Poster Session - Abstracts

Search for extra heavy gauge bosons through the process $p + p \to e^+ + e^- + j$ at LHC

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We have used the process $p+p \to e^+ + e^- + j$ to study the production at LHC of heavy gauge bosons predicted by the littlest Higgs Model (LHM). Little Higgs theory was proposed as a possible mechanism of electroweak symmetry breaking. These models predict the existence of new heavy gauge bosons, a new top quark, triplet scalars to cancel the quadratically divergent contributions to the Higgs mass induced by the SM gauge bosons, fermions, Higgs bosons, etc... The littlest Higgs model (LHM) is one of the simplest and phenomenologically acessible variation of the little Higgs models. The new particles appearing in the model will emerge characteristic signatures at the present or future high energy collider experiments.

We have investigated the signatures of the new neutral gauge bosons predicted by LHM that will be produced in the proton-proton collisions with $\sqrt{s} = 14$ TeV that will occur at LHC. Through the use of this particular process, that includes the production of new gauge bosons associated to one hadronic jet, we have looked for distributions and variables that could distinguish the LHM gauge bosons from other extended models.

Probing torsion action effects at LHC

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The low-energy effects of torsion, which is a possible and phenomenologically interesting component of the gravity theory, have been considered by many authors. Here, we consider the possible effects of gravity with torsion at LHC, using the framework of effective field theory. We consider torsion as a massive pseudo-vector particle that interacts with the fermions of the SM. For large masses the effect of torsi on can be approximated by the four-formion interation. These new interactions a re characterized by a new dimensionless parameter, the coupling constant η, considered to be the same for all fermions, and by the mass of the torsion fiel d M_{TS}. The phenomenological consequences of these interactions were alread y explored at many experiments such LEP1, LEP1.5 and TEVATRON and some physical observables were used to put limits int the two dimensional $(M_{TS} - \eta)$ p arameter space using the experimental data available at that time.

Next year, the Large Hadron Collider (LHC) will start its operation at CERN. Th anks to the unprecedented energies and luminosities, it will allow particle physics the possibility to explore the TeV energy range for the first time and discover new phenomena, which go beyond the so successful SM. One of the new phenomena that can be explored is torsion. The great energies and luminosities of the LHC can improve our limits on the torsion parameters, in particular, exploring the tors ion mass range above 1 TeV. This is very important, since it was showed that is for this torsion mass range that the framework of effective contact four-fermions interactions is more adequate.

One of the most suited processes to investigate the presence of possible deviations from the SM is the $t\bar{t}$ production. The LHC will be a top factory producing about 8 million $t\bar{t}$ pairs per experiment per year at low luminosity (10 fb^{-1}/year) and the determination of the top production characteristics will be one of the the first measurements to be carried out with the large statistics available at the LHC. In this work we used the process $pp \longrightarrow t\bar{t}$ with $\sqrt{s} = 14$ TeV to explore the phenomenological consequences of a torsion action. The new interactions among the torsion and the fermions of the SM would increase the cross section for this process. Deviations from the predicted SM cross section, including NLO corrections, allowed us to calculate the new limits on the torsion parameters that will be put by the sensitivity of LHC. In our calculations we considered three years of operation of the LHC at low and high luminosities, leading to the integrated values of 30 fb^{-1} and 300 fb^{-1}, respectively. Since these results depend on the ability to identify b-jets, we considered b-tagging efficiencies of 60% for low luminosity and 50% for high luminosity.

Search for $Z' \longrightarrow e^+e^-$ from minimal 3-3-1 model

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The number of fermions generation is one of the open questions in the Standard Model (SM), and even in the most popular SM extensions, this problem continues without answer. The 3-3-1 model, based on the group $SU(3)_C \otimes SU(3)_L \otimes U(1)_L$, presents a first step to understand the flavor question. One studies the possibility to detect a new neutral gauge boson (Z') predicted by the model in the process $pp \longrightarrow e^+e^-$ at LHC. Our results show that a clear signal can be found for $M_{Z'} = 1.5$ TeV. The forward backward asymmetry in rapidity bins is used to distinguish between 3-3-1 model and GUTs predictions.

Search for Hybrid Mesons with the GlueX Experiment at JLAB

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The mechanism of confinement remains as an outstanding problem yet to be fully understood in Quantum Chromodynamics Theory (QCD). The long distance scale does not allow perturbative QCD calculations, and most of the predictions at this scale are based on QCD inspired models or QCD lattice calculations with still large uncertainties. On the other hand, QCD allows bound states of quarks and gluons, the so called hybrid mesons. These states are different from those allowed in the standard Quark Model, for gluons can also participate with some degrees of freedom to the hybrid meson state. Therefore, observing and fully establishing these states can shed light on the gluon dynamics inside the nucleons and, consequently, lead to a better understanding of the confinement mechanism in QCD.

