic dispersion relations.

The developments carried out are used as a reference to analyze the dispersion of
neutrinos coming from very distant sources that in principle are altered by the effects generated by the presence of the hypothetical dark matter particles.

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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.

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Dirac neutrino masses

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Realization of B-L models for neutrino masses and dark matter

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Strong gravitational radiation from a simple dark matter model

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A rather minimal possibility is that dark matter consists of the gauge bosons of a spontaneously broken symmetry. Here we explore the possibility of detecting the gravitational waves produced by the phase transition associated with such breaking. Particularly promising for LISA is the super-cool dark matter regime, with DM masses above 100 TeV, for which we find that the gravitational wave signal is notably strong. ONLINE TALK.

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Dark Matter in a Standard Model extension with additional $U(1)$ symmetry

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We consider a model with $U(1)'$ local gauge symmetry, additional to the Standard Model gauge symmetry, which is broken by a singlet field scalar. In addition, the scalar sector contains two doublet scalar field. One of them is the usual Standard Model doublet scalar field that breaks the electroweak symmetry, meanwhile the second one is included to introduce the Weak Interacting Massive Particle that play the role of candidate for Dark Matter. The Z_2 discrete symmetry can be considered to eliminated the interactions in the potential which do not allow the stability of the Dark Matter candidate. We solve the Boltzmann equation to find the relic density for Dark Matter as a function of the scalar potential parameters, the new symmetry breaking scale and the $U(1)'$ gauge coupling constant.

28

Dark energy from SO(3) and SU(2) representations of the Yang-Mills-Scalar theory.

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In this work we study the cosmological implications of a Yang-Mills-Scalar theory in the SO(3) and SU (2) representations in expanding Friedmann-Lemaître-Robertson-Walker universe. First, we show that not all configurations of the fields are compatible with an isotropic space-time as it is claiming in literature and then, after choosing carefully a particular configuration of the fields, we use the dynamical systems technique to study the cosmological implications of the models, in particular we show that it is posible to describe the late time evolution of the universe.

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Phenomenological and experimental searches for compressed stau-neutralino production at the LHC.

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We propose an experimental search for physics beyond the standard model at the Compact Muon Solenoid (CMS) experiment, using as benchmark a supersymmetric model in the electroweak sector. We focus in final states containing a hadronic tau, a jet from initial state radiation and a large imbalance of energy in the transverse plane of the detector. The search focuses in compressed mass spectra scenarios, where the mass difference between the stau ($\widetilde{\tau}$) and the lightest supersymmetric particle, the neutralino ($\widetilde{\chi}_0$), is small. The proposed analysis is of special scientific interest, since, it is motivated by a direct connection between particle physics and cosmology. To obtain the correct relic dark matter density predicted by cosmology, in thermal dark matter models, the mass gap between the $\widetilde{\tau}$ and the $\widetilde{\chi}_0$ must be small. The phase space at LHC for compressed $\widetilde{\tau}'s$ is very difficult to prove. A phenomenological study has been performed for the proposed final state, showing good sensitivity to search for new physics in this difficult region, which yet remains as uncharted territory at the LHC.

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Neutrinos in Left-Right Mirror Model

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We consider the extension of the Standard Model with $SU(3)_C \times SU(2)_R \times SU(2)_L \times U(1)_{Y'}$ gauge symmetry and additional exotic fermions known as mirror fermions. A double seesaw approach method is performed to fit the neutrino masses with normal hierarchy. We calculate the decay rates for heavy neutrino for different channels, and we find that their branching ratios are nearly equal for heavy neutrino mass of the order of TeV's.

31

Universal 3-3-1 models

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New family independent 3-3-1 models without exotic electric charges are constructed using as a basis closed sets of fermions which includes each one the particles and antiparticles of all the electrically charged fields.

32

Looking for lepton-number-violating processes in $|\Delta L| = 2$ decays of B_s meson and Λ_b baryon

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Lepton-number violation can be induced by the exchange of an on-shell Majorana neutrino N in rare semileptonic $|\Delta L| = 2$ decays of the B_s meson and Λ_b baryon. We investigate the production of such a heavy sterile neutrino through these four-body $\mu^+\mu^+$ channels and explore the sensitivity that can be reached at the LHCb and CMS experiments. For heavy neutrino lifetimes of τ_N = [1, 100, 1000] ps and integrated luminosities collected of 10 and 50 fb^{-1} at the LHCb and 30, 300, and 3000 fb^{-1} at the CMS, we find a significant sensitivity on branching fractions of the orders $\sim 10^{-9} - 10^{-8}$. In the kinematically allowed mass ranges of mN, we exclude regions on the parameter space $(m_N, |V_{\mu N}|^2)$ associated with the heavy neutrino.

