IGFAE
Instituto Galego de Física de Altas Enerxías

USC
UNIVERSIDADE DE SANTIAGO DE COMPOSTELA

XUNTA DE GALICIA

Annual Report 2018

IGFAE Executive Board
July 12th 2019

EXCELENCIA MARÍA DE MAEZTU
07/2017-07/2021

AGENCIA ESTATAL DE INVESTIGACIÓN

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INTRODUCTION

2018 has been a year of intense changes for our Institute. The most important actions from the Maria de Maeztu grant were implemented during the first half of the year and in-depth modifications in the organization were put in place. Most notably, the Global Talent program, the program included in the Maria de Maeztu grant to attract young new researchers that could open new lines at the institute was finalized. Two new group leaders, Thomas Dent in experimental gravitational wave detection, and Riccardo Borsato in integrable systems, were hired. These two new additions have proven very successful in the first year of the grant. At the same time, four new Global Talent Fellows, Miguel Angel Escobedo, Joshua Renner, Antonio Romero and Jeremy Dalseno joined some of the existing programs of the institute. The institute has also been quite succesful in external grants for individual researchers, in particular in the very competitive La Caixa programs, with two INPhINIT fellows for PhD students, Joao Barata and Filip Jurukovic, and one La Caixa Junior Leader for Riccardo Borsato. This shows the value of the Global Talent call as a way to attract extra external funds when good candidates are hired.

Intense changes in the organization of the institute were put in place in 2018. On the one hand, IGFAE new regulation was approved during the first semester. This allowed to implement a much more efficient managerial structure, with internal committees to help the director of the institute and, most importantly, the constitution of the Scientific Advisory Board (SAB) composed of internationally renowned researchers, also with extensive experience in scientific management. The new governance model has been simplified in the regulations, with the Governing Board as the highest body for decisions and an executive director, both assisted by the SAB. The SAB, on the other hand, is an independent body with specific tasks of periodic evaluations – the first of which took place in March 2019. An Executive Board with the conveners of the 3+1 Strategic Research Areas has been formed, with weekly meetings that improved a lot the organization of the different actions and the communication inside the Institute. The (internal) Scientific Committee has also been enlarged so that all the programs of the institute are represented.

From a scientific point of view, one of the most important changes in the Institute was establishing a new scientific program on experimental detection of gravitational waves. IGFAE joined the LIGO collaboration in 2018 after the arrival of Thomas Dent and the team he has been formed, with collaboration of researchers from the Auger program. This new line fills a gap on the scientific agenda of the Institute. Only the available fund from the Maria de Maeztu project (around a 20% of the total MdM funds are devoted to open this new program) made this possible. The high expectations that the scientific community have in this new way to look at the Cosmos will indeed

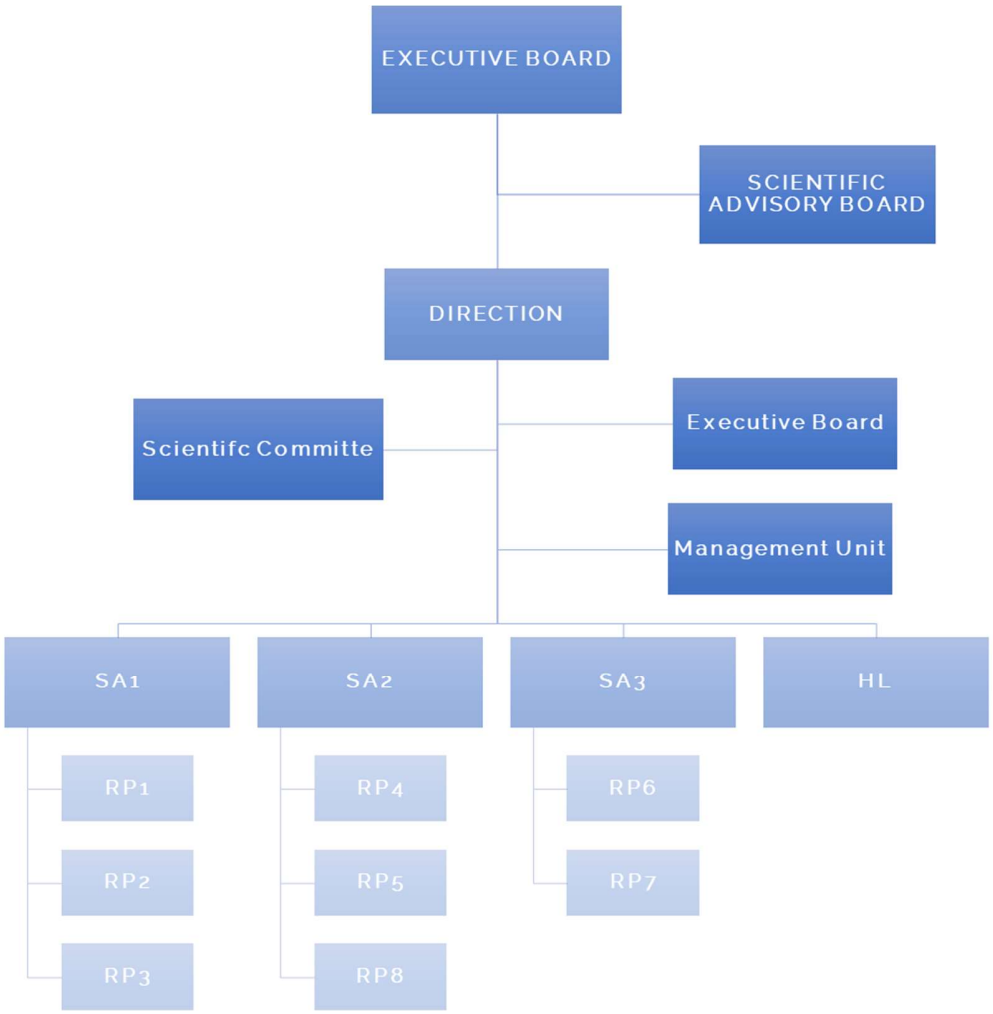
find their place at IGFAE.

