XIII CPAN DAYS

Report of Contributions

https://indico.ific.uv.es/e/CPAN2022

Contribution ID : **462** Type : **not specified**

A Green's basis for the bosonic SMEFT to dimension 8

Abstract

We present a basis of dimension-eight Green's functions involving Standard Model (SM) bosonic fields, consisting of 86 new operators. Rather than using algebraic identities and integration by parts, we prove the independence of these interactions in momentum space, including a discussion on evanescent bosonic operators.

Our results pave the way for renormalising the SM effective field theory (SMEFT), as well as for performing matching of ultraviolet models onto the SMEFT, to higher order. To demonstrate the potential of our construction, we have implemented our basis in matchmakereft and used it to integrate out a heavy singlet scalar and a heavy quadruplet scalar up to one loop. We provide the corresponding dimension-eight Wilson coefficients. Likewise, we show how our results can be easily used to simplify cumbersome redundant Lagrangians arising, for example, from integrating out heavy fields using the path-integral approach to matching.

Primary author(s) : DÍAZ CARMONA, Álvaro (Universidad de Granada); CHALA, Mikael (Universidad de Granada); GUEDES, Guilherme (Universidad de Granada, Universidade do Minho)

Presenter(s) : DÍAZ CARMONA, Álvaro (Universidad de Granada)

Track Classification : Física Teórica

Contribution ID : **465** Type : **not specified**

The new and gauge invariant Littlest Higgs Model with T-parity

Abstract

In this talk we will first review the Littlest Higgs model with T-parity (LHT), based on the global symmetry group SU(5) broken spontaneously to SO(5), to highlight the pathologies it presents due to the non trivial interplay between the discrete T-parity symmetry and the non-linear realization of the global symmetry. In particular, we will show that the Yukawa Lagrangian responsible for providing mass terms for the heavy fermions is not gauge invariant because their right-handed components transforms in a non-linear representation of SO(5) and such a transformation does not commute, not even restricting to the gauged subgroup, with T-parity. To cure this issue, while preserving most of the structure of the original LHT, we propose to enlarge the global symmetry group with an extra [SU(2)xU(1)]^2 factor broken spontaneously to [SU(2)xU(1)] giving rise to new T-odd scalars. This also allows us to introduce the minimal set of fermionic degrees of freedom required to give masses to all fermions while preserving gauge invariance.

Primary author(s) : Mr. PÉREZ-POYATOS, Jose María (Universidad de Granada); ILLANA, José Ignacio (Universidad de Granada)

Presenter(s) : Mr. PÉREZ-POYATOS, Jose María (Universidad de Granada)

Track Classification : Física Teórica

Contribution ID : **467** Type : **not specified**

Improved bounds on heavy quark EDMs and implications for BSM

Abstract

Electric dipole moment (EDM) searches play an crucial role in constraining CP violation sources beyond the Standard Model. We derive new bounds on the EDM of charm and bottom quarks and explore its implications for different New Physics models (1905.02513), with special attention to the so-called Manohar-Wise model, with additional color-octet scalars. For this model, we compute the full set of one-loop diagrams and the enhanced higher-order effects from the Weinberg operator and Barr-Zee diagrams (2111.09397). The constraints on the model parameters from the neutron EDM are studied, finding a powerful complementarity with other flavor obsevables.

Primary author(s) : RUIZ VIDAL, Joan (IFIC - University of Valencia and CSIC)

Co-author(s) : GISBERT MULLOR, Hector (TU Dortmund); MIRALLES AZNAR, Víctor (INFN Rome)

Presenter(s) : RUIZ VIDAL, Joan (IFIC - University of Valencia and CSIC)

Track Classification : Física Teórica

Contribution ID : **468** Type : **not specified**

An ultraviolet completion for the Scotogenic model

Abstract

The Scotogenic model is an economical scenario that generates neutrino masses at the 1-loop level and includes a dark matter candidate. This is achieved by means of an ad-hoc Z_2 symmetry, which forbids the tree-level generation of neutrino masses and stabilizes the lightest Z_2-odd state. Neutrino masses are also suppressed by a quartic coupling, usually denoted by λ5. While the smallness of this parameter is natural, it is not explained in the context of the Scotogenic model. We construct an ultraviolet completion of the Scotogenic model that provides a natural explanation for the smallness of the λ5 parameter and induces the Z2 parity as the low-energy remnant of a global U(1) symmetry at high energies. The low-energy spectrum contains, besides the usual Scotogenic states, a massive scalar and a massless Goldstone boson, hence leading to novel phenomenological predictions in flavor observables, dark matter physics and colliders.

Primary author(s) : Mr. ESCRIBANO VALIENTE, Pablo; VICENTE, Avelino (IFIC)

Presenter(s) : Mr. ESCRIBANO VALIENTE, Pablo

Track Classification : Física Teórica

Contribution ID : **469** Type : **not specified**

Using Machine Learning techniques in phenomenological studies in flavour physics

Abstract

In the recent years, a series of measurements in the observables RK() *and RD*() concerning the semileptonic decays of the B mesons have shown hints of violations of Lepton Flavour Universality (LFU). An updated model-independent analysis of New Physics violating LFU, by using the Standard Model Effective Field Theory (SMEFT) Lagrangian with semileptonic dimension six operators at $\Lambda = 1$ TeV is presented. We perform a global fit, in order to assess the impact of the New Physics in a broad range of observables including B-physics, electroweak precision test, Higgs physics and nuclear β decays. We discuss the relevance of the mixing in the first generation for the observables with heavier lepton flavours. We use for the first time in this context a Montecarlo analysis of the likelihood function to extract the confidence intervals and correlations between observables. Our results show that a suitable strategy is to use a Gradient Boosting predictor as a proxy of the real likelihood function, and to analyze the SHAP values as a measure of the impact of each parameter of SMEFT Lagrangian in the fit.

Primary author(s) : ALDA GALLO, Jorge (Universidad de Zaragoza); GUASCH INGLADA, Jaume (Universitat de Barcelona); PENARANDA-RIVAS, Siannah (University of Zaragoza)

Presenter(s) : ALDA GALLO, Jorge (Universidad de Zaragoza)

Track Classification : Física Teórica

Contribution ID : **471** Type : **not specified**

SHAPE COEXISTENCE IN STRONTIUM ISOTOPES

Tuesday, 22 March 2022 09:45 (15)

Abstract

The shape of nuclei is determined by a fine balance between the stabilizing effect of closed shells and the pairing and quadrupole force that tends to make them deformed. As other well known cases, located in the A = 100 mass region, as Yb, Zr or Nb for example, Sr isotopes are good candidates to study the existence of this nuclear deformation. In particular in this case, particle-hole excitations are favored because of the presence of the proton subshell closure Z = 40, resulting in low-lying intruder bands.

The aim of this contribution is the study of the nuclear structure of 92-102 Sr even-even isotopes using the Interacting Boson Model with configuration mixing to reproduce excitation energies, B(E2) transition rates, nuclear radii and two-neutron separation energies.

For the whole chain of isotopes analyzed, good agreement between theoretical and experimental values of excitation energies, transition rates, separation energies, radii and isotope shift has been found. Furthermore, the wave functions, together with the mean field energy surfaces and the value of nuclear deformation have been analyzed.

This study will clarify the presence of low-lying intruder states in even-even Sr isotopes and the way it connects with the onset of deformations. Lightest Sr isotopes considered present a spherical structure while heaviest one are clearly deformed. The onset of deformation at N = 60 is induced by the crossing of the regular and intruder configuration, furthermore, both families of states present an increase of deformation with the neutron number.

Primary author(s) : MAYA BARBECHO, Esperanza (Universidad de Huelva); GARCÍA-RAMOS, Jose-Enrique (University of Huelva)

Presenter(s) : MAYA BARBECHO, Esperanza (Universidad de Huelva)

Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **472** Type : **not specified**

Semileptonic tau decays beyond the Standard Model

Abstract

Hadronic τ decays are studied as probe of new physics. We determine the dependence of several inclusive and exclusive τ observables on the Wilson coefficients of the low-energy effective theory describing charged-current interactions between light quarks and leptons. The analysis includes both strange and non-strange decay channels. The main result is the likelihood function for the Wilson coefficients in the tau sector, based on the up-to-date experimental measurements and state-of-the-art theoretical techniques. The likelihood can be readily combined with inputs from other low-energy precision observables. We discuss a combination with nuclear beta, baryon, pion, and kaon decay data. In particular, we provide a comprehensive and model-independent description of the new physics hints in the combined dataset, which are known under the name of the Cabibbo anomaly.

Primary author(s) : DÍAZ CALDERÓN, David (IFIC); Dr. RODRÍGUEZ-SÁNCHEZ, Antonio (IJCLab, Orsay); Dr. FALKOWSKI, Adam (IJCLab, Orsay); Dr. CIRIGLIANO, Vincenzo (Los Alamos); GONZALEZ ALONSO, Martin

Presenter(s) : DÍAZ CALDERÓN, David (IFIC)

Track Classification : Física Teórica

Contribution ID : **473** Type : **not specified**

Asymptotic expansions and causal representations through the loop-tree duality

Abstract

Precision calculations needed to disentangle SM predictions from BSM effects involve the calculation of higher-order quantum corrections which pose technical challenges. An alternative to the traditional method has been proposed in the form of the loop-tree duality theorem. We present a newly found purely causal representation of the dual integrands and the definitions of several classes of multiloop topologies as well as their loop-tree duality representations. While the effectiveness of employing the loop-tree duality for obtaining asymptotic expansions has been shown previously in the large-mass limit for Higgs production through gluon fusion, we derive a more general method for asymptotic expansion of scattering amplitudes within the loop-tree duality formalism. We apply and analyse this method for the scalar two- and three-point functions at one-loop order and apply it to highly boosted Higgs boson production.

Primary author(s) : PLENTER, Judith (IFIC - UV/CSIC)

Co-author(s) : RODRIGO, Germán (IFIC UV-CSIC)

Presenter(s) : PLENTER, Judith (IFIC - UV/CSIC)

Track Classification : Física Teórica

Contribution ID : **474** Type : **not specified**

Effective quantum gravity, cosmological constant and the Standard Model of particle physics

Abstract

The cosmological constant problem (CCP) and the formulation of consistent quantum gravity belong to the shortlist of the most important unsolved fundamental problems of physics. In the case of CCP the problem is to explain the extremely precise (55 orders in the Standard Model) fine-tuning between the independent vacuum part and the induced one, that is a function of symmetry breaking in the models of particle physics. The situation with CCP is so difficult that it makes sense to give up from attempting its solution and accept the need for a fine tuning between the vacuum and induced counterparts of the observed energy density of the vacuum. In this case, we meet the challenging situation with the renormalization group running of the vacuum or induced summands of the cosmological constant
at low energies.
Assuming the effective approach to quantum gravity and the Vilkovisky-DeWitt scheme of unique effective action, one can derive the exact, well-defined, renormalization group running of the vacuum cosmological constant. It turns out that, owing to the mentioned fine-tuning with the induced part, this running imposes severe restrictions on the possible extensions of the Minimal Standard Model of particle physics, concerning the magnitude of the vacuum expectation value of the corresponding Higgs fields.

Primary author(s) : Prof. SHAPIRO, Ilya (Universidade Federal de Juiz de Fora, Minas Gerais, Brazil)

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Track Classification : Física Teórica

Contribution ID : **475** Type : **not specified**

Development of SPAD detectors with improved sensitivity in NIR region

Tuesday, 22 March 2022 10:00 (20)

Abstract

Near-infrared (NIR) light is used in several non-invasive biomedical techniques to measure blood flow in deep tissues. Light from a NIR laser is injected into the sample and the scattered photons are detected using Single Photon Avalanche Diodes (SPADs), which are Avalanche Photo-Diodes (APD) operated in Geiger mode. From the SPAD signals the local blood flow can be inferred. In this work, we target the development and characterisation of SPADs with high Photon Detection Efficiency (PDE) in the NIR range, low Dark Count Rate (DCR) and fast timing. In the first stage of the project, SPADs with multiplication layers buried at different depths have been designed at IFAE and produced in 150nm CMOS technology. CMOS has the advantage of being a cost-effective commercial technology for production of large matrices and, in addition, allows to build very compact devices thanks to the capability of integrating the quenching mechanism and readout electronics on chip. In this study, we present results of the characterization of SPAD devices with an active area of 50×50 μm2 operated with an external passive quenching circuit. We compared properties, such as DCR and PDE, of the different SPAD designs, and their dependence on temperature. The PDE for 780 nm light of SPADs with a buried multiplication layer was observed to be in the range of 15-20% with a DCR of the order of 2 kHz. The results of these first prototypes are promising and are being followed up by the development of a new generation of SPADs in the CMOS technology at IFAE.

Primary author(s) : Ms. GAUTAM, VIVEKA (IFAE)

Co-author(s) : Dr. CASANOVA, Raimon (IFAE); Dr. TERZO , Stefano (IFAE); Dr. GRINSTEIN , Sebastian (IFAE)

Presenter(s) : Ms. GAUTAM, VIVEKA (IFAE)

Session Classification : Investigación orientada, tecnología e innovación

Track Classification : Investigación orientada, tecnología e innovación

Contribution ID : **476** Type : **not specified**

Pion generalized parton distributions: what theory, lattice QCD and experiment can tell us?

