

Jornadas del ICTEA 2024



Informe de contribuciones

ID de Contribución: 7

Tipo: **sin especificar**

Objetivos científicos de la agrupación CPAN española de física de partículas, astropartículas y nuclear

martes, 7 de mayo de 2024 9:00 (1h 30m)

Presentador: Dr. COSTA MEZQUITA, María José (Directora del CPAN)

Clasificación de la sesión: Presentaciones invitadas

ID de Contribución: 8

Tipo: **sin especificar**

Observatorio Astronómico Nacional

lunes, 6 de mayo de 2024 12:15 (1h 30m)

Presentador: Prof. BACHILLER, Rafael (Director OAN)

Clasificación de la sesión: Presentaciones invitadas

ID de Contribución: 14

Tipo: **Investigador MOMA**

Geomagnetic Compensation in Hyper-Kamiokande

lunes, 6 de mayo de 2024 17:50 (15 actas)

Hyper-Kamiokande is a large-scale international neutrino detection project established in Japan. In this talk I will be discussing the work of the last two years on the design of the detector's geomagnetic field compensation system, the studies, conclusions and problems derived, as well as the presentation of the final, recently agreed design.

Autor: RODRÍGUEZ CABO, Sara (ICTEA - Universidad de Oviedo)

Presentador: RODRÍGUEZ CABO, Sara (ICTEA - Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 15

Tipo: Investigador FPAUO

Fractons, dipole symmetry breaking and gravity

martes, 7 de mayo de 2024 12:55 (15 actas)

Fractons are excitations with limited mobility that may appear in dipole-conserving models. I will introduce a family of quantum field theories for monopole and dipole charges, featuring quadratic two-derivative kinetic terms. The dipole symmetry algebra is realized in a discretized internal space, connected to the physical space via a background gauge field. Using Hubbard-Stratonovich transformation and large-N techniques, I will show that the effective action displays a fractonic immobile Nambu-Goldstone mode. Fractons naturally couple to two-index symmetric tensor gauge fields resembling spatial metrics. Additionally, a Lorentz covariant version of dipole symmetry will be introduced, with gauge fields containing massive and massless two-index tensors, resembling linearized gravity with lower-spin modes. I will mention how the theory can be consistently coupled to a curved background metric.

Autor: AFXONIDIS, Evangelos (ICTEA - Universidad de Oviedo)

Presentador: AFXONIDIS, Evangelos (ICTEA - Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 17

Tipo: **Investigador MOMA**

Reconstructing turbulence-distorted wavefronts through laser-beam profiles

lunes, 6 de mayo de 2024 17:05 (15 actas)

Adaptive optics (AO) compile a variety of techniques that produce high quality images in ground-based telescopes. Most used AO techniques require the use of laser guide stars, but they induce errors due to its limited width and low altitude, such as anisoplanatism and cone-effect problems. This study proposes an alternative AO system that eliminates these issues while maintaining the correction of the aberration introduced by the atmosphere. In contrast with similar techniques such as Projected Pupil Plane Pattern (PPPP) that uses two pictures, Wavefronts Obtained from Measurements from Beamprofiles through Atmospheric Turbulence (WOMBAT) requires only one picture, which decreases the complexity of the system. Even with just picture, WOMBAT manages to achieve similar results to PPPP in wavefront correction.

Autor: BUENDÍA ROCA, Alejandro (ICTEA - Universidad de Oviedo)

Presentador: BUENDÍA ROCA, Alejandro (ICTEA - Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 18

Tipo: **Investigador MOMA**

Structural design of the New Robotic Telescope (NRT)

lunes, 6 de mayo de 2024 14:15 (15 actas)

El New Robotic Telescope será un telescopio de clase 4 metros con tiempos de respuesta muy rápidos, alcanzando cualquier objetivo del cielo en menos de 30 segundos. Esto supone un importante reto en términos de rigidez estructural y minimización de vibraciones. Se presentan los aspectos fundamentales de la estructura de este telescopio, su comportamiento estático y dinámico, así como la tecnología que se está empleando para desarrollar modelos FEM paramétricos que permitan optimizar el diseño.

