Workshop da Rede Nacional de Física de Altas Energias (RENAFAE) 2022

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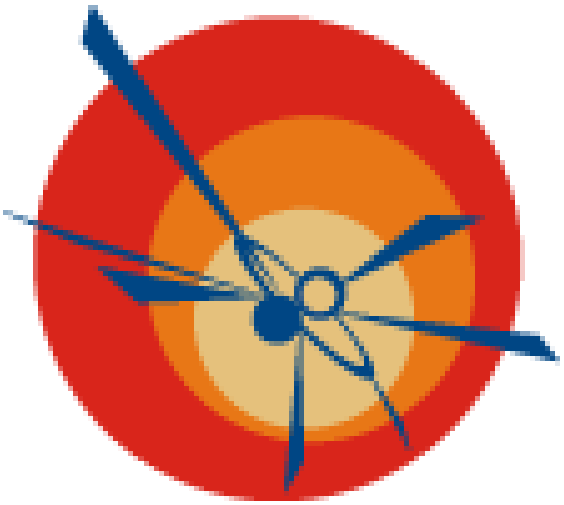

Livro de Resumos

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The Cherenkov Telescope Array (CTA) is the next-generation ground-based observatory for gamma-ray astronomy, covering a very broad energy range from 20 GeV to beyond 100 TeV. In this work, we are probing the potential of the CTA observatory, through its planned extragalactic survey, in detecting BL Lac sources. The population of these AGNs is being simulated according to a luminosity function tuned in the GeV energy range to the Fermi-LAT data and extrapolated to the TeV region assuming different spectral shapes at the source. We also account for the absorption of the VHE gamma-ray flux in the extragalactic medium due to the interaction with the Extragalactic Background Light (EBL). Both northern and southern sites are included in the study with telescope effects consistent with the instrument response functions (IRFs) of the final array configurations and the telescope inclination. A total of 1000 h of exposure time is simulated in order to scan a region covering 25% of the sky using a celestial grid of equally spaced points.

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Development of the Slow Controller of the RPC System Link for LS2 Update of the CMS/HL-LHC Experiment

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The upgrade phase II of the RPC Link system is ongoing to meet all requirements for the HL-LHC. Capability to work in a high radiation environment, improvement of timing resolution, and increasing the incoming rate capability of system and output bandwidth of system are the main goals of this project. In this project, the new RPC Back-End electronics which is a new scope in this era also will be responsible to receive the hits and sending them to the next Muon Track Finder Layers. Additionally, the new link system must be controlled by the new version of Slow Controller. The distribution of the TTC clock and fast trigger commands, setting the FEB's thresholds, reconfiguration of the Link system FPGAs, and reading the Link system Status are the main functionalities of the new Slow Controller. It should be notice that the new Slow Controller will be controlled by the RPC online software. In this project, we are going to define all necessary functions of the new Slow Controller in more detail. All of these functions will be implemented into the FPGA. In the first step, we will study all necessary functions requested by the new Link system. Then, these functions are translated to the corresponding firmware and implemented into the FPGA and equipment for high-speed data communications. In parallel, the necessary software routines will be developed on the RPC online software. Finally, the proper functionality of the control and communication chain will be surveyed.

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Simulation and data analysis in astroparticle physics

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One of the main concerns of experimental astroparticle physics is to characterize and measure the fluxes of different particle species of cosmic origin that arrive at Earth. In the most energetic regimes (above 10^{15} eV for the charged component of cosmic rays and 10^{11} eV for gamma rays), only arrays of detectors deployed at the ground and with large collection areas (hundreds to thousands of km^2) reach the sensibility required to study these particles. In such facilities, the properties of the cosmic rays are inferred after the observation of the cascades of particles and radiation they induce in the atmosphere — the so-called extensive air showers. This process of deconvolution of shower observables into the characteristics of the primary particle depends on the description of how shower particles interact with and radiate into the atmosphere. In this scenario, the present contribution is a compilation of results obtained through Monte Carlo simulations of extensive air showers and the study of their observables. The results aim at the improvement of data-analysis techniques as well as the proposal of new ones. In particular, the simulations allowed for a study of the depth of shower maximum, an important quantity for the determination of the mass composition of the primary cosmic-ray spectrum. The Cherenkov-light emitted by shower electrons, an important source of signal for optical detectors, is also a subject of analysis. An ongoing study of extreme fluctuations of the longitudinal profiles of the extensive air showers is discussed as well.

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Instrumentation for the Cherenkov Telescope Array

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The Cherenkov Telescope Array (CTA) will be the world's next generation of very high energy gamma-ray telescopes, composed of more than 100 telescopes installed in both hemispheres, with one of the sites in La Palma, in the Canary Islands, and another in Paranal, in northern Chile. The CTA is formed by an international consortium with more than 1,500 members from more than 150 institutes in 25 countries. The three classes of CTA telescopes will provide broad coverage in the energy spectrum, ranging from 20 GeV to 100 TeV, that is, capturing gamma rays whose energies are billions to trillions of times greater than those of visible light. The CTA aims to improve the current angular resolution and energy sensitivity by about an order of magnitude in the search for sources of gamma radiation in the universe.

In this talk, we present a summary of Brazilian efforts on the project and installation of CTA telescopes.

Keywords: Astroparticle physics, Gamma astronomy, Telescopes.

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Brazilian Contribution to Instrumentation in the ALPHA Experiment

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The ALPHA Collaboration currently operates 2 different experimental apparatus for antihydrogen (Hbar) studies: ALPHA-2 is dedicated to precision spectroscopic measurements (both in the optical and in the microwave regions of the spectrum) while ALPHA-g was designed for gravitational experiments. In this talk, I will review some of the recent contributions of the Brazilian team to the