Abstract

We discuss how the knowledge of the pion valence-quark distribution function (either obtained from theory, lattice QCD or experiment) can be extended to off-forward kinematics to construct the corresponding generalized parton distribution (GPD). The discussion is based upon the hypothesis of the existence of an energy scale at which the hadron can be completely understood in terms of (fully dressed) valence degrees of freedom, the so called hadronic scale, and an all orders evolution scheme. In addition to being compatible with empirical and lattice results, the obtained GPDs fulfill all the prescriptions from QCD and exhibit agreement with contemporary predictions from continuum Schwinger methods.

Primary author(s) : RAYA, Khépani; RODRIGUEZ QUINTERO, José (Universidad de Huelva)

Presenter(s) : RAYA, Khépani

Track Classification : Física Teórica

Contribution ID : **479** Type : **not specified**

Towards a precise top quark mass

Monday, 21 March 2022 15:00 (20)

Abstract

Presenter(s) : APARISI POZO, Javier (IFIC)

Session Classification : Red Temática de Física del LHC

Contribution ID : **480** Type : **not specified**

Differential tt(+jets) cross sections in the l+jets channel with 139 fb-1 ATLAS data

Monday, 21 March 2022 15:20 (20)

Abstract

Presenter(s) : PRINCIPE MARTIN, Miguel (Universidad Autónoma de Madrid)

Session Classification : Red Temática de Física del LHC

Contribution ID : **481** Type : **not specified**

The top quark electro-weak couplings after LHC Run 2

Monday, 21 March 2022 15:40 (20)

Abstract

Presenter(s) : MIRALLES LÓPEZ, Marcos

Session Classification : Red Temática de Física del LHC

Contribution ID : **482** Type : **not specified**

Latest measurements of inclusive and differential cross sections in the tW process at 13 TeV with the CMS detector

Monday, 21 March 2022 16:00 (20)

Abstract

Presenter(s) : RODRIGUEZ BOUZA, Victor (UO)

Session Classification : Red Temática de Física del LHC

Contribution ID : **483** Type : **not specified**

CMS results for top squark searches at 13 TeV with full Run-II data

Monday, 21 March 2022 16:20 (20)

Abstract

Presenter(s) : GONZÁLEZ FERNÁNDEZ, Juan Rodrigo (Universidad de Oviedo)

Session Classification : Red Temática de Física del LHC

Contribution ID : **484** Type : **not specified**

Searches for electroweak production of supersymmetric particles with the ATLAS detector

Monday, 21 March 2022 16:40 (20)

Abstract

Presenter(s) : MORENO MARTÍNEZ, Carlos (Institut de Física d'Altes Energies (IFAE))

Session Classification : Red Temática de Física del LHC

Contribution ID : **485** Type : **not specified**

A_FB in the SMEFT: the LHC as a Z physics laboratory

Monday, 21 March 2022 17:30 (20)

Abstract

Presenter(s) : BRESÓ, Víctor (Universitat de Valencia)

Session Classification : Red Temática de Física del LHC

Contribution ID : **486** Type : **not specified**

Fine-Tuning in the 2HDM

Monday, 21 March 2022 17:50 (20)

Abstract

Presenter(s) : BERNAL GONZÁLEZ, Alexander (IFT UAM-CSIC)

Session Classification : Red Temática de Física del LHC

Contribution ID : **487** Type : **not specified**

Search for nonresonant Higgs boson pair production in final state with two bottom quarks and two leptons in proton-proton collisions at sqrt[s] = 13 TeV

Monday, 21 March 2022 18:10 (20)

Abstract

Presenter(s) : LEON HOLGADO, Jaime (CIEMAT)

Session Classification : Red Temática de Física del LHC

Contribution ID : **488** Type : **not specified**

Triple Higgs couplings of the 2HDM at the LHC

Monday, 21 March 2022 18:30 (20)

Abstract

Presenter(s) : RADCHENKO, Kateryna (IFT-UAM)

Session Classification : Red Temática de Física del LHC

Contribution ID : **489** Type : **not specified**

Recent searches for light scalars with the ATLAS detector

Monday, 21 March 2022 18:50 (20)

Abstract

Presenter(s) : SALVADOR SALAS, Adrian (The Barcelona Institute of Science and Technology (BIST) (ES))

Session Classification : Red Temática de Física del LHC

Contribution ID : **490** Type : **not specified**

Multiboson signals in the UN2HDM

Monday, 21 March 2022 19:10 (20)

Abstract

Presenter(s) : SEABRA, João (IFT UAM)

Session Classification : Red Temática de Física del LHC

Contribution ID : **491** Type : **not specified**

La ”Red LHC”: presente y futuro

Monday, 21 March 2022 19:30 (20)

Abstract

Presenter(s) : GARCIA, Carmen (IFIC)

Session Classification : Red Temática de Física del LHC

Contribution ID : **492** Type : **not specified**

Heavy Ion collisions in LHCb

Tuesday, 22 March 2022 08:50 (20)

Abstract

Presenter(s) : CORREDORIA, Imanol (USC)

Session Classification : Red Temática de Física del LHC

Contribution ID : **493** Type : **not specified**

Prospects for light scalar sectors at LHCb

Tuesday, 22 March 2022 09:10 (20)

Abstract

Presenter(s) : RAMOS, Maria (IFT)

Session Classification : Red Temática de Física del LHC

Contribution ID : **494** Type : **not specified**

Rare Radiative Decays at LHCb

Tuesday, 22 March 2022 09:30 (20)

Abstract

Presenter(s) : JASHAL, Brij Kishor (IFIC)

Session Classification : Red Temática de Física del LHC

Contribution ID : **495** Type : **not specified**

Measurement of the inclusive isolated-photon cross section in pp collisions at sqrt(s) = 13 TeV using 36 fb^-1 of ATLAS data

Tuesday, 22 March 2022 09:50 (20)

Abstract

Presenter(s) : Dr. CAMARERO MUNOZ, Daniel (Universidad Autonoma de Madrid (ES))

Session Classification : Red Temática de Física del LHC

Contribution ID : **496** Type : **not specified**

High-Luminosity Upgrade of the CMS Inner Tracker

Tuesday, 22 March 2022 10:10 (20)

Abstract

Presenter(s) : LASAOSA GARCÍA, Clara (Instituto de Física de Cantabria)

Session Classification : Red Temática de Física del LHC

Contribution ID : **497** Type : **not specified**

Muon trigger upgrades in the CMS experiment for the HL-LHC

Tuesday, 22 March 2022 10:30 (20)

Abstract

Presenter(s) : SOTO RODRIGUEZ, Alejandro (University of Oviedo)

Session Classification : Red Temática de Física del LHC

Contribution ID : **498** Type : **not specified**

LHC Computing Perpectives in Spain for Run3 and HL-LHC

Tuesday, 22 March 2022 10:50 (20)

Abstract

Presenter(s) : VILLAPLANA, Miguel (IFIC (CSIC-UV))

Session Classification : Red Temática de Física del LHC

Contribution ID : **499** Type : **not specified**

COMCHA: Hardware accelerators for High Energy Physics

Tuesday, 22 March 2022 11:10 (20)

Abstract

Presenter(s) : Dr. OYANGUREN, Arantza (IFIC- Valencia)

Session Classification : Red Temática de Física del LHC

Contribution ID : **500** Type : **not specified**

Quantum Simulation and Quantum Phase Transitions of an extended Agassi model.

Tuesday, 22 March 2022 09:15 (15)

Abstract

Quantum simulations provide a fast-developing and powerful tool to realize the analysis of various physical systems of quantum nature and should be able to outperform classical computers and solve previously intractable problems. As such, many experimental setups are being proposed to validate the feasibility of the quantum simulation of different physical models. One prominent many-body quantum system in Nuclear Physics is the Agassi model, which is a two-level system that includes a combination of long range monopole-monopole and short range pairing interactions. An extended Agassi model that adds a more general pairing interaction, presents a very rich quantum phase diagram that gives rise to several quantum phase transitions (QPTs) of different character, making it of great interest in the field of QPTs. In this talk, we will present this model, propose an experimental setup for it's quantum simulation and analyze its QPTs using machine learning tools.

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Co-author(s) : GARCÍA-RAMOS, Jose-Enrique (University of Huelva); ARIAS, Jose (Universidad de Sevilla); PEDRO, Pérez Fernández (Universidad de Sevilla); LAMATA, Lucas (Universidad de Sevilla)

Presenter(s) : SÁIZ CASTILLO, Álvaro (Universidad de Sevilla)

Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **503** Type : **not specified**

Cross section studies of alpha clustering light nuclei

Monday, 21 March 2022 18:00 (15)

Abstract

There are several reactions that require a better understanding in Nuclear Astrophysics. The most relevant one is 12C(α,γ)16O. The reason for this is both the unmitigated importance of the reaction and the complexity of its cross section at the relevant energies of static helium burning (300 keV) which uncertainty is still undesirably large. As there is no state of natural parity to serve as a resonance for radiative capture in the energy region of interest, the total cross section originates from a sum of resonance tails and direct captures, both, to the ground and excite states of 16O. Among the resonance tails contributing are those of bound subthreshold states, i.e., the 1- state at -45 keV and the 2+ state at -200 keV below the ⍰+12C threshold [1]. One of the methods to study these contributions consists in determining all the important reduced α-widths of the subthreshold states by indirect measurements, that are more sensitive to the ⍰-width than the direct radiative capture measurement. With this aim, we propose to use the 19F(p,α)16O reaction to populate α-unbound states in 16O [2].

Another reaction of interest is 7Li(3H,n)9Be. Since long, 9Be has been thought to be produced in tiny quantities in big bang nucleosynthesis. However, network calculations of big bang nucleosynthesis yields, indicates that the 7Li(3H,n)9Be reaction, enhances the 9Be abundance by many orders of magnitude compare to that previously found, as [3,4] suggested. A way of estimating the cross section for 7Li(3H, n)9Be would be to infer it from data of the similar reaction, 7Li(3He,p)9Be, as this cross section is more simple to measure.

In this work, we present the experiments that we performed to study both reactions at CMAM facility (Madrid, Spain), one in Nov. 2020 for 19F(p,α)16O reaction and the other one in Feb. 2021. The experimental setup is identical and consists of 14 pixelated silicon detectors in 2x2 that cover forward angles from 27º to 87º [5], three telescopes with multi-segmented silicon detectors in 16x16 in the front that cover from 82º to 171º backwards and behind 3 silicon PAD detectors (just for the 7Li(3He,p)9Be reaction study). The telescope arrangement will allow us the discrimination between the proton channel and the competing deuteron channel originated from the 7Li(3He, d)8Be reaction. We will present an early stage of the analysis process for both reactions.

[1] L. Buchmann. The Astrophysical Journal 468 (1996) L127-L130.

[2] K.Spyrou, et. al. Z. Phys. A 357 (1997) 283-289

[3] J. R. King, et. al. The Astrophysical Journal 478 (1997) 778-786.

[4] M. Kusakabe, https://arxiv.org/abs/1208.4210

[5] L.M. Fraile, J. Äystö. Nuclear Instruments and Methods in Physics Research A 513 (2003) 287-290

Primary author(s) : GARCÍA TÁVORA, Vicente (IEM - CSIC); Prof. TENGBLAD, Olof (IEM - CSIC); Dr. GARCÍA BORGE, María José (IEM - CSIC)

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Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **504** Type : **not specified**

Consistency tests of the β+ decay of 8B with the R-Matrix formalism

Monday, 21 March 2022 17:45 (15)

Abstract

The study of 8B is of interest for both astrophysics and nuclear structure. From the astrophysical point of view, 8B is part of the hydrogen-burning chain that occurs inside the stars [1]. In addition, its decay is the source of high-energy solar neutrinos above 2 MeV being it the main contributor to what was known as the "solar neutrino problem" [2]. On the nuclear structure side, the β+ decay of 8B opens a window to the structure of 8Be. 8Be contains two notable features in the QEC-window of 8B: a broad 2+ state at 3 MeV [3] and a 2+ isospin doublet formed by its 16.6 and 16.9 MeV relatively narrow levels, the only known case of almost equal isospin mixing between nuclear states [4]. These three 2+ levels break in two α particles, gives rise to an α-continum spectrum.

Our team, in collaboration with our colleges of the MAGISOL (Madrid-Aarhus-Goteborg at ISOLDE) group, has conducted multiple experiments to study the structure of the 8Be nucleus, the most recent one is the IS633 experiment [5], which took place in May of 2017 at the ISOLDE facility at CERN in Switzerland. Its main goal was to characterize the feeding to the 2+ isospin doublet of 8Be through the β+ decay of 8B; the results were analysed by S.Viñals [5]. The feeding to the doublet was resolved for first time in a beta-decay work. The feeding to the 2+ states in 8Be was analysed using the R-Matrix formalism. This analysis concluded that, the 16.6 and 16.9 MeV states of 8Be are completely isospin mixed [6], in accordance with the theoretical predictions.

In this contribution, we present the current results and a continuation of the R-matrix analysis; in this new approach, we have imposed a series of constraints upon our data with the aim of testing the consistency of the present results when compared with previous experiments [7].