Autor: RODRÍGUEZ PEREIRA, César (ICTEA - Universidad de Oviedo)

Coautores: SÁNCHEZ LASHERAS, Fernando; GRACIA RODRÍGUEZ, Javier

Presentador: RODRÍGUEZ PEREIRA, César (ICTEA - Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 19

Tipo: Investigador FPAUO

Muon identification techniques in the CMS experiment

martes, 7 de mayo de 2024 12:25 (15 actas)

One of the key concepts of any analysis in High Energy Physics is the search for a more precise measurement to have a result more reliable and more compatible with the actual process. To achieve this, it is necessary to develop different techniques to identify the objects that make up the analysis. In particular, for the proton-proton collisions produced in the Large Hadron Collider (LHC), one of the main objects of study is the leptons, and specifically in the Compact Muon Solenoid (CMS) experiment, the muons.

The muons are mainly identified by the trace they leave behind as they pass through the detector. With this information, the muons can be arranged in several categories depending on how well identified they have been. These categories have different characteristics like greater efficiency, i.e. the number of muons that are really muons with respect to all the muons identified, or more events with these leptons, and hence, less efficiency and less confidence.

A new technique based on a multivariate analysis (MVA) will be presented along with its performance in the two main data-taking periods of the LHC, the Run 2 and Run 3, and it will be compared with the main strategy used nowadays, the cut-based identification which involves a criteria-based selection of trace parameters.

Autor: AYLLÓN TORRESANO, Jorge (ICTEA - Universidad de Oviedo)

Presentador: AYLLÓN TORRESANO, Jorge (ICTEA - Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 20

Tipo: **Investigador FPAUO**

Scale-separation and supergravity

lunes, 6 de mayo de 2024 14:30 (15 actas)

I will briefly discuss the so-called scale-separation problem, which emerges when trying to describe our Universe from a String Theory perspective. In particular, I will comment on the possibility to realize scale-separation within some minimally supersymmetric three-dimensional supergravity model, derived from type-IIA supergravity and admitting Anti-de-Sitter vaca.

Autor: MORITTU, Matteo (ICTEA - Universidad de Oviedo)

Presentador: MORITTU, Matteo (ICTEA - Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 21

Tipo: Investigador FPAUO

Measurements of WZ properties in Run 3 with the CMS detector

lunes, 6 de mayo de 2024 17:20 (15 actas)

The production of dibosons (VV, where V can be either a W or Z boson) holds a crucial role in the understanding of the electroweak sector of the Standard Model as well as its possible extensions. The WZ process allows to test several theoretical features of interest, such as: charge asymmetries in the initial state, measurement of the polarization fractions for W and Z bosons and provides direct access to trilinear gauge couplings.

The properties of the WZ production have been measured with high precision on several occasions by both CMS and ATLAS collaborations at different centre of mass energies of 5, 7, 8 and 13 TeV in pp collisions at LHC, using final states with three leptons. With the beginning of Run 3 in 2022 and the achievement of a new energy frontier in proton-proton collisions at 13.6 TeV at the LHC, the CMS Collaboration is starting to perform their first studies and measurements of the WZ process at this new energy.

Autor: OBESO MENÉNDEZ, Miguel (ICTEA - Universidad de Oviedo)

Presentador: OBESO MENÉNDEZ, Miguel (ICTEA - Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 22

Tipo: Investigador FPAUO

AdS₂ vacua from SL(2,R) T-duality

lunes, 6 de mayo de 2024 18:05 (15 actas)

The AdS₂/CFT₁ correspondence plays a key role in the microscopical description of extremal black holes, AdS₂ being part of the geometry that appears in their near horizon limit in any dimension.

Another useful application of the AdS₁/CFT₂ correspondence is to the holographic description of superconformal line defects in higher dimensional CFTs. Geometrically, a sign that an AdS₂ solution may be describing a superconformal line defect is that it flows asymptotically locally to a higher dimensional AdS background, dual far from the defects to the higher dimensional CFT in which they are embedded.