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Revised Criteria for Stability in the General Two-Higgs Doublet Model

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We will revise one of the methods given in the literature to determine the necessary and sufficient conditions that the parameters must satisfy to have a stable scalar potential in the general two-Higgs doublet model. We will give a procedure that facilitates finding the conditions for stability of a scalar potential. The stability guarantees that the scalar potential has a global minimum, that is, the potential is bounded from below, which is a necessary condition to implement the spontaneous gauge-symmetry breaking in the models.

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Deviations to Tri-Bi-Maximal mixing in the limit of $\mu - \tau$ symmetry

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In the limit of an approximate $\mu - \tau$ symmetry in the neutrino mass matrix, we explore deviations to the Tri-Bi-Maximal mixing pattern in the neutrino sector. The correction matrix is parametrized as $U_{ij}(\phi, \sigma)U(\alpha_1, \alpha_2)$, where ϕ is the rotation angle in the ij flavors, and σ, α_1 and α_2 are complex phases. We show that the $ij = 13$ and 23 scenarios are able to predict the current values of neutrino mixings and that it is possible to constrain the Majorana CP phases by studying their correlation with the mixing angles. We study the impact of such predictions in the neutrinoless double beta decay. The predicted regions are sharp for the quasi-degenerate ordering and can be tested in forthcoming experiments.

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Type II seesaw in an extended Two Higgs Doublet Model

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General Two Higgs Doublet Models (2HDM) are popular Standard Model extensions but feature flavor changing interactions and lack neutrino masses. We revisit a 2HDM where neutrino masses are generated via type I seesaw and propose an extension where neutrino masses are generated via a type II seesaw mechanism and flavor changing interactions are absent via the presence of a U(1) gauge symmetry. After considering a variety of bounds such those rising from higgs, collider physics and electroweak precision we show that our model stands as an interesting extension of the general Two-Higgs-Doublet Model. Possible dark matter realizations are also discussed.

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High Scales masses, for one model coming of E_6 Gauge Group

Author: Richard Benavides[None]

We explore the possibility of achieving unification of the standard model coupling constants in a possible way to E_6 breaking pattern, $E_6 \to SU(3)_c \otimes SU(2)_L \otimes U_I \otimes U_{51\bar{I}} \otimes U_{32\bar{I}}$. We find in this particular pattern that, the unification scale occurs at 2×10^{16} TeV.

39

Mixing and mass Matrix of neutrino in the Two Higgs Doublet Model type III

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In this work we propose an extension to the Standard Model in which we consider a type-III two-Higgs-doublet model (2HDM-III) plus massive neutrinos and the horizontal flavor symmetry S3. Where the Yukawa matrices in the flavor-adapted basis are represented by means of a matrix with two texture zeros. Also, the active neutrinos are considered as Majorana particles and their masses are generated through the type-I seesaw mechanism. The unitary matrices that diagonalize the mass matrices, as well as the flavor-mixing matrices, are expressed in terms of fermion mass ratios. we compare, through a $\chi 2$ test, the theoretical expressions of the flavor-mixing angles with the masses and flavor-mixing leptons current experimental data.

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Minimal Z' models for flavor anomalies

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We present the most general solutions for the charges of a nonuniversal Z' model with the same content of fermions of the
standard model plus three
right-handed neutrinos. From our analysis,
we show the existence of three different scenarios which, as far as we know, are new in the literature.
However, these solutions reduce to very well-known cases for particular choices of the free parameters.
We also define several benchmark models in order to show the flexibility of our parameterizations.
Finally, we show that it is possible to adjust some
of these benchmark models to several observables, including C_9 and C_{10} which are involved in the LHCb anomalies.
We use the upper limits on the Z' cross-sections
of extra gauge vector bosons Z' decaying into dileptons from the ATLAS data at 13 TeV with an accumulated luminosity of 36.1˜fb^{-1}
to set the 95\% CL allowed regions in the parameter space for a Z' mass of 5˜TeV.

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Neutrino Physics: The PMNS mixing matrix

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Since the elegant proposal of a new way to represent neutrinos [1] as linear combinations of new mass eigenstates, it has become a great challenge to not only understand how this process works in nature but to measure the combinations rates, and directly detect neutrinos. With the indirect detection of neutrinos and later confirmation of oscillations, neutrino physicists today focus on measuring the mixing parameters [2] and explain the mechanism that bestows neutrinos with masse [3], the latter which necessitate physics beyond Standard Model of Particle Physics.
In this work, we will review the most important properties of neutrinos and explain the development of the PMNS mixing matrix and its implications.