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Co-author(s) : GARCIA BORGE, Maria Jose (ISOLDE-CERN); Prof. TENGBLAD, Olof (IEM - CSIC); VIÑALS ONSÈS, Sílvia (CSIC - IEM)

Presenter(s) : FERNANDEZ RUIZ, Daniel (IEM-CSIC)

Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **505** Type : **not specified**

Experimental tests of a scanner prototype for medical imaging with protons developed at IEM-CSIC

Tuesday, 22 March 2022 10:20 (20)

Abstract

Proton therapy requires precise knowledge of the patient's anatomy to guarantee an accurate dose delivery [1]. X-ray computed tomography (CT) images are currently used to calculate the relative stopping power (RSP) needed for proton therapy treatment planning [2]. Recent studies indicate that tomographic imaging using protons has the potential to provide directly more accurate measurement of RSP with significantly lower radiation dose than X-rays [3].
The proton CT (pCT) scanner prototype developed at IEM-CSIC is composed of a tracking system of two double-sided silicon strip detectors, and the CEPA4 detector as the residual energy detector. Our pCT scanner prototype was tested at the Cyclotron Centre Bronowice (CCB) facility in Krakow, Poland during the first week of June 2021. The planar imaging capabilities of our pCT scanner prototype were studied using three different planar phantoms of aluminum and PMMA: a uniform phantom of PMMA, a cross-shaped phantom of aluminum and PMMA, and a Derenzo-type phantom of aluminum and PMMA. Planar images were reconstructed from pixelated detectors, and they were converted into continuous images by uniformly distributing the statistics of each pixel over the pixel area. With the pCT scanner prototype, it was possible to differentiate and localize the different materials that composed the phantoms. The images displayed great fidelity with respect to the actual shapes. The dimensions of the cross-shaped and Derenzo-type phantom were obtained by getting the grey-level profiles of different regions of interest (ROI) and fitting them to a super-Gaussian function, reporting their values within the full width at half maximum (FWHM) and full width at tenth maximum (FWTM). The spatial resolution of this pCT scanner prototype was determined with the study of the Derenzo-type phantom. The scanner prototype was capable to resolve structures with sizes up to 2 mm and 3 mm while using proton beams of 100 MeV and 110 MeV, respectively. Likewise, volumetric phantoms composed of cylindrical matrices made of PMMA with air, alcohol, and water structures were imaged at different angular positions. Current work is being done to generate the tomographic reconstruction of the three-dimensional phantoms. The continuation of this work includes a new experiment that will be carried out during April 2022 at the CCB facility. This new experiment aims to study more complex phantoms with proton beams with energies around 200 MeV.
In this conference, I will present the planar imaging capabilities of our pCT scanner prototype we obtained, alongside the status of the tomographic reconstructions of the imaged volumetric phantoms.

References

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Session Classification : Investigación orientada, tecnología e innovación

Track Classification : Investigación orientada, tecnología e innovación

Contribution ID : **506** Type : **not specified**

Relative biological effectiveness in the spatial fractionation of hadron therapy beams.

Monday, 21 March 2022 15:15 (15)

Abstract

RELATIVE BIOLOGICAL EFFECTIVENESS IN THE SPATIAL FRACTIONATION OF HADRON THERAPY BEAMS.

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-INTRODUCTION-

Radiotherapy is the treatment of cancer using ionizing radiation for curative or palliative purposes. From the Physics perspective, these treatments are prepared through the study of the interactions between the radiation with the tumour and its surrounding healthy tissue. Due to the complexity of the situation, the precise design of these treatments with analytical tools is an impossible endeavour. Hence, we need to use numerical tools such as Monte Carlo simulations in order to examine these processes.

The most widespread sources used in these therapies are electrons and photons. The use of hadrons may improve the effectiveness of the treatment for certain types of cancer and patient profiles. Furthermore, they can spare a larger proportion of the healthy tissue surrounding the tumour. This effect is rooted in the most basic physical properties of hadrons.

At present, more than 10,000 patients have been treated with 12C in the HIMAC and, in the HIT, patients are being treated with 4He and the treatments with 16O are being developed. This technique combined with the spatial fractionation of the beams increases their efficacy and reduces the secondary effects considerably. Theoretical and preclinical studies have been carried out in which the great effectiveness of 20Ne ions is demonstrated [1, 2]. The aim of this work is to compare the biological doses obtained through the use of the spatial fractionation of 4He, 12C and 20Ne ions using the Monte Carlo simulation.

-MATERIALS & METHODS-

Based on the optimization carried out by González et al. [1] we implemented a program in Geant4 and FLUKA Monte Carlo (MC) codes, to calculate dose and the dose-average linear energy transfer (LETd), quantities that help us assess the biological effectiveness of a particle source.

Three different rectangular minibeams were used as sources. The 4He with dimension of 900 um x 2 cm, the 12C with dimension of 600 um x 2 cm and the 20Ne with dimension of 500 um x 2 cm, the others simulation parameters used were similar to values reported in the reference [1].

From the dose and the LETd values obtained by MC, the Relative Biological Effectiveness (RBE) was estimated for the Human Salivary Gland (HSG) cell lines. The RBE calculation was performed adjusting the values presented by Furusawa et al. [3] for the ions studied.

-RESULTS-

The values obtained for the physical dose and the LETd of the 12C and 20Ne ions are very similar to those published by González et al. 2017 and 2018 [1] [4], as we use very similar conditions for the simulations.

We found that the ratio between the dose at the tumour site and normal tissue is much higher in the 20Ne level compared to 12C. However, for the conditions of our study, it is observed, that the biological dose of the 20Ne beam decrease inside the tumor region. This is due to the fact that the dependence between alpha and LETd for HSG cells becomes maximum for values of 150 keV/um. At a depth of 70 mm, that LETd value is already exceeded (>150 keV/um), the alpha values begin to decrease as a result of the overkill effect and so does the biological dose.

-CONCLUSIONS-

• For high energies (> 200 MeV per nucleon) significant differences are found in the dose and LETd values between the two simulation codes used.

• Depending on the response of the tumour cell lines to LETd, the most suitable ion will depend on the depth of the lesion to be treated.

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Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **508** Type : **not specified**

Search of causal Feynman integrals with quantum algorithm

Abstract

We present a novel benchmark application of a quantum algorithm to Feynman loop integrals. The two on-shell states of a Feynman propagator are identified with the two states of a qubit and a quantum algorithm is used to unfold the causal singular configurations of multiloop Feynman diagrams. To
identify such configurations, we exploit Grover's algorithm for querying multiple solutions over unstructured datasets, which presents a quadratic speed-up over classical algorithms when the number of solutions is much smaller than the number of possible configurations. A suitable modification is introduced to deal with topologies in which the number of causal states to be identified is nearly half of the total number of states. The output of the quantum algorithm in IBM Quantum and QUTE Testbed simulators is used to bootstrap the causal representation in the loop-tree duality of representative multiloop topologies. The algorithm may also find application and interest in graph theory to solve problems involving
directed acyclic graphs.

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Track Classification : Física Teórica

Contribution ID : **510** Type : **not specified**

Z'-explorer: confronting Z' models against LHC data

Abstract

Z' boson is a hypothetical mediator that appears in a wide variety of New Physics models, and Z' searches at the LHC have been performed in all SM visible channels, providing limits that must be taken into account non-trivially at the time of constraining each BSM proposal. To ease this task, we present a software, Z'-explorer, to automatically test Z' models against LHC data. By simply providing couplings and decay widths, Z'-explorer allows exploring the parameter space of a given model, determining the most sensitive visible channel for Z' exclusion/detection. We also present a software update, Z'-explorer 2.0, which includes a minimal extension to dark sectors, providing the possibility to explore Z' as an s-channel mediator to fermionic dark matter. This talk is based on 2005.05194 and 2109.13194.

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Track Classification : Física Teórica

Contribution ID : **514** Type : **not specified**

Gauge dependence in QCD correlation functions

Abstract

Correlation functions are the building blocks in quantum field theory, from which any physical observable can be (in principle) calculated. In a theory with gauge symmetry, however, correlation functions are not physical objects, being dependent on the particular gauge fixing prescription. In this work a novel approach is presented, which allows to separately calculate, within the class of linear covariant gauges, the gauge dependent part of an arbitrary correlation function. This framework, which consists in introducing a Stueckelberg field and other auxiliary fields in the theory, allows to generalize the Landau-Khalatnikov-Fradkin transformations, known in quantum electrodynamics, to the case of non abelian gauge symmetry. Consistency checks have been carried out by calculating the gauge dependent parts of the gluon propagator at the one loop level and of the quark propagator at the two loops level.

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Presenter(s) : Dr. DALL'OLIO, Pietro

Track Classification : Física Teórica

Contribution ID : **516** Type : **not specified**

Probing nucleon 3D structure at the Electron-Ion Collider

Abstract

In this talk I will discuss how the future Electron-Ion Collider can help us better understand the 3-dimensional partonic structure of nucleons, in particular transverse-momentum-dependent functions, focusing on di-jet and heavy-quark production processes.

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Track Classification : Física Teórica

Contribution ID : **518** Type : **not specified**

Transverse-momentum structure of the proton

Abstract

After fifty years of investigations, the nucleon structure is still far from being understood and continues to represent a unique test bench for QCD. Despite the enormous progresses achieved in five decades of deep-inelastic scattering (DIS) experiments, a number of crucial open questions are still on the carpet and subject of intense theoretical and experimental studies. In the last two decades, semi-inclusive DIS was established as a unique tool for the study of the non-collinear structure of nucleons, involving the parton transverse momentum pT as an additional degree of freedom. Requiring the detection of at least one final state-hadron in coincidence with the scattered lepton, it opened the way not only to measure of the chiral-odd transversity distribution, the last missing leading-twist collinear parton distribution function, but also to a variety of new pT-dependent PDFs, known as TMDs. Describing correlations between the quark transverse momentum and the quark or the nucleon spin (spin-orbit correlations), TMDs account for a number of intriguing effects observed in polarized and unpolarized reactions, and allow for a 3-dimensional description of the nucleon in momentum space. Furthermore, they could provide insights into the yet unmeasured quark orbital angular momentum. At leading-twist, eight TMDs enter the SIDIS cross section in conjunction with a fragmentation function. In addition, going to the twist-3 level allows us to probe novel quark-gluon correlations.

The HERMES experiment collected a wealth of data using the 27.6 GeV polarized HERA lepton beam and various polarized and unpolarized gaseous targets. This allows for a series of unique measurements of observables sensitive to this multidimensional (spin) structure of the nucleon, probed through specific azimuthal modulations in the distribution of hadrons produced in semi-inclusive DIS. Amplitudes of some of these modulations sensitive to the beam and/or target polarization, recently extracted for the first time also in a three-dimensional kinematic space, will be presented in more detail.

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Track Classification : Física Teórica

Contribution ID : **521** Type : **not specified**

Monte Carlo simulations for proton beams supported by a Fano test

Monday, 21 March 2022 15:30 (15)

Abstract

-Introduction-

Monte Carlo simulations have been traditionally used to calculate ionization chamber dose responses for photons and electron beams in an accurate way. In these type of calculations, there are uncertainties that come from the physical models and uncertainties related to the transport algorithms. The latter can be estimated using self-consistency tests. One of them is the Fano test, which based on the Fano theorem.

In this work, a Fano test is implemented to prove the feasibility of different Monte Carlo codes for proton transport (PENH, TOPAS and FLUKA). Optimal simulation parameters in each case have been determined, and this permits to use these codes for the calculation of the correction factors of ionization chambers used in protontherapy.

-Materials & Methods-

Using the reciprocity theorem, a geometry has been designed according to Ref. [1], to implement the Fano test for proton beams of 50, 100, 150, and 200 MeV, using the last version of the three Monte Carlo codes considered (PENH, TOPAS and FLUKA). First of all, the depth dose distribution in the chamber cavity has been obtained in order to analyze the charge particle equilibrium. Next, the effects produced by changing the transport parameters in the different codes has been studied.

-Results-

All the codes considered pass the Fano test for proton beams provided the contribution of the nuclear reactions are fully neglected; otherwise the theoretical dose is overestimated and the Fano test is not fulfilled properly.

-Conclusions-

PENH, FLUKA and TOPAS fulfill the Fano test for monoenergetic proton beams from 50 to 200 MeV if nuclear reaction contributions are neglected in all the simulations. This result makes feasible using these Monte Carlo codes for the calculation of correction factors in ionization chambers used in protontherapy.

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Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **523** Type : **not specified**

Dependence of microdosimetric mean values on the cell nucleus size and eccentricity for radiopharmaceutical alpha emitters

Monday, 21 March 2022 16:45 (15)

Abstract

Radiopharmaceutical therapy (RPT) is based on the use of radiolabeled agents affine to antigens overexpressed in tumor cell environments. This type of treatment has the potential to improve outcomes for oncologic patients due to its ability to concentrate radiation in a small environment around the tumor.

This phenomenon is based on the much higher linear energy transfer (LET) of the alphas emitted together with their considerably shorter range as compared to beta emissions. In this work, we studied how the microdosimetric quantities are affected by the displacement of the cell nucleus and variations in its radius. Interestingly, microdosimetry can help in the assessment of the biological effect of these particles to fully take advantage of the features mentioned above.

Previously, an analytic algorithm was developed upon which microdosimetric quantities (yF, yD, zF, zD) were calculated for spherical cells whose membrane acted as uniform source [Bertolet et al. Radiat. Res. (2020)]. Besides exploring the influence of the eccentricity and radius of the nucleus, the analytic model was tested under these conditions.

To calculate the distribution of these microdosimetric quantities, Monte Carlo simulations were run with Geant4-DNA. Our preliminary results show that the microdosimetry quantities are not affected significantly by the cell nucleus position, while the dependence on the nucleus radius is clearly more significant. The analytical method agrees reasonably well with the Geant4 simulations.

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Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **524** Type : **not specified**

Study of deformed two-body weakly bound nuclei in the strong-coupling and application to reactions

Tuesday, 22 March 2022 10:15 (15)

Abstract

The structure of two exotic weakly bound nuclei (17C and 11Be) is studied with a 2-body model: a weakly bound neutron and the core. The core is considered to have a permanent quadrupole deformation and a single collective rotational degree of freedom, while the neutron moves under the deformed potential created by the core.