I will present general results on the construction of AdS₂ solutions to Type II supergravity via U(1) and SL(2) T-dualities, paying special attention to the conditions for preservation of supersymmetry. I then exploit these to construct new classes of small N=4 solutions in Type II supergravity.

I also applied this procedure to two solutions in Type IIA Supergravity with CP³ along the internal space. These preserve N=(5,0) or N=(6,0) supersymmetry and realise the superconformal algebras $\mathfrak{osp}(5|2)$ and $\mathfrak{osp}(6|2)$. This results in four new classes of AdS₂ solutions, realising these superconformal algebras, hinting that a more general class AdS₂×CP³×Σ may exist.

Autores: CONTI, Andrea (ICTEA - Universidad de Oviedo); LOZANO, Yolanda (ICTEA - Universidad de Oviedo)

Presentador: CONTI, Andrea (ICTEA - Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 23

Tipo: **Investigador FPAUO**

MC simulation of high energy physics using hardware accelerators

martes, 7 de mayo de 2024 11:20 (15 actas)

Given the probabilistic nature of proton-proton collisions, montecarlo-based simulations (MC) of high energy physics processes are the best handle an experimental particle physicist has in order to compare data to prediction. As of now, the state-of-the-art predictions often reach next-to-next-to-leading order (NLO) accuracies (in expansions of QCD strong coupling). The limiting factor is, however, not a theoretical one; but a computational one: most of the theoretical predictions are often computed using CPUs, which are limited in the amount of multithreading one can achieve. In this presentation, a new proposal using FPGA-based (hardware) accelerators that aims to reduce even more the computational cost of MC production is reviewed.

Autor: VICO, Carlos (ICTEA - Universidad de Oviedo)**Presentador:** VICO, Carlos (ICTEA - Universidad de Oviedo)**Clasificación de la sesión:** Sesión ICTEA

ID de Contribución: 24

Tipo: **Investigador FPAUO**

Timing the Trigger: Clock Signal Distribution in the CMS Level 1 Trigger System

lunes, 6 de mayo de 2024 14:00 (15 actas)

In this talk, we explore the creation and management of timing signals at the Large Hadron Collider (LHC), specifically within the CMS Level 1 Trigger system. We'll discuss how these signals are generated from particle collisions and their role in synchronizing the CMS Trigger. Additionally, we'll cover the integration of these signals with the physical link domain in the backend FPGAs of the Trigger. This will provide insights into maintaining timing accuracy and ensuring precise data processing in particle physics experiments.

Autor: LEGUINA LÓPEZ, Pelayo (ICTEA- Universidad de Oviedo)

Presentador: LEGUINA LÓPEZ, Pelayo (ICTEA- Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 25

Tipo: Investigador FPAUO

Measurement of the inclusive $t\bar{t}$ cross section in the lepton+jets channel and the combination with the dilepton channel at 5.02 TeV with 2017 data.

martes, 7 de mayo de 2024 11:50 (15 actas)

A new energy regime, 5.02 TeV, for top quark pair productions in proton-proton collisions using 302 pb⁻¹ of data collected in 2017 by the CMS experiment at the LHC is explored. The top quark pair production cross section is measured using events with one electron or one muon and multiple (b-tagged) jets. The result is combined with a previous measurement in the electron-muon final state using the same dataset.

Autor: DEL RIEGO BADÁS, Javier (ICTEA - Universidad de Oviedo)

Presentador: DEL RIEGO BADÁS, Javier (ICTEA - Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 26

Tipo: **Investigador FPAUO**

Defect CFTs, Rigid Holography and C-Theorems

lunes, 6 de mayo de 2024 17:35 (15 actas)

We study scalar CFTs in $d=4,6$ with planar defects and study the RG flows induced by the defects. Taking a double scaling limit, bulk loops are suppressed, simplifying the analysis. We study the beta function of the defect couplings and give conditions for the stability of the theory. We construct a Hamiltonian $\mathcal{H}$ and prove using rigid holography techniques and the Hamilton-Jacobi that the beta function is a gradient of $\mathcal{H}$, fulfilling a C-theorem.

