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Galician Institute of High Energy Physics

Annual Report, 2017

The Standard Model to the Limits

The Standard Model (SM) is our best construction of the microscopic reality at the most fundamental level. The level of performance with experiment is extremely high.

Our Institute has played a fundamental role in this broad field of research, that includes the search for new physics beyond the Standard Model (SM) using the LHCb experiment (RP1), the study of the Quantum Chromodynamic (QCD) matter at extreme conditions (RP2) and the investigations on string theory, both from a formal and applied point of view (RP3).

The LHCb experiment is designed to perform searches for new physics beyond the Standard Model using the enormous flux of beauty and charmed hadrons produced at the LHC. The main research lines at IGFAE are: measurement of observables sensitive to lepton universality violation in b-hadron decays, measurement of CP violating observables in B decays to vector mesons, study of rare decays of mesons with b and s quarks and measurement of observables in proton-lead collisions. Important results belonging to these working lines, with crucial input from IGFAE members, have been published during 2017.

The study of the QCD matter at high temperatures and densities constitutes the main interest of the QCD phenomenology group at IGFAE. Under these extreme conditions, all hadronic matter is in a universal form, generically known as the Quark Gluon Plasma (QGP), which is also the state of the universe right after the Big Bang. The main goal of our research work is the characterisation of this material. Do to so, we have continued our activities on different lines, which include heavy-ion collisions, high-energy QCD and the description of strongly interacting matter in effective models like Skyrme. Some highlights during 2017 concern the use of top quarks for characterising the QGP and the study of high gluon densities. Moreover, our group has also been involved in the elaboration of physics case for future experiments.

Last but not least, the IGFAE theory group has performed research in more formal areas of particle physics, with a strong interest in string theory, During 2017 the group has been especially interested in Holography, that is, the duality between Quantum Field Theory (QFT) and gravity, and in AdS/CFT correspondence. This correspondence provides powerful computing tools for different scenarios, including Quark Gluon Plasma or Condensed Matter systems.

Beyond the SM searches with LHCb

The LHCb experiment is designed to perform high-precision measurements of CP-violation and search for New Physics beyond the Standard Model (SM) using the enormous flux of beauty and charmed hadrons produced at the LHC. The LHCb detector is a single-arm spectrometer with excellent tracking and particle identification capabilities. During Run 1 and Run 2, it has acquired 10 fb^{-1} of data, surpassing the initial predictions.

The IGFAE is a founder member of the LHCb experiment. The institute was involved in the construction and installation of the Silicon Tracker together with the EPFL at Lausanne, the University of Zürich and the University of Heidelberg. The Silicon Tracker consists of two separate silicon micro-strip detectors; the Inner Tracker and the Tracker Turicensis. In total, it has 270,000 electronic channels. The IGFAE was responsible for 50% of the construction of the Inner Tracker and for the Experiment Control System for both sub-detectors. The coordination of the Silicon Tracker subsystem has been leaded by IGFAE members for several years.

Results obtained from already collected data are limited by statistics in the search for new phenomena. To overcome this an upgraded detector, with a readout at 40 MHz and a more flexible software-based trigger, will allow an increase in data rate and in the trigger efficiencies, especially in decays to hadronic final states. In addition, it will be possible to change triggers to explore different physics as LHC discoveries point us to the most interesting channels. The IGFAE is involved in two subsystems: the LHCb vertex detector (VELO) and the High-Level Trigger (HLT) system. The installation of the upgraded detector will start next year 2019.

An ambitious R&D program on silicon sensors for the VELO was carried out by the IGFAE. The upgraded VELO must be lightweight, radiation hard, vacuum compatible, and must drive data to the data acquisition system at speeds of up to 1.6 Tbits/s. These challenges are met with a new design based on hybrid pixel detectors, to be positioned within 5.1 mm of the LHC colliding beams. The sensors have 55x55 μm^2 square pixels and are read out by a new ASIC (VeloPix). The hottest ASIC must cope with integrated hit rates of up to 800 MHz and produce an output data rate of over 15 Gbits/s, adding up to 1.6 Tbits/s of data for the ~41 Mpixels of the whole upgraded VELO. The sensor guard ring design has been improved to cope with the high irradiation levels, which are highly non-uniform and reach $8x10^{15}$ 1 MeV neq cm^{-2} at the innermost region. The material budget is optimised with the use of evaporative CO_2 coolant circulating in microchannels within a thin silicon substrate.

The first version of the VeloPix ASIC was thoroughly tested over the second half of 2016 and the first half of 2017 by IGFAE researchers. Several Heavy-Ion Irradiation campaigns showed an unexpected SEL (Single Event Latch-up) sensitivity in the pixel matrix as well as SET (Single Event Transient) in the SLVS receivers. A second version of the ASIC was submitted in 2017. The ASICs underwent again SEU and SEL tests up to a total fluence of 10 million ions cm^{-2}. Throughout the test no current increase was observed, indicating that the SEL problem had been solved, there were no upsets on the SLVS reset receiver, and a test pulse run showed no SEU in the FIFO. Hence the design is considered to have fully addressed all the issues seen.

The electrical readout chain has been fully assembled for a half detector module. This includes the OPB (Opto Power Board), vacuum feedthrough, data tapes, low voltage cables, control and VeloPix hybrids and sensor triples. A mechanical demonstrator for a full range with 6 mounted modules has also been successfully assembled. The testing is performed fully in the context of the LHCb readout chain with the MiniDAQ2, which is already able to successfully control the OPB and VeloPixes. The firmware for the MiniDAQ2 system has been mainly developed at IGFAE.

One of the main characteristics of the LHCb upgrade is the full software trigger. Different technologies can be used for the HLT farm. The possibility of an HLT based on GPU instead of CPU can significantly improve the farm's computing power per euro at any of the LHCb upgrade phases. For this reason, we considered to join that effort. IGFAE contributes to the development of VELO clusterization algorithms, muon identification algorithms and track matching algorithms using GPU´s.

The 2017 LHCb scientific production amounts to 80 papers published in high impact journals (Nature Physics, Physical Review Letters, Journal of High Energy Physics, etc.). According to the SCOPUS database, more than 95% of the articles have been published in "first decil" category journals. The main physics analysis research lines at IGFAE are: measurement of observables sensitive to lepton universality violation in b-hadron decays, measurement of CP violating observables in B decays to vector mesons, study of rare decays of mesons with b and s quarks and measurement of observables in proton-lead collisions. Important results with crucial input from IGFAE members have been published outside the 2017 time-span in these working lines. Out of the bulk of LHCb results published in 2017 the following ones contain relevant contributions from IGFAE members.

"Tests of lepton universality with B0→K*l+l- decays, JHEP08(2017)055", which reports measurements of the ratio of the branching fractions of the B0→K*mu+mu- and B0→K*e+e- decays, called R(K*). This ratio is accurately predicted by the SM assuming that the

electroweak couplings of leptons to gauge bosons are independent of their flavour. This key feature of the SM is known as "lepton universality". The measurements of R(K*) performed by LHCb in different regions of the dilepton invariant mass squared are compatible with the SM expectations at the level of 2.1 to 2.5 standard deviations. Further analyses with more data are needed to clarify whether or not the SM correctly predicts the value of R(K*).

"Measurement of the Bs→mu+mu- branching fraction and effective lifetime and search for B0→ mu+mu- decays, PRL 118, 191801 (2017)". Within the SM, the Bs→mu+mu- and B0→ mu+mu- decays are very rare because they occur only through loop diagrams and are helicity-suppressed. Their time-integrated branching fractions are predicted in the SM with small uncertainty thus being sensitive probes for physics beyond the SM. In this paper an excess of Bs→mu+mu- decays is reported with a significance of 7.8 standard deviations, representing the first observation of this decay in a single experiment. An upper limit is also determined for the Bd→mu+mu- branching fraction. All results are in agreement with the SM expectations.

"Improved limit on the branching fraction of the rare decay Ks→mu+mu-, Eur. Phys. J. C 77:678". This decay proceeds exclusively through a flavour-changing neutral current transition, which cannot occur at tree level in the SM. Due to this suppression the decay is sensitive to possible contributions from dynamics beyond the SM. The observed yield is consistent with the background-only hypothesis and yields a limit on the branching fraction of 0.8 x 10^{-9}.

"Measurements of forward t\bar{t}, W+b\bar{b} and W+c\bar{c} production in pp collisions at \sqrt{s}=8 TeV", PLB 767 (2017) 110-120. The production of t\bar{t} pairs from proton-proton collisions in the forward region is of considerable interest, since it may be sensitive beyond the SM physics. Furthermore, forward t\bar{t} events can be used to constrain the gluon parton distribution function at large momentum fraction. This paper reports measurements of production cross-sections in pp collisions at 8 TeV corresponding to an integrated luminosity of 2 fb^{-1}.

There are four papers published by IGFAE members in collaboration with external theoreticians. Two papers, "Likelihood analysis of supersymmetric SU(5) GUTs, Eur. Phys. J. C77 (2017) no.2, 104" and "Likelihood Analysis of the Minimal AMSB Model, Eur. Phys. J. C77 (2017) no.4, 268", explore how to constrain models beyond the SM using accelerator and cosmology data. Other two papers, "On lepton non-universality in exclusive b→sll decays, Phys.Rev. D96 (2017)" and "Large hadronic power corrections or new physics in the rare decay B→K* μ + μ −, JHEP 1707 (2017) 025", make further studies on the implications of the hints of anomalies observed by LHCb in b→sll transitions.

Hot and dense QCD in the LHC era and beyond

The main interest of the QCD phenomenology group is the application of perturbative QCD techniques to conditions of high temperature and/or large densities. Under these conditions, all hadronic matter is in a universal form, generically known as the Quark Gluon Plasma, which is also the state of the whole Universe some microseconds after the Big Bang. This material is created in laboratory by colliding two heavy nuclei at high energies (LHC energies are the highest at present). Characterizing this material is the main objective of our work. Do to so, we have continued our activities on the different lines: heavy-ion collisions and the Quark Gluon Plasma, high-energy QCD and the description of strongly interacting matter in effective models like Skyrme. Some highlights during 2017 are the following:

- In order to analyse the time structure of the Quark Gluon Plasma, the use of top quarks has been proposed in in Phys. Rev. Lett. 120 (2018) no.23, 232301. In fact, the top production and its semileptonic decay offer different time scales: top decay, W decay and formation of a quark-antiquark pair in singlet colour state, whose pass through the plasma, with the associated energy los processes, leaves an imprint in the reconstructed W mass. This observable has a promising future in the HL/HE-LHC and at the FCC-hh.
- We have also contributed to the predictions for cold nuclear matter effects in proton-lead collisions at 8.16 TeV for different observables, published in Nucl.Phys. A972 (2018) 18-85.
- The study of high gluon densities are also relevant in the partonic wave function of protons and nuclei at high energies, where a mechanism of saturation can also appear. In the past year, the group has released a new set of nuclear parton distribution functions, the so-called EPPS16, published in Eur. Phys. J. C77 (2017) no.3, 163, that, for the first time, include data from pPb collisions at the LHC. This analysis is the most updated existing one and the basis for future inclusions of new sets of data from the LHC.
- On the other hand, the study of correlations between partons in the initial state of hadronic collisions has been extended from gluons (employed to describe the ridge phenomenon observed in pp, pPb and PbPb collisions at the LHC) to quarks in Phys. Rev. D95 (2017) no.3, 034025. For gluons, it was proven before that the ridge is related with the existence of Bose enhancement in the wave function of the projectile and target. For quarks, Pauli blocking appears that suggests the existence of anticorrelations as a possible signature.

In other order of things, we have also contributed to the elaboration of two physics cases:

- The one for heavy-ion-physics studies using the multi-TeV lead LHC beams in the fixed-target mode, AFTER@LHC, published in Few Body Syst. 58 (2017) no.5, 148. We detailed the possible contributions of AFTER@LHC to heavy-ion physics with a specific emphasis on quarkonia and presented performance simulations for a selection of observables. These showed that Υ(nS), J/ψ and ψ(2S) production in heavy-ion collisions can be studied in new energy and rapidity domains with the LHCb and ALICE detectors. We also discussed the relevance to analyse the Drell-Yan pair production in asymmetric nucleus-nucleus collisions to study the factorisation of the nuclear modification of partonic densities and of further quarkonia to restore their status of golden probes of the quark-gluon plasma formation.
- Also, in the CERN Yellow Report (2017) no.3, 635-692, the physics case for nuclear collisions at the proposed Future Circular Collider at CERN, that would deliver pp, pPb and PbPb collisions at centre-of-mass energies of 100, 63 and 39 TeV/nucleon respectively, is presented. The group participated prominently in the small-x and hard probes working groups, and in the editorial work.