By diagonalizing the Hamiltonian on the basis of the transformed harmonic oscillator (THO), the wave functions and energies for the bound states and some resonances are obtained. The low-lying structure obtained for 17C and 11Be is tested by performing stripping and pick-up reactions, respectively. Good agreement is found by comparing with the experimental data from [Chin. Phys. Lett. 35 (2018) 082501] and [Phys. Lett. B 811 (2020) 135939].

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Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **527** Type : **not specified**

Probing pion's insight at future colliders: a glue-led structure

Abstract

Understanding the mechanisms in charge of "shaping" hadrons inside is among the most charming problems in physics. Indeed, new experimental facilities such as the EIC are planned, and an unprecedented amount of information about hadron's complexity is expected to arise. This work takes advantage of the current situation to perform the first systematic feasibility study of accessing pion's structure at an electron-ion collider. We employ state-of-the art models for generalized parton distributions to compute the amplitude for Deeply Virtual Compton Scattering (DVCS) in the one-pion exchange approximation at EIC kinematic. Predictions for the expected event-rates and beam-spin asymmetries are shown. We demonstrate that DVCS off virtual pions will be measurable at the EIC. Moreover, we evince that gluons play the dominant role, modulating the expected number of events through interference with the quark distribution. Finally, a sign-inversion for the observed beam-spin asymmetries is found to take place, triggering a clear signal for a glue-led regime.

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Track Classification : Física Teórica

Contribution ID : **528** Type : **not specified**

Reaction Cross Sections of the Short- and Long-lived β+ Emitters of Interest in PET Range Verification in Particle Therapy

Monday, 21 March 2022 15:45 (15)

Abstract

In PET-based beam range verification for particle therapy, new measurements and evaluations of the reaction cross-sections producing β+ emitters are required in order to compare the measured and simulated activity distribution in the patient.
We have conducted a comprehensive experimental campaign at several facilities using different ion beams in the therapeutic energy range and different PET imaging technologies to detect short-lived (online PET monitoring) and long-lived (offline PET monitoring) radionuclides. The following experimental data will be presented:
a) The proton-induced production of the long-lived 11C (t1/2=20 min), 13N (t1/2=9.9 min) and 15O (t1/2=2 min) isotopes produced in the main elements of the human body (C, N and O), measured at the Spanish National Center of Accelerators (CNA) up to 20 MeV, and at the West German Proton Therapy Center (WPE) from 30 up to 200 MeV.
b) The proton-induced cross-sections of the short-lived 12N (t1/2=11 ms) in C, 38mK (t1/2=0.92 s) in Ca and 29P (t1/2=4 s) in P up to 200 MeV and the carbon-induced cross-sections of 12N and 10C (t1/2=19 s) in C up to 400 MeV/u, measured at the Heidelberg Ion-Beam Therapy Center (HIT).
The relevance of the new data and future work to improve PET range verification will be discussed.

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Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **530** Type : **not specified**

Three-gluon vertex from quenched lattice simulations in general kinematics

Abstract

We present results for three-gluon vertex form factors in a relatively general kinematics using quenched lattice gauge theory. Three-gluon vertex is the key ingredient of Yang-Mills theory, reflecting its non-Abelian nature and serving as a unique testing ground for any non-perturbative approach such as Dyson-Schwinger techniques. In this work, we have focused on a partially asymmetric kinematic configuration containing both the symmetric (all moments are equal) and the asymmetric (one of the moments is zero) cases studied in the past as particular limits. We will pay special attention to the infrared limit, where a logarithmic singularity, related to the gluon mass generation mechanism and ghost masslessness, features a zero-crossing in both the symmetric and asymmetric cases.

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Presenter(s) : PINTO GÓMEZ, Fernando (Universidad Pablo de Oliavide)

Track Classification : Física Teórica

Contribution ID : **531** Type : **not specified**

Study of the 11Li+64Zn reaction at energy around the Coulomb barrier

Tuesday, 22 March 2022 10:30 (15)

Abstract

We present preliminary new data of the reaction 11Li+64Zn, recently measured at the radioactive nuclear beam facility of TRIUMF (Vancouver, Canada) at the energy of 22.5 MeV. The halo nucleus of 11Li is composed of a core nucleus of 9Li and two loosely bound neutrons. Due to the weakly bound structure, the dipole Coulomb polarizability strongly affects the elastic scattering at energies around the Coulomb barrier, producing a strong reduction of the elastic cross section with respect to the Rutherford cross section and a high breakup probability. During this talk, we discuss in detail the detection system and the analysis of the experimental data. Finally, we compare the preliminary experimental data with an optical model calculation, which includes a coulomb dipole polarization potential, and with Continuum-Discretized Coupled-Channels (CDCC) calculations considering a three-body model of 11Li.

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Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **532** Type : **not specified**

Axial-vector meson contributions to the HFS of muonic hydrogen

Abstract

Extremely precise measurements in muonic hydrogen allow to extract properties from the proton, due to its impact on the energy levels.
Such extractions require however from a commensurate precision for other contributions affecting the energy levels, such as two-photon exchange effects.
In this talk, we compute the axial-vector meson contribution to the hyperfine splitting of muonic hydrogen, that is relevant to assess the proton Zemach radius, finding significant differences with respect to previous estimates.

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Track Classification : Física Teórica

Contribution ID : **533** Type : **not specified**

In-vivo and inbeam monitoring of PET activation in proton therapy: tests in a chicken embryo model with 18O-enriched water

Monday, 21 March 2022 16:15 (15)

Abstract

Clinical PET imaging for in-vivo 3D activation verification in proton therapy suffers from two major drawbacks: minimal activation near the Bragg Peak region and biological washout. Here, we investigate the possibility of using 18O-enriched water (18-W) for in-vivo range verification in a clinical scenario. PET images are acquired with a novel in-beam system that can detect and process on-the-fly PET activity produced during and after irradiation.

Head and neck cancer cells were grown as xenografts in an in-vivo chick embryo chorioallantoic membrane (CAM) model. Three tumours were infused with 18-W, in vivo and irradiated with a clinical 80-MeV proton beam at the Quironsalud proton therapy center. Activity was recorded in two separated periods, during irradiation (beam-on) and decay (beam-off) with a specific PET setup consisting of 6 phoswich detector blocks with 338 pixels each, with of 1.55x1.55 x LYSO (7mm)+GSO (8mm) . The system was coupled to a fast data acquisition system able to sustain rates up to 10 Msingles/sec.

Dynamic 3D maps of the activity in the eggs were reconstructed from coincidences during irradiation, showing the spot structure of the treatment plan. Measured decay curves were correlated with dynamic PET images and 3D activity maps and fitted to a sum of exponentials including the decay of 11C, 13N, 15O and 18F, to obtain the individual contribution for each isotope.

3D PET activity maps during irradiation can be reconstructed in a clinical scenario with sub-ms and sub-mm resolutions. Decay analysis shows specific activity of 18F close to the tumour area several minutes after irradiation. This validates the experimental setup for its use for in-beam on-the-fly reconstruction of the 3D activity spatial distribution as well as late specific 18F activity entrapped in the tumour.

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Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **534** Type : **not specified**

Mapping the SMEFT to discoverable models

Abstract

The Standard Model Effective Field Theory (SMEFT) has proved a suitable framework to study extensions of the Standard Model in a bottom-up approach. \\
In this project we focus on minimal extensions of the SM that will generate certain 4-fermion operators in the SMEFT and use constraints on the Wilson coefficients to derive bounds on the particle masses in said extensions.\\
However, only a finite number out of these in theory infinitely many models will be phenomenologically interesting.
Allowing only for models that provide an interplay between direct and indirect search and avoid charged Dark Matter leads to a bunch of restrictions that make a classification of these models non-trivial. \\
At this stage we use the \textit{ModelGenerator}, a tool built in Mathematica, for a systematic approach to classify these interesting models.

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Track Classification : Física Teórica

Contribution ID : **535** Type : **not specified**

Triple Higgs couplings in the 2HDM and their impact at e+e− colliders

Abstract

Two Higgs doublet models (2HDM) are one of the simplest and most popular extensions to the SM and predict very different scalar interactions compared to the SM. These new interactions include new triple couplings of the SM-like Higgs bosons with itself and with the new Higgs bosons present in the 2HDM. In consequence, these new triple Higgs interactions can enter at tree-level in the cross section production of two Higgs bosons. In this talk, we analyze the main production channels at e^{+}e^{-} colliders in the 2HDM, namely e^{+}e^{-}\to h_{i}h_{j}\nu\bar{\nu} and e^{+}e^{-}\to h_{i}h_{j}Z with h_{i}h_{j}=hh,\ hH,\ HH\ \text{or}\ AA, and we study the possible effects coming from the triple Higgs couplings. The results of the cross sections are presented in benchmark planes where large triple Higgs couplings can be realized inside the region allowed by all the relevant theoretical and experimental constraints. We also discuss on the relevance of studying the differential cross section on the invariant mass of the two final Higgs bosons to extract the effects of the triple Higgs couplings at future e^{+}e^{-} colliders. We explore the differential cross sections for several benchmark points and sizable effects from \lambda_{hhh}, \lambda_{hhH}, \lambda_{hHH} and \lambda_{hAA} are found, specially at large center-of-mass energies in the h_{i}h_{j}\nu\bar{\nu} production channel.

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Track Classification : Física Teórica

Contribution ID : **536** Type : **not specified**

Latest advances in a Compton camera for medical applications

Tuesday, 22 March 2022 11:00 (20)

Abstract

The IRIS group of IFIC has completed the development, characterization and first tests of MACACO III Compton camera. The system performance has been enhanced through the use of new photodetectors and readout electronics (the AliVATA board) and of neural networks in the data analysis. In addition, tests are being carried out with alternative electronics (the ASIC TOFPET2 from PETsys) in order to improve the timing resolution and readout speed. The system is being evaluated both for hadron therapy treatment monitoring and for radiotracer imaging.

In-beam tests have been carried out in different locations. At the National Accelerator Center (CNA) in Sevilla, tests were carried out with 18 MeV protons impinging a graphite target to produce 4.4 MeV photons. The target was moved in 1 mm steps which were detected by the system. In the clinical gantry of Krakow's protontherapy centre, with a proton beam impinging a RW3 phantom at different energies around 90 MeV, range variations of 2 mm have been detected in a preliminary analysis. Furthermore, background reduction strategies are being implemented to improve the signal-to-noise ratio of the reconstructed images. The use of silicon sensors to reject secondary particles interacting in the Compton camera results in a reduction of the image background, according to simulations. This method has been patented and experimental verification is also ongoing.

Moreover, tests have been initiated with the system to image radiopharmaceuticals for diagnostic or treatment assessment purposes. Initial tests have served to image successfully a home-made Derenzo-like phantom filled with 18F-FDG. The phantom has four sectors with rods ranging from 6 to 3 mm and is placed at a distance of 30 mm from the first detector. The 4 mm rods are clearly visible and improvements are ongoing.

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Session Classification : Investigación orientada, tecnología e innovación

Track Classification : Investigación orientada, tecnología e innovación

Contribution ID : **537** Type : **not specified**

Estado y perspectivas de la fuente de neutrones HiSPANoS del CNA

Tuesday, 22 March 2022 09:00 (15)

Abstract

HiSPANoS (Hispalis Neutron Source) es la primera fuente de neutrones basada en aceleradores de partículas de España. En los últimos años una actualización llevada a cabo en el acelerador tándem de 3 MV del Centro Nacional de Aceleradores (CNA) ha permitido disponer de haces de iones pulsados y comprimidos en pulsos del orden del nanosegundo, lo que ha permitido convertir a HiSPANoS también en la primera línea de tiempo de vuelo (TOF) de neutrones de nuestro país.
En HiSPANoS los neutrones son producidos mediante reacciones nucleares tales como (p,n), (d,n) o (α,n) que nos permiten producir neutrones rápidos, epitérmicos y térmicos (mediante moderación), dependiendo del blanco de producción utilizado y de la energía del haz de iones incidente.
En este trabajo se presentarán los últimos estudios realizados para la caracterización de los haces pulsados de iones y del tiempo de vuelo para neutrones rápidos. Además, se mostrarán distintos experimentos llevados a cabo tanto por el equipo local como por usuarios externos como muestra de las diferentes aplicaciones y perspectivas de nuestra instalación de neutrones: caracterización de detectores de neutrones, imagen, medida de campos de neutrones con interés en física médica, irradiación de yemas de frutales para modificaciones genéticas, medidas de reacciones (n, chp), y producción de neutrones mediante reacciones (α,n), entre otras.

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Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **539** Type : **not specified**

Measurement of thick target total neutron yields for the 27Al(alpha,n)30P reaction at CMAM using the miniBELEN neutron counter

Tuesday, 22 March 2022 09:30 (15)

Abstract

Abstract
Neutron production through α-induced nuclear reactions is relevant in several fields. Specifically, (α,n) reactions are interesting in nuclear astrophysics as a source of neutrons for the slow neutron capture nucleosynthesis (the s-process) [TAI16] and in the α-particles capture process (the α-process) [WOO92, BLI17]. Other fields of interest include the neutron-induced background in underground laboratories [BET10], which is a crucial issue in low counting rate experiments, and in nuclear facilities such as nuclear reactors and particle accelerators [MUR02]. Currently, evaluated data is available only for a limited number of isotopes and the databases present large discrepancies in some cases.