All IGFAE scientific programs performed very well during 2018, with some outstanding results that can be found in this report. IGFAE is now in a growing pace and the next couple years promise to be especially important for the future decades.

1. ORGANIZATION

The IGFAE new bylaw fixes a very simple organization with basically two governing bodies, the Governing Board and the director and associate director(s), and a advisory body, the Scientific Advisory Board (SAB) with a very relevant role in the periodic evaluations, one of the most important additions to the previous system. At the same time, the directorate of the Institute can propose and constitute different commissions or committees with specific roles. At present there is a Scientific Committee, formed by representatives of the different scientific programs, and an Executive Board, formed by the four conveners of the Strategic Research Areas plus the directorate and the Chief Operator Officer, head of the Management Unit. The Management Unit has been reinforced in 2018, but the main reinforcements will take place in 2019 and the following years, once the new system is implemented and fully functional.

On the other hand, the Research Programs (eight, after the addition of the LIGO program) are organized in three Strategic Research Areas plus one Horizontal Line for continuous assessment of new experimental opportunities



The composition of the different bodies is the following

Governing Board

The Governing Board is the highest body with full decision power on the Institute. It is formed by the Rector of the University of Santiago de Compostela, that is also its president, two more representatives of the university and three members of Xunta de Galicia. In 2018

Universidade de Santiago de Compostela

President: Juan Viaño Rey (until June 2018) and Antonio López (since June 2018)

Isabel Rodríguez Moldes (until June 2018) and Vicente Pérez Muñuzuri (after June 2018)

Máximo Plo Casasús

Xunta de Galicia

José Alberto Díaz de Castro

María Jesús Tallón Nieto

Faustino Infante Roura

Scientific Advisory Board

The SAB has an important role in assisting the direction and the Governing Board in the decision taking process related with scientific agenda and performance, in particular, periodic evaluations.

Sergio Bertolucci (Università Bologna)

Barbara Erazmus (SUBATECH, Nantes)

Paolo Giubelino (FAIR Director – Darmstadt)

Gabriela González (Louisiana State University)

Francis Halzen (University of Wisconsin) – chair

Larry McLerran (Institute for Nuclear Theory director – Seattle)

Giulia Zanderighi (CERN and Max Planck Munich)

Director – Carlos A. Salgado

Associate Director – Abraham Gallas

Together with this structure from IGFAE regulations, the directorate has put in place

Conveners of the Strategic Research Areas

Elena G. Ferreiro – Strategic Area 1

Jaime Álvarez Muñiz – Strategic Area 2

Dolores Cortina – Strategic Area 3

Néstor Armesto – Horizonta Line

Scientific Committee

Formed by members of the different programs. This is an internal committee for periodic discussion about different topics of the institute. In 2018 the members of this committee were

Jaime Álvarez Muñiz (convener SA2)

Néstor Armesto (convener HL)

Dolores Cortina (convener SA3)

José Angel Hernando

Elena González Ferreiro (convener SA1)

Diego Martínez Santos

Juan José Saborido

José Luis Miramontes

Enrique Zas

Executive Board

Formed by the conveners of the strategic areas plus director, associate director and head of the Management Unit. The EB meets weekly and is the most dynamical body for assisting the director in the day-by-day issues.

Management Unit

A MU has started in 2018 with the hiring of a Chief Operator Officer as expected from the MdM project. The COO is Ricardo Rodríguez. The unit will grow in the following years. In 2018 it is formed by

Ricardo Rodríguez – COO

Ana Belén Vázquez – Project manager and accounting

Marcos Seco – Computing

1.1. TEAM

The members of the Institute are practically the same as the last year, with the difference of one researcher more and 3 women increased in the team. The information is completed in the annex 1.

Category		Male	Female
Administrative and Technical Staff	11	6	5
Emeritus	2	2	0
Postdocs	14	11	3
Scientific staff	33	29	4
Students	39	30	9
Total	**97**	**77**	**20**

2. FINANCES[1]

	Expenses
Scientific lab equipment	62,585 €
Software & licenses	1,576 €
RD meetings & protocole	7,765 €
Travel costs	266,981 €
Communication	1,009 €
Hardware equipment	43,481 €
Other institutions	43,036 €
Personnel cost	934,061 €
Workshops, conferences & lectures inscriptions	25,248 €
Other publications	1,197 €
Furnishing	2,299 €
Consumable material	15,569 €
Other research costs	125,496 €
Furnishing repairment	233 €
Printing	575 €
Workshops, conferences & lectures external	843 €
Total	**2,631,529 €**

3. RESEARCH ACTIVITY

SA1 The Standard Model to the Limits

Our best understanding of the microscopic reality is encapsulated in the Standard Model (SM) of particle physics. Developed in the early 1970s, it has successfully explained almost all experimental results and precisely predicted a wide variety of phenomena. Over time and through many experiments, the Standard Model has become established as a well-tested physics theory.

Our Institute has played a fundamental role in this broad field of research, which includes the search for new physics beyond the Standard Model (SM) using the LHCb experiment (RL1), the study of the Quantum Chromodynamic (QCD) matter at extreme conditions (RL2) and the investigations on string theory, both from a formal and applied point of view (RL3).

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

[1] Data under review and processing.

been published during 2018.

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 2018 concern the use of top quarks and quarkonia 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 2018 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.

RP1 – The Beyond the SM searches with LHCb

LHCb is the experiment designed to perform high-precision measurements of CP-violation and search for New Physics beyond the Standard Model (SM) at the LHC. The LHCb detector is a single-arm spectrometer with excellent tracking and particle identification capabilities.

The 2018 proton-proton run ended successfully in October 2018 with a record luminosity of 2.5 fb^{-1} delivered by LHC and 2.2 fb^{-1} collected by LHCb. A total of 10,2 fb^{-1} were delivered to LHCb in Run 1 + Run 2 data taking periods, with 9,2 fb^{-1} collected by the experiment. The proton-proton run was followed by an equally successful heavy ion run at $\sqrt{S_{NN}} = 5.02\ TeV$, with a recorded luminosity of Pb-Pb collisions of about 0.2 nb^{-1}. This is the largest Pb-Pb sample ever collected by LHCb. In addition, a substantial sample of Pb-Ne collisions in fixed target mode has also been collected.