Autor: CARREÑO BOLLA, Ignacio (ICTEA - Universidad de Oviedo)

Presentador: CARREÑO BOLLA, Ignacio (ICTEA - Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 27

Tipo: Investigador FPAUO

Search for long-lived particles decaying to final states with a pair of muons in proton-proton collisions at a CM energy of 13.6 TeV

lunes, 6 de mayo de 2024 16:35 (15 actas)

Presented here is an inclusive search for long-lived particles decaying to a pair of displaced muons. This search analyzes data collected in 2022 by the CMS experiment at the CERN LHC in proton-proton collisions at $\sqrt{s}=13.6$ TeV, adding up to an integrated luminosity of 36.7 fb⁻¹. The experimental signature is a pair of oppositely charged muons (displaced dimuons) originating from a common secondary vertex spatially separated from the pp interaction, considering distances that go from several hundred micrometers to several meters. The results of the analysis are interpreted in the frameworks of two simplified models: the hidden Abelian Higgs model, in which the Higgs boson decays to a pair of long-lived dark photons, and R-parity violating supersymmetry model, in which long-lived neutralinos decay to a pair of muons and a neutrino. The results here presented improve substantially the ones in the previous analysis performed using data taken at $\sqrt{s}=13$ TeV. The key of this improvements, particularly significant at low masses and long lifetimes, are the improved triggers for displaced muons and the offline analysis refinements.”

Autor: SOTO RODRIGUEZ, Alejandro (Universidad de Oviedo - ICTEA)

Presentador: SOTO RODRIGUEZ, Alejandro (Universidad de Oviedo - ICTEA)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 28

Tipo: Investigador FPAUO

Triggering on muon showers in the Barrel Muon Trigger of the CMS experiment for the HL-LHC upgrades.

lunes, 6 de mayo de 2024 13:45 (15 actas)

The Phase-2 CMS upgrade for HL-LHC includes replacing the trigger and data acquisition system. Upgrades to the readout electronics will enable a maximum L1 accept rate of 750 kHz with a latency of 12.5 μ s. The muon trigger, using multi-layer systems, reconstructs and measures muon momenta by analyzing data from muon chambers with pattern recognition algorithms running on FPGA processors. The Layer-1 Barrel Muon Filter refines and correlates information from barrel muon stations before sending it to the track finders. An algorithm for detecting and identifying muon showers has been developed, demonstrated in firmware, and assessed for physics performance.

Autores: VICO, Carlos (ICTEA - Universidad de Oviedo); PRADO, Javier (ICTEA - Universidad de Oviedo)

Presentador: PRADO, Javier (ICTEA - Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 29

Tipo: Investigador FPAUO

Search for CP violation using ttH production

martes, 7 de mayo de 2024 13:10 (15 actas)

The origin of the matter antimatter asymmetry in the universe is one of the unsolved questions in physics. The CP-violating processes in the standard model are not enough to explain the full difference and some beyond the standard model extensions suggest CP-violation might arise in the Higgs sector. In particular, the Higgs coupling to fermions has not yet been proven to be invariant under CP transformations. In this talk I'll cover the search for CP violation in the top Yukawa coupling using the production of a Higgs (H) boson in association with two top quarks. The measurement is performed in final states containing multiple electrons, muons, or tau leptons decaying to hadrons and a neutrino, using proton-proton collisions recorded at a center-of-mass energy of 13 TeV by the CMS experiment.

Autor: RAMON ALVAREZ, Clara (Universidad de Oviedo - ICTEA)**Presentador:** RAMON ALVAREZ, Clara (Universidad de Oviedo - ICTEA)**Clasificación de la sesión:** Sesión ICTEA

ID de Contribución: 30

Tipo: Investigador MOMA

Redes Neuronales Convolucionales Unidimensionales (1D CNN) para la caracterización de exoplanetas en tránsito

martes, 7 de mayo de 2024 12:40 (15 actas)