The Measurement of Alpha Neutron Yields and spectra (MANY) collaboration is a coordinated effort by several Spanish research groups with the aim to carry out measurements of (α,xn) reactions yields, cross-sections and spectra. The project relies on the use of α-beams produced by the accelerators at Centro de Micro-Ánalisis de Materiales (CMAM, Madrid, Spain) and Centro Nacional de Aceleradores (CNA, Seville, Spain).

In this work we report the results of the measurement of thick target total neutron yields from the 27Al(alpha,n)30P reaction. This measurement has been part of the commissioning of the miniBELEN detector, a novel modular and transportable neutron long counter, and the 45º beam-line at CMAM for the MANY program in (alpha,n) reactions. The design and the experimental characterization of miniBELEN using 252Cf neutron sources will be also presented.

Acknowledgments
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Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **540** Type : **not specified**

Primeros experimentos en una fuente de neutrones impulsada por láser para la medida de reacciones nucleares

Monday, 21 March 2022 15:00 (15)

Abstract

Los láseres de alta potencia (~PW) y pulso ultracorto (~fs) se presentan como una alternativa prometedora a los aceleradores convencionales para la producción de haces de neutrones. Estas fuentes de neutrones impulsada por láser (LDNS por sus siglas en inglés), de pulso corto y alto flujo instantáneo, resultan especialmente atractivas para las aplicaciones en física nuclear basadas en la técnica de tiempo de vuelo. Sin embargo, es necesario caracterizar las condiciones experimentales asociadas a este tipo de fuentes ya que afectan a la respuesta de los detectores comúnmente utilizados en medidas de reacciones nucleares.

Este trabajo recoge los resultados preliminares de una campaña experimental desarrollada en otoño de 2021 en la instalación láser DRACO (PW) del Centro Helmholtz Dresden-Rossendorf (HZDR) en Dresde, Alemania, con el objetivo de estudiar la viabilidad de llevar a cabo medidas de reacciones nucleares en el complejo entorno de una LDNS.

Mientras que los trabajos anteriores se han realizado, o bien con alta tasa de repetición pero con baja potencia, o bien con alta potencia (PW) pero con baja repetición (modo single-shot); en DRACO hemos conseguido producir haces de neutrones de alta repetición (~200 disparos al día) en un sistema de alta potencia. La producción de un haz con alta frecuencia nos ha permitido utilizar, además de centelleadores y detectores de burbujas convencionales, un detector de diamante con baja eficiencia para medir señales individuales debidas a las interacciones de neutrones rápidos, lo que constituye el primer paso hacia los experimentos de reacciones inducidas por neutrones rápidos en una LDNS.

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Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Investigación orientada, tecnología e innovación

Contribution ID : **541** Type : **not specified**

Radiografía, gammagrafía, imagen de neutrones y tomografía: capacidades de imagen en el Centro Nacional de Aceleradores.

Tuesday, 22 March 2022 10:40 (20)

Abstract

El Centro Nacional de Aceleradores (CNA) es una instalación científico-técnica singular de carácter multidisciplinar situada en el Parque Científico-Tecnológico de la Isla de la Cartuja en Sevilla. Entre sus instalaciones podemos destacar un Acelerador Tándem de 3 MV, donde se ha instalado la primera fuente de neutrones basada en aceleradores de partículas de España, un acelerador ciclotrón de 18/9 MeV y un irradiador de 60Co. Asimismo, el CNA dispone de escáner PET/TAC de uso clínico y tubos de rayos X portátiles usados para estudios de fluorescencia de rayos X.

Aprovechando la complementariedad de las distintas fuentes de irradiación disponibles en el CNA, en los últimos años se han desarrollado varias campañas con el objetivo de estudiar el potencial del centro en técnicas de análisis por imagen. En este contexto, se han utilizado cámaras, sensores CCD y centelleadores comerciales para producir radiografía con rayos X, rayos gamma y neutrones, tanto térmicos como rápidos. En este trabajo, se presenta la optimización del setup experimental tanto en resolución como en calidad y tiempo de exposición de las imágenes obtenidas; así como los resultados preliminares del análisis no destructivo realizado a objetos de interés arqueológico y patrimonio cultural. Recientemente se ha adquirido una mesa rotatoria comercial que nos permite llevar a cabo tomografías. Estas han sido aplicadas exitosamente con rayos gamma y con neutrones tanto a objetos arqueológicos como a modelos de hallazgos arqueológicos reales.

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Session Classification : Investigación orientada, tecnología e innovación

Track Classification : Investigación orientada, tecnología e innovación

Contribution ID : **542** Type : **not specified**

Penning-Trap Mass Spectrometry in Granada: Novel Techniques

Tuesday, 22 March 2022 10:00 (15)

Abstract

Penning-trap mass spectrometry provides the most precise and accurate mass values of elementary charged particles to super-heavy elements. Still, there is room for improvement in aspects such as the attainable mass-to-charge ratio or the sensitivity that motivates further developments. At the University of Granada, we are developing a new technique based on fluorescence detection through a 40Ca+ sensor ion using the TRAPSENSOR facility. The scattered photons will be used to measure the normal mode eigenfrequencies of the unbalanced crystal formed by this ion and a target one [1] when the crystal is cooled to the ground state of motion [2]. This technique is universal (for any mass-to-charge ratio), non-destructive and only one target ion is needed.
In this contribution, we will present the status of the TRAPSENSOR facility [3] and the recent results. So far, laser cooling to the Doppler limit of externally produced ions and the formation of crystalline structures have been achieved [4]. In parallel, we have built a laser-desorption ion source which has been tested for ions of interest such as thorium or rhenium, of importance in the field of nuclear clocks and neutrino mass measurements, respectively. We will also comment on the results obtained using an alternative approach to the well-known induced-current detection method using superconducting coils. Our approach is based on quartz crystals as room-temperature high quality-factor resonators, for which we have demonstrated a novel feature of faster detection [5]. Finally, we will summarize the perspectives for the implementation of the new technique in the quantum regime using an ultra-high finesse laser cavity to access the 40Ca+ clock transition.

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Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **543** Type : **not specified**

HENSA/ANAIS: measuring the neutron flux at the Canfranc Underground Laboratory for dark matter purposes

Monday, 21 March 2022 17:30 (15)

Abstract

The High Efficiency Neutron Spectrometry Array (HENSA) is a detection system based on the Bonner Spheres principle [THO02]. In order to be sensitive at different energy ranges, HENSA is composed by ten independent long 3He-filled proportional counters embedded in High Density PolyEthylene (HDPE) moderators with different sizes. The neutron flux spectrum is unfolded from the experimental counting rates by means of appropriate reconstruction algorithms. Key to the reliability of the reconstruction process is the use of a priori information. This is typically achieved by means of Monte Carlo calculations or from previous measurements.

Early versions of HENSA have already been used for the characterization of the neutron background at the Canfranc Underground Laboratory (LSC), before the start of the scientific experiments [JOR13], and in the shallow underground facility Felsenkeller in Dresden [GRI20]. Currently, a long term characterization of the neutron flux is being carried out the LSC: in hall A from October 2019 [ORR21] and in hall B since March 2021 [MON21]. Measurements in hall B are foreseen during 2022 and 2023.

The HENSA/ANAIS collaboration aims for the precise determination of the neutron flux at hall B of the Canfranc Underground Laboratory, that could affect ANAIS-112, an experiment looking for the dark matter annual modulation using NaI scintillators [AMA21]. In this work we present and discuss the current status of the measurements in hall B of the LSC. In addition, FLUKA Monte Carlo calculations of the neutron flux spectrum at the LSC will be reported.

Acknowledgments
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Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **544** Type : **not specified**

Study of beta decay properties for Pr to Nd nuclei (A~160) relevant for the formation of the r-process rare-earth peak

Tuesday, 22 March 2022 10:45 (15)

Abstract

Around half of the nuclei heavier than iron are created via the rapid neutron capture process (r-process). For nuclear masses A>100, there are two main peaks in the r-process elemental solar system abundances, located at A~130 and A~195, which are associated with the neutron shell closure during the (n,γ)⟶(γ,n) equilibrium. In contrast, the rare-earth peak (REP) is a small - but clear - peak around mass A=160, which originates from the freeze-out during the late phases after neutron exhaustion. The formation of the REP offers a unique probe for the study of the late-time conditions on the r-process site. According to theoretical models and sensitivity studies, half-lives (T1/2) and beta-delayed neutron emission probabilities (Pn) of very neutron-rich nuclei for 55< Z<64 are the most influential ones on the formation of the REP [1,2].
The BRIKEN project [3,4], launched in 2016 at the RIBF in the RIKEN Nishina Center, aims to measure beta-decay properties for a large number of nuclei on the path of the r-process. Accordingly, T1/2 and Pn-values for the most influential nuclei to the REP formation from Ba to Eu (A~160) have been measured for the first time with BRIKEN. In this work, the measurements of T1/2 and beta-delayed neutron branching probabilities (P1n) for several Pr and Nd isotopes in the mass region A~160 will be discussed. Preliminary experimental results on P1n-values will be presented for the first time.

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Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **545** Type : **not specified**

Study of dead time and pileup corrections for measurements secondary neutrons in proton therapy with moderated He3-filled detectors and digital acquisition systems

Monday, 21 March 2022 16:00 (15)

Abstract

Proportional neutron counters, such as He3-filled tubes, are the most efficient and widely used thermal neutron sensors. These detectors are based on the reaction mechanism He3(n,p)H3 with a Q-value of 764 keV. For fast neutron counting applications, proportional counters are typically embedded in neutron moderator materials. Neutron proportional counters have a relatively low gamma sensitivity, thus being well suited for counting applications in mixed neutron/gamma radiation fields. Dead time and pileup effect can be limiting factors in high neutron counting rate experiments with proportional counters. Pileup takes place when two or more detected events occur close enough in time that the measurement system responds as if it is a single event. The characteristic rise time of the pulse signal in a He3 proportional counter is fairly slow compared with other detectors (~ 4-8 us). For this reason, integration times of several microseconds should be used in the counting electronics. In practice, for these kinds of detectors, corrections due to dead time and pileup are required at counting rates ~5 kcps. The present work is motivated by measurements of secondary neutrons produced in proton therapy facilities at clinical conditions, where the proper assessment of dead time and pileup corrections is required at counting rates in the range typically from 10 – 50 kcps.

In this work, we have studied dead time and pileup corrections when using a self-triggered Digital Acquisition System (DAQ). In particular, it is used the GASIFIC DAQ [1] which is based on the SIS3316 digitizer module from Struck [2]. The GASIFIC DAQ relies on a trapezoidal digital filter which is implemented in the firmware of the SIS3316 digitizer. The GASIFIC DAQ is a non-paralizable system [3] by construction.

For this study, an algorithm that emulates the DAQ firmware has been developed. The algorithm has been validated with experimental waveform samples from low and high counting rate measurements. Finally, a simulation code for the reconstruction of the full data stream has been developed. The simulation reconstructs the observed trigger rate and energy deposited spectrum, in the He3 neutron counter, from experimental waveforms from single events. The reconstruction enables the estimation of the real neutron counting rate producing the observable information in the measurement. The application of this technique for measurements of stray secondary neutrons in proton therapy at clinical conditions (~30 kcps) is discussed.

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Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **546** Type : **not specified**

Spectrometry of cosmic-rays neutrons with HENSA: project status and future developments

Monday, 21 March 2022 18:15 (15)

Abstract

Neutrons are produced continuously as a secondary radiation from cosmic-rays interactions in the upper atmosphere of our planet. The characterization of such secondary neutrons is connected with different fields such as environmental radioactivity [1], single event upsets (SEUs) in microelectronics [2], the physics of cosmic-rays and space weather [3].
In this work, the High Efficiency Neutron Spectrometry Array (HENSA) is presented [4]. HENSA is intended for high efficiency measurements of cosmic-rays neutrons and the neutron background in underground facilities [5]. The operation of HENSA is based on the same principle that the Bonner Spheres Spectrometers (BSS) [6]. A topological modification of the detector geometry has enabled to improve the detection efficiency between 5 up to 10 times over the standard BSS [6]. The current version of HENSA is composed by an array of ten He-3 tubes, each one embedded in different materials including high density polythylene moderators, cadmium shieldings and lead neutron converters. This setup allows for spectral sensitivity from thermal up to GeV's neutrons. For cosmic-rays neutrons, the high detection efficiency of HENSA provides near real-time measurements of the neutron spectrum on a time scale of tens of minutes up to few hours, thus enabling possible applications in space weather as a neutron monitor with spectral sensitivity. Moreover, in 2020 HENSA has been used to map the cosmic-rays neutron background along the spanish territory in quiet solar conditions during the beginning of the solar cycle #25. Currently, a new version of HENSA, called HENSA++, is being developed for space weather applications. In HENSA++, the total number of detectors is increased up to 15 in order to improve the spectral resolution at intermediate (1 eV − 100 keV) and high (20 − 300 MeV) energies, respectively. In the present work, the status of the design methodology for HENSA++ and the challenges for the reconstruction of wide energy range spectra (thermal up to 1 GeV) from BSS measurements are discussed. Preliminary results from the 2020 cosmic-rays neutrons campaign with HENSA are also presented.

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Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **547** Type : **not specified**

The Higgs boson: a promising portal to New Physics

Abstract

The Higgs boson, responsible for the mass of the SM fundamental particles, plays a central role in propounding New Physics (NP) that might shed some light on the still unanswered questions present within the standard frame of particle physics. For example, the appearance of resonances in the scattering of longitudinally polarized vector bosons (intimately related to the Higgs mechanism) would be a clear indication of the presence of such NP.

In this presentation I will talk about the importance of the Higgs particle to unravel the questions that we do not get to understand using the standard framework and then focus on the advances in our phenomenological studies on vector boson scattering (VBS) to look for new heavy resonant states.