The operational efficiency was 90,6% and all subdetectors operated in a very stable way. A flexible trigger strategy was in place that allowed LHCb to take data in diverse beam conditions, profiting from all useful luminosity to perform physics studies. The installation activities for the upgrade started immediately at the beginning of LHC Long Shutdown 2 and are now in full swing.

The upgraded detector will be able to read out all sub-detectors at 40MHz and to select physics events of interest by means of a pure software trigger at the bunch crossing rate of the LHC. This capability will allow the experiment to collect data with high efficiency at a luminosity of 2×10^{33} $cm^{-2}s^{-1}$. Flavour-physics measurements will be performed with much higher precision than is possible with the current detector, and across a wider range of observables. The flexibility inherent in the new trigger scheme will also allow the experiment to diversify its physics programme into important areas beyond flavour.

Researchers from the IGFAE are involved in the upgrade of the LHCb vertex sub-detector (VELO, Vertex Locator), and the high-level trigger (HLT) since 2008 and 2014 respectively. Concerning the VELO considerable progress has been made last year. The sensor order has been completely fulfilled last year, and a second production order of the second VeloPix (Readout ASIC) submission was launched and fulfilled in January. Changes in the Front-end and GBTX hybrids production have been applied to solve the quality and planarity problems and now are good. The IGFAE LHCb group has been producing the High-Speed and High Voltage flex cables for the whole sub-detector. A dedicated test stand has been set up for quality assurance. Metrology has been done to the GBTX hybrids to characterise and pinpoint the low quality of their BGA´s soldering. In the electronics workshop two more prototypes were assembled with the second version of the readout ASIC

VeloPix to be fully characterised in the laboratory. These prototypes were irradiated at the USC X-ray facility up to 400 Mrad to certify their radiation hardness (see Figure 1).

Fig 1. X-ray irradiation of VeloPix prototype.

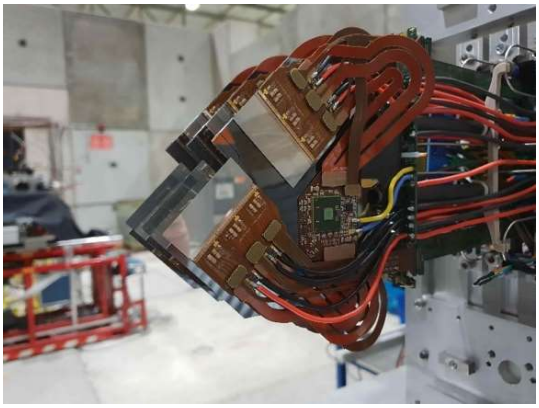


Fig 2. Test beam with 6% of the VELO sub-detector.

For the readout chain, developments in the firmware and hardware have continued during 2018. All this progress in the readout software and hardware was tested in a dedicated test beam with three modules of the VELO sub-detector fully instrumented accounting for 6% of the whole detector (see Figure 2.). Tracks from particle beams were measured for the first time. IGFAE group was one of the main contributors to this test beam.

In addition to all these activities the IGFAE LHCb group participated in the Production Readiness Review of VELO upgrade frontend electronics https://indico.cern.ch/event/725985/ and in the VELO Upgrade Module Production Readiness Review https://indico.cern.ch/event/724616/overview .

One of the main characteristics of the LHCb upgrade is the full software trigger. The possibility of an HLT based on GPUs instead of CPUs can significantly improve the farm's computing power per euro at any of the LHCb upgrade phases. IGFAE contributes to the development of VELO clusterization algorithms, muon identification algorithms and track matching algorithms using GPU´s. The efforts in the trigger for strangeness decays for the LHCb upgrade progressed smoothly, a first version of the specific tracking using the VELO, the UT (Upstream Tracker) and the muon stations was set in 2018. Also, started the efforts for the integration of this algorithm into the GPU framework, Allen.

In addition, new ideas for the strangeness program where explored, and documented in JHEP05(2019)048 as well as in CERN yellow reports.

Since 2018, the reconstruction and trigger tasks of LHCb are organized in a subdetector-like WG called Real Time Analysis (RTA). IGFAE became part of the Spanish commitment to RTA.

The year 2018 has been highly successful for the LHCb physics output, with 50 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 in 2018:

- *Measurement of the ratio of the* $B^0 \to D^{*-}\tau^+\nu_\tau$ *and* $B^0 \to D^{*-}\mu^+\nu_\mu$ *branching fractions using three-prong tau-lepton decays, Phys. Rev. Lett. 120, 17802 (2018).*
- *Test of lepton flavour universality by the measurement of the* $B^0 \to D^{*-}\tau^+\nu_\tau$ *branching fraction using three-prong decays, Phys. Rev. D 97, 072013 (2018).*
- *First measurement of the CP*-violating phase $\phi_s^{d\bar{d}}$ in $B_s^0 \to (K^+\pi^-)(K^-\pi^+)$ decays, JHEP03 (2018) 140.
- *Search for a dimuon resonance in the* Υ *mass region, JHEP09 (2018) 147*.
- *Measurement of the inelastic pp cross*-section at a centre-of-mass energy of 13 TeV, JHEP06 (2018) 100.
- Study of the B0 → ρ(770)0K*(892)0 mode with an amplitude analysis of B0 → (π+π−)(K+π−) decays, LHCb-PAPER-2018-042, http://arxiv.org/abs/1812.07008 submitted to JHEP.