El método del tránsito es una técnica de detección de exoplanetas que consiste en analizar las curvas de luz estelares en busca de señales de tipo tránsito que se producen cuando el planeta cruza la línea de visión limitada entre su estrella anfitriona y un telescopio que la observa. Las redes neuronales convolucionales unidimensionales (1D CNN) han supuesto un gran avance en este campo de la investigación ya que permiten automatizar el proceso de detección de este tipo de señales. En mi última investigación he ido un paso más allá y he empleado modelos 1D CNN para extraer los principales parámetros planetarios extraíbles de la forma de los tránsitos y teorizados en los modelos de Mandel y Agol. Además, he empleado el concepto de curvas en fase que permitirán a un segundo modelo 1D CNN obtener el radio del planeta y el semieje mayor de la órbita. Los resultados obtenidos muestran que los modelos 1D CNN son no solo muy precisos, obteniendo resultados muy similares a los algoritmos actuales, sino que también permiten analizar sets de curvas de luz muy grandes en muy poco tiempo, evitando además caracterizar las estrellas previamente.

Autor: IGLESIAS ÁLVAREZ, Santiago (Instituto Universitario de Ciencias y Tecnologías Espaciales de Asturias)

Presentador: IGLESIAS ÁLVAREZ, Santiago (Instituto Universitario de Ciencias y Tecnologías Espaciales de Asturias)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 31

Tipo: Investigador MOMA

Búsqueda de exoplanetas en corrientes estelares extragalácticas

martes, 7 de mayo de 2024 11:35 (15 actas)

La identificación de exoplanetas orbitando estrellas pertenecientes a corrientes estelares extragalácticas nos permite estudiar las características, tanto físicas como poblacionales, de los sistemas planetarios en estrellas con origen externo a nuestra Galaxia. Además es clave para investigar el impacto que los eventos de acreción sufridos por las galaxias enanas primigenias hayan podido tener en la estructura y evolución de dichos sistemas planetarios.

En este trabajo se presenta una primera búsqueda de planetas extrasolares en la corriente de Arturo, identificando estrellas pertenecientes a dicha corriente a partir de datos dinámicos derivados de observaciones del satélite GAIA, así como de datos fotométricos obtenidos de imágenes de campo amplio del telescopio espacial TESS.

Autores: DÍEZ ALONSO, Enrique (Instituto de Ciencias y Tecnologías Espaciales de Asturias (ICTEA)); DE COS JUEZ, Javier (ICTEA- Universidad de Oviedo); IGLESIAS ÁLVAREZ, Santiago (Instituto Universitario de Ciencias y Tecnologías Espaciales de Asturias)

Presentador: DÍEZ ALONSO, Enrique (Instituto de Ciencias y Tecnologías Espaciales de Asturias (ICTEA))

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 32

Tipo: Investigador MOMA

Asteroid morphological modelling and YORP detection by light curve inversion method

martes, 7 de mayo de 2024 13:25 (15 actas)

Models for near-Earth asteroids (3103) Eger, (161989) Cacus, (2100) Ra-Shalom and (12711) Tukmit were computed with archival data from DAMIT and ALCDEF and 24 new lightcurves provided by the Instituto Astrofísico Canarias 80 and Telescopio Abierto Remoto 2 telescopes at the Teide Observatory (Tenerife, Spain) during 2021 and 2022. The shape models and rotation state parameters (α , β , γ) were computed by applying the lightcurve inversion method to the data. For (3103) Eger and (161989) Cacus, our shape models and rotation state parameters agree with previous works, though they have smaller uncertainties. For (2100) Ra-Shalom, our results also agree with previous studies. Still, we find that a Yarkovsky - O'Keefe - Radzievskii - Paddack acceleration of $\dot{a} = (0.223 \pm 0.237) \times 10^{-8} \text{ rad d}^{-2}$ slightly improves the fit of the lightcurves, suggesting that (2100) Ra-Shalom could be affected by this acceleration. We also present for the first time a shape model for (12711) Tukmit, along with its rotation state parameters ($\alpha = 3.484900 \pm 0.000031 \text{ hr}$, $\beta = 27^\circ \pm 8^\circ$, $\gamma = 9^\circ \pm 15^\circ$).