GlueX is a dedicated experiment aiming at mapping the lighest hybrid meson states and is planned to be fully commissioned for data taking in 2013.

In this contribution, the search for hybrid mesons with the planned GlueX experiment at JLAB, USA, will be discussed.

Dark Matter Halos and the Anisotropy of Cosmic Rays

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We study the top-down scenario for high energy cosmic ray formation in which they result from the decay of dark matter particles in the halos of the Milky Way and the Andromeda galaxies. We estimate the anisotropy patterns which would result if the halos had the NFW and the Moore et al. density profiles. We also take into account the acceptance of the Pierre Auger experiment.

Measurement of B_s oscillations with the ATLAS detector at LHC

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An analysis has been prepared to measure B_s^0-$\bar{B}_s^0$ oscillations with the ATLAS detector in the first years after the startup of LHC in 2007. Kinematic resolutions of B_s^0 candidates from the hadronic channels $B_s^0 \to D_s^- \pi^+$ and $B_s^0 \to D_s^- a_1^+$, which have been produced with the PYTHIA Monte Carlo program, are used as input to measure the oscillation frequency. The Δm_s reach is derived from unbinned maximum likelihood amplitude fits using a B_s^0 event sample generated with a simplified Monte Carlo method. The study shows that with 20 fb^{-1} a 5 σ measurement of Δm_s is possible up to 20 fb^{-1}.

$B_s \to \phi\phi$ Selection in the LHCb Experiment

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The LHCb detector has as one of its main objectives to make precise measurements in CP violation. The usual way to measure CP violation is using the angles from the triangles formed in the complex plane by the unitarity relations of the CKM matrices. One of these angles is χ and the decay channel $B_s \to \phi\phi$ is sensitive to it. The goal is to provide a selection for this channel and obtain the sensitivity LHCb can reach in the angle χ.

J/ψ Measurement at RHIC.

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Charmonium production measurement can reveal properties of the hot and dense matter produced at RHIC collisions. Scenarios for the charmonium formation include the color octet model and the more phenomenological color evaporation model. They can be tested in measurements from "point like" p+p collisions. Nuclear effects such as Cronin effect, gluon shadowing, and nuclear absorption can modify the yield observed in larger systems. In hot and dense matter formed at RHIC, if the environment is rich in deconfined quarks, the $c\bar{c}$ pair binding is disfavored due to color screening. In contrast, the considerable amount of open charm can recombine in charmonium. The feed-down from heavier quarkonia decays play an important role in the final yield observed as well. PHENIX Experiment at RHIC has measured J/ψ in p+p, d+Au, Cu+Cu, and Au+Au collisions at energies up to $\sqrt{s} = 200$ GeV/c. It covers mid and forward rapidities via electron and muon decays respectively. J/ψ production dependence with momentum, number of binary collisions, and rapidity will be shown. Comparison with some theoretical models will address for the production and in-medium effects over the yield.

Ultra High Energy Cosmic Rays, Meteors and Lightning Detection Using RADAR Technique.

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A receptor situated at a long distance from a Very High Frequency TV transmistter (30 – 300 MHz) can not have direct signal reception due to the curvature of the Earth and the fact that VHF waves do not reflect on the ionosphere. But if a meteor penetrates Earth's atmosphere, its ionized trail will be able to reflect the electromagnetic wave, thus ocorring reception of the TV VHF signal for as long as the ionized trail exist. Not only meteor trails can reflect these signals but also airplanes, Ultra High Energy Cosmic Rays (UHECR), lightings, etc. The signal received is singular for each reflected object, thus we are able to characterize the signals recepted. The detection of UHECR by a radio acquisition system is the main objective of the project MARIACHI (Mixed Apparatus for Radar Investigation of Atmospheric Cosmic rays of High Ionization) located on Brookhaven National Laboratory, New York, USA, and the project DRACON (Detecção de RAios Cósmicos utilizando Ondas eletromagnéticas) on Physics Institute of UFRJ, Brasil.

Due to the fact that the ionization of the meteor in the earths atmosphere have a relatively long lifetime (> 0.1s) and that the study of forward scattering of television signals by meteors is a well known technique, these meteors are used for, in this work, to calibration and validation of the experimental apparatus, always bearing in mind the future ob jective of detection of ultra high energy cosmic rays.