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Track Classification : Física Teórica

Contribution ID : **548** Type : **not specified**

Methodology for improving the local neutron dose equivalent determination in mixed radiation fields of protons and neutrons using PADC based dosimeters.

Monday, 21 March 2022 16:30 (15)

Abstract

The Radiaton Physics Group at Universitat Autònoma de Barcelona (UAB) uses Poly-Allyl-Diglicol-Carbonate (PADC) based passive dosimeters in order to measure the neutron component in general mixed radiation fields, including those encountered in proton radiotherapy. Essentially, the whole dosimeter is constituted by a layer of PADC and several layers of diverse materials acting as neutron converters, in which incident neutrons produce protons. These protons originate submiscroscopic damage (latent tracks) in the PADC, which can be afterwards enhanced through an electrochemical process that allows visualising and counting the tracks and, therefore, quantifying the neutron field. The physics and working principles of this dosimeter are explained elsewhere [1]. One great advantage of this dosimeter is that it is not sensitive to the photon component, so its use is of specific interest in photon-neutron mixed fields. Our group participates in the task of characterizing the radiation field present in proton therapy installations in the frame of WG9 (Radiation dosimetry in Radiotherapy) of EURADOS (The European Radiation Dosimetry Group). One of the aims, is to determine the out-of-field dose equivalent due to neutrons at patient's radiological organs of interest. For this purpose, water slab and anthropomorphic phantoms are filled with several types of dosimeters, which need accurate and specific characterization.

We consider a mixed radiation field in a small volume constituted by neutrons and protons (let us disregard photons as the PADC dosimeter is intrinsically insensitive to them). In proton radiotherapy, protons can come from the scattered beam or from, essentially, "non-local" neutrons (far neutrons or neutrons not reaching the neutron converters). As the calibration coefficient of the entire dosimeter is obtained in, basically, a pure field of neutrons in calibration facilities, whereas in the real situation we can find protons reaching the PADC itself, therefore producing damage (etchable tracks), leading to an overestimation of the neutron dose equivalent. A methodology to deal with this problem is proposed and applied to results from a recent intercomparison of the response of several passive detectors in an irradiation campaign at CERF (The CERN-EU high-energy Reference Field) [2], in the frame of EURADOS-WG9, where a mixed radiation field of, at least, neutrons, photons and protons is present [2]. To employ this methodology, it is necessary to use Monte Carlo simulations to model the facility, as well as to know the probability of a neutron or proton reaching the dosimeter and the PADC layer. It is found that under this situation and under this model, up to 30 % of the track density of the PADC layer is coming from protons or, probably, non-local neutrons.

References:
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Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **549** Type : **not specified**

CTA status

Monday, 21 March 2022 15:00 (15)

Abstract

Presenter(s) : LOPEZ-COTO, Ruben (INFN-Padova)

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **550** Type : **not specified**

Science with the LST

Monday, 21 March 2022 15:20 (15)

Abstract

Presenter(s) : BERNARDOS MARTÍN, María Isabel (Instituto de Astrofísica de Andalucía - CSIC)

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **551** Type : **not specified**

Aprovechamiento innovador de telescopios Cherenkov: Interferometría de Intensidad

Monday, 21 March 2022 15:40 (15)

Abstract

Presenter(s) : JIMÉNEZ MARTÍNEZ, Irene (CIEMAT)

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **552** Type : **not specified**

Multi-Messenger Alert Broker

Monday, 21 March 2022 16:00 (15)

Abstract

Presenter(s) : ARTERO, Manuel (IFAE)

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **553** Type : **not specified**

Status and perspectives of continuous gravitational-wave searches with LIGO and Virgo

Monday, 21 March 2022 16:20 (15)

Abstract

Presenter(s) : PICCINNI, Ornella (IFAE)

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **554** Type : **not specified**

Implications for first-order cosmological phase transitions and the formation of primordial black holes from the third LIGO-Virgo observing run

Monday, 21 March 2022 16:40 (15)

Abstract

Presenter(s) : ROMERO-RODRÍGUEZ, Alba (IFAE)

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **555** Type : **not specified**

Axion search with the BabyIAXO helioscope: status and prospects

Monday, 21 March 2022 17:30 (15)

Abstract

Presenter(s) : ALTENMÜLLER, Konrad (CAPA, Universidad de Zaragoza)

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **556** Type : **not specified**

TREX-DM experiment at Canfranc Underground Laboratory

Monday, 21 March 2022 17:50 (15)

Abstract

Presenter(s) : PEREZ, Oscar (Universidad de Zaragoza)

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **557** Type : **not specified**

Measurement of the underground argon radiopurity for Dark Matter direct searches

Monday, 21 March 2022 18:10 (15)

Abstract

Presenter(s) : LUZZI, Ludovico

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **558** Type : **not specified**

DUNE Low Energy and Beyond the Standard Model Physics Studies

Tuesday, 22 March 2022 09:30 (15)

Abstract

Presenter(s) : CUESTA, Clara (Ciemat)

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **559** Type : **not specified**

ProtoDUNE-SP performance, results and future prospects

Tuesday, 22 March 2022 09:50 (15)

Abstract

Presenter(s) : GARCÍA PERIS, Miguel Ángel (IFIC (UV-CSIC))

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **560** Type : **not specified**

Scintillation Light Detection in DUNE Far Detectors

Tuesday, 22 March 2022 10:10 (15)

Abstract

Presenter(s) : PÉREZ-MOLINA, Laura (CIEMAT)

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **561** Type : **not specified**

Status of the NEXT experiment

Tuesday, 22 March 2022 10:30 (15)

Abstract

Presenter(s) : SIMÓN ESTÉVEZ, Ander (DIPC - University of Chicago)

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **562** Type : **not specified**

Applications of the scintillation light signals in the Short Baseline Near Detector

Tuesday, 22 March 2022 10:50 (15)

Abstract

Presenter(s) : NICOLÁS-ARNALDOS, Francisco Javier (University of Granada)

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **563** Type : **not specified**

T2K Status and plans

Tuesday, 22 March 2022 09:10 (15)

Abstract

Presenter(s) : ANTONOVA, Maria (IFIC, CSIC-Univ Valencia)

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **564** Type : **not specified**

Acoustic Studies for the KM3NeT deep-sea Neutrino Telescope

Tuesday, 22 March 2022 11:10 (15)

Abstract

Presenter(s) : DIEGO-TORTOSA, Dídac (Universitat Politècnica de València (UPV) – Institut d'Investigació per a la Gestió Integrada de Zones Costaneres (IGIC))

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **565** Type : **not specified**

The Upgrade of the T2K ND280 Detector

Tuesday, 22 March 2022 08:50 (15)

Abstract

Presenter(s) : LUX, Thorsten (IFAE)

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **566** Type : **not specified**

DarkSide-20k and the Future Liquid Argon Dark Matter Program

Monday, 21 March 2022 19:30 (15)

Abstract

Presenter(s) : PESUDO FORTES, Vicente (CIEMAT / LSC)

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **567** Type : **not specified**

Artificial Intelligence for background rejection in DEAP-3600

Monday, 21 March 2022 18:30 (15)

Abstract

Presenter(s) : CÁRDENAS MONTES, Miguel (CIEMAT)

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **568** Type : **not specified**

The CMB Lensing Imprint of Cosmic Voids

Monday, 21 March 2022 18:50 (15)

Abstract

Presenter(s) : DEMIRBOZAN, Umut Emek (IFAE)

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **569** Type : **not specified**

Cosmological radiation density with non-standard neutrino-electron interactions

Monday, 21 March 2022 19:10 (15)

Abstract

Presenter(s) : PASTOR, Sergio (IFIC, CSIC-Univ Valencia)

Session Classification : RENATA (Red Nacional Temática de Astropartículas)

Contribution ID : **570** Type : **not specified**

β Decay Spectra Determination for the Reactor Antineutrino Anomaly

Abstract

The Reactor Anomaly has been a source of great interest for the physics community in recent years(1).
The generally accepted Huber-Muller conversion model to calculate the antineutrino spectrum has raised several questions about the related experimental results and the different approximations used.
Improved measurements of nuclear data of relevant isotopes plus the use of the Summation Calculation
method for the determination of β decay spectra brings an alternative way of calculation. Moreover,
critical calculations of β decay spectra using standard data bases' β feedings currently suffer the problem of the Pandemonium Effect, which can be solved with the application of the Total Absorption
Gamma Spectroscopy (TAGS) method. Montecarlo tools, such as the use of a precise event generator
for simulations that takes into account: ɣ cascade branchings, β feedings, β spectra shapes, conversion
electrons and electron-positron pairs generation, are required to obtain reliable simulated β decay spectra. These simulations are essential to compare experiments to detailed theoretical calculations to
determine trustworthy reactors' antineutrino spectra predictions. The development of such computational tool and some advances of the collaboration's experiment of the measurement of relevant beta decay spectra with telescopic detectors will be discussed in this presentation.

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Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **571** Type : **not specified**

Highlights from the LHC Run-2 physics exploitation and prospects for Run-3

Tuesday, 22 March 2022 12:30 (30)

Abstract

Presenter(s) : JOSA, Isabel (CIEMAT)

Session Classification : Plenary Session

Contribution ID : **572** Type : **not specified**

Nuclear science and applications at IFMIF DONES

Tuesday, 22 March 2022 13:05 (30)

Abstract

Presenter(s) : CANO-OTT, Daniel (CIEMAT)

Session Classification : Plenary Session

Contribution ID : **573** Type : **not specified**

High Energy Multi-messenger Astronomy

Tuesday, 22 March 2022 13:40 (30)

Abstract

Presenter(s) : SALESA, Francisco (IFIC (CSIC-Univ Valencia))

Session Classification : Plenary Session

Contribution ID : **574** Type : **not specified**

Status of the Standard Model determination of the muon g-2

Tuesday, 22 March 2022 16:00 (30)

Abstract

Presenter(s) : HERDOIZA, Gregorio (IFT UAM-CSIC)

Session Classification : Plenary Session

Contribution ID : **575** Type : **not specified**

Latest results on light-sterile neutrinos: MicroBooNE experiment's first results

Tuesday, 22 March 2022 16:35 (30)

Abstract

Presenter(s) : CRESPO-ANADÓN, José I. (CIEMAT)

Session Classification : Plenary Session

Contribution ID : **576** Type : **not specified**

Pushing the QCD frontier, and more, at the future Electron-Ion Collider

Tuesday, 22 March 2022 17:40 (30)

Abstract

Presenter(s) : DALLA TORRE, Silvia (INFN Trieste)

Session Classification : Plenary Session

Contribution ID : **577** Type : **not specified**

Status of the detector upgrades for HL-LHC

Tuesday, 22 March 2022 18:15 (30)

Abstract

Presenter(s) : LACASTA, Carlos (IFIC (CSIC-Univ Valencia))

Session Classification : Plenary Session

Contribution ID : **578** Type : **not specified**

De protones interestelares al Flash radioinmunoterápico

Tuesday, 22 March 2022 18:50 (30)

Abstract

Presenter(s) : MAZAL, Alejandro (Centro de Protonterapia Quironsalud, Madrid)

Session Classification : Plenary Session

Contribution ID : **579** Type : **not specified**

Kilonova: an electromagnetic signal of heavy element nucleosynthesis

Tuesday, 22 March 2022 19:25 (30)

Abstract

Presenter(s) : MARTÍNEZ PINEDO, Gabriel (GSI and TU Darmstadt)

Session Classification : Plenary Session

Contribution ID : **580** Type : **not specified**

Physics potential for HL-LHC and next future circular colliders

Wednesday, 23 March 2022 09:05 (30)

Abstract

Presenter(s) : MANGANO, Michelangelo (CERN)

Session Classification : Plenary Session

Contribution ID : **581** Type : **not specified**

Accelerator and detector developments for future colliders; physics potential of e+e- linear colliders

Wednesday, 23 March 2022 09:40 (30)

Abstract

Presenter(s) : FUSTER, Juan A. (IFIC (CSIC-Univ Valencia))

Session Classification : Plenary Session

Contribution ID : **582** Type : **not specified**

Complementarities (and incompatibilities) in Dark Matter searches

Wednesday, 23 March 2022 10:15 (30)

Abstract

Primary author(s) : CIRELLI, Marco (LPTHE CNRS/Sorbonne Paris)

Presenter(s) : CIRELLI, Marco (LPTHE CNRS/Sorbonne Paris)

Session Classification : Plenary Session

Contribution ID : **583** Type : **not specified**

Future Large Facilities for the study of Gravitational Waves: The Einstein Telescope

Wednesday, 23 March 2022 11:15 (30)

Abstract

Presenter(s) : MARTÍNEZ, Mario (ICREA/IFAE)

Session Classification : Plenary Session

Contribution ID : **584** Type : **not specified**

Charla del equipo gestor del Plan Nacional y discusión

Wednesday, 23 March 2022 11:50 (70)

Abstract

Presenter(s) : MARTINEZ RIVERO, Celso (IFCA (CSIC-UC))

Session Classification : Plenary Session

Contribution ID : **585** Type : **not specified**

Inauguración

Tuesday, 22 March 2022 12:00 (30)

Abstract

Session Classification : Plenary Session

Contribution ID : **586** Type : **not specified**

Los patrones de las reacciones nucleares

Tuesday, 22 March 2022 11:15 (15)

Abstract

Las medidas de las secciones eficaces de las reacciones nucleares suelen hacerse referidas a un patrón que se toma como referencia bien conocida. Finalmente, la incertidumbre viene limitada por la precisión con la que puedan establecerse dichos patrones.
Se presentan las últimas contribuciones a la determinación de los patrones básicos de las reacciones inducidas por neutrones en los principales actínidos fisibles.