During 2017, part of the group belonged to the ALICE collaboration, participating on the internal committees and authorising the collaboration papers.

Besides, the group continued working on: (i) on string models as phenomenological models for QCD in the soft domain, both on the description of strangeness production in the quark-gluon string models and of azimuthal asymmetries in particle production in the string percolation model; and (ii) in the research line on topological solitons, Skyrmions and their applications to Nuclear Physics and Astrophysics, in 2017 the main activities dealt with the mathematical problems of such models, like the existence of BPS submodels in the Skyrme model, the concept and bounds on the volume of solitons, and solitons in external magnetic fields.

String theory and relation with other fields

The IGFAE theory group performs research in more formal areas of particle physics, with a strong interest in String Theory, both from a formal and applied point of view. During the last years the group has been especially interested in Holography, that is, the duality between Quantum Field Theory and Gravity which relates the strong coupling limit of the QFT side to the weak-coupling limit in the Gravity side. This correspondence provides powerful computing tools for different scenarios, including Quark Gluon Plasma or Condensed Matter

systems. In the last couple of years the group has also developed an intense activity in numerically solving the Gravity problem for metrics of interest in AdS/CFT correspondence.

The work developed by group is summarized in the next paragraphs. We can distinguish three driving lines of our research:

Gauge-Gravity duality and Holography

AdS/CFT duality is a computational tool with which one can study Quantum Field Theoy in the non-perturbative strong coupling regime. This is a central part of our studies and we have focused on the following aspects:

- Out of equilibrium dynamics. It's gravity dual involves time dependent evolution in numerical relativity. An efficient code has been set up to deal with them and we have performed numerical studies of periodically driven systems at strong coupling, in a toy model involving a scalar in global AdS (Floquet system). We have proven that the system has a stability regions were quantum coherence is preserved. Also we proved that a holographic version of time-chrystals can be obtained as Floquet condensates by means of a suitable quench.
- Translation symmetry breaking and the dynamical emergence of phonons. We have addressed the topic with both quantum field theory and holographic methods. The study of the symplest dynamical translation-breaking model in field theory has allowed to prove general statements like the presence of higher-derivative terms and the necessity of breaking relativistic invariance explicitly. Also the demonstration that holography is able to capture the bad metal phenomenology and describe quantitatively the presence of a gapped soft collective mode in the conductivity and the existence of sub-harmonic response in strongly-coupled driven systems.
- Construction of string dual geometries for defects in N=4 super Yang-Mills in (2+1) dimensions (defect theories) with flavor in the Veneziano limit. These defects are generated by D5-branes, which act as sources in the equations of supergravity. When the flavors are massless the solution we found is analytic and displays an anisotropic Lifshitz-like invariance.
- Non-relativistic anyons. We modeled holographically a strongly coupled non-relativistic anyonic fluid characterized by its dynamical and hyperscaling violation exponents. We focused in the analysis of the collective excitations of dense matter in the presence of an external magnetic field. In particular we obtained the dispersion relation of the holographic zero sound, as well as the diffusion constant, the conductivities and the susceptibility.

Consistent generalizations of General Relativity

Motivated from generic expectations for a consistent theory of quantum gravity, a long standing problem is related to the consistence conditions for higher-curvature corrections to General Relativity. In this sense the following items have been scrutinized:

- Causality issues raised by these terms in three dimensions and their relation to the sign problem of the Newton constant.
- Consistence of T-duality and black hole thermodynamics in the case of the BTZ black hole.

Generalization of the AdS5xS5 duality

The work during 2017 was a continuation of the investigation on the, so called, lambda-deformation of the superstring theory in AdS5xS5 proposed by our group in 2015. This is an integrable theory that was originally proposed as a possible Lagrangian formulation of the deformation of the S-matrix of the superstring theory obtained by replacing its group of symmetries with a quantum group. Subsequently, several authors (including R. Borsato, now in our group) verified that it specifies a consistent solution of the supergravity equations. The main part of the work developed in 2017 was the construction of exact classic solutions of the deformed theory similar to the giant magnons of Hofman-Maldacena and Chen-Dorey-Okamura in the theory of superstrings in AdS5xS5, and the comparison of some of its properties (spectrum, dispersion matrix, etc.) with those of the deformed S-matrix. The objective was to support the proposed relatioship between the lambda-deformation and the quantum group deformed S-matrix. One of the main difficulties is that the Lagrangian action of the lambda-deformation does not have global symmetries which, in particular, makes it difficult to identify the conserved quantities that correspond to energy and momentum. An important result of our work is a proposal to define the energy and momentum and the verification that they satisfy the same dispersion relations as the energy and momentum of the fundamental excitations that define the S-matrix.

Some of the above results are summarized in the following articles:

José D. Edelstein, Gastón Giribet, Carolina Gómez, Ercan Kilicarslan, Matías Leoni and Bayram Tekin. Causality in 3D massive gravity theories, Physical Review D 95 (2017) 104016

Anxo Biasi, Pablo Carracedo, Javier Mas, Daniele Musso (Santiago de Compostela U. & Santiago de Compostela U., IGFAE), Alexandre Serantes (ICTS, Mumbai). Floquet Scalar Dynamics in Global AdS, JHEP 1804 (2018) 137

Andrea Amoretti (Intl. Solvay Inst., Brussels & Brussels U., PTM), Daniel Areán (Porto U.), Blaise Goutéraux (Nordita & Royal Inst. Tech., Stockholm & Stockholm U.), Daniele Musso (Santiago de Compostela U., IGFAE). DC resistivity of quantum critical, charge density wave states from gauge-gravity duality, Phys.Rev.Lett. 120 (2018) no.17, 171603

Andrea Amoretti (Brussels U., PTM), Daniel Areán (Porto U.), Blaise Goutéraux (Nordita & Royal Inst. Tech., Stockholm & Stockholm U.), Daniele Musso (Santiago de Compostela U. & Santiago de Compostela U., IGFAE). Effective holographic theory of charge density waves, Phys.Rev. D97 (2018) no.8, 086017

C. Appadu, T.J. Hollowood, José L. Miramontes, D. Price and D.M.Schmidtt. Giant Magnons of String Theory in the Lambda Background, JHEP 1707 (2017) 098

Cosmic Particles and Fundamental Physics

Astroparticle physics is a rapidly evolving field of research at the intersection of astronomy, particle physics and cosmology, observing the Universe with the advanced instrumentation of particle physics, while connecting the Big Bang model of the origin and evolution of the Universe to the Standard Model of particle physics. Astroparticle physics aims to gain insight into long-standing enigmas at the heart of our understanding of the Universe such as: What can we learn about the most extreme events in our universe by combining all messengers at our disposal namely high-energy cosmic rays, gamma-rays, neutrinos and gravitational waves? What is the nature of Dark Matter and Dark Energy? What are the intricate properties of neutrinos and what can they tell us about Fundamental Physics? IGFAE is tackling these fundamental questions in Physics with two research programmes.

Extremely energetic cosmic rays and neutrinos – Large exposure experiments

Detection of Ultra-High-Energy Cosmic Rays (UHECR) and neutrinos demands observatories spreading over areas of thousands of km2 and operating for long periods of time. With this idea in mind the Pierre Auger Observatory was conceived in 1999. Auger is the world's largest and most sensitive ground-based air-shower array for the detection of UHECR and UHE neutrinos. IGFAE is a member of the Pierre Auger Observatory since 2001. Located near the town of Malargüe in the Mendoza province in Argentina, the Pierre Auger Observatory is

contributing to deciphering some of the long-standing and most important questions in Astroparticle Physics, such as what are the sources of the UHECR at energies above 1018 eV, what is their nature and what are the mechanisms responsible for the acceleration of the observed particles to energies a million times larger than those of the protons accelerated at the LHC. Auger has observed a suppression in the energy spectrum of UHECR but it is not clear if it is due to particles being limited in energy because of interactions with the cosmic microwave background, or due to cosmic sources running out of steam to accelerate particles. The Auger collaboration will install additional particle detectors ('AugerPrime') to those existing to discriminate between the electron and muon content of the shower to help determine the mass of the primary cosmic-ray, a key observable to decipher among the two scenarios. This upgrade will also deepen the understanding of hadronic showers and interactions at center-of-mass energies above those accessible at the LHC.

In 2017 the Astroparticle Physics group at IGFAE has continued its successful participation in the Pierre Auger Observatory. The activities of the group are mainly focused in the analysis of data related to the measurement of the energy spectrum of UHECR, their composition, the determination of their arrival directions and distribution in the sky, the search for UHE neutrinos, and the study of UHECR properties using the radio-technique. Remarkably, the group contributed directly to two of the most important discoveries in the field of Astroparticle Physics in 2017, that were awarded with the "Physics World Breakthrough of the Year" for the top ten discoveries of 2017.

By studying the distribution of the arrival directions of more than 30000 cosmic rays, the Auger Collaboration discovered a dipolar anisotropy, significant at 5.2 standard deviations, in a direction where the distribution of galaxies is relatively high. It was found that the rate of arrival of cosmic rays is ~ 6% greater from one half of the sky than from the opposite one, with the excess lying 120 degrees away from the Galactic center. This provides observational evidence that cosmic rays with energies about a million times greater than that of the protons accelerated in the Large Hadron Collider come from much further away than from our own Galaxy, clearly indicating an extragalactic origin for the particles (Observation of a large-scale anisotropy in the arrival directions of cosmic rays above 8 x 1018 eV. Pierre Auger Collaboration, Science 357, 1266–1270 (2017)). The Astroparticle Physics group at IGFAE contributed directly to this discovery by analyzing inclined showers induced by ultra-high energy cosmic rays that arrive at Earth at large angles with respect to the vertical to the ground and that allowed to extend the field of view of the Auger Observatory towards the Northern hemisphere. This key piece of Auger analysis activities were coordinated by IGFAE member I. Valiño.

The Astroparticle Physics group at IGFAE also contributed directly to the follow-up of the source of the Gravitational Wave event GW170817 discovered by the LIGO and Virgo Collaborations and traced back to a binary neutron-star (BNS) system in the outskirts of the galaxy NGC 4993 at approximately 40 Mpc distance from the Earth. The same collision was also seen 1.7 s later in gamma-rays as a result of a short duration (< 2 s) gamma-ray burst (GRB) and, subsequently, across the electromagnetic spectrum, with radio, optical, and X-ray detections by a plethora of observatories across the globe (Multi-messenger Observations of a Binary Neutron Star Merger. Astrophysical Journal Letters 848, no.2, L12, 2017). The event marks the beginning of a new era in Astronomy and Astrophysics since it is the first source of GW seen also in electromagnetic radiation. In a joint and unprecedented effort by the neutrino observatories ANTARES and IceCube, the Pierre Auger cosmic-ray and neutrino observatory along with LIGO and Virgo GW detectors, scientists have searched for neutrino emission from this merger. Remarkably, at the moment of the merger the source was in an almost ideal position in the sky for neutrino detection with the surface detector array of the Pierre Auger Observatory (see Figure). No candidate neutrino events were found in directional coincidence with the position of the source within +/- 500 s of the onset of the BNS merger, nor in the subsequent 14 days. The non-detection allowed us to put limits on neutrino production in BNS for the first time (Search for High-energy Neutrinos from Binary Neutron Star Merger GW170817 with ANTARES, IceCube, and the Pierre Auger Observatory. ANTARES, IceCube, Auger, LIGO & Virgo Collabs., Astrophysical Journal Letters 850, no. 2, L35, 2017). The members of IGFAE, E. Zas and J. Alvarez-Muñiz in charge of the Multi-Messenger and Neutral Particle analysis activities in the Pierre Auger Collaboration respectively, carried out and coordinated this work.

Figure: Localizations and sensitive sky areas at the time of the GW170817 event in equatorial coordinates: 90% credible-level localization of GW170817 (red contour), direction of the galaxy NGC 4993 (black plus symbol), ANTARES´s horizon separating down-going (north of horizon) and up-going (south of horizon) neutrino directions (dashed blue line), and Auger's fields of view for Earth-skimming (darker blue) and down-going (lighter blue) directions. IceCube's up-going and down-going directions are on the northern and southern hemispheres, respectively.