Data acquired during the Lyrids shower of 2005 on BNL and the Leonids shower of 2005 on UFRJ will be shown. With the analysis of these data we were able to detect events that can not be explained with todays techniques. We strongly believe that some of these events can be ultra high energy cosmic ray. But, to be sure of it and to characterize this signal we need to desenvolve a coincidence system of the radio signal and a particle detector array system.

QCD at finite temperature and chemical potential with positive fermion determinant

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The expansion of the fermionic determinant in QCD about the chemical potential parameter is calculated generating an effective Yang Mills Lagrangian. As the chemical potential produce a non-possitive fermion determinant, it is not possible to make Monte-Carlo simmulations in Lattice QCD. This technique of the expansion of determinant is used in order to get a positive measure. Nevertheless we find that the order of the expansion is restricted for the case of the massles quarks. We propose a criteria to cut the infinite gluon series in order to get the appropriate effective Lagrangian for a high temperature system and low baryon densities.

Principal Component Analysis applied to strangeness reconstruction in Heavy Ion Collision Environment.

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Relativistic Heavy Ion collision allows us to study nuclear matter behavior at extreme temperature and density, conditions that are similar to the conditions predicted for the early universe. In 2001, the Relativistic Heavy Ion collider (RHIC) has started operations with the goal of recreating and studying a new state of matter called Quark Gluon Plasma, which would be the result of a phase transition from the normal confined hadronic matter to a deconfined state of Quarks and Gluons. In this scenario, the production of strange particles is an important tool to probe the thermodynamical conditions of the system formed. The STAR experiment (Solenoidal Tracker at RHIC) measures thousands of particles produced in the collisions at RHIC, and to be able to identify uniquely each particle is already a challenge. Even more is the reconstruction of decayed particle such as the strange particles Lambda, and Xi, which decay through weak interaction leaving only tracks of its daughter particles. The most common way to reconstruct these particles is through the invariant mass reconstruction technique. However, in a heavy ion collision environment, the combinatorial background can overwhelm the invariant mass spectra and thus, usually a set of topological parameters has to be used to improve the signal to background. We propose a study of principal component analysis applied to the topological cuts of the secondary decay particles reconstruction at STAR, to optimize the signal and minimize the combinatorial background. With this approach, we hope to present an optimization technique that can be used for more rare particles such as the Omegas.

Strange and Multi-Strange Particle Production in AU+AU Collisions at RHIC

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Relativistic Heavy Ion Collision provides a rich environment to study the strongly interacting matter in extreme conditions of energy density and high temperature. In these conditions, a phase transition from ordinary hadronic matter to a plasma of deconfined quarks and gluons is expected to happen. In search for signatures of the Quark Gluon Plasma, the STAR experiment (Solenoidal Tracker at RHIC) measures several hadronic and eletromagnetic observables of relativistic heavy ion collisions generated by the RHIC accelerator at Brookhaven Laboratoty, NY. One of the most important observables that yields information of the system created at RHIC is the production of strange particles. Chemical composition of the system formed can be determined by the particle ratios and the kinetic freeze-out temperature of the system evolution can be deduced from the strange particle spectra. With the accumulated data from 5 years of RHIC operations, STAR can present a complete picture of strangeness production in collisions at RHIC with Au+Au, Cu+Cu, d+Au and p+p reactions at center of mass energies of 62.4, 130 and 200 GeV per nucleon pair. Yields and spectra of identified particles K^0_S, Lambdas, Xi's and Omega allows a systematic study with complete excitation function from the energy region of AGS and SPS up to the top RHIC energies. Detailed comparison to statistical models considering thermal and chemical equilibrium, and hydrodynamical models, provide important insight into the hadron production mechanism which in turn reveals important characteristics of the system.

Phase Motion in the Scalar Low-Mass $\pi\pi$ Amplitude in $D^+ \to \pi^-\pi^+\pi^+$ Decay

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Applying the Amplitude Difference method to Fermilab experiment E791 $D^+ \to \pi^-\pi^+\pi^+$ data, we measure the low mass $\pi^+\pi^-$ phase motion. Our results suggest a significant phase variation, compatible with the existence of an isoscalar $\sigma(500)$ meson, as previously reported using an isobar model fit to the full Dalitz-plot density.

Dissipation and non-local effects in the QCD phase transition

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We investigate the role of dissipation and memory effects in the nonequilibrium dynamics of the chiral and deconfinement transitions of QCD after a high-energy heavy ion collision. To study dissipation and noise effects on deconfinement in a pure gauge theory, we adopt a Langevin description and perform lattice simulations for $SU(2)$ and $SU(3)$. Following the time evolution of the Polyakov loop, we show that the effects of dissipation are remarkable. As a first step to the development of a non-local systematic expansion of the memory kernel that appears in the process of phase conversion in the chiral transition, we present a phenomenological extension of analytic results obtained in a controlled fashion in a quantum-mechanical analogue. Considering the early-time behavior of the evolution of the chiral condensate, we discuss modifications brought about by the first non-markovian corrections.