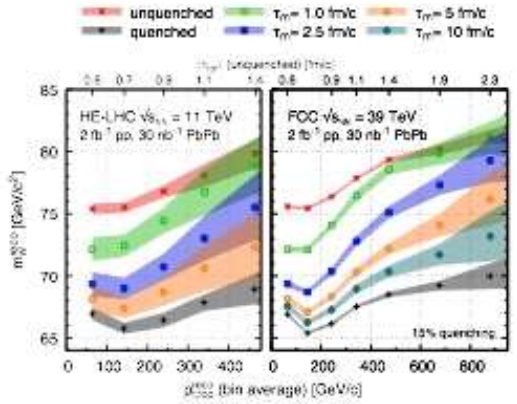
As a result of the collaboration of several members of our group with some theoretical physicists the following articles were published in 2018 with a reduced number of authors.

Likelihood Analysis of the pMSSM11 in Light of LHC 13-TeV Data, Eur.Phys.J. C78 (2018) no.3, 256. Likelihood Analysis of the Sub-GUT MSSM in Light of LHC 13-TeV Data, Eur.Phys.J. C78 (2018) no.2, 158. Probing SUSY effects in $K_S^0 \to \mu^+\mu^-$ *, JHEP 1805 (2018) 024.*

In 2018 the WP1 of ERC-StG-639068, oriented to the search of the NMSSM A1 Higgs, was successfully completed. No signal was found, and world best limits in the region near the Y resonances were set. The results were published in JHEP 08 (2018) 147.
New ideas for the "exotics" program of LHCb have been documented in CERN yellow reports. Activities in Phenomenology also continued during 2018.

RP2 – Hot and dense QCD in the LHC era and beyond

The QCD phenomenology group of IGFAE aims to make essential contributions to the understanding of QCD dynamics in conditions of large temperatures or densities. These conditions are relevant for the evolution of the early Universe and the stars. The new experimental conditions, especially the large LHC collision energy, allow for a much deeper understanding of QCD matter, with new observables that are more directly comparable with theoretical calculations. In fact, the high energies reached in heavy ion collisions at the LHC allow precision studies of the expected hot QCD medium produced in the collision, generically known as the Quark Gluon Plasma (QGP).

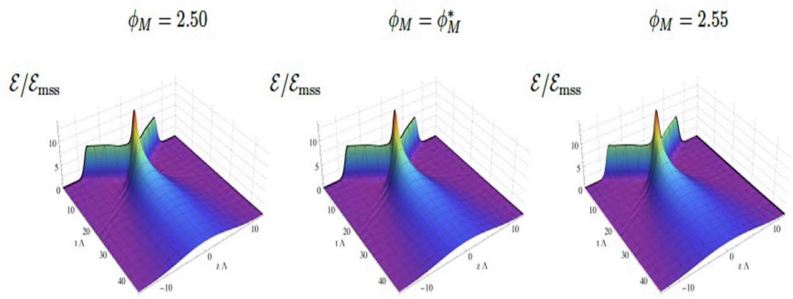


Characterizing this material is one of the objectives of our work. Do to so, we have continued our activities on the different lines: heavy-ion collisions and the Quark Gluon Plasma, high energy QCD and the description of strongly interacting matter in effective models like Skyrme. Some highlights during 2018 are the following:

The group has pioneered proposals to access the time structure of the QGP. To do so, the use of top quarks has been put forward in Phys. Rev. Lett. 120 (2018) no.23, 232301. In fact, the top production and its semi leptonic 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 loss processes, leaves an imprint in the reconstructed W mass. This observable has a promising future in the new experimental proposals, as the HL/HE-LHC and at the FCC-hh.
The group has also focused on the study of other hard processes that involve high momentum or mass scales. Hard probes can be computed in perturbative QCD; their production and propagation

through the medium can thus provide information on the nature and properties of this medium. We have studied the production of quarkonium -bound states of charm or beauty quarks- in pPb and PbPb collisions at the LHC energies considering initial and final state effects, paying a particular attention to the excited states of quarkonium and their suppression, in JHEP 1810 (2018) 094. We have got the plenary talk on quarkonia at Quark Matter 2018.

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 particular, the correlations and the ridge structure within the glasma approximation have been studied in JHEP 1805 (2018) 207. The double and triple inclusive gluon production at mid rapidity taking into account quantum interference in pA scattering has been published in Eur.Phys.J. C78 (2018) 9.



Besides, the group continued working in the research line on topological solitons, Skyrmions and their applications to nuclear Physics and astrophysics, as in JHEP 1803 (2018) 023.

Moreover, the applicability of holography to analyse relativistic collisions in strongly coupled gauge theories with thermal phase transitions is developed in Phys. Rev. Lett. 121 (2018) 26, 261601, giving rise to a new hydro formulation with a QCD critical point.

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, in such a way that heavy-ion collisions can be studied in new energy and rapidity domains with the LHCb and ALICE detectors.

Also, 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, has been presented. The talk *Future physics opportunities for high-density QCD at the LHC with heavy-ion and proton* beams (Report from Working Group 5 of the Workshop on the Physics of the CERN HL-LHC, and Perspectives at the HE-LHC) has been delivered by the group.

Besides, the group continued working on string models as phenomenological models for QCD in the soft domain.

RP3 - String Theory

String Theory provides a fruitful framework to explore interesting problems in high-energy physics; most notably, putting together General Relativity and Quantum Mechanics in a consistent manner. One of the most robust ideas obtained in this framework is the AdS/CFT correspondence, a holographic duality relating Quantum Field Theory with gravity in higher dimensions. Since its inception, it became a powerful tool to describe strongly coupled phenomena ranging from QCD-like quantum field theories to lower dimensional condensed matter problems. A key aspect of this duality is the appearance of integrable structures. Furthermore, albeit less explored, the AdS/CFT correspondence can be used to understand space-time as an emergent concept and, in particular, to shed some light into a central problem in physics: how to go from General Relativity to Quantum Gravity. Our group is focused on these issues along three lines of research, whose highlights during 2018 are discussed next.

Holographic tools for strongly coupled quantum systems

The group has a wide experience in the uses of the AdS/CFT correspondence to tackle strongly coupled quantum systems; particularly in introducing flavour degrees of freedom in QCD-like quantum field theories. Among its different applications, we have explored in the past year multi-layered systems at finite temperature [JHEP 1802 (2018) 139], non-commutative planar condensed matter systems [Int. J. Mod. Phys. A33 (2018) 1850078], quantum critical ground states breaking translations spontaneously [Phys. Rev. D 97 (2018) 086017], and the temperature scaling of charge density wave quantum critical phases [Phys. Rev. Lett. 120 (2018) 171603].