Dark Matter and the nature of neutrinos

Despite all previous efforts, some of the fundamental properties of the neutrinos remain unknown. Notably, these include neutrino mass and whether the neutrino is its own anti-particle or not (in other words, whether it is a Majorana-type particle or a Dirac-type particle).

These are crucial questions whose answer has revolutionary implications in Particle Physics and Cosmology. These issues can be explored by studying the beta decay of selected isotopes.

IGFAE is a member of the NEXT experiment, an international collaboration to search for the hypothetical neutrino-less double beta decay in 136Xe, a process only allowed if neutrinos are Majorana-type particles. Its observation would also demonstrate the violation of lepton number. For this purpose, the NEXT collaboration is currently operating a medium-sized detector, NEXT-White, at the Underground Laboratory of Canfranc (LSC) in the Spanish Pyrenees, and plans to build starting in 2020 a large 100 kg Xenon detector, NEXT-100. This project is financed by ERC, national and regional funds. NEXT activities at IGFAE have been funded by MINECO.

The NEXT group at IGFAE has been deeply involved in the operation of the NEXT-White detector, being responsible for its daily calibration with Kr decays (The NEXT Collaboration, G. Martínez-Lema et al., Calibration of the NEXT-White detector using 83mKr decays, JINST 13 (2018) P10014 & G. Martínez Lema, Ph.D thesis to be presented in Dec. 2018). J.A. Hernando a member of the NEXT group at IGFAE is responsible for the calibration, reconstruction and coordination of the physics analysis. Also the NEXT group has taken a fundamental role in the development of the NEXT software with J.A. Hernando being the software and analysis project manager of the experiment (The NEXT experimental analysis and data flow at PyHEP 2018 Workshop (Bulgaria)).

The NEXT group is also very active in the analysis to estimate the energy scale and energy resolution, and in the use of Neural Networks to efficiently reject background contamination (The NEXT Collaboration, J. Renner et al., Initial results on energy resolution of the NEXT-White detector, JINST 13 (2018) no.10, P10020 & NEXT Collaboration, A. Simón et al., Electron drift properties in high pressure gaseous xenon, JINST 13 (2018) no.07, P07013. The NEXT Collaboration, J. Renner et al., Background rejection in NEXT using deep neural networks, JINST 12 (2017) no.01, T01004).

Since his incorporation to IGFAE in 2017 as a Ramón y Cajal fellow, D. González a NEXT member, has built a gas-detector laboratory to test small-gas TPC prototypes with optical readout for the development of a new Electro-Luminiscence technique. He has been the proponent of two mayor NEXT R+D programs to improve the electro-luminescence readout, and to improve tracking resolution using different gas mixtures (The NEXT Collaboration, R. Felkai et al., Helium–Xenon mixtures to improve the topological signature in high pressure gas xenon TPCs, Nucl. Instrum. Meth. A905 (2018) 82-90 & NEXT Collaboration, C.A.O. Henriques et al., Secondary scintillation yield of xenon with sub-percent levels of CO 2

additive for rare-event detection, Phys. Lett. B773 (2017) 663-671. In July 2018 a specialized thematic workshop of optical TPCs "Scintillation meets gaseous detectors" was held at IGFAE.

The future plans involve commissioning and operating NEXT-100 the 100-kg Xenon detector at LSC. A request for funding for the years 2019-2021 was submitted to the Spanish Agency of Research in collaboration with other Spanish institutions in NEXT (DIPC, IFIC and UPV).

Nuclear Physics from the Lab to Improve People's Health

Nuclear Physics is a mature discipline that concentrates on the understanding of the structure of atomic nuclei and forces at play in the nuclear medium. Impressive progress has been achived in this field, but there are still some not answered key questions related to how the chemical elements were created during the evolution of the universe, how is the energy generated in the stars, what are the limits of existence of nuclei, how are complex nuclei built from their basic constituents, or even what are the fundamental properties of the interactions at play in atomic nuclei.

The scientific strategy of the nuclear physics area at IGFAE covers a broad spectrum of experimental activities ranging from fundamental research and aiming to dilucidate the answer of the above mention topics, up to development of societal applications, namely in the field of human health. The implementation of this strategy is based on two research programs: the structure of the nuclear many-body systems and its astrophysical and cosmological implication and the commissioning and exploitation of the Laser Laboratory for Accelerator and Applications . Following this structure, we will present the scientific highlights of the activity performed in 2017.

Education and training of new researcher is a fundamental piece of our activity. Four PhD students have been working with us in 2017 in the different research programs. One of them, E. Leal got the doctoral degree in March 2017. Our students have attended different specialised international schools complementing their education and profited from long research stays in different international laboratories.

One of o ur Postdocs, J.L Rodríguez Sánchez was awarded this year with the Prize to the best PhD work in Nuclear Physics 2016/17 (Grupo especializado de Física Nuclear de la RSEF).

The structure of the nuclear many-body systems and its astrophysical and cosmological implications

The approach we follow to unravel the fundamental properties of matter is the study of the many body structure and dynamics of nuclei. Present studies work in the knowledge frontier and continously look for higher precision experiments linked to the existing and in-construction worldwide radioactive ion beam facilities.

The detection of gravitational waves from a neutron-star merger by the LIGO–VIRGO collaboration, followed by the observation of electromagnetic radiation by numerous telescopes, boosted experimental and theoretical physics in many domains. Nuclear physics was not an exception

Contribution to FAIR/R3B experiment. Reaction studies induced by exotic projectiles at relativistic energies

The interpretation of neutron-star merger data and the expected new observations demand high precision nuclear data, in particular of heavy neutron-rich nuclei to reproduce the observations. This breakthrough puts focus on the Facility for Antiproton and Ion Research (FAIR), that will offer unique physics opportunities to determine the properties of heavy neutron-rich nuclei of relevance to r- process of nucleosynthesis. The R3B experimentwill be a perfect laboratory to conduct advanced research projects combining these intense heavy neutron-rich beams and new generation nuclear physics equipment. Both will allow the study of nuclear matter in similar conditions to those met in neutron stars.

IGFAE develops an outstanding experimental program based on reactions induced by exotic projectiles at relativistic energies and contribute to the R&D program related to the R3B experiment at FAIR (https://fair-center.eu/). We are deeply engaged with the completion and exploitation of this versatile set up to perform experiments with Relativistic Heavy Ions in inverse kinematics.

Since May 2017, D. Cortina Gil, is the spokesperson of the R3B experiment (https://fair-center.eu/for-users/experiments/nustar/experiments/r3b.html). IGFAE has also an outstanding contribution to the data sorting of previous experimental campaigns and H. Álvarez Pol leds the R3B simulation software development (R3BRoot).

Along 2017 IGFAE has participated on the R3B cave refurbishment necessary to develop the experimental program in FAIR Phase 0. R3B cave needs to house the newly constructed detectors (i.e: GLAD, NeuLAND and CALIFA).

CALIFA construction and implementation

Since 2008 IGFAE leds the design and construction of CALIFA, a dedicated gamma and proton calorimeter that will sourround the R3B target. Up to 192 detection units, covering the angular region between 45-90 deg in polar angle have been built and tested in our laboratories along 2017 (from quality control to final performance of the detection units). Those tests were extended to commissioning under realistic conditions with the irradiation at Krakow proton cyclotron facility (160 MeV p beam), inducing 16O(p,2p) reactions in direct kinematics, that allowed to evaluate the efficiency and detector response.

Definition of R3B/ Phase 0 experimental program

In May 2017 FAIR management opened a call to evaluate the experimental proposals that would be performed during FAIR Phase 0 (2019-2021). IGFAE participated in the ellaboration of five experimental proposals that were approved by the FAIR PAC (October 2017), covering topics that go from structure of exotic nuclear species, study of reactions of astrophysical interest to the comprehension of nuclear reaction mechanisms or constraining the nuclear equation of state.

One of them, led by J. Benlliure Anaya , proposes to investigate the potential-energy surface and the dynamics of fission over a broad range in fissility and excitation energy, taking advantage of relativistic radioactive beams and the advanced SOFIA@R3B setup, using (p,2pf) and Coulomb excitation to investigate fission of unstable nuclei in inverse kinematics. This combination will give, for the first time, access to the complete characterization of the fissioning system and the fission fragments. This worldwide unique next-generation fission experiment will provide the most comprehensive data collection on fission barriers, fission yields, and neutrons and gamma rays emitted in coincidence.

Studies of the structure and dynamics of the nucleus at beam energies around the Coulomb barrier studied using active targets. Commissioning of ACTAR-TPC

IGFAE develops experimental activities in the low energy regime around the Coulomb barrier.

This activity makes use of different facilities and focus on the use of active targets.

In November 2017, the detector ACTAR TPC funded by the European Research Council via an ERC/Starting Grant was fully commissioned at GANIL (http://www.ganil-spiral2.eu). The technical challenge to connect 16.384 electronic channels on a surface of 25x25 cm2 was tried out with the prototype and was fully operational. The full 128 x 128 pad detector was tested at GANIL using a SPIRAL1 beam of 18O at 3.2 AMeV in 100 mbar of iC4H10. Two experiments (p,p) and (p,a) were carried out to build the excitation functions of the well-

known nuclei 19F and 21Na. The measured resolutions for the (p,p) and (p,a) channels provided very good results. The commissioning was performed by members of the collaboration that involved researchers from GANIL, USC, K.U. Leuven, CENBG and IPNO-Orsay. The detector is now ready to use for physics experiments. Currently, four experiments are approved at GANIL with ACTAR TPC, among them one led by B. Fernández-Domínguez to study the spectroscopy of the unbound proton-rich nucleus 33K which is expected to run in 2019. In addition, the program with active targets that is being conducted by researchers at the IGFAE is now expanding with a new experiment approved at the RCNP(Japan) to study the spectroscopy of 18C using the American active target AT TPC.

Fission campaing at VAMOS/GANIL

The ongoing campaign at VAMOS/GANIL continued in 2017 with the realization of the experiment E753 (Spokesperson: M. Caamaño) by an international team of institutions from Spain, France, Sweden, and Portugal, and partially funded by ERC/ENSAR2. The aim of this experiment is the study of the role of shell effects in high-energy fission and quasi-fission reactions, including the measurement of prompt gammas with the AGATA detector. This is the first time that fragment isotopic identification, and thus structure information, is obtained for quasi-fission reactions. The data analysis is being carried out in collaboration with IPN Orsay and the INFN-Laboratory of Legnaro/University of Padova (Italy), where a PhD student is being co-supervised by M. Caamaño at the USC.

In parallel, data from previous experiments on the campaign continue to be analysed and communicated. Among them, we can mention the invited presentation at the Nuclear Chemistry Gordon Conference (New London, USA); and the publication "Energy balance and deformation at scission in 240Pu fission" M. Caamaño and F. Farget, PLB 770, 72 (2017), where for the first time, experimental data is used to extract the balance between fission fragments of deformation and intrinsic energy.

On the instrumental sidethe development and construction of a new detector, based on the "Time Projection Chamber" technique with optical read out. The aim is to measure and record complete tracks of fission fragments from fixed targets in direct kinematics.

Paricipation in CERN-n_TOF collaboration

IGFAE researchers contributr to the facility maintenance, the data taking and its technical and scientific analysis. We shared authorship in 20 SCI peer reviewed articles. Esther Leal-Cidoncha defended her PhD thesis directed by I. Durán and C. Paradela by March 2017

Among the societal appplications identified in 2017 we highlight:

Participation in data evaluation

I. Durán is IAEA consultant, his work leaded to the publication of Evaluation of the Neutron data Standards, Nuclear data Sheets 148(2018)143-188, with Allan Carlson and 19 al., putting the USC affiliation among the most outstanding nuclear institutions at world level, as NIST(USA), IAEA(International), EC-JRC-Geel (EU), Rosatom (Russia), JIAEA (Japan), CIAE (China) or ANU (Australia).

Creation of a Spin-off company for the indoor radon detection and mitigation.

IGFAE hosts a dedicated laboratory for the detection and study of environmental radioactivity (LAR). LAR speciality is the development of new detection systems and protocoles to determine the presence of indoor radon and its mitigation. In November 2017, a substantial part of the associated technology and knowledge was transfer to the newly created spin-off INTERA S.L. (participated by USC and the IGFAE founding partners J. Benlliure, D. Cortina and J.J Llerena).