Primary author(s) : DURAN, IGNACIO (USC)

Presenter(s) : DURAN, IGNACIO (USC)

Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **587** Type : **not specified**

Gauge dependence in QCD correlation functions

Monday, 21 March 2022 15:00 (15)

Correlation functions are the building blocks in quantum field theory, from which any physical observable can be (in principle) calculated. In a theory with gauge symmetry, however, correlation functions are not physical objects, being dependent on the particular gauge fixing prescription. In this work a novel approach is presented, which allows to separately calculate, within the class of linear covariant gauges, the gauge dependent part of an arbitrary correlation function. This framework, which consists in introducing a Stueckelberg field and other auxiliary fields in the theory, allows to generalize the Landau-Khalatnikov-Fradkin transformations, known in quantum electrodynamics, to the case of non abelian gauge symmetry. Consistency checks have been carried out by calculating the gauge dependent parts of the gluon propagator at the one loop level and of the quark propagator at the two loops level.

Abstract

Presenter(s) : DALL'OLIO, Pietro (Universidad de Huelva)

Session Classification : Física Teórica

Contribution ID : **588** Type : **not specified**

Three-gluon vertex from quenched lattice simulations in general kinematics

Monday, 21 March 2022 15:15 (15)

We present results for three-gluon vertex form factors in a relatively general kinematics using quenched lattice gauge theory. Three-gluon vertex is the key ingredient of Yang-Mills theory, reflecting its non-Abelian nature and serving as a unique testing ground for any non-perturbative approach such as Dyson-Schwinger techniques. In this work, we have focused on a partially asymmetric kinematic configuration containing both the symmetric (all moments are equal) and the asymmetric (one of the moments is zero) cases studied in the past as particular limits. We will pay special attention to the infrared limit, where a logarithmic singularity, related to the gluon mass generation mechanism and ghost masslessness, features a zero-crossing in both the symmetric and asymmetric cases.

Abstract

Presenter(s) : PINTO GÓMEZ, Fernando (Universidad Pablo de Oliavide)

Session Classification : Física Teórica

Contribution ID : **589** Type : **not specified**

Triple Higgs couplings in the 2HDM and their impact at e+e− colliders

Monday, 21 March 2022 15:30 (15)

Two Higgs doublet models (2HDM) are one of the simplest and most popular extensions to the SM and predict very different scalar interactions compared to the SM. These new interactions include new triple couplings of the SM-like Higgs bosons with itself and with the new Higgs bosons present in the 2HDM. In consequence, these new triple Higgs interactions can enter at tree-level in the cross section production of two Higgs bosons. In this talk, we analyze the main production channels at e^{+}e^{-} colliders in the 2HDM, namely e^{+}e^{-}\to h_{i}h_{j}\nu\bar{\nu} and e^{+}e^{-}\to h_{i}h_{j}Z with h_{i}h_{j}=hh,\ hH,\ HH\ \text{or}\ AA, and we study the possible effects coming from the triple Higgs couplings. The results of the cross sections are presented in benchmark planes where large triple Higgs couplings can be realized inside the region allowed by all the relevant theoretical and experimental constraints. We also discuss on the relevance of studying the differential cross section on the invariant mass of the two final Higgs bosons to extract the effects of the triple Higgs couplings at future e^{+}e^{-} colliders. We explore the differential cross sections for several benchmark points and sizable effects from \lambda_{hhh}, \lambda_{hhH}, \lambda_{hHH} and \lambda_{hAA} are found, specially at large center-of-mass energies in the h_{i}h_{j}\nu\bar{\nu} production channel.

Abstract

Presenter(s) : ARCO GARCÍA, Francisco Manuel (IFT UAM-CSIC)

Session Classification : Física Teórica

Contribution ID : **590** Type : **not specified**

The Higgs boson: a promising portal to New Physics

Monday, 21 March 2022 15:45 (15)

The Higgs boson, responsible for the mass of the SM fundamental particles, plays a central role in propounding New Physics (NP) that might shed some light on the still unanswered questions present within the standard frame of particle physics. For example, the appearance of resonances in the scattering of longitudinally polarized vector bosons (intimately related to the Higgs mechanism) would be a clear indication of the presence of such NP. In this presentation I will talk about the importance of the Higgs particle to unravel the questions that we do not get to understand using the standard framework and then focus on the advances in our phenomenological studies on vector boson scattering (VBS) to look for new heavy resonant states.

Abstract

Presenter(s) : ASIÁIN, Iñigo (ICCUB- Universitat de Barcelona)

Session Classification : Física Teórica

Contribution ID : **591** Type : **not specified**

The new and gauge invariant Littlest Higgs Model with T-parity

Monday, 21 March 2022 16:00 (15)

In this talk we will first review the Littlest Higgs model with T-parity (LHT), based on the global symmetry group SU(5) broken spontaneously to SO(5), to highlight the pathologies it presents due to the non trivial interplay between the discrete T-parity symmetry and the non-linear realization of the global symmetry. In particular, we will show that the Yukawa Lagrangian responsible for providing mass terms for the heavy fermions is not gauge invariant because their right-handed components transforms in a non-linear representation of SO(5) and such a transformation does not commute, not even restricting to the gauged subgroup, with T-parity. To cure this issue, while preserving most of the structure of the original LHT, we propose to enlarge the global symmetry group with an extra [SU(2)xU(1)]^2 factor broken spontaneously to [SU(2)xU(1)] giving rise to new T-odd scalars. This also allows us to introduce the minimal set of fermionic degrees of freedom required to give masses to all fermions while preserving gauge invariance.

Abstract

Presenter(s) : Mr. PÉREZ-POYATOS, Jose María (Universidad de Granada)

Session Classification : Física Teórica

Contribution ID : **592** Type : **not specified**

Search of causal Feynman integrals with quantum algorithm

Monday, 21 March 2022 16:15 (15)

We present a novel benchmark application of a quantum algorithm to Feynman loop integrals. The two on-shell states of a Feynman propagator are identified with the two states of a qubit and a quantum algorithm is used to unfold the causal singular configurations of multiloop Feynman diagrams. To identify such configurations, we exploit Grover's algorithm for querying multiple solutions over unstructured datasets, which presents a quadratic speed-up over classical algorithms when the number of solutions is much smaller than the number of possible configurations. A suitable modification is introduced to deal with topologies in which the number of causal states to be identified is nearly half of the total number of states. The output of the quantum algorithm in IBM Quantum and QUTE Testbed simulators is used to bootstrap the causal representation in the loop-tree duality of representative multiloop topologies. The algorithm may also find application and interest in graph theory to solve problems involving directed acyclic graphs.

Abstract

Presenter(s) : RENTERIA, Andres (IFIC UV-CSIC)

Session Classification : Física Teórica

Contribution ID : **593** Type : **not specified**

Asymptotic expansions and causal representations through the loop-tree duality

Monday, 21 March 2022 16:30 (15)

Precision calculations needed to disentangle SM predictions from BSM effects involve the calculation of higher-order quantum corrections which pose technical challenges. An alternative to the traditional method has been proposed in the form of the loop-tree duality theorem. We present a newly found purely causal representation of the dual integrands and the definitions of several classes of multiloop topologies as well as their loop-tree duality representations. While the effectiveness of employing the loop-tree duality for obtaining asymptotic expansions has been shown previously in the large-mass limit for Higgs production through gluon fusion, we derive a more general method for asymptotic expansion of scattering amplitudes within the loop-tree duality formalism. We apply and analyse this method for the scalar two- and three-point functions at one-loop order and apply it to highly boosted Higgs boson production.

Abstract

Presenter(s) : PLENTER, Judith (IFIC - UV/CSIC)

Session Classification : Física Teórica

Contribution ID : **594** Type : **not specified**

Z'-explorer: confronting Z' models against LHC data

Monday, 21 March 2022 17:30 (15)

Z' boson is a hypothetical mediator that appears in a wide variety of New Physics models, and Z' searches at the LHC have been performed in all SM visible channels, providing limits that must be taken into account non-trivially at the time of constraining each BSM proposal. To ease this task, we present a software, Z'-explorer, to automatically test Z' models against LHC data. By simply providing couplings and decay widths, Z'-explorer allows exploring the parameter space of a given model, determining the most sensitive visible channel for Z' exclusion/detection. We also present a software update, Z'-explorer 2.0, which includes a minimal extension to dark sectors, providing the possibility to explore Z' as an s-channel mediator to fermionic dark matter. This talk is based on 2005.05194 and 2109.13194.

Abstract

Presenter(s) : SANDÁ SEOANE, Rosa María (IFT)

Session Classification : Física Teórica

Contribution ID : **595** Type : **not specified**

Improved bounds on heavy quark EDMs and implications for BSM

Monday, 21 March 2022 17:45 (15)

Electric dipole moment (EDM) searches play an crucial role in constraining CP violation sources beyond the Standard Model. We derive new bounds on the EDM of charm and bottom quarks and explore its implications for different New Physics models (1905.02513), with special attention to the so-called Manohar-Wise model, with additional color-octet scalars. For this model, we compute the full set of one-loop diagrams and the enhanced higher-order effects from the Weinberg operator and Barr-Zee diagrams (2111.09397). The constraints on the model parameters from the neutron EDM are studied, finding a powerful complementarity with other flavor obsevables.

Abstract

Presenter(s) : RUIZ VIDAL, Joan (IFIC - University of Valencia and CSIC)

Session Classification : Física Teórica

Contribution ID : **596** Type : **not specified**

Semileptonic tau decays beyond the Standard Model

Monday, 21 March 2022 18:00 (15)

Hadronic τ decays are studied as probe of new physics. We determine the dependence of several inclusive and exclusive τ observables on the Wilson coefficients of the low-energy effective theory describing charged-current interactions between light quarks and leptons. The analysis includes both strange and non-strange decay channels. The main result is the likelihood function for the Wilson coefficients in the tau sector, based on the up-to-date experimental measurements and state-of-the-art theoretical techniques. The likelihood can be readily combined with inputs from other low-energy precision observables. We discuss a combination with nuclear beta, baryon, pion, and kaon decay data. In particular, we provide a comprehensive and model-independent description of the new physics hints in the combined dataset, which are known under the name of the Cabibbo anomaly.

Abstract

Presenter(s) : DÍAZ CALDERÓN, David (IFIC)

Session Classification : Física Teórica

Contribution ID : **597** Type : **not specified**

An ultraviolet completion for the Scotogenic model

Monday, 21 March 2022 18:15 (15)

The Scotogenic model is an economical scenario that generates neutrino masses at the 1-loop level and includes a dark matter candidate. This is achieved by means of an ad-hoc Z_2 symmetry, which forbids the tree-level generation of neutrino masses and stabilizes the lightest Z_2-odd state. Neutrino masses are also suppressed by a quartic coupling, usually denoted by λ5. While the smallness of this parameter is natural, it is not explained in the context of the Scotogenic model. We construct an ultraviolet completion of the Scotogenic model that provides a natural explanation for the smallness of the λ5 parameter and induces the Z2 parity as the low-energy remnant of a global U(1) symmetry at high energies. The low-energy spectrum contains, besides the usual Scotogenic states, a massive scalar and a massless Goldstone boson, hence leading to novel phenomenological predictions in flavor observables, dark matter physics and colliders.

Abstract

Presenter(s) : ESCRIBANO VALIENTE, Pablo (IFIC)

Session Classification : Física Teórica

Contribution ID : **598** Type : **not specified**

Mapping the SMEFT to discoverable models

Monday, 21 March 2022 18:30 (15)

The Standard Model Effective Field Theory (SMEFT) has proved a suitable framework to study extensions of the Standard Model in a bottom-up approach. \\ In this project we focus on minimal extensions of the SM that will generate certain 4-fermion operators in the SMEFT and use constraints on the Wilson coefficients to derive bounds on the particle masses in said extensions.\\ However, only a finite number out of these in theory infinitely many models will be phenomenologically interesting. Allowing only for models that provide an interplay between direct and indirect search and avoid charged Dark Matter leads to a bunch of restrictions that make a classification of these models non-trivial. \\ At this stage we use the \textit{ModelGenerator}, a tool built in Mathematica, for a systematic approach to classify these interesting models.

Abstract

Presenter(s) : ESSER, Fabian (IFIC)

Session Classification : Física Teórica

Contribution ID : **599** Type : **not specified**

A Green's basis for the bosonic SMEFT to dimension 8

Monday, 21 March 2022 18:45 (15)

We present a basis of dimension-eight Green's functions involving Standard Model (SM) bosonic fields, consisting of 86 new operators. Rather than using algebraic identities and integration by parts, we prove the independence of these interactions in momentum space, including a discussion on evanescent bosonic operators. Our results pave the way for renormalising the SM effective field theory (SMEFT), as well as for performing matching of ultraviolet models onto the SMEFT, to higher order. To demonstrate the potential of our construction, we have implemented our basis in matchmakereft and used it to integrate out a heavy singlet scalar and a heavy quadruplet scalar up to one loop. We provide the corresponding dimension-eight Wilson coefficients. Likewise, we show how our results can be easily used to simplify cumbersome redundant Lagrangians arising, for example, from integrating out heavy fields using the path-integral approach to matching.