References
[1] Maki, Z., Nakagawa, M., & Sakata, S. (1962). Remarks on the unified model of elementary particles. Progress of Theoretical Physics, 28(5), 870-880.
[2] C. Patrignani et al. (Particle Data Group), Chin. Phys. C, 40, 100001 (2016) and 2017 update.
[3] De Gouvêa, A. (2016). Neutrino mass models. Annual Review of Nuclear and Particle Science, 66, 197-217.

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

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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 ΔM(F, DM) = 20 GeV and a branching ratio BR(F ⟶ μχ) = 100%. Also, more area of parameter space can be excluded complementing Fermi-LAT and High Energy Stereoscopic System (HESS) experiments for gamma rays.

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Arbitrarily coupled $p-$forms in cosmological backgrounds

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In this talk we consider a model based on interacting $p-$forms and explore some cosmological applications. Restricting to gauge invariant actions, we build a general Lagrangian allowing for arbitrary interactions between the $p-$forms (including interactions with a $0-$form, scalar field) in a given background in D dimensions. For simplicity, we restrict the construction to up to first order derivatives of the fields in the Lagrangian. We discuss with detail the four dimensional case and devote some attention to the mechanism of topological mass generation originated by the coupling $B \wedge F$ between a $1-$form and a $2-$form. As a result, we show the system of the interacting $p-$forms $(p = 1, 2, 3)$ is equivalent to a parity violating, massive, Proca vector field model. Finally, we present a minimalistic cosmological scenario composed by a $3-$form coupled to a $0-$form. We study the dynamics of the system and determine its critical points and stability. Among the results, we show that this system offers an interesting arena to cosmological applications, such as dark energy, due to the existence of scaling matter solutions.

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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.

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Modeling of the atmospheric profile at the height of Galeras volcano using GEANT4

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The high energys group of the University of Nariño works in one of the most recent applications using atmospheric muons for the study of the internal structure of Galeras volcano through scintillation detectors. For this type of study, the characterization of the site where the detector will be installed is important.

In this poster, we intend to explain the estimation of the atmospheric profile as part of this characterization, using GDAS to obtain it and GEANT4 for its modeling.

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An overview on B anomalies

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In this work we present a review of the anomalies generated by the transition $b \to c l \nu$, 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.

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Advances in the composite higgs model

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In this work, it is proposed to investigate the composite Higgs scenario, in order to explain or solve problems presented by the standard model of elementary particle physics. For this, it is proposed to

study in the first instance the problem of hierarchy and later build an effective Lagrangian through the formalism of Callan-Coleman-Wess-Zumino in the composite model. In this formalism, the Higgs does not arise as an elementary particle but as a pseudo-Nambu-Goldstone boson, that is, a compound produced through a spontaneous symmetry broken.

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Estructuras Algebraicas y Geométricas de la Relatividad Especial

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Special relativity - which deserves more attention than it is normally granted in courses in mechanics and electrodynamics - is the gateway to the study of fundamental physics and the technological use of information networks, global positioning systems (GPS) and different information technologies that also embrace condensed matter. Observing the broad panorama of work posed by relativity, it is considered that it is essential to explore diverse mathematical and physical areas immersed in relativity with the purpose of actively participating in all this universe of knowledge that, for this case, includes the study of space- time and its potential scientific application.

This paper studies algebraic and geometric structures that involve some aspects of group theory to describe the Galileo, Lorentz, Poincaré and Lie groups, which help analyze properties of symmetry and translation in different physical contexts. It is necessary to describe algebraic behavior through algebras such as linear and Lie, which helps to show that the previous structures are groups, allowing to generalize principle and laws of conservation that can be studied in mechanics or electromagnetic theory. These fundamentals are basic in the understanding of classical and quantum field theory, which substantially influences diverse physical properties of light behavior and its interaction with matter, such as photonic materials that exhibit exotic properties when analyzed in media different to vacuum.

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DARK ENERGY FROM MODIFIED GRAVITY AND THE HOLOGRAPHIC PRINCIPLE

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The holographic dark energy could be interpreted as an infrared cut-off for modified gravity theories $f(R)$. In this approach, several reference modified gravity models can be analyzed, and a reconstruction method for different cosmological scenarios can be done. From the analysis of the autonomous system and the stability of perturbations to the dark energy sector, it was found that the forbidden gap $-7.6 < \omega_{eff} < -1.07$ present in $f(R)$ models is now allowed.