Commissioning and exploitation of the Laser Laboratory for Accelerator and Applications

The Laser Laboratory for Acceleration and Applications (L2A2) aims at developing new technologies and applications related to laser-plasma accelerators. This scientific infrastructure, promoted by IGFAE researchers (J. Benlliure Anaya), was built between 2013 and 2016. During that period the IGFAE team took the responsibility of coordinating the project, and in particular, the global design of the infrastructure, a 700 m2 facility including a clean room hosting a 50 TW laser system, a radio-protected experimental area, a laboratory with mechanical, electronic and optic workshops, and the operation rooms of the laser and the experiments.

The research program led by IGFAE at L2A2 focused on medical applications of laser-accelerated particles. At present this program concentrates in two initiatives: new laser-driven X-ray sources and their application in imaging (LaseX), and laser-driven production of radio-isotopes for PET imaging (LaserPET)

LaseX: A new laser-driven X-ray sources and their application in imaging

Low-energy laser pulses produced at L2A2 (1 mJ, 25 fs, 1kHz), efficiently focused (~ 10 m2) on different target materials, generate a plasma where electrons are accelerated up to some tens of kiloelectronvolts. The interaction of these electrons with the same target material

generates X-rays within the same range of energies. The advantage of these new X-ray sources, with respect to conventional ones, is the micrometric size of the focus. Under such conditions one can produce X-ray images with much better quality and lower doses. Moreover, one can also produce images not only based on the simple absorption technique, but also taking advantage of the phase of the produced X-rays, the so-called "phase-contrast imaging". This technology provides an additional sensitivity to the density of the exposed object, which is particularly interesting for biological samples.

Along 2017 the IGFAE team designed and built a laser driven X-ray source that was installed at the radio-protected area of the L2A2. The main elements of this source are:

- Laser-beam transport and focalization system. This system not only guides and focuses the laser pulses into the plasma target, but also generates a probe beam to characterize the plasma generated at the target.
- Plasma-target. A motorized assembly for the positioning of the target at the laser focus, typically a 100x100x1 mm3 copper plate, and the refreshment of the target material shot-by-shot at 1 kHz.
- X-ray detection system based on a CdTe detector for the spectral characterization of the source and TLD dosimeters for the dose measurement.
- On-line control system to remotely control the target assembly movement, the operation of the sensors and the data acquisition system.

An experimental campaign was also performed with the first low-energy laser beam delivered by L2A2. This campaign allowed for the characterization the X-ray source and first imaging applications based on the standard absorption technique. The results were presented at the Targ3 workshop "Targetry for High Repetition Rate Laser-Driven Sources" (Salamanca, June 2017) and a dedicated paper will be submitted soon.

LaserPET: A laser-driven production of radio-isotopes for PET imaging

This project was the core of the funding proposal for the construction of the L2A2. The aim of the project is to develop the technology required for the competitive production of radioisotopes used in positron-emission tomography (PET) by using laser-particle accelerators. The main argument is that present technologies for the production of PET isotopes are based on a centralized production and distribution scheme because of the rather large cost of the infrastructure required. Compact laser-accelerators could become the enabling technology for the on-demand production of PET radioisotopes, opening the

possibility of using short-lived isotopes, such as 11C, 13N or 15O, of special interest for the diagnostic of neurodegenerative and cardiovascular diseases.

The first milestone of this project is the design and construction of a laser-driven proton source delivering protons at energies above 10 MeV in a continuous operation mode at 10 Hz. For this purpose the L2A2 laser system is equipped with a high-energy laser line (1 J, 30 fs, 10 Hz). Focusing these laser pulses in few squared microns one can produce energy densities around 5 1019 W/cm2, sufficient for the acceleration of protons at the above mentioned energies.

The main activities carried out by the IGFAE team along 2017 are:

- Validation of the radiation shielding and the radiation security system installed at L2A2.
- Installation of the vacuum chamber hosting the experiment.
- Installation of the vacuum line between the laser compressor and the experimental chamber.
- Design and installation of the laser pulses transport and focusing system.
- Design and installation of a proton detection system based on passive CR39 sensors.

These activities were part of the IGFAE's contribution to the "Retos/Colaboración" research grant in collaboration with the company PLA.S.L.,and the I3M and CNM research institutes from CSIC. Moreover, the ELI-ALPS facility granted a contract to IGFAE for the construction of a high repetition rate plasma mirror. All these activities were reported in several workshops and invited seminars.

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Annual Report 2017

The team

IGFAE Executive Board

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EXCELENCIA MARÍA DE MAEZTU

07/2017-07/2021

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Inferences on mass composition and tests of hadronic interactions from 0.3 to 100 EeV using the water-Cherenkov detectors of the Pierre Auger Observatory

Aab,A. et al. **[Auger** collaboration**]**

IGFAE authors: Alvarez-Muniz, J.; Vazquez, R.A.; Valino, I.; Zas, E.; Parente, G.; Lopez Casado, A.; Pedreira, F.; Torralba Elipe, G.; García Plana,B

Phys. Rev. D, 96, 122003

RL4, RL2, RL1

DOI: 10.1103/PhysRevD.96.122003

Spectral calibration of the fluorescence telescopes of the Pierre Auger Observatory

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Astropart. Phys., 95, 44

RL4, RL2, RL1

DOI: 10.1016/j.astropartphys.2017.09.001

Observation of a large-scale anisotropy in the arrival directions of cosmic rays above 8 × 1018 eV

Aab,A. et al. **[Auger** collaboration**]**

IGFAE authors: Alvarez-Muniz, J.; Vazquez, R.A.; Valino, I.; Zas, E.; Parente, G.; Lopez Casado, A.; Pedreira, F.; Torralba Elipe, G.; García Plana,B

Science, 357, 1266

RL4, RL2, RL1

DOI: 10.1126/science.aan4338

Multi-resolution anisotropy studies of ultrahigh-energy cosmic rays detected at the Pierre Auger Observatory

Aab,A. et al. **[Auger** collaboration**]**

IGFAE authors: Alvarez-Muniz, J.; Vazquez, R.A.; Valino, I.; Zas, E.; Parente, G.; Lopez Casado, A.; Pedreira, F.; Torralba Elipe, G.; García Plana,B

J. Cosmol. Astropart. Phys., 6, 026

RL4, RL2, RL1

DOI: 10.1088/1475-7516/2017/06/026

Combined fit of spectrum and composition data as measured by the Pierre Auger Observatory

Aab,A. et al. **[Auger** collaboration**]**

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J. Cosmol. Astropart. Phys., 4, 038

RL4, RL2, RL1

DOI: 10.1088/1475-7516/2017/04/038

A Targeted Search for Point Sources of EeV Photons with the Pierre Auger Observatory

Aab,A. et al. **[Auger** collaboration**]**

IGFAE authors: Alvarez-Muniz, J.; Vazquez, R.A.; Valino, I.; Zas, E.; Parente, G.; Lopez Casado, A.; Pedreira, F.; Torralba Elipe, G.; García Plana,B

Astrophys. J. Lett., 837, L25

RL4, RL2, RL1

DOI: 10.3847/2041-8213/aa61a5

Muon counting using silicon photomultipliers in the AMIGA detector of the Pierre Auger observatory

Aab,A. et al. **[Auger** collaboration**]**

IGFAE authors: Alvarez-Muniz, J.; Vazquez, R.A.; Valino, I.; Zas, E.; Parente, G.; Lopez Casado, A.; Pedreira, F.; Torralba Elipe, G.; García Plana,B

J. Instrum., 12, P03002

RL4, RL2, RL1

DOI: 10.1088/1748-0221/12/03/P03002

Search for photons with energies above 1018 eV using the hybrid detector of the Pierre Auger Observatory

Aab,A. et al. **[Auger** collaboration**]**

IGFAE authors: Alvarez-Muniz, J.; Vazquez, R.A.; Valino, I.; Zas, E.; Parente, G.; Lopez Casado, A.; Pedreira, F.; Torralba Elipe, G.; García Plana,B

J. Cosmol. Astropart. Phys., 4, 009

RL4, RL2, RL1

DOI: 10.1088/1475-7516/2017/04/009

First Observation of the Rare Purely Baryonic Decay B0 →p p-

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

Phys. Rev. Lett., 119, 232001

RL1

DOI: 10.1103/PhysRevLett.119.232001

Measurement of the shape of the Λ0b → Λ+ c μ-νμ differential decay rate

Aaij,R. et al. **[LHCb** collaboration**]**

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Phys. Rev. D, 96, 112005

RL1

DOI: 10.1103/PhysRevD.96.112005

Updated search for long-lived particles decaying to jet pairs

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

Eur. Phys. J. C, 77, 812

RL1

DOI: 10.1140/epjc/s10052-017-5178-x

Measurement of the B ± production cross-section in pp collisions at √s=7 and 13 TeV

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

JHEP, 12, 26

RL1

DOI: 10.1007/JHEP12(2017)026

Measurement of the Υ(nS) polarizations in pp collisions at √s=7 and 8 TeV

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

JHEP, 12, 110

RL1

DOI: 10.1007/JHEP12(2017)110

Bose-Einstein correlations of same-sign charged pions in the forward region in pp collisions at √s=7 TeV

Aaij,R. et al. **[LHCb** collaboration**]**

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JHEP, 12, 25

RL1

DOI: 10.1007/JHEP12(2017)025

χc1 and χc2 Resonance Parameters with the Decays χc1,c2 →j /ψμ+μ-

Aaij,R. et al. **[LHCb** collaboration**]**

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Phys. Rev. Lett., 119, 221801

RL1

DOI: 10.1103/PhysRevLett.119.221801

Search for Baryon-Number Violating Ξb0 Oscillations

Aaij,R. et al. **[LHCb** collaboration**]**

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Phys. Rev. Lett., 119, 181807

RL1

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Updated branching fraction measurements of B (s) 0 → K S 0 h + h ′ − decays

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

JHEP, 11, 27

RL1

DOI: 10.1007/JHEP11(2017)027

Measurement of CP violation in B 0 → J/ψK S 0 and B 0 → ψ(2S)K S 0 decays

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

JHEP, 11, 170

RL1

DOI: 10.1007/JHEP11(2017)170

Measurement of CP observables in B ± → DK *± decays using two- and four-body D final states

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

JHEP, 11, 156

RL1

DOI: 10.1007/JHEP11(2017)156

Study of b b ¯ correlations in high energy proton-proton collisions

Aaij,R. et al. **[LHCb** collaboration**]**

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JHEP, 11, 30

RL1

DOI: 10.1007/JHEP11(2017)030

Observation of D0 Meson Decays to π+π-μ+μ- and K+K-μ+μ- Final States

Aaij,R. et al. **[LHCb** collaboration**]**

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Phys. Rev. Lett., 119, 181805

RL1

DOI: 10.1103/PhysRevLett.119.181805

Improved limit on the branching fraction of the rare decay K0 s→μ+ μ-

Aaij,R. et al. **[LHCb** collaboration**]**

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Eur. Phys. J. C, 77, 678

RL1

DOI: 10.1140/epjc/s10052-017-5230-x

Study of prompt D 0 meson production in pPb collisions at √sNN=5 TeV

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

JHEP, 10, 90

RL1

DOI: 10.1007/JHEP10(2017)090

Observation of the Doubly Charmed Baryon Ξcc + +

Aaij,R. et al. **[LHCb** collaboration**]**

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Phys. Rev. Lett., 119, 112001

RL1

DOI: 10.1103/PhysRevLett.119.112001

Measurement of Bs0 and Ds- Meson Lifetimes

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova,

V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

Phys. Rev. Lett., 119, 101801

RL1

DOI: 10.1103/PhysRevLett.119.101801

Study of charmonium production in b -hadron decays and first evidence for the decay Bs0

Aaij,R. et al. **[LHCb** collaboration**]**

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Eur. Phys. J. C, 77, 609

RL1

DOI: 10.1140/epjc/s10052-017-5151-8

Observation of the Decays Λb0 →χc1pK- and Λb0 →χc2pK-

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

Phys. Rev. Lett., 119, 062001

RL1

DOI: 10.1103/PhysRevLett.119.062001

Test of lepton universality with B 0 → K *0 ℓ + ℓ − decays

Aaij,R. et al. **[LHCb** collaboration**]**

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JHEP, 8, 55

RL1

DOI: 10.1007/JHEP08(2017)055

Resonances and CP violation in Bs 0and B¯s0→J/ψK+ K−decays in the mass region above the φ(1020)