Autor: RODRÍGUEZ RODRÍGUEZ, Javier (ICTEA - Universidad de Oviedo)

Presentador: RODRÍGUEZ RODRÍGUEZ, Javier (ICTEA - Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 33

Tipo: **Investigador MOMA**

Noise-free wavefront prediction for open-loop AO system based on recurrent models

martes, 7 de mayo de 2024 13:40 (15 actas)

Ground based telescopes encounter a significant challenge in the form of atmospheric turbulence, which results in the acquired images appearing distorted and lacking sharpness. To address this issue, adaptive optics is employed, a technology that effectively mitigates wavefront aberrations by adjusting the shape of a deformable mirror's surface. Furthermore, the integration of neural networks into the control system has showcased notable enhancements, both in atmospheric correction and turbulence prediction. Specifically, in this work 2DLSTM network structure is employed, which has shown good efficiency in slope prediction over a time sequence. Aiming to address the prediction of turbulence data without the noise introduced by reading instruments. Through the experiments carried out in this research, it is shown that such neural models are able to learn to a certain extent the noise patterns of the system. This way, the obtained data can closely resemble real-world turbulence conditions.

Autor: PÉREZ, Saúl (Instituto Universitario de Ciencias y Tecnologías Espaciales de Asturias (ICTEA))

Presentador: PÉREZ, Saúl (Instituto Universitario de Ciencias y Tecnologías Espaciales de Asturias (ICTEA))

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 34

Tipo: **Investigador MOMA**

Breaking Ground on the Moon: Regolith as a Key Component in Lunar Thermal Energy Storage.

lunes, 6 de mayo de 2024 18:20 (15 actas)

Regolith, abundant on the lunar surface, possesses properties that make it an attractive candidate for thermal energy storage (TES). Its porosity and thermal conductivity allow for efficient heat transfer and heat retention, crucial for storing thermal energy during lunar day-night cycles. By using regolith as a TES medium, lunar habitats and infrastructures can effectively capture excess heat during the day and release it when needed during cold lunar nights.

TES using regolith holds immense potential for addressing the energy and thermal management challenges inherent to lunar exploration and habitation. By harnessing the unique properties of regolith as a storage material, innovative TES systems can contribute to the sustainability, resilience, and advancement of lunar infrastructure, paving the way for long-term human presence on the Moon.

Autor: Dr. MARQUÉS SIERRA, Antonio Luis (ICTEA - Universidad de Oviedo)

Presentador: Dr. MARQUÉS SIERRA, Antonio Luis (ICTEA - Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 35

Tipo: Investigador MOMA

Cosmic insights from galaxy clusters: Exploring magnification bias on sub-millimetre galaxies

lunes, 6 de mayo de 2024 16:50 (15 actas)

Magnification bias, an observational effect of weak gravitational lensing, is studied through angular correlations of sources at different redshifts, particularly with sub-millimeter galaxies (SMGs), providing astrophysical and cosmological insights. Investigating the magnification bias effect exerted by galaxy clusters on SMGs within the Λ CDM model, constraints on cosmological and astrophysical parameters are derived using a cross-correlation function and a Markov Chain Monte Carlo algorithm. Results, while consistent with Λ CDM, show less constrained parameters due to broader redshift distributions and limited cluster statistics. Nevertheless, the study highlights the potential of using galaxy clusters as lenses for magnification bias studies, with opportunities for improvement through expanding the lens sample size.

Autores: Sr. CRESPO, David (ICTEA - Universidad de Oviedo); Dr. GONZÁLEZ-NUEVO, Joaquín (ICTEA - Universidad de Oviedo); Dr. CASAS, José Manuel (Universidad de Oviedo); Dr. BONAVERA, Laura (ICTEA - Universidad de Oviedo); Dr. MUÑIZ CUELLI, Marcos (SISSA); FERNÁNDEZ FERNÁNDEZ, Rebeca (ICTEA - Universidad de Oviedo); Sra. RODRÍGUEZ CABO, Sara (ICTEA - Universidad de Oviedo)

Presentador: FERNÁNDEZ FERNÁNDEZ, Rebeca (ICTEA - Universidad de Oviedo)

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 36

Tipo: **Investigador FPAUO**

Artificial Intelligence at CERN

martes, 7 de mayo de 2024 12:05 (20 actas)

Since its creation in 1954, CERN has positioned itself as a world leader in development of hardware and algorithmic technology for fundamental physics, with a tremendous potential and practical impact on industry and society.