We have also used holographic tools to deal with time dependent processes in strongly coupled systems, which are mapped to dynamical gravitational problems demanding numerical simulation. We investigated the case of time dependent couplings and scrutinized ranges of frequencies and amplitudes for which the system retains coherence, seeking parametric resonances: the system absorbs energy until it collapses into a black hole [JHEP 1804 (2018) 137]. A broader family of confined (completely resonant) systems whose mildly non-linear wave dynamics was studied is the Gross-Pitaevskii equation [Phys. Rev. E 98 (2018) 032222] as well as the weakly nonlinear dynamics of gravitationally backreacting perturbations in global AdS_4.

Integrability in String Theory and the AdS/CFT correspondence

The group is well recognised for its contributions in the application of integrability to the study of the AdS/CFT correspondence. Integrability amounts to the existence of an infinite number of conserved quantities. It was found in both sides of the AdS/CFT correspondence and provided new tools to investigate non-perturbatively the conjectured duality. On the gravity (or AdS) side, integrability is manifested by the appearance of integrable sigma-models that describe the world-sheet theories for

strings moving in curved space-times with an AdS factor. The success of the methods provided by integrability in the AdS/CFT correspondence motivated substantial activity in exploring deformations of this type of string sigma-models that preserve integrability, and in the development of new strategies to obtain exact results in those cases.

We considered the exact S-matrix governing the planar spectral problem for strings on AdS spaces which are dual to 2D and 4D conformal quantum field theories and showed that they are invariant under a novel boost symmetry [Nucl. Phys. B 928 (2018) 321]. When the boost is included, the symmetries of the R-matrix close into a q-Poincaré superalgebra [Phys. Rev. D 97 (2018) 066001]. Non-abelian T-duality and Yang-Baxter deformations of Green-Schwarz strings were further considered [JHEP 1808 (2018) 027].

In a somehow separate direction, a six-dimensional Superconformal Field Theory arising in Massive IIA String Theory was considered. The dynamics of string solitons was studied, showing that the associated Hamiltonian system is both non-integrable and chaotic, implying the non-integrability of the dual Conformal Field Theory.

From General Relativity to Quantum Gravity

This line of research is younger than the other two and is based on a recent paper which shows that not all local Lorentz invariant Lagrangians are consistent as low-energy effective theories. When gravity is included, the study of Eikonal graviton scattering strongly suggests the necessity of a stringy UV completion. In order to have a better understanding of this result, in the framework of a two-parameter family of quadratic theories of gravity exhibiting T-duality, which includes (but goes beyond) String Theory, we showed that the temperature and entropy of a BTZ black hole are invariant under T-duality on general grounds. Interestingly enough, the AdS/CFT correspondence enforces quantization conditions on these parameters [JHEP 1806 (2018) 142]. While studying higher-curvature gravity actions we realized that there is a family with remarkable properties: (i) just gravitons in vacuum, (ii) non-hairy black holes and, most interestingly, (iii) a well-behaved cosmology with a mechanism of geometric inflation deserving further study.

SA2 Cosmic Particles and Fundamental Physics

RP4. Extremely energetic cosmic rays and neutrinos – Large exposure experiments

Detection of Ultra-High-Energy Cosmic Rays (UHECR) and neutrinos with energies in excess of 1 EeV (1018 eV) requires observatories spreading over areas of thousands of km2 and operating for long periods of time. To fulfil these requirements, the Pierre Auger Observatory was conceived in the 1990's as the world's largest ground-based air-shower array for the detection of UHECR and UHE neutrinos. Auger is a hybrid detector combining a surface detector of 1600 water-Cherenkov stations that sample the UHECR-induced atmospheric shower front at the ground level, and a set of 4 fluorescence detectors to measure the light emitted by the passage of the shower particles through the atmosphere.
Picture of one of the Water-Cherenkov detectors of the Pierre Auger Observatory (in the forefront), and one of the Fluorescence Detector bulidings (in the foreground).

IGFAE has been involved with the Pierre Auger Observatory since its early years. Located near the town of Malargüe in the Mendoza province in Argentina, the 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. The Auger collaboration is currently installing additional scintillator detectors ('AugerPrime') above the water-Cherenkov stations to discriminate between the electron and muon content of the shower with the aim of determining the mass of the primary cosmic-ray, a key observable to decipher among the scenarios that could explain the observed suppression of the UHECR spectrum. These measurements are also crucial to determine the proton content of the primary UHECR flux, the decisive ingredient for estimating the physics potential of existing and future UHECR, UHE neutrino, and gamma-ray detectors. The upgrade will also deepen the understanding of hadronic showers and interactions at center-of-mass energies above those accessible at the LHC (see Figure).
In 2018 IGFAE has continued its successful participation in the Observatory. The activities are mainly focused in the analysis of inclined events arriving at the Auger detectors with zenith angles with respect to the vertical to ground exceeding 60o. These showers traverse much larger atmospheric depths than those nearer the vertical and, as a result, are characterized by the dominance of secondary energetic muons at the ground, since the electromagnetic component of the shower is

largely absorbed. The study of these events enables an independent measurement of the energy spectrum of UHECR, their composition, the determination of their arrival directions and distribution in the sky, the study of UHECR properties using the radio-technique and last but not least the search for UHE neutrinos.

The search for UHE neutrinos with the surface detector stations of the Observatory continued in 2018. Neutrino selection criteria were applied to inclined showers in the period up to 31 August 2018 with no candidates found. Stringent and competitive upper limits to the content of UHE neutrinos in the primary cosmic beam were derived from the lack of neutrino candidates in Auger, both integrated over all the sky and as a function of equatorial declination. Of special interest was the search for neutrinos in spatial coincidence with the position of the blazar TXS 0506+056, a potential source of neutrinos and cosmic-rays at TeV-PeV energies identified by the IceCube Observatory. These limits were presented at the UHECR 2018 conference (J. Alvarez-Muñiz, Multi-messenger Astrophysics at Ultra-High Energy with the Pierre Auger Observatory. UHECR 2018, 8-12 Oct. 2018, Paris).