Aaij,R. et al. **[LHCb** collaboration**]**

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JHEP, 8, 37

RL1

DOI: 10.1007/JHEP08(2017)037

First Observation of a Baryonic Bs0 Decay

Aaij,R. et al. **[LHCb** collaboration**]**

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Phys. Rev. Lett., 119, 041802

RL1

DOI: 10.1103/PhysRevLett.119.041802

Observation of the B+ →d∗-K+π+ decay

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

Phys. Rev. D, 96, 011101

RL1

DOI: 10.1103/PhysRevD.96.011101

Observation of the decay Bs 0 → ηc φ and evidence for Bs 0 → ηc π + π −

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

JHEP, 7, 21

RL1

DOI: 10.1007/JHEP07(2017)021

Measurement of the CP Violation Parameter A Γ in D0 →k+K-and D0 →π+π- Decays

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

Phys. Rev. Lett., 118, 261803

RL1

DOI: 10.1103/PhysRevLett.118.261803

Search for the Decays Bs0 →τ+τ- and B0 →τ+τ-

Aaij,R. et al. **[LHCb** collaboration**]**

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Phys. Rev. Lett., 118, 251802

RL1

DOI: 10.1103/PhysRevLett.118.251802

Measurements of prompt charm production cross-sections in pp collisions at √s=5 TeV

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Hernando Morata, J.A.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardin

JHEP, 6, 147

RL1, RL5

DOI: 10.1007/JHEP06(2017)147

Observation of the decay Λb 0 → pK − μ + μ − and a search for CP violation

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

JHEP, 6, 108

RL1

DOI: 10.1007/JHEP06(2017)108

Measurement of the J/ψ pair production cross-section in pp collisions at √s=13 TeV

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

JHEP, 6, 047

RL1

DOI: 10.1007/JHEP06(2017)047

Measurement of the Bs0 →μ+μ- Branching Fraction and Effective Lifetime and Search for B0 →μ+μ- Decays

Aaij,R. et al. **[LHCb** collaboration**]**

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V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

Phys. Rev. Lett., 118, 191801

RL1

DOI: 10.1103/PhysRevLett.118.191801

Study of J /ψ Production in Jets

Aaij,R. et al. **[LHCb** collaboration**]**

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Phys. Rev. Lett., 118, 192001

RL1

DOI: 10.1103/PhysRevLett.118.192001

Observation of Five New Narrow Ωc0 States Decaying to Ξc+ K-

Aaij,R. et al. **[LHCb** collaboration**]**

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Phys. Rev. Lett., 118, 182001

RL1

DOI: 10.1103/PhysRevLett.118.182001

Study of the D 0 p amplitude in Λb 0 → D 0 pπ − decays

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

JHEP, 5, 30

RL1

DOI: 10.1007/JHEP05(2017)030

Search for the B s 0 → η′φ decay

Aaij,R. et al. **[LHCb** collaboration**]**

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JHEP, 5, 158

RL1

DOI: 10.1007/JHEP05(2017)158

Measurement of matter-antimatter differences in beauty baryon decays

Aaij,R. et al. **[LHCb** collaboration**]**

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Nat. Phys., 13, 391

RL1, RL5

DOI: 10.1038/nphys4021

Search for massive long-lived particles decaying semileptonically in the LHCb detector

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

Eur. Phys. J. C, 77, 224

RL1

DOI: 10.1140/epjc/s10052-017-4744-6

Observation of the suppressed decay Λb 0 → pπ − μ + μ −

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

JHEP, 4, 29

RL1

DOI: 10.1007/JHEP04(2017)029

Search for long-lived scalar particles in B+ →k+χ (μ+μ-) decays

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

Phys. Rev. D, 95, 071101

RL1

DOI: 10.1103/PhysRevD.95.071101

New algorithms for identifying the flavour of B0mesons using pions and protons

Aaij,R. et al. **[LHCb** collaboration**]**

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Eur. Phys. J. C, 77, 238

RL1, RL5

DOI: 10.1140/epjc/s10052-017-4731-y

Evidence for the two-body charmless baryonic decay B+→ pΛ¯

Aaij,R. et al. **[LHCb** collaboration**]**

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JHEP, 4, 162

RL1

DOI: 10.1007/JHEP04(2017)162

Observation of Bc+ →d0K+ Decays

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

Phys. Rev. Lett., 118, 111803

RL1

DOI: 10.1103/PhysRevLett.118.111803

Measurements of charm mixing and CP violation using D0→K±π∓ decays

Aaij,R. et al. **[LHCb** collaboration**]**

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Phys. Rev. D, 95, 052004

RL1, RL5

DOI: 10.1103/PhysRevD.95.052004

Measurement of the ratio of branching fractions and difference in CP asymmetries of the decays B + → J/ψπ + and B + → J/ψK +

Aaij,R. et al. **[LHCb** collaboration**]**

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JHEP, 3, 36

RL1

DOI: 10.1007/JHEP03(2017)036

Measurement of the B± production asymmetry and the CP asymmetry in B±→J/ψK± decays

Aaij,R. et al. **[LHCb** collaboration**]**

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Phys. Rev. D, 95, 052005

RL1

DOI: 10.1103/PhysRevD.95.052005

Measurement of the phase difference between short- and long-distance amplitudes in the B+→K+ μ+ μ- decay

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

Eur. Phys. J. C, 77, 161

RL1

DOI: 10.1140/epjc/s10052-017-4703-2

Search for decays of neutral beauty mesons into four muons

Aaij,R. et al. **[LHCb** collaboration**]**

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JHEP, 3, 1

RL1, RL5

DOI: 10.1007/JHEP03(2017)001

Observation of Bc+ →j /ψD (*)K (*) decays

Aaij,R. et al. **[LHCb** collaboration**]**

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Phys. Rev. D, 95, 032005

RL1

DOI: 10.1103/PhysRevD.95.032005

Observation of the Annihilation Decay Mode B0 →k+K-

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Hernando Morata, J.A.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardin

Phys. Rev. Lett., 118, 081801

RL1, RL5

DOI: 10.1103/PhysRevLett.118.081801

Observation of the Decay Ξb- →pK-K-

Aaij,R. et al. **[LHCb** collaboration**]**

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Phys. Rev. Lett., 118, 071801

RL1

DOI: 10.1103/PhysRevLett.118.071801

Measurement of the b -Quark Production Cross Section in 7 and 13 TeV pp Collisions

Aaij,R. et al. **[LHCb** collaboration**]**

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Phys. Rev. Lett., 118, 052002

RL1, RL5

DOI: 10.1103/PhysRevLett.118.052002

Observation of B +⟶ J / ψ 3 π +2 π - and B +⟶ ψ (2 S) π +π +π - decays

Aaij,R. et al. **[LHCb** collaboration**]**

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Eur. Phys. J. C, 77, 72

RL1, RL5

DOI: 10.1140/epjc/s10052-017-4610-6

Amplitude analysis of B+ →j /ψϕK+ decays

Aaij,R. et al. **[LHCb** collaboration**]**

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Phys. Rev. D, 95, 012002

RL1, RL5

DOI: 10.1103/PhysRevD.95.012002

Observation of J /ψϕ Structures Consistent with Exotic States from Amplitude Analysis of B+ →j /ψϕK+ Decays

Aaij,R. et al. **[LHCb** collaboration**]**

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Phys. Rev. Lett., 118, 022003

RL1, RL5

DOI: 10.1103/PhysRevLett.118.022003

Observation of the decay Bs0 →φπ+π- and evidence for B0 →φπ+π-

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Hernando Morata, J.A.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardin

Phys. Rev. D, 95, 012006

RL1, RL5

DOI: 10.1103/PhysRevD.95.012006

First Experimental Study of Photon Polarization in Radiative Bs0 Decays

Aaij,R. et al. **[LHCb** collaboration**]**

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Phys. Rev. Lett., 118, 021801

RL1, RL5

DOI: 10.1103/PhysRevLett.118.021801

Observation of charmless baryonic decays B (s)0 →p p - h+h'-

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fernandez Prieto, A.;

Phys. Rev. D, 96, 051103

RL1

DOI: 10.1103/PhysRevD.96.051103

Measurement of B0, Bs 0, B+ and Λb 0 production asymmetries in 7 and 8 TeV proton–proton collisions

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

Phys. Lett. B, 774, 139

RL1

DOI: 10.1016/j.physletb.2017.09.023

Prompt and nonprompt J/ψ production and nuclear modification in pPb collisions at sNN=8.16 TeV

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

Phys. Lett. B, 774, 159

RL1

DOI: 10.1016/j.physletb.2017.09.058

Observation of ηc(2S)→pp¯ and search for X(3872)→pp¯ decays

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Hernando Morata, J.A.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardin

Phys. Lett. B, 769, 305

RL1, RL5

DOI: 10.1016/j.physletb.2017.03.046

Search for CP violation in the phase space of D0 → π+π−π+π− decays

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Hernando Morata, J.A.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardin

Phys. Lett. B, 769, 345

RL1, RL5

DOI: 10.1016/j.physletb.2017.03.062

Measurement of forward tt¯, W+bbï¿½ and W+ccï¿½ production in pp collisions at s=8 TeV

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Hernando Morata, J.A.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Cid, E.L.; Fe

Phys. Lett. B, 767, 110

RL1, RL5

DOI: 10.1016/j.physletb.2017.01.044

Measurement of CP asymmetry in D0 → K−K+ decays

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Hernando Morata, J.A.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Cid, E.L.; Fe

Phys. Lett. B, 767, 177

RL1, RL5

DOI: 10.1016/j.physletb.2017.01.061

Search for the suppressed decays B+ → K+K+π− and B+ → π+π+K−

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Hernando Morata, J.A.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Cid, E.L.; Fe

Phys. Lett. B, 765, 307

RL1, RL5

DOI: 10.1016/j.physletb.2016.11.053

Search for the CP-violating strong decays η → π+π− and η'(958)→π+π−

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Hernando Morata, J.A.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Cid, E.L.; Fe

Phys. Lett. B, 764, 233

RL1, RL5

DOI: 10.1016/j.physletb.2016.11.032

Observation of the Ξb −→J/ψΛK− decay

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Cid, E.L.; Fern

Phys. Lett. B, 772, 265

RL1

DOI: 10.1016/j.physletb.2017.06.045

Measurement of CP asymmetries in D± → η′π± and Ds ±→η′π± decays

Aaij,R. et al. **[LHCb** collaboration**]**

IGFAE authors: Santos, D.M.; Gallas, A.; Romero Vidal, A.; Vidal, X.C.; Vazquez Regueiro, P.; Adeva, B.; Hernando Morata, J.A.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardin

Phys. Lett. B, 771, 21

RL1, RL5

DOI: 10.1016/j.physletb.2017.05.013

Heavy-flavor production and medium properties in high-energy nuclear collisions --What next?

Aarts,G. et al.

IGFAE authors: Ferreiro, E.G.