The fundamental physics studied at CERN, both from the experimental and theory side, involves the treatment of very large data sets and the exploitation of advanced mathematical constructs. Since decades, this implied the development and application of progressively more sophisticated AI algorithms: this led to the discovery of the Higgs boson in 2012, and to CERN being at the forefront of AI applications both in software and hardware in the 2020s.

The CMS Experiment, with about 6200 active members between physicists and engineers at any level, has a very rich AI/ML program encompassing all theoretical, experimental, and technical aspects where these techniques are useful.

In this talk I will review, as the new Machine Learning Coordinator for the CMS Experiment, the landscape of the AI and ML use at CERN and avenues of collaboration where the HEP AI experience can assist and complement other areas of academic and industrial research and applications.

Autor: Prof. VISCHIA, Pietro (Universidad de Oviedo and Instituto de Ciencias y Tecnologías Espaciales de Asturias (ICTEA))

Presentador: Prof. VISCHIA, Pietro (Universidad de Oviedo and Instituto de Ciencias y Tecnologías Espaciales de Asturias (ICTEA))

Clasificación de la sesión: Sesión ICTEA

ID de Contribución: 37

Tipo: **sin especificar**

The European Southern Observatory (ESO): building, operating and developing world-leading astronomical observatories

lunes, 6 de mayo de 2024 11:30 (45 actas)

The European Organisation for Astronomical Research in the Southern Hemisphere (ESO) currently operates two world-leading observatories: the VLT and VLTI in the optical/infrared and ALMA (a partnership with North America and East Asia) in the submillimeter and millimeter domain. ESO is also beyond 50% complete in the construction of the largest optical/infrared telescope, the ELT, and is part of the development of the Cherenkov Telescope Array Observatory (CTAO). Through competitive access to its operational facilities and open access to the science archives, ESO data generate more than 1000 refereed papers per year, which include a number of scientific breakthroughs. The optical/IR observatories are being continuously upgraded through, in particular, new instrumentation, and ALMA is also starting an ambitious development programme called Wide-Band Sensitivity Upgrade. I will underline how these activities act as a catalyser for Research and Development, and offer opportunities to scientists, engineers, institutes and companies

Presentador: Dr. BARCÓNS JAUREGUI, Xavier (ESO Director General)

Clasificación de la sesión: Presentaciones invitadas

ID de Contribución: 38

Tipo: **sin especificar**

The Level-1 Trigger upgrade of the CMS experiment at the LHC: challenges and future prospects

lunes, 6 de mayo de 2024 10:00 (1h 30m)

The HL-LHC will open an unprecedented window on the weak-scale nature of the universe, providing high-precision measurements of the standard model (SM) as well as searches for new physics beyond the SM. Collecting the information-rich datasets required by such measurements and searches will be a challenging task, given the harsh environment of 200 proton-proton interactions per bunch crossing. For this purpose, CMS is designing an efficient data-processing hardware trigger including tracking and high-granularity calorimeter information. Trigger data analysis will be performed through sophisticated algorithms including widespread use of Machine Learning. The system design is expected to take advantage of advances in FPGA and link technologies, providing a high-performance, low-latency computing platform for large throughput and sophisticated data correlation across diverse sources. The expected impact on the physics reach of the experiment will be summarised in this presentation.