Abstract

Presenter(s) : DÍAZ CARMONA, Álvaro (Universidad de Granada)

Session Classification : Física Teórica

Contribution ID : **600** Type : **not specified**

A_{FB} in the SMEFT: the LHC as a Z physics laboratory

We study the forward-backward asymmetry A_{FB} in $pp \to l^+l^-$ at the Z peak within the Standard Model Effective Field Theory (SMEFT). We find that this observable provides per mille level constraints on the vertex corrections of the Z boson to quarks, which close a flat direction in the electroweak precision SMEFT fit. Moreover, we show that current A_{FB} data is precise enough so that its inclusion in the fit improves significantly LEP bounds even in simple New Physics setups. This demonstrates that the LHC can compete with and complement LEP when it comes to precision measurements of the Z boson properties.

Abstract

Presenter(s) : BRESÓ-PLA, Victor (UV)

Session Classification : Física Teórica

Contribution ID : **601** Type : **not specified**

Using Machine Learning techniques in phenomenological studies in flavour physics

Tuesday, 22 March 2022 09:00 (15)

In the recent years, a series of measurements in the observables RK(*) and RD(*) concerning the semileptonic decays of the B mesons have shown hints of violations of Lepton Flavour Universality (LFU). An updated model-independent analysis of New Physics violating LFU, by using the Standard Model Effective Field Theory (SMEFT) Lagrangian with semileptonic dimension six operators at Λ = 1 TeV is presented. We perform a global fit, in order to assess the impact of the New Physics in a broad range of observables including B-physics, electroweak precision test, Higgs physics and nuclear β decays. We discuss the relevance of the mixing in the first generation for the observables with heavier lepton flavours. We use for the first time in this context a Montecarlo analysis of the likelihood function to extract the confidence intervals and correlations between observables. Our results show that a suitable strategy is to use a Gradient Boosting predictor as a proxy of the real likelihood function, and to analyze the SHAP values as a measure of the impact of each parameter of SMEFT Lagrangian in the fit.

Abstract

Presenter(s) : ALDA GALLO, Jorge (Universidad de Zaragoza)

Session Classification : Física Teórica

Contribution ID : **602** Type : **not specified**

Probing pion's insight at future colliders: a glue-led structure

Tuesday, 22 March 2022 09:15 (15)

Understanding the mechanisms in charge of "shaping" hadrons inside is among the most charming problems in physics. Indeed, new experimental facilities such as the EIC are planned, and an unprecedented amount of information about hadron's complexity is expected to arise. This work takes advantage of the current situation to perform the first systematic feasibility study of accessing pion's structure at an electron-ion collider. We employ state-of-the art models for generalized parton distributions to compute the amplitude for Deeply Virtual Compton Scattering (DVCS) in the one-pion exchange approximation at EIC kinematic. Predictions for the expected event-rates and beam-spin asymmetries are shown. We demonstrate that DVCS off virtual pions will be measurable at the EIC. Moreover, we evince that gluons play the dominant role, modulating the expected number of events through interference with the quark distribution. Finally, a sign-inversion for the observed beam-spin asymmetries is found to take place, triggering a clear signal for a glue-led regime.

Abstract

Presenter(s) : MORGADO CHÁVEZ, Jose Manuel (Universidad de Huelva)

Session Classification : Física Teórica

Contribution ID : **603** Type : **not specified**

Axial-vector meson contributions to the HFS of muonic hydrogen

Tuesday, 22 March 2022 09:45 (15)

Extremely precise measurements in muonic hydrogen allow to extract properties from the proton, due to its impact on the energy levels. Such extractions require however from a commensurate precision for other contributions affecting the energy levels, such as two-photon exchange effects. In this talk, we compute the axial-vector meson contribution to the hyperfine splitting of muonic hydrogen, that is relevant to assess the proton Zemach radius, finding significant differences with respect to previous estimates.

Abstract

Presenter(s) : SANCHEZ-PUERTAS, Pablo (IFAE)

Session Classification : Física Teórica

Contribution ID : **604** Type : **not specified**

Probing nucleon 3D structure at the Electron-Ion Collider

Tuesday, 22 March 2022 10:15 (15)

In this talk I will discuss how the future Electron-Ion Collider can help us better understand the 3-dimensional partonic structure of nucleons, in particular transverse-momentum-dependent functions, focusing on di-jet and heavy-quark production processes.

Abstract

Presenter(s) : ECHEVARRIA, Miguel (Universidad del Pais Vasco)

Session Classification : Física Teórica

Contribution ID : **605** Type : **not specified**

Pion generalized parton distributions: what theory, lattice QCD and experiment can tell us?

Tuesday, 22 March 2022 09:30 (15)

We discuss how the knowledge of the pion valence-quark distribution function (either obtained from theory, lattice QCD or experiment) can be extended to off-forward kinematics to construct the corresponding generalized parton distribution (GPD). The discussion is based upon the hypothesis of the existence of an energy scale at which the hadron can be completely understood in terms of (fully dressed) valence degrees of freedom, the so called hadronic scale, and an all orders evolution scheme. In addition to being compatible with empirical and lattice results, the obtained GPDs fulfill all the prescriptions from QCD and exhibit agreement with contemporary predictions from continuum Schwinger methods.

Abstract

Presenter(s) : RAYA, Khépani (UHU)

Session Classification : Física Teórica

Contribution ID : **606** Type : **not specified**

Transverse-momentum structure of the proton

Tuesday, 22 March 2022 10:00 (15)

After fifty years of investigations, the nucleon structure is still far from being understood and continues to represent a unique test bench for QCD. Despite the enormous progresses achieved in five decades of deep-inelastic scattering (DIS) experiments, a number of crucial open questions are still on the carpet and subject of intense theoretical and experimental studies. In the last two decades, semi-inclusive DIS was established as a unique tool for the study of the non-collinear structure of nucleons, involving the parton transverse momentum pT as an additional degree of freedom. Requiring the detection of at least one final state-hadron in coincidence with the scattered lepton, it opened the way not only to measure of the chiral-odd transversity distribution, the last missing leading-twist collinear parton distribution function, but also to a variety of new pT-dependent PDFs, known as TMDs. Describing correlations between the quark transverse momentum and the quark or the nucleon spin (spin-orbit correlations), TMDs account for a number of intriguing effects observed in polarized and unpolarized reactions, and allow for a 3-dimensional description of the nucleon in momentum space. Furthermore, they could provide insights into the yet unmeasured quark orbital angular momentum. At leading-twist, eight TMDs enter the SIDIS cross section in conjunction with a fragmentation function. In addition, going to the twist-3 level allows us to probe novel quark-gluon correlations. The HERMES experiment collected a wealth of data using the 27.6 GeV polarized HERA lepton beam and various polarized and unpolarized gaseous targets. This allows for a series of unique measurements of observables sensitive to this multidimensional (spin) structure of the nucleon, probed through specific azimuthal modulations in the distribution of hadrons produced in semi-inclusive DIS. Amplitudes of some of these modulations sensitive to the beam and/or target polarization, recently extracted for the first time also in a three-dimensional kinematic space, will be presented in more detail.

Abstract

Presenter(s) : SCHNELL, Gunar (University of the Basque Country UPV/EHU)

Session Classification : Física Teórica

Contribution ID : **607** Type : **not specified**

Effective quantum gravity, cosmological constant and the Standard Model of particle physics

Tuesday, 22 March 2022 10:30 (15)

The cosmological constant problem (CCP) and the formulation of consistent quantum gravity belong to the shortlist of the most important unsolved fundamental problems of physics. In the case of CCP the problem is to explain the extremely precise (55 orders in the Standard Model) fine-tuning between the independent vacuum part and the induced one, that is a function of symmetry breaking in the models of particle physics. The situation with CCP is so difficult that it makes sense to give up from attempting its solution and accept the need for a fine tuning between the vacuum and induced counterparts of the observed energy density of the vacuum. In this case, we meet the challenging situation with the renormalization group running of the vacuum or induced summands of the cosmological constant at low energies. Assuming the effective approach to quantum gravity and the Vilkovisky-DeWitt scheme of unique effective action, one can derive the exact, well-defined, renormalization group running of the vacuum cosmological constant. It turns out that, owing to the mentioned fine-tuning with the induced part, this running imposes severe restrictions on the possible extensions of the Minimal Standard Model of particle physics, concerning the magnitude of the vacuum expectation value of the corresponding Higgs fields.

Abstract

Presenter(s) : SHAPIRO, Ilya (Universidade Federal de Juiz de Fora)

Session Classification : Física Teórica

Contribution ID : **608** Type : **not specified**

Effects of excited state quantum phase transitions over the out-of-time-order correlators in systems with a U (n) dynamical algebra

Tuesday, 22 March 2022 11:00 (15)

Abstract

Effects of excited state quantum phase
transitions over the out-of-time-order
correlators in systems with a U (n) dynamical
algebra
Jamil Khalouf-Rivera, Miguel Carvajal, Francisco P´erez-Bernal,
Jos´e Enrique Garc´ıa-Ramos, Lea F. Santos, Qian Wang
Lie algebras are widely used to study systems in different fields of Physics. In particular, two levels bosonic models based on unitary algebras U (n) are used to describe the long-range interaction Ising model as well as molecular stretching vibrations -U (2)-, molecular bending motion -U (3)-, the rovibrational structure of diatomic molecules -U (4)-, and collective nuclear degrees of freedom -U (6)-.
In systems with a U (n) dynamical algebra, a model Hamiltonian can be defined with a single control parameter, which drives the system from U (n − 1) and to SO(n) dynamical symmetries. It is well known that in such systems a second order ground state quantum phase transition (QPT) occurs for a critical value of such control parameter. Moreover, an excited state QPT appears in the broken-symmetry phase.
In this work, we show that there is a fundamental difference between the U (2) case and models with U (n) with n ≥ 3. As an application, we compute the long time limit average of the out-of-time-order correlators in models with n = 2 and 3.

Primary author(s) : KHALOUF-RIVERA, Jamil (Universidad de Huelva); Dr. CARVAJAL ZAERA, Miguel (Universidad de Huelva / Centro de Estudios Avanzados en Física, Matemáticas y Computación); PEREZ BERNAL, Francisco (Universidad de Huelva)

Presenter(s) : KHALOUF-RIVERA, Jamil (Universidad de Huelva)

Session Classification : Red FNUC (Red Temática de Física Nuclear)

Track Classification : Red Temática de Física Nuclear (FNUC)

Contribution ID : **609** Type : **not specified**

New developments on SiC dosimeters and detectors at IMB-CNM

Tuesday, 22 March 2022 09:40 (20)

Abstract

Due to their low leakage current, low noise levels, high thermal conductivity, and potential radiation hardness, SiC devices offer various advantages over Si devices in certain applications. Particularly, they are being considered for harsh environment operation, such as in plasma diagnostic systems in future nuclear fusion reactors, high energy physics applications and medical application as dosimeter or microdosimeters. In my talk, I will present the last technological and experimental results obtained with SiC sensors in different applications.

Primary author(s) : PELLEGRINI, Giulio (IMB-CNM-CSIC)

Presenter(s) : PELLEGRINI, Giulio (IMB-CNM-CSIC)

Session Classification : Investigación orientada, tecnología e innovación

Track Classification : Investigación orientada, tecnología e innovación

Contribution ID : **610** Type : **not specified**

News from NuPECC

Monday, 21 March 2022 18:35 (10)

Abstract

Presenter(s) : GOMEZ CAMACHO, Joaquin (Centro Nacional de Aceleradores - Universidad de Sevilla)

Session Classification : Red FNUC (Red Temática de Física Nuclear)

Contribution ID : **611** Type : **not specified**

Reunión red FNUC

Monday, 21 March 2022 18:45 (40)

Abstract

Presenter(s) : FRAILE, Luis Mario (rupo de Física Nuclear & IPARCOS, Universidad Complutense de Madrid (UCM))

Session Classification : Red FNUC (Red Temática de Física Nuclear)

Contribution ID : **612** Type : **not specified**

Probing Muon g-2 with Sleptons at LHC and Dark Matter Experiments

Monday, 21 March 2022 19:00 (15)

Inspired by the latest measurement of muon anomalous magnetic moment (muon g-2) by FermiLab we explore the implications about muon g-2 of supersymmetric grand unified theories (GUTs) in a class with non-universal gaugino masses at the GUT scale. The discrepancy between the Standard Model (SM) predictions and the experimental results in muon g-2 can be solved by the contributions from the supersymmetric particles, and the fundamental parameter space compatible with the muon g-2 solution typically favors light sleptons (<~ 800 GeV), charginos (<~ 900 GeV) and LSP neutralino (<~ 600 GeV). In addition to resolve the muon g-2 problem, these mass scales for sleptons, charginos and neutralinos are in reach of LHC currently, and it is expected to have a stronger impact from LHC-Run3. We find that the chargino mass can be probed up to about 600 GeV, and LHC-Run3 is expected to test chargino up to about 700 GeV. Even though there is no direct impact on the slepton masses, these experiments are able to probe the sleptons up to about 350 GeV. However, these scales depend on the handedness of light slepton states, and one can still realize solutions with lighter charginos when the lighter slepton is mostly right-handed. The strongest impact from chargino-neutralino productions is observed when LSP is Bino-like and the chargino is Wino-like, which leads to chargino-neutralino coannihilation scenario, even though the NLSP may happen to be a lighter slepton state. The spectra of SUSY particles involving relatively light chargino, slepton together with LSP neutralino yield also interesting results which can be tested at the current dark matter experiments. In this talk, we present prospects in probing the muon g-2 resolution together with sleptons and charginos at the upcoming LHC experiments and confront it with the current and projected results from the direct dark matter detection experiments.

Abstract

Presenter(s) : ÜN, Cem Salih (UHU)

Session Classification : Física Teórica

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Abstract

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