Eur. Phys. J. A, 53, 93

RL2

DOI: 10.1140/epja/i2017-12282-9

Multi-messenger observations of a binary neutron star merger

Abbott,B.P. et al. **[Auger** collaboration**]**

IGFAE authors: Alvarez-Muniz, J.; Vazquez, R.A.; Valino, I.; Zas, E.; Parente, G.; Lopez Casado, A.; Pedreira, F.; Fernández Morales,M; Garcia Pardinas, J.; Torralba Elipe, G.; García Plana,B

Astrophys. J. Lett., 848, L12

RL4, RL2, RL6, RL1

DOI: 10.3847/2041-8213/aa91c9

Kaon femtoscopy in Pb-Pb collisions at s NN =2.76 TeV

Acharya,S. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Phys. Rev. C, 96, 064613

RL2

DOI: 10.1103/PhysRevC.96.064613

J /ψ Elliptic Flow in Pb-Pb Collisions at sNN =5.02 TeV

Acharya,S. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Phys. Rev. Lett., 119, 242301

RL2

DOI: 10.1103/PhysRevLett.119.242301

Charged-particle multiplicity distributions over a wide pseudorapidity range in proton-proton collisions at √s= 0.9, 7, and 8 TeV

Acharya,S. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Eur. Phys. J. C, 77, 852

RL2

DOI: 10.1140/epjc/s10052-017-5412-6

Measurement of deuteron spectra and elliptic flow in Pb–Pb collisions at √sNN = 2.76 TeV at the LHC

Acharya,S. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Eur. Phys. J. C, 77, 658

RL2

DOI: 10.1140/epjc/s10052-017-5222-x

Searches for transverse momentum dependent flow vector fluctuations in Pb-Pb and p-Pb collisions at the LHC

Acharya,S. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

JHEP, 9, 32

RL2

DOI: 10.1007/JHEP09(2017)032

Measurement of D-meson production at mid-rapidity in pp collisions at √s=7 TeV

Acharya,S. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Eur. Phys. J. C, 77, 550

RL2

DOI: 10.1140/epjc/s10052-017-5090-4

Energy dependence of forward-rapidity J / ψ and ψ(2 S) production in pp collisions at the LHC

Acharya,S. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Eur. Phys. J. C, 77, 392

RL2

DOI: 10.1140/epjc/s10052-017-4940-4

Production of π0 and η mesons up to high transverse momentum in pp collisions at 2.76 TeV

Acharya,S. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Eur. Phys. J. C, 77, 339

RL2

DOI: 10.1140/epjc/s10052-017-4890-x

Measuring KS 0K± interactions using Pb–Pb collisions at sNN=2.76 TeV

Acharya,S. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Phys. Lett. B, 774, 64

RL2

DOI: 10.1016/j.physletb.2017.09.009

Linear and non-linear flow mode in Pb–Pb collisions at sNN=2.76 TeV

Acharya,S. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Phys. Lett. B, 773, 68

RL2

DOI: 10.1016/j.physletb.2017.07.060

Production of muons from heavy-flavour hadron decays in p–Pb collisions at sNN=5.02 TeV

Acharya,S. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Phys. Lett. B, 770, 459

RL2

DOI: 10.1016/j.physletb.2017.03.049

BPS submodels of the Skyrme model

Adam C., Sanchez-Guillen J., Wereszczynski A.

IGFAE authors: Adam, C.; Sanchez-Guillen, J.

Phys. Lett. B, 769, 362

RL2

DOI: 10.1016/j.physletb.2017.04.003

Volume of a vortex and the Bradlow bound

Adam C., Speight J.M., Wereszczynski A.

IGFAE authors: Adam, C.

Phys. Rev. D, 95, 116007

RL2

DOI: 10.1103/PhysRevD.95.116007

Gauged BPS baby Skyrmions with quantized magnetic flux

Adam C., Wereszczynski A.

IGFAE authors: Adam, C.

Phys. Rev. D, 95, 116006

RL2

DOI: 10.1103/PhysRevD.95.116006

Evolution of the longitudinal and azimuthal structure of the near-side jet peak in Pb-Pb collisions at sNN =2.76 TeV

Adam,J. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Phys. Rev. C, 96, 034904

RL2

DOI: 10.1103/PhysRevC.96.034904

Anomalous Evolution of the Near-Side Jet Peak Shape in Pb-Pb Collisions at sNN =2.76 TeV

Adam,J. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Phys. Rev. Lett., 119, 102301

RL2

DOI: 10.1103/PhysRevLett.119.102301

Insight into particle production mechanisms via angular correlations of identified particles in pp collisions at √s=7 TeV

Adam,J. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Eur. Phys. J. C, 77, 569

RL2

DOI: 10.1140/epjc/s10052-017-5129-6

Measurement of electrons from beauty-hadron decays in p-Pb collisions at √sNN=5.02 TeV and Pb-Pb collisions at √sNN=2.76 TeV

Adam,J. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

JHEP, 7, 52

RL2

DOI: 10.1007/JHEP07(2017)052

K∗(892)0 and ϕ(1020) meson production at high transverse momentum in pp and Pb-Pb collisions at s NN =2.76 TeV

Adam,J. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Phys. Rev. C, 95, 064606

RL2

DOI: 10.1103/PhysRevC.95.064606

Enhanced production of multi-strange hadrons in high-multiplicity proton-proton collisions

Adam,J. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Nat. Phys., 13, 535

RL2

DOI: 10.1038/nphys4111

Addendum to: Centrality dependence of high-pT D-meson suppression in Pb-Pb collisions at √sNN=2.76 TeV

Adam,J. et al. **[Alice** collaboration**]**

IGFAE authors: Armesto, N.; Ferreiro, E.G.; Salgado, C.A.; Pajares, C.

JHEP, 6, 032

RL2

DOI: 10.1007/JHEP06(2017)032

Flow Dominance and Factorization of Transverse Momentum Correlations in Pb-Pb Collisions at the LHC

Adam,J. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Phys. Rev. Lett., 118, 162302

RL2

DOI: 10.1103/PhysRevLett.118.162302

Measurement of azimuthal correlations of D mesons with charged particles in pp collisions at √s=7 TeV and p–Pb collisions at √sNN=5.02 TeV

Adam,J. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Eur. Phys. J. C, 77, 245

RL2

DOI: 10.1140/epjc/s10052-017-4779-8

W and Z boson production in p-Pb collisions at √sNN=5.02 TeV

Adam,J. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

JHEP, 2, 77

RL2

DOI: 10.1007/JHEP02(2017)077

Determination of the event collision time with the ALICE detector at the LHC

Adam,J. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Eur. Phys. J. Plus, 132, 99

RL2

DOI: 10.1140/epjp/i2017-11279-1

Charged-particle multiplicities in proton–proton collisions at √s=0.9 to 8 TeV

Adam,J. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Eur. Phys. J. C, 77, 33

RL2

DOI: 10.1140/epjc/s10052-016-4571-1

Centrality dependence of the pseudorapidity density distribution for charged particles in Pb–Pb collisions at sNN=5.02 TeV

Adam,J. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Phys. Lett. B, 772, 567

RL2

DOI: 10.1016/j.physletb.2017.07.017

Measurement of the production of high-pT electrons from heavy-flavour hadron decays in Pb–Pb collisions at sNN=2.76 TeV

Adam,J. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Phys. Lett. B, 771, 467

RL2

DOI: 10.1016/j.physletb.2017.05.060

φ-Meson production at forward rapidity in p–Pb collisions at sNN=5.02 TeV and in pp collisions at s=2.76 TeV

Adam,J. et al. **[Alice** collaboration**]**

IGFAE authors: Armesto, N.; Ferreiro, E.G.; Salgado, C.A.; Pajares, C.

Phys. Lett. B, 768, 203

RL2

DOI: 10.1016/j.physletb.2017.01.074

J/ψ suppression at forward rapidity in Pb–Pb collisions at sNN=5.02ï¿½TeV

Adam,J. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Phys. Lett. B, 766, 212

RL2

DOI: 10.1016/j.physletb.2016.12.064

A facility for pion-induced nuclear reaction studies with HADES

Adamczewski-Musch,J. et al. **[HADES** collaboration**]**

IGFAE authors: Garzon, J.A.

Eur. Phys. J. A, 53, 188

RL6

DOI: 10.1140/epja/i2017-12365-7

Analysis of the exclusive final state npe+e- in the quasi-free np reaction

Adamczewski-Musch,J. et al. **[HADES** collaboration**]**

IGFAE authors: Garzon, J.A.

Eur. Phys. J. A, 53, 149

RL6

DOI: 10.1140/epja/i2017-12341-3

Δ(1232) Dalitz decay in proton-proton collisions at T=1.25 GeV measured with HADES at GSI

Adamczewski-Musch,J. et al. **[HADES** collaboration**]**

IGFAE authors: Garzon, J.A.

Phys. Rev. C, 95, 065205

RL6

DOI: 10.1103/PhysRevC.95.065205

Inclusive Λ production in proton-proton collisions at 3.5 GeV

Adamczewski-Musch,J. et al. **[HADES** collaboration**]**

IGFAE authors: Garzon, J.A.

Phys. Rev. C, 95, 015207

RL6

DOI: 10.1103/PhysRevC.95.015207

Azimuthally Differential Pion Femtoscopy in Pb-Pb Collisions at sNN =2.76 TeV

Adamová,D. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Phys. Rev. Lett., 118, 222301

RL2

DOI: 10.1103/PhysRevLett.118.222301

Production of Σ (1385) ± and Ξ (1530) 0 in p–Pb collisions at √sNN=5.02 TeV

Adamová,D. et al. **[Alice** collaboration**]**

IGFAE authors: Ferreiro, E.G.

Eur. Phys. J. C, 77, 389

RL2

DOI: 10.1140/epjc/s10052-017-4943-1

Measurement of the πk atom lifetime and the πk scattering length

Afanasyev,L. et al. **[DIRAC** collaboration**]**

IGFAE authors: Romero Vidal, A.; Adeva, B.; Saborido, J.; Plo, M.

Phys. Rev. D, 96, 052002

RL1

DOI: 10.1103/PhysRevD.96.052002

Search for High-energy Neutrinos from Binary Neutron Star Merger GW170817 with ANTARES, IceCube, and the Pierre Auger Observatory

Albert,A. et al. **[Antares, Auger, IceCube, Ligo and Virgo** collaboration**]**

IGFAE authors: Alvarez-Muniz, J.; Vazquez, R.A.; Valino, I.; Zas, E.; Parente, G.; Lopez Casado, A.; Pedreira, F.; Torralba Elipe, G.; García Plana,B

Astrophys. J. Lett., 850, L35

RL4, RL2, RL1

DOI: 10.3847/2041-8213/aa9aed

Quark correlations in the color glass condensate: Pauli blocking and the ridge

Altinoluk T., Armesto N., Beuf G., Kovner A., Lublinsky M.

IGFAE authors: Armesto, N.

Phys. Rev. D, 95, 034025

RL2

DOI: 10.1103/PhysRevD.95.034025

A holographic perspective on phonons and pseudo-phonons

Amoretti A., Areán D., Argurio R., Musso D., Zayas L.A.P.

IGFAE authors: Musso,D

JHEP, 5, 51

RL3

DOI: 10.1007/JHEP05(2017)051

Extracting $\hat{q}$ from single inclusive data at RHIC and at the LHC for different centralities: a new puzzle?

Andrés C., Armesto N., Luzum M., Salgado C.A., Zurita P.

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Nucl. Part. Phys. Proc., 289-290, 105

RL2

DOI: 10.1016/j.nuclphysbps.2017.05.020

Extracting $\hat{q}$ in event-by-event hydrodynamics and the centrality/energy puzzle

Andres C., Armesto N., Niemi H., Paatelainen R., Salgado C.A., Zurita P.

IGFAE authors: Paatelainen, R.; Armesto, N.; Salgado, C.A.

Nucl. Phys. A, 967, 492

RL2

DOI: 10.1016/j.nuclphysa.2017.05.115

Energy loss as the origin of a universal scaling law of the elliptic flow

Andrés C., Braun M., Pajares C.

IGFAE authors: Pajares, C.

Eur. Phys. J. A, 53, 41

RL2

DOI: 10.1140/epja/i2017-12226-5

Factorization of in-medium parton branching beyond the eikonal approximation

Apolinário L., Armesto N., Milhano J.G., Salgado C.A.

IGFAE authors: Armesto, N.; Salgado, C.A.

Nucl. Part. Phys. Proc., 289-290, 117

RL2

DOI: 10.1016/j.nuclphysbps.2017.05.023

Giant magnons of string theory in the lambda background

Appadu C., Hollowood T.J., Miramontes J.L., Price D., Schmidtt D.M.

IGFAE authors: Miramontes, J.L.

JHEP, 7, 98

RL3

DOI: 10.1007/JHEP07(2017)098

Production of ϕ Mesons on Nuclear Targets in the Quark–Gluon String Model

Arakelyan G.H., Merino C., Shabelski Y.M.

IGFAE authors: Merino, C.

Phys. At. Nucl., 80, 1198

RL2

DOI: 10.1134/S1063778817060035

Inelastic nuclear screening for different secondaries produced in p+Pb collisions at LHC energy

Arakelyan G.H., Merino C., Shabelski Yu.M., Shuvaev A.

IGFAE authors: Merino, C.

Phys. Rev. D, 95, 074013

RL2

DOI: 10.1103/PhysRevD.95.074013

Performance of resistive plate chambers under irradiation of 136Xe at relativistic energies

Ayyad Y., Benlliure J., Casarejos E., Duran I., Paradela C.

IGFAE authors: Benlliure, J.; Duran, I.

Nucl. Instr. Meth. Phys. Res. A, 866, 111

RL6, RL7

DOI: 10.1016/j.nima.2017.06.014

Likelihood analysis of the minimal AMSB model

Bagnaschi,E. et al.

IGFAE authors: Santos, D.M.; Borsato, M.; Chobanova, V.; Lucio Martinez, M.