Autor: Dr. ZABI, Alexandre (CMS L1 Trigger Project Manager)

Presentador: Dr. ZABI, Alexandre (CMS L1 Trigger Project Manager)

Clasificación de la sesión: Presentaciones invitadas

ID de Contribución: 39

Tipo: Investigador FPAUO

INTREPID: INnovative TRiggEr techniques for beyond the standard model Physlcs Discovery at the LHC

martes, 7 de mayo de 2024 10:50 (30 actas)

The discovery of the Higgs boson at the Large Hadron Collider (LHC) closes a central chapter of the standard model (SM) of particle physics while raising several questions, such as the nature of dark matter, an explanation to neutrino masses, or the origin of baryon asymmetry in the Universe. The answer to those questions could be linked to the production of beyond the SM (BSM) particles which may have long lifetimes, compared to SM particles at the weak scale. If these long-lived particles (LLPs) were to be produced at the LHC, they would yield non-standard signatures which require dedicated identification algorithms. A complex filtering (trigger) system running sophisticated algorithms allows to decide, in real time, whether a given event of interest should be saved for data analysis or discarded. The general goal of this proposal is to enhance the trigger capabilities to enable the discovery of LLPs and thus find evidence of BSM physics exploring innovative technologies that may be of use in future facilities. With several years before the start of the High-Luminosity LHC (HL-LHC), it is now the perfect time to explore alternative trigger architectures and technologies not considered in the plans of the collaboration and that could not be explored otherwise. To this end, I will use a multidisciplinary approach involving advanced Machine Learning techniques and top-of-the-line ultra-fast processing platforms to propose an innovative solution that will improve the capabilities of future trigger systems. The foreseen studies might be the only way in which LLPs can be discovered at the HL-LHC. Any manifestation of such particles will revolutionise the field of High Energy Physics and help to answer several fundamental questions regarding the energy scale and nature of the BSM physics. Beside progressing in the frontiers of science, the designed techniques can be of great use for industries requiring real-time processing of large data-volumes to extract features.

Autor: FOLGUERAS, Santiago (ICTEA - Universidad de Oviedo)**Presentador:** FOLGUERAS, Santiago (ICTEA - Universidad de Oviedo)**Clasificación de la sesión:** Sesión ICTEA

ID de Contribución: 41

Tipo: **sin especificar**

Gravitational Waves from the Fifth Dimension

lunes, 6 de mayo de 2024 15:05 (1h 30m)

The discovery of gravitational waves has opened a new experimental window into the Universe. The fact that the relevant dynamics is often out of equilibrium is both a formidable challenge and a golden opportunity. I will explain how holography, a tool that originated in string theory, can shed light on the relevant physical processes in cosmology and astrophysics. In particular, I will describe applications to cosmological phase transitions, to neutron star mergers and to spacetime singularities.

Presentador: Dr. MATEOS SOLÉ, David Julián (UB)**Clasificación de la sesión:** Presentaciones invitadas

ID de Contribución: 42

Tipo: Investigador MOMA

DiSCo-TNOs: Understanding Ices in the Solar System with the James Webb Space Telescope

martes, 7 de mayo de 2024 13:55 (30 actas)

The trans-Neptunian objects (TNOs), along with the Oort cloud comets and the icy moons of the giant planets, constitute the primary reservoirs of ices in the Solar System. Decades of ground- and space-based observations of the icy Solar System, as well as NASA and ESA spacecraft exploration, have unveiled a myriad of molecular species. At the same time, ices play a pivotal role as carriers of volatiles in protoplanetary disks, crucial for understanding the chemistry that ultimately dictates the organic composition of planets. Disk snowlines are pivotal in shaping the compositions of Solar System planets, moons, and small bodies.

The distribution of CHONS ices during the planetary formation in protoplanetary disks leaves a footprint in the composition of ice bodies. However, despite being a focal point of interest since the discovery of Albion in 1992, ices had remained elusive for decades, but not anymore!.

We are embarking on a new era in the study of ices in the Solar System, exoplanets, and disks, thanks to the advanced instrumentation aboard the James Webb Space Telescope. In this presentation, I will discuss some of the initial findings from various Webb observing programs ranging from small, red, cold classical bodies akin to Arrokoth, to the large dwarf planets, Eris, Makemake, and Pluto, ice giants with a warm heart. Hopefully, this presentation will catalyze discussions on how compositional characterization of small bodies in the NIR spectrum could naturally deep the understanding of the icy ingredients in planetary systems.

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Clasificación de la sesión: Sesión ICTEA