Auger is closing in on the origin of the UHECR. Already in 2017 the Auger Collaboration discovered a significant dipolar anisotropy in the arrival directions of UHECR with energies above 8 EeV, with the excess pointing 120 degrees away from the Galactic center, providing observational evidence of an extragalactic origin for the particles. In 2018 a more detailed study was performed (Large-scale Cosmic-Ray Anisotropies above 4 EeV Measured by the Pierre Auger Observatory, Astrophysical Journal 868, 4 (2018)). By splitting the energy range above 8 EeV in three bins, it was found that the amplitude of the dipole increases with energy, while the directions of the dipoles in each energy bin are consistent with an extragalactic origin of UHECR at all the energies considered. This study used showers induced by UHECR that arrive at Earth with zenith angles up to 80o, an analysis to which the Astroparticle Physics group at IGFAE contributed directly and that allowed to extend the field of view of the Observatory (located in the South) towards the Northern hemisphere.

From the organizational point of view, an update of the Performance and Analysis Task Structure of the Pierre Auger Collaboration was done in 2018. A new data analysis task called “Multi-messenger Physics” was created, and the sub-tasks for photon and neutrino searches were merged together into the new analysis task dubbed “Neutral Particles”. Two members of IGFAE were appointed as co-conveners of these two tasks, namely Enrique Zas for the Multi-messenger Physics and Jaime Alvarez-Muñiz for the Neutral Particles.

IGFAE also contributed in 2018 to the radio technique for detection of UHE cosmic particles using coherent radio pulses in the MHz-GHz frequency range. This technique has been realized in a great deal of activities with the development of many experiments using Antarctic ice and the atmosphere

as shower calorimeters. In 2018 the radio emission in the 30 to 80 MHz band from UHECR-induced extensive air showers with zenith angles between 60o and 84o was measured using the Auger Engineering Radio Array (AERA) of the Pierre Auger Observatory. (Observation of inclined EeV air showers with the radio detector of the Pierre Auger Observatory, A. Aab et al JCAP 10 (2018) 026). In contrast to air showers with more vertical incidence, inclined air showers illuminate large ground areas of several km2 with radio signals and are thus measurable with sparse radio-antenna arrays with grid sizes of a km or more, allowing cost-effective and very large detectors to be built. This is particularly attractive as radio detection provides direct access to the energy in the electromagnetic cascade of an air shower, which in case of inclined air showers is not accessible by arrays of particle detectors on the ground. One highlight in the radio activities at Auger has been the funding of a project to add radio antennas to each of the existing water-Cherenkov stations of the array (see Figure). This "Radio Upgrade" will allow extending the shower-by-shower mass sensitivity to nearly horizontal showers.
Three-dimensional rendering of an upgraded station of the Surface Detector array of the Pierre Auger Observatory, comprised of (from bottom to top) a water-Cherenkov Detector station, a layer of scintillators, and a radio antenna.

The Astroparticle Physics group at IGFAE pioneered the simulation work of coherent radio pulses from high-energy showers in the MHz to GHz frequency range. This has proved to be crucial for the development of the radio technique for the detection of UHE cosmic particles. Such simulations are used in practically all experiments exploiting the technique, for instance in the Antarctic Impulsive Transient Antenna (ANITA) detector. ANITA is a suborbital balloon payload flying above Antarctica at ~36 km altitude carrying an array of antennas to observe radio emission from the interactions of cosmic particles with the Antarctic ice. During the ANITA flights two intriguing events of energies in the EeV range have been detected. They are observed to arrive from below the horizon and to have an electric field polarization matching that expected in atmospheric showers coming out of the Earth. A possible explanation is that they are induced by the decay of tau leptons that could be produced by astrophysical tau-neutrinos traversing the Earth. However, dedicated simulations of these events and the corresponding calculation of the exposure of ANITA for diffuse neutrino fluxes, performed in 2018 in collaboration with IGFAE, allowed to reject a Standard Model tau-neutrino explanation (Comprehensive analysis of anomalous ANITA events disfavours a diffuse tau-neutrino flux origin. A. Romero-Wolf et al. Phys. Rev. D 99, 063011 (2019)). Key to these calculations was the simulation of the expected flux of tau leptons after the propagation inside the Earth of a flux of UHE tau neutrinos performed at IGFAE (A Comprehensive Approach to Tau-Lepton Production by High-

Energy Tau Neutrinos Propagating Through Earth. J. Alvarez-Muñiz et al. Phys. Rev. D 97, 023021 (2018)). The true nature of these events remains an open issue.

RP5 Dark Matter and Fundamental Physics

- **NEXT**

The discovery of neutrino oscillations by the SNO and Superkamiokande experiments (Nobel Prize in Physics in 2015) demonstrated that neutrinos have mass, in contradiction with the postulates of the Standard Model (SM). This has now led us to focus on some fundamental questions not yet answered: what is the nature of the neutrinos? Are the neutrinos pure neutral particles? Is the neutrino its own-antiparticle? There is currently a competitive worldwide race, with several experiments running or in preparation, to answer those questions whose implications are profound and could change our understanding of Cosmology and Particle Physics.

Presently, the only viable phenomenon that could be used as a probe of the nature of the neutrino is the discovery of a very rare and hypothetical decay, a neutrino-less double decay (0), which could happen in certain nuclei. There are currently several experiments using different techniques and isotopes looking for this decay. Leading the field are the xenon experiments, KamlandZEN and EXO, and the germanium experiment, GERDA. No signal has been found yet and this imposes strong constraints on the Majorana neutrino mass.