Eur. Phys. J. C, 77, 268

RL1

DOI: 10.1140/epjc/s10052-017-4810-0

Likelihood analysis of supersymmetric SU(5) GUTs

Bagnaschi,E. et al.

IGFAE authors: Santos, D.M.; Borsato, M.; Chobanova, V.; Lucio Martinez, M.

Eur. Phys. J. C, 77, 104

RL1

DOI: 10.1140/epjc/s10052-017-4639-6

Spallation-induced fission reactions

Benlliure J., Rodríguez-Sánchez J.L.

IGFAE authors: Benlliure, J.; Rodriguez-Sanchez, J.L.

Eur. Phys. J. Plus, 132, 120

RL6, RL7

DOI: 10.1140/epjp/i2017-11377-0

Knockout and fragmentation reactions using a broad range of tin isotopes

Bertulani,C.A. et al.

IGFAE authors: Benlliure, J.; Cortina-Gil, D.; Rodriguez-Sanchez, J.L.; Caamano, M.; Alvarez, H.; Díaz Cortés,J

Phys. Rev. C, 96, 034303

RL6, RL7

DOI: 10.1103/PhysRevC.96.034303

Delayed collapses of Bose-Einstein condensates in relation to anti-de Sitter gravity

Biasi A.F., Mas J., Paredes A.

IGFAE authors: Mas, J.

Phys. Rev. E, 95, 032216

RL3

DOI: 10.1103/PhysRevE.95.032216

Energy balance and deformation at scission in 240Pu fission

Caamaño M., Farget F.

IGFAE authors: Caamano, M.

Phys. Lett. B, 770, 72

RL6

DOI: 10.1016/j.physletb.2017.04.041

β -decay half-lives and β -delayed neutron emission probabilities for several isotopes of Au, Hg, Tl, Pb, and Bi, beyond N=126

Caballero-Folch,R. et al.

IGFAE authors: Benlliure, J.

Phys. Rev. C, 95, 064322

RL6, RL7

DOI: 10.1103/PhysRevC.95.064322

Adiabatic pumping solutions in global AdS

Carracedo P., Mas J., Musso D., Serantes A.

IGFAE authors: Mas, J.; Musso,D

JHEP, 5, 141

RL3

DOI: 10.1007/JHEP05(2017)141

Probing jet decoherence in heavy ion collisions

Casalderrey-Solana J., Mehtar-Tani Y., Salgado C.A., Tywoniuk K.

IGFAE authors: Salgado, C.A.

Nucl. Phys. A, 967, 564

RL2

DOI: 10.1016/j.nuclphysa.2017.07.008

Radiopurity assessment of the energy readout for the NEXT double beta decay experiment

Cebrián,S. et al. **[NEXT** collaboration**]**

IGFAE authors: Hernando Morata, J.A.; Palmeiro Pazos,B; Martinez-Lema, G.; Gonzalez, D.

J. Instrum., 12, T08003

RL6, RL5

DOI: 10.1088/1748-0221/12/08/T08003

Ground-state configuration of neutron-rich Al 35 via Coulomb breakup

Chakraborty,S. et al.

IGFAE authors: Cortina-Gil, D.; Gonzalez, D.

Phys. Rev. C, 96, 034301

RL6, RL7, RL5

DOI: 10.1103/PhysRevC.96.034301

Large hadronic power corrections or new physics in the rare decay B → K ∗ μ + μ −?

Chobanova V.G., Hurth T., Mahmoudi F., Santos D.M., Neshatpour S.

IGFAE authors: Santos, D.M.

JHEP, 7, 25

RL1

DOI: 10.1007/JHEP07(2017)025

D3–D5 theories with unquenched flavors

Conde E., Lin H., Penï¿½n J.M., Ramallo A.V., Zoakos D.

IGFAE authors: Ramallo, A.V.

Nucl. Phys. B, 914, 599

RL3

DOI: 10.1016/j.nuclphysb.2016.11.016

Physics with ions at the Future Circular Collider

d'Enterria,D. et al.

IGFAE authors: Armesto, N.; Salgado, C.A.

Nucl. Phys. A, 967, 888

RL2

DOI: 10.1016/j.nuclphysa.2017.06.029

Causality in 3D massive gravity theories

Edelstein J.D., Giribet G., Gómez C., Kilicarslan E., Leoni M., Tekin B.

IGFAE authors: Edelstein, J.D.

Phys. Rev. D, 95, 104016

RL3

DOI: 10.1103/PhysRevD.95.104016

EPPS16: nuclear parton distributions with LHC data

Eskola K.J., Paakkinen P., Paukkunen H., Salgado C.A.

IGFAE authors: Paukkunen, H.; Salgado, C.A.

Eur. Phys. J. C, 77, 163

RL2

DOI: 10.1140/epjc/s10052-017-4725-9

First inverse-kinematics fission measurements in a gaseous active target

Farget,F. et al.

IGFAE authors: Alvarez, H.

Nucl. Phys. A, 958, 246

RL6

DOI: 10.1016/j.nuclphysa.2016.12.003

Development of a silicon bulk radiation damage model for Sentaurus TCAD

Folkestad,Å. et al. **[LHCb** collaboration**]**

IGFAE authors: Vieites Diaz, M.; Garcia Pardinas, J.

Nucl. Instr. Meth. Phys. Res. A, 874, 94

RL1

DOI: 10.1016/j.nima.2017.08.042

High precision measurement of the Ne 19 β -decay half-life using real-time digital acquisition

Fontbonne,C. et al.

IGFAE authors: Ramos, D.

Phys. Rev. C, 96, 065501

RL6

DOI: 10.1103/PhysRevC.96.065501

Spectroscopy of Fe 61 via the neutron transfer reaction H 2 (Fe 60,p) Fe ∗ 61

Giron,S. et al.

IGFAE authors: Fernandez-Dominguez, B.

Phys. Rev. C, 95, 035806

RL6

DOI: 10.1103/PhysRevC.95.035806

Determination of the neutron-capture rate of C 17 for r -process nucleosynthesis

Heine,M. et al.

IGFAE authors: Benlliure, J.; Cortina-Gil, D.; Caamano, M.; Alvarez, H.; Gonzalez, D.

Phys. Rev. C, 95, 014613

RL6, RL7, RL5

DOI: 10.1103/PhysRevC.95.014613

Neutron-skin effect in direct-photon and charged-hadron production in Pb+Pb collisions at the LHC

Helenius I., Paukkunen H., Eskola K.J.

IGFAE authors: Paukkunen, H.

Eur. Phys. J. C, 77, 148

RL2

DOI: 10.1140/epjc/s10052-017-4709-9

Secondary scintillation yield of xenon with sub-percent levels of CO2 additive for rare-event detection

Henriques,C.A.O. et al. **[NEXT** collaboration**]**

IGFAE authors: Hernando Morata, J.A.; Palmeiro Pazos,B; Martinez-Lema, G.; Gonzalez, D.

Phys. Lett. B, 773, 663

RL6, RL5

DOI: 10.1016/j.physletb.2017.09.017

Lepton nonuniversality in exclusive b →sℓℓ decays

Hurth T., Mahmoudi F., Martínez Santos D., Neshatpour S.

IGFAE authors: Santos, D.M.

Phys. Rev. D, 96, 095034

RL1

DOI: 10.1103/PhysRevD.96.095034

Non-relativistic anyons from holography

Jokela N., Jï¿½rveläï¿½ J., Ramallo A.V.

IGFAE authors: Ramallo, A.V.

Nucl. Phys. B, 916, 727

RL3

DOI: 10.1016/j.nuclphysb.2017.01.014

The impact of the intruder orbitals on the structure of neutron-rich Ag isotopes

Kim Y.H., Biswas S., Rejmund M., Navin A., Lemasson A., Bhattacharyya S., Caamaño M., Clément E., de France G., Jacquot B.

IGFAE authors: Caamano, M.

Phys. Lett. B, 772, 403

RL6

DOI: 10.1016/j.physletb.2017.06.058

The one loop gluon emission light cone wave function

Lappi T., Paatelainen R.

IGFAE authors: Paatelainen, R.

Ann. Phys., 379, 34

RL2

DOI: 10.1016/j.aop.2017.02.002

Unveiling saturation effects from nuclear structure function measurements at the EIC

Marquet C., Moldes M.R., Zurita P.

IGFAE authors: Rodríguez Moldes,M

Phys. Lett. B, 772, 607

RL2

DOI: 10.1016/j.physletb.2017.07.035

Neutron spectroscopy of 26Mg states: Constraining the stellar neutron source 22Ne(α,n)25Mg

Massimi,C. et al. **[n_TOF** collaboration**]**

IGFAE authors: Duran, I.

Phys. Lett. B, 768, 1

RL6

DOI: 10.1016/j.physletb.2017.02.025

Neutron capture cross section measurement of U 238 at the CERN n-TOF facility in the energy region from 1 eV to 700 keV

Mingrone,F. et al. **[n_TOF** collaboration**]**

IGFAE authors: Duran, I.

Phys. Rev. C, 95, 034604

RL6

DOI: 10.1103/PhysRevC.95.034604

Can transition radiation explain the ANITA event 3985267?

Motloch P., Alvarez-Muñiz J., Privitera P., Zas E.

IGFAE authors: Alvarez-Muniz, J.; Zas, E.

Phys. Rev. D, 95, 043004

RL4

DOI: 10.1103/PhysRevD.95.043004

Medium-induced gluon radiation in hard forward parton scattering in the saturation formalism

Munier S., Peigné S., Petreska E.

IGFAE authors: Petreska, E.

Phys. Rev. D, 95, 014014

RL2

DOI: 10.1103/PhysRevD.95.014014

Evolution of triaxial shapes at large isospin: Rh isotopes

Navin,A. et al.

IGFAE authors: Caamano, M.

Phys. Lett. B, 767, 480

RL6

DOI: 10.1016/j.physletb.2016.11.020

Applicability of pion–nucleus Drell–Yan data in global analysis of nuclear parton distribution functions

Paakkinen P., Eskola K.J., Paukkunen H.

IGFAE authors: Paukkunen, H.

Phys. Lett. B, 768, 7

RL2

DOI: 10.1016/j.physletb.2017.02.009

Status of nuclear PDFs after the first LHC p–Pb run

Paukkunen H.

IGFAE authors: Paukkunen, H.

Nucl. Phys. A, 967, 241

RL2

DOI: 10.1016/j.nuclphysa.2017.05.014

Accurate isotopic fission yields of electromagnetically induced fission of U 238 measured in inverse kinematics at relativistic energies

Pellereau,E. et al.

IGFAE authors: Benlliure, J.; Cortina-Gil, D.; Rodriguez-Sanchez, J.L.; Fernandez-Dominguez, B.; Caamano, M.; Alvarez, H.

Phys. Rev. C, 95, 054603

RL6, RL7

DOI: 10.1103/PhysRevC.95.054603

Coulomb breakup of neutron-rich 29,30Na isotopes near the island of inversion

Rahaman,A. et al.

IGFAE authors: Cortina-Gil, D.; Gonzalez, D.

J. Phys. G, 44, 045101

RL6, RL7, RL5

DOI: 10.1088/1361-6471/aa594d

Background rejection in NEXT using deep neural networks

Renner,J. et al. **[NEXT** collaboration**]**

IGFAE authors: Hernando Morata, J.A.; Palmeiro Pazos,B

J. Instrum., 12, T01004

RL5

DOI: 10.1088/1748-0221/12/01/T01004

High-accuracy determination of the neutron flux in the new experimental area n_TOF-EAR2 at CERN

Sabate-Gilarte,M. et al. **[n_TOF** collaboration**]**

IGFAE authors: Duran, I.; Ferreiro, E.G.; Fernandez-Dominguez, B.; Caamano, M.

Eur. Phys. J. A, 53, 210

RL6, RL2

DOI: 10.1140/epja/i2017-12392-4

Application and performance of an ML-EM algorithm in NEXT

Simón,A. et al. **[NEXT** collaboration**]**

IGFAE authors: Hernando Morata, J.A.; Palmeiro Pazos,B; Martinez-Lema, G.; Gonzalez, D.;

J. Instrum., 12, P08009

RL5,RL6

DOI: 10.1088/1748-0221/12/08/P08009

Isotopic production cross sections of residual nuclei in the spallation reaction Xe 136 (200A MeV) + p

Tassan-Got,L. et al.