Nuclear photoproduction of vector mesons at high energies

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The nuclear vector meson photoproduction in photon-nucleus collisions and in ultraperipheral heavy ion collisions is addressed considering the color dipole formalism for QCD dynamics at high energies. We predict the total and differential cross sections for the processes $\gamma A \to VX$ and $AA \to (V)\,AA$, where V can be any vector meson ($V = \rho$, ω, ϕ, J/Ψ, Υ). Predictions for the future linear colliders and CERN LHC are given.

DCC Signals in Cosmic Rays?

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We investigate the production of disoriented chiral condensates in ultra high energy collisions and look for an intrinsic signature they could produce in ongoing and future cosmic ray experiments. This is implemented by comparing the atmosphere showers generated after the chiral symmetry breakdown to well-known data, e.g. on iron. We also speculate on the nature of the events and its connection with Centauro and anti-Centauro observations.

Aspects of matter-anti-matter asymmetries and other symmetry breakings in relativistic heavy ion collisions and cosmology

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Matter-anti-matter asymmetries observed and expected to be present in several areas such as relativistic heavy ion collisions and cosmology are discussed considering ideas present or envisaged to be present in the phase diagram of strong interactions. The assumptions don't (necessarily) rely on non-equilibrium conditions. For this, spontaneous symmetry breakings in strong interacting systems are also briefly discussed.

Small-x Physics in Double Vector Meson Production

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The double vector meson production in two photon collisions and ultraperipheral heavy ion collisions is addressed considering different apprroximations for the QCD dynamics at high energies. We estimate the total and differential cross section for the process $\gamma\gamma \rightarrow V_1 V_2$, where V_1 and V_2 can be any two vector mesons ($V_i = \rho, \omega, \phi, J/\Psi, \Upsilon$). Predictions for the future linear colliders (TESLA, CLIC and ILC) and LHC are given.

Search for Bilepton from its Contributions to e^- e^- Collisions *E. Ramirez Barreto, Y. A.*

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We study the contribution of double charged bilepton gauge boson, predicted by the minimal version of $SU(3)_C \times SU(3)_L \times U(1)_X$ model, to e^-e^- collision. We obtain the total cross sections and distributions, for the processes $e^- + e^- \longrightarrow e^- + e^- + \gamma$ and $e^- + e^- \longrightarrow \mu^- + \mu^- + \gamma$. For $\sqrt{s}$ from 0.5 TeV to 3 TeV, corresponding to the next linear colliders (ILC and CLIC) operating as an e^-e^- machine. We compare the results obtained from 3-3-1 model with the Standard Model calculation and we conclude that these processes can show evidence for these exotic particles.

Study of Particle Production using a Thermal Model applied to Relativistic Heavy Ion Collisions.

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Relativistic Heavy Ion Collisions is used to create and study matter at extreme conditions of temperature and energy density, similar to the conditions after the Big-Bang. Presently, with this purpose, gold-gold collisions at the energy of 200 GeV per pair of nucleons are being measured by the experiments of the Relativistic Heavy Ion Collider (RHIC) based near NY, in Long Island. Next year, the LHC will start operations and will have collisions of Lead-Lead nuclei at energies of 5500 GeV per pair of nucleons. Already at RHIC, several unexpected new characteristics have emerged from the data. One example is the fact that the matter formed seems to evolve much like a perfect liquid rather than a gas of free quarks and gluons as it was originally predicted. Thus understanding the particle production in these collisions is fundamental. We have done some simulations using a thermal model analysis package which allow us to extract essential properties of the hot and dense fireball expected to be produced in such collisions. In particular, this model provides the conditions of the system at a given stage in its evolution, namely at chemical freeze-out, when all the inelastic scattering ceases to occur. We compare the model calculations with data for a large variety of hadron yield ratios and some of our first results are in good agreement with values obtained in other studies. In addition, using the parameterization of the results we hope to make some predictions for the expected particle production rates at the LHC.

The sin(2β) measurement at the LHCb experiment.

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In the present work we show the sensitivity of the LHCb experiment to measure sin(2β) in B $\rightarrow J/\psi K_s$ decays after one year of data taking. The trigger efficiency, the background and detector effects on this measurements are also taken into account.