One of the current operating experiments with xenon is NEXT. The detector is a High-Pressure Xenon gas Time Projection Chamber with Electro Luminescence readout (HPgXe-EL TPC). The TPC ensures the reconstruction of the electron trajectories, while the EL readout guarantees an excellent energy resolution. In addition, the detector materials are ultra radio-pure to minimize the background energy spectrum. NEXT resolution is expected to be 1% FWHM at the Q released energy of the 0 in xenon, almost 2.5 times better than its direct competitor using xenon.

The detector is a cylindrical and asymmetric TPC. An interaction in the HPgXe-EL TPC produces an initial scintillation signal (S1) and secondary electrons by ionization, which under the influence of an electric field, drift towards the anode, where they enter a stronger electric field producing a signal (S2) of electro-luminescence (EL) photons. These photons are recorded by a tracking plane and an energy plane. The former is located behind the anode, and provides the position of the electrons, allowing for reconstruction of the electron tracks. The energy plane, located before the cathode, is instrumented with PMTs, and records the total EL light. The track reconstruction is a unique

capability of NEXT, and it allows one to discriminate the signal (2 electrons) in the main background events of gamma interactions (mostly one electron).

The NEXT collaboration was formed in 2008, mostly by Spanish and USA groups. IGFAE is one of the founding members. Since 2008 the collaboration has constructed a series of prototypes to validate the detector concept. In 2016, the collaboration installed a large prototype, NEXT-White, at the Laboratorio Subterráneo de Canfranc (LSC) in the Spanish Pyrenees.

NEXT-White apparatus operates inside a radio-pure vessel surrounded by a lead shield castle. The detector and the open castle, stationed in Hall A of the LSC, are shown in the left pane of figure 1. Some parts of the detector are shown in the right panel of figure 1: a) field cage, b) anode plate, c) high voltage feedthroughs, d) the energy plane, f) the tracking plane.

Fig. 5. The NEXT-White detector in the hall A at the Laboratorio Subterráneo de Canfranc (Spain).

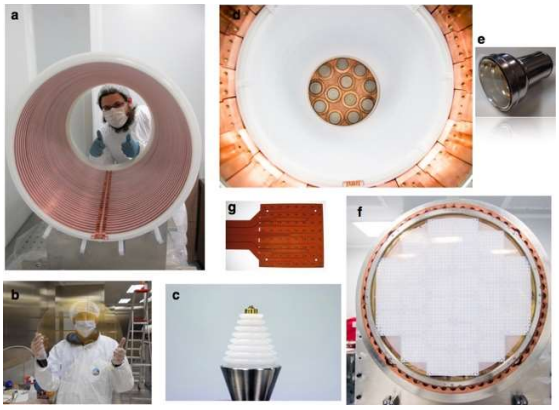


Fig.6 Different components of the NEXT-White detector (see text for details).

NEXT-White started operation in late 2016. It operated at 7 bars for 7 months in 2017, and at 10 bars for 9 months in 2018. The detector has shown very good stability. NEXT-White has been continuously calibrated with ^{83m}Kr decays, and several external sources, including ^{137}Cs and ^{208}Tl. Almost a million triggers have been recorded daily in 2018. This large amount of data has allowed us to map precisely the response of the detector. With the large statistics obtained we have estimated the energy resolution to be 0.82 % FWHM at the ^{208}Tl photo-peak, very close in energy to the decay, Q = 2459 keV. This has established NEXT-White as the xenon detector with the best energy resolution in the world. In addition, the data collected in 2018 has allowed us to estimate the two-electron identification using the double-escape peak of the ^{208}Tl gamma, and a background energy spectrum was obtained by taking data without calibration sources for 34 days. In Fig.2 we

show the energy resolution of the ^{208}Tl photo-peak (left panel), the two-electron efficiency vs one-electron rejection measured with the double-escape peak of ^{208}Tl (central panel), and the background energy spectrum measured in 34 days of data (right panel).

The members of IGFAE in the NEXT collaboration, have been responsible for the calibration of the detector during 2018. In particular, G. Martínez-Lema, defended his Ph.D. thesis on this subject in December 2018. The members of IGFAE, especially B. Palmeiro and G. Martínez, have been main contributors to these three relevant results which will be published in the following months.

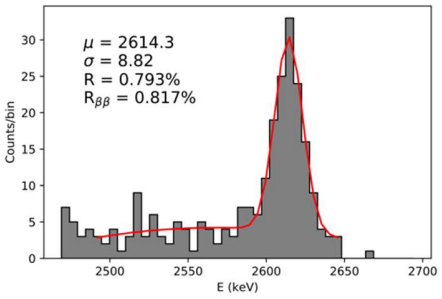


Fig.7 The ^{208}Tl photo-peak energy distribution

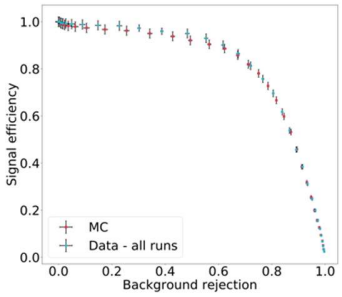


Fig.8 Two-electron efficiency vs one-electron rejection

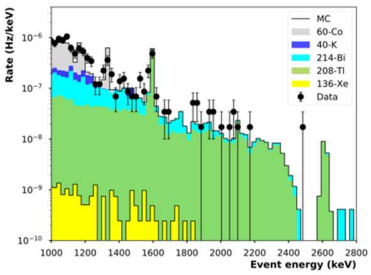


Fig.9 Background energy spectrum for 34 days

The year 2019 will be a crucial for NEXT. For the first half of 2019, the detector will be operated with enriched xenon, which will allow to measure the spectrum of the double beta decay with two neutrinos and will confirm the capabilities of NEXT to perform the search for the zero-neutrino mode. In addition, during 2019, the collaboration will begin construction of the NEXT-100 detector, which is expected to start operations in 2020. Thanks to the excellent energy resolution, the determination of the background and the two-electron identification obtained with the NEXT-White (see previous figure), we estimated that NEXT-100 will be able to set a limit on the Majorana neutrino mass of 60 meV, competitive with the current experiments.