IGFAE authors: Benlliure, J.; Rodriguez-Sanchez, J.L.; Fernandez-Dominguez, B.

Phys. Rev. C, 95, 044606

RL6, RL7

DOI: 10.1103/PhysRevC.95.044606

Heavy-Ion Physics at a Fixed-Target Experiment Using the LHC Proton and Lead Beams (AFTER@LHC): Feasibility Studies for Quarkonium and Drell–Yan Production

Trzeciak B., Da Silva C., Ferreiro E.G., Hadjidakis C., Kikola D., Lansberg J.P., Massacrier L., Seixas J., Uras A., Yang Z.

IGFAE authors: Ferreiro, E.G.

Few-Body Syst., 58, 148

RL2

DOI: 10.1007/s00601-017-1308-0

Effective proton-neutron interaction near the drip line from unbound states in F 25,26

Vandebrouck,M. et al. **[R3B** collaboration**]**

IGFAE authors: Benlliure, J.; Cortina-Gil, D.; Caamano, M.; Alvarez, H.; Boillos Betete,J

Phys. Rev. C, 96, 054305

RL6, RL7

DOI: 10.1103/PhysRevC.96.054305

Measurement of the U 238 (n,γ) cross section up to 80 keV with the Total Absorption Calorimeter at the CERN n-TOF facility

Wright,T. et al. **[n_TOF** collaboration**]**

IGFAE authors: Duran, I.

Phys. Rev. C, 96, 064601

RL6

DOI: 10.1103/PhysRevC.96.064601

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14 December 2018

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07/2017-07/2021

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Santiago de Compostela, Spain

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Apoyo a Unidades de Excelencia María de Maeztu
Carlos Alberto Salgado López
7/1/2017 - 6/30/2021
MICINN
MDM-2016-0692
2,000,000 euros

Consolidación e estruturación de unidades de investigación competitivas (Grupos de referencia competitiva)
José Fernando Benlliure Anaya
1/1/2017 - 11/30/2020
CONSELLERÍA DE EDUCACIÓN E ORDENACIÓN UNIVERSITARIA
ED431C 2017/54
400,000 euros

Consolidación e estruturación de unidades de investigación competitivas (Grupos de referencia competitiva)
José Luis Miramontes Antas
1/1/2017 - 11/30/2020
CONSELLERÍA DE EDUCACIÓN E ORDENACIÓN UNIVERSITARIA
ED431C 2017/07
400,000 euros

Consolidación e estruturación de unidades de investigación competitivas (Proxectos de persoal investigador con traxectoria excelente)
Carlos Alberto Salgado López
1/1/2017 - 11/30/2020
CONSELLERÍA DE EDUCACIÓN E ORDENACIÓN UNIVERSITARIA
ED431F 2017/01
200,000 euros

QCD a alta temperatura y densidad desde escalas pequeñas a grandes
Elena González Ferreiro, Carlos Alberto Salgado López

1/1/2018 - 12/31/2019

MINECO - Plan Estatal (2013-2016)

FPA2017-83814-P

145,200 euros

Análisis de las partículas más energéticas de la naturaleza: el observatorio Pierre Auger

Jaime Álvarez Muñiz, Enrique Zas Arregui

1/1/2018 - 12/31/2019

MINECO - Plan Estatal (2013-2016)

FPA2017-85114-P

145,200 euros

Búsquedas de nueva física con experimento mejorado LHCb del CERN

Abraham Antonio Gallas Torreira, Pablo Vázquez Regueiro

1/1/2018 - 12/31/2019

MINECO - Plan Estatal (2013-2016)

FPA2017-89204-C2-1-P

931,700 euros

Búsquedas de nueva física con experimento mejorado LHCb del CERN

Diego Martínez Santos, Veronika Chobanova

1/1/2018 - 12/31/2019

MINECO - Plan Estatal (2013-2016)

FPA2017-89204-C2-2-P

133,100 euros

Holografía, gravitación y teorías gauge

Javier Mas Solé, José Luis Miramontes Antas

1/1/2018 - 12/31/2019

MINECO - Plan Estatal (2013-2016)

FPA2017-84436-P

48,400 euros

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Campus Vida, Universidade de Santiago de Compostela,
Santiago de Compostela, Spain

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Hot and dense QCD in the LHC era (Hot LHC)
Carlos Alberto Salgado López
1/1/2012 - 12/31/2017
European Commission - VII PM - Ideas
279579
1,379,376 euros

Solving Challenges in Nuclear Data (CHANDA)
José Fernando Benlliure Anaya
12/1/2013 - 11/30/2017
European Commission - VII PM - Capacidades
605203
97,000 euros

Collaboration for high-energy physics and astrophysics on the basis of unique scientific facility NEVOD
Juan Antonio Garzón Heydt
1/1/2014 - 12/31/2017
National Research Nuclear University MEPHI

Challenging the Standard Model using an extended Physics program in LHCb (BSMFLEET)
Diego Martínez Santos
1/4/2015 - 3/31/2020
European Commission - Horizon 2020
ERC-2014-STG-639068
1,499,855 euros

Hard Probes of Hot and Dense QCD Matter (HppQCD)

Carlos Alberto Salgado López

1/7/2015 - 8/31/2017

European Commission - Horizon 2020

660952

158,122 euros

European Nuclear Science and Application Research 2 (ENSAR2)

Héctor Álvarez Pol

3/1/2016 - 2/29/2020

European Commission - Horizon 2020

654002

105,500 euros

Desafíos presentes y futuros del experimento LHCb del CERN. - RETOS 2014

Abraham Antonio Gallas Torreira

1/1/2015 - 12/31/2017

MINECO - Plan Estatal (2013-2016)

FPA2014-57896-C4-1-R

885,720 euros

Calibración y reconstrucción de NEXT. - RETOS 2014

José Angel Hernando Morata

1/1/2015 - 12/31/2018

MINECO - Plan Estatal (2013-2016)

FIS2014-53371-C4-2-R

100,430 euros

Holografía e Integrabilidad en Teorías Cuánticas de Campos y Cuerdas. - EXCELENCIA 2014

Javier Mas Solé

1/1/2015 - 12/31/2018

MINECO - Plan Estatal (2013-2016)

FPA2014-52218-P

160,930 euros

Interacciones fundamentales en condiciones extremas. - EXCELENCIA 2014

Nestor Armesto Pérez, Carlos Alberto Salgado López

1/1/2015 - 12/31/2017

MINECO - Plan Estatal (2013-2016)

FPA2014-58293-C2-1-P

243,210 euros

Sistema de Tomografía Industrial de Muones y Radiografía Multivariable de rayos cósmicos para la Detección de Trafico Ilegal de Material Radioactivo Especial (MACROESCANER2015). Feder-Innterconecta 2015

Juan Antonio Garzón Heydt

2/1/2016 - 1/1/2018

Digafer, S.A.

154,880 euros

Agrupacións estratéxicas 2015 - AEFIS

Carlos Alberto Salgado López

9/8/2015 - 12/31/2017

Consellería de Cultura, Educación e Ordenación Universitaria

AGRUP2015/11
500,000 euros

Búsqueda de nueva física en asimetrías con violación CP en LHCb - EXCELENCIA 2015
Bernardo Adeva Andany
1/1/2016 - 12/31/2017
MINECO - Plan Estatal (2013-2016)
FPA2015-67133-P
37,500 euros

Desafiando al Modelo Estandar con un nuevo programa de física en LHCb. - EXCELENCIA 2015
Diego Martínez Santos
1/1/2016 - 12/31/2017
MINECO - Plan Estatal (2013-2016)
FPA2015-70479-P
45,375 euros

Contribución al programa científico de investigación nuclear a baja energía de excitación en instalaciones europeas tipo TOF e ISOL 2016. - EXCELENCIA 2015
Ignacio Durán Escribano
1/1/2016 - 12/31/2018
MINECO - Plan Estatal (2013-2016)
FPA2015-71690-P
130,438 euros

Experimento R3B del día cero en el GSI y contribución a la construcción del Demostrador de CALIFA. - EXCELENCIA 2015

Dolores Cortina Gil

1/1/2016 - 12/31/2018

MINECO - Plan Estatal (2013-2016)

FPA2015-69640-C2-1-P

242,000 euros

Participación en el Observatorio Pierre Auger: AugerPrime. - RETOS 2015

Enrique Zas Arregui

1/1/2016 - 12/31/2017

MINECO - Plan Estatal (2013-2016)

FPA2015-70420-C2-1-R

278,300 euros

Proyecto para la investigación, desarrollo y validación de un sistema que, mediante el uso de blancos primarios y secundarios, genere radiofármacos por aceleración láser. - RETOS COLABORACIÓN 2015

José Fernando Benlliure Anaya

6/1/2015 - 12/31/2018

MINECO - Plan Estatal (2013-2016)

RTC-2015-3278-1

218,042 euros

Desenvolvemento de novas tecnoloxías para a prevención de radón (TECRA) Conecta Peme 2016

Dolores Cortina Gil

10/18/2016 - 3/17/2019

ATI Sistemas SL

72,981 euros

Desenvolvemento de novas tecnoloxías para a prevención de radón (TECRA)
Conecta Peme 2016
Dolores Cortina Gil
10/18/2016 - 6/17/2019
Padreiro SL
37,441 euros

Desenvolvemento de novas tecnoloxías para a prevención de radón (TECRA)
Conecta Peme 2016
José Fernando Benlliure Anaya
10/18/2016 - 6/17/2019
Galaicontrol sl
44,403 euros

Desenvolvemento de novas tecnoloxías para a prevención de radón (TECRA)
Conecta Peme 2016
José Fernando Benlliure Anaya
10/18/2016 - 6/17/2019
ARRAELA , S.L.
55,504 euros

Axuda complementaria aos contratos postdoutorais da modalidade B 2016
Antonio Romero Vidal
7/31/2016 - 7/30/2018
Consellería de Cultura, Educación e Ordenación Universitaria
POS-B/2016/009
20,000 euros

Axuda complementaria aos contratos postdoutorais da modalidade B 2016
Pablo Cabanelas Eiras
7/31/2016 - 7/30/2018
Consellería de Cultura, Educación e Ordenación Universitaria
POS-B/2016/015
20,000 euros

Búsqueda de nueva física en el detector LHCb del CERN siguiendo las aproximaciones directa e indirecta
Xabier Cid Vidal
1/1/2016 - 12/31/2017
Ministerio de Economía, industria y Competitividad
IJCI-2014-21751
6,000 euros

Desarrollo de un sistema de control automático de la concentración de radón en edificios. RETOS-COLABORACIÓN 2016
Dolores Cortina Gil
3/7/2016 - 12/31/2019
AEI - Agencia Estatal de Investigación
RTC-2016-5627-1
127,751 euros

Medida de rayos cósmicos con un detector tipo Trasgo en la base antártica española. EXCELENCIA 2016
Juan Antonio Garzón Heydt
12/30/2016 - 12/29/2019
AEI - Agencia Estatal de Investigación

CTM2016-77325-C2-2-P

35,090 euros

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Campus Vida, Universidade de Santiago de Compostela,
Santiago de Compostela, Spain

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Bayesian analysis of the mass composition of Ultra-high Energy Cosmic Rays
Guillermo Torralba Elipe
11/2/2017
Director: Enrique Zas Arregui

On gravitational Phase Transitions, T-duality and Symmetry Breaking in AdS-CFT
Jesús Aníbal Sierra García
9/8/2017
Director: José Daniel Edelstein Glaubach

Holographic Thermalization in Finite-Size Systems
Alexandre Serantes Rubianes
5/30/2017
Director: Javier Mas Solé

Study of the decays B0(s) -> Kst Kstb and first observation of the Bs -> Phi Kstb decay at the LHCb experiment
Brais Sanmartín Sedes
12/18/2017
Director: Bernardo Adeva Andany, Cibrán Santamarina Ríos

Neutron-induced fission fragment angular distribution and cross section of uranium targets at CERN-n_TOF
Esther Leal Cidoncha
5/22/2017
Director: Ignacio Durán Escribano

Measurement of the inelastic pp cross-sections using the LHCb experiment and development of a new vertex detector
Álvaro Dosil Suárez
5/5/2017
Director: Abraham Antonio Gallas Torreira

Phenomenological studies of initial state effects and jet quenching in High-Energy Nuclear Collisions at LHC

Carlota Andrés Casas

10/25/2017

Director: Carlos Pajares Vales, Carlos Alberto Salgado López