R&D on gaseous detectors for Rare Event Searches and new lab

In 2018, a new lab for the R&D on gaseous detectors has been made fully functional at IGFAE. It consists of 3 main setups, fed by an ultra-high purity (<1 ppm O_2) gas system. The latter features purity control (cold and hot getter) and monitoring (via RGA), vacuum and pressure gauges, recirculation, gas flow regulators, recovery system, a custom spectrophotometer (400-900 nm), several optical sensors, filters and windows. It has been commissioned up to 10 bar. A custom data acquisition, slow control, analysis scripts, and data sharing scheme has been consolidated too. In

this short operational time, two novel amplification structures have been developed at the lab, and presented at the La Rochelle conference on MicroPattern Gaseous Detectors (MPGD). One, dubbed FAT-GEM, is an ultra-thick acrylic piece (5 mm) with 2 mm-holes, and has shown to allow an energy resolution corresponding to 0.9% at the energy of interest for NEXT (1% is the experiment's target value) while withstanding twice the electric field achievable with meshes, and being readily scalable, unlike the former. It therefore shows great potential for the multi-ton program of NEXT. The second one is a ceramic RPWELL, the first MPGD able to work in LXe conditions (165 K) while being spark-protected (the absence of a proper material was the technological bottleneck in this case). This successful result anticipates excellent and stable single-photon detection capability when coupled to a photocathode, in a double-stage configuration, as demonstrated at the conference. It raises hope for operation at LAr temperature (87K) in pure Ar atmosphere, that will be a breakthrough for neutrino physics, if achieved. The ceramic plate was developed at IGFAE in collaboration with ICMM-Madrid and featured an invited talk at the opening of the ceremony:
https://indico.cern.ch/event/757322/contributions/3330725/attachments/1840439/3017220/PresentationRD51atLaRochelle.pdf
https://indico.cern.ch/event/757322/contributions/3396504/attachments/1838689/3018396/Arindam_MPGD_2019.pdf

As of today, the lab comprises 3 systems dubbed '*Nausicaas*' (**N**uclei with **A** under **U**ranium **S**tudied **I**n a **C**hamber with **A**ccurate **A**-discrimination) after the main Optical TPC sitting at the lab center, and developed in collaboration with the FICA group also at the Institute (Fig.3). Complementary to the main setup, Nausicaa0 is devoted to the characterization of new structures (used in connection with the two aforementioned results), and Nausicaa2 to R&D in various gases, focused on spectroscopic analysis, time response and yields. Results obtained with the Optical TPC Nausicaa can be found in the report by the FICA group. The lab currently has a high-working activity, especially in relation with the study of scintillation in pressurized gases, that is driven by the international collaborations NEXT (neutrino mass and nature), DarkSide (WIMP-detection) and DUNE (neutrino oscillations). These are carried out in Nausicaa2.

In parallel, several articles have been published or submitted in the context of novel low-diffusion Xe-based mixtures for electroluminescence chambers, e.g., NEXT (up to a factor x5 reduction in diffusion), with special emphasis on Xe-CH_4 and Xe-He:

- **Xe/He:** arXiv:1902.05544 (submitted to JINST), Nucl.Instrum.Meth. A905 (2018) 82-90.
- **Xe/CH_4/CF_4/CO_2:** Nucl.Instrum.Meth. A 877(2018)157, JHEP 1901 (2019) 027.

In this context, the development of a microscopic simulation of the scintillation mechanisms at IGFAE has been essential to properly interpret and extrapolate the measurements, when needed.

Fig. 10. Status of the lab space in March 2017 (top) and now (bottom)[2].

RP8 - Gravitational Waves

A new era of Gravitational Wave (GW) Astronomy has begun in 2015 with the landmark observation of the first black hole binary (BBH) merger by the LIGO and Virgo Collaborations, followed by 9 other detections in 2015 and 2017. These discoveries (summarized in the Figure below) opened a completely new window to probe the cosmos. In September 2017, gravitational waves from binary neutron star (BNS) coalescence were detected at the LIGO/Virgo observatory, opening the stage for multi-messenger astronomy. This remarkable event was first detected with gravitational waves

[2] *Three setups ('Nausicaas') can be seen. The bulk of the gas system (injection, recovery, recirculation, purification, vacuum) is placed in the table underneath Nausicaa2 and the wall behind.*

and then observed as a short gamma-ray burst. Later on, the afterglow of the explosion, known as a kilonova, was observed through essentially the entire electromagnetic spectrum.

IGFAE joined the LIGO Collaboration in October 2018. The newly formed group (IGFAE-GW) presently consists of 5 researchers led by Dr. Thomas Dent, a senior researcher who has been a member of the LIGO-Virgo Collaboration since March 2009.

The IGFAE-GW group devotes their activities in this field to the all-sky search for GW signals from mergers of compact binary systems in past (O1 & O2) and future (O3 that started in April 2019 & O4 scheduled for 2021) observing runs of the LIGO-Virgo network, with low latency follow-up of event candidates. The group has major contributions to one of the analysis pipelines, dubbed PyCBC for the detection of gravitational wave signals from the coalescence of compact binary systems (CBC). This pipeline is a key part of the LIGO-Virgo analysis program. The group is also involved in the astrophysics of compact binaries via analysis of populations of GW sources, with the goal to contribute to decipher the so far unclear origin and evolution of massive stellar black hole binaries.

The development and application of Bayesian methods in multi-messenger astronomy including joint sources of GW and high-energy neutrinos is also a key activity at IGFAE. This multi-messenger work is being pursued along with members of the group who are also members of the Pierre Auger Collaboration. Gravitational waves are expected to be more commonly seen with the improved sensitivity of the LIGO and Virgo in 2019 and with the future KAGRA detector, implying a better chance of performing current astronomy with these observatories by tying these detections to electromagnetic, neutrino and cosmic-ray signals. This multi-messenger framework is expected to play a major role in the future of astronomy and is already a key part of the activities of the IGFAE-GW group.

Concerning future involvement in instrumental work, windows of opportunity are being identified for making contributions to the hardware of the Advanced interferometers for future runs in 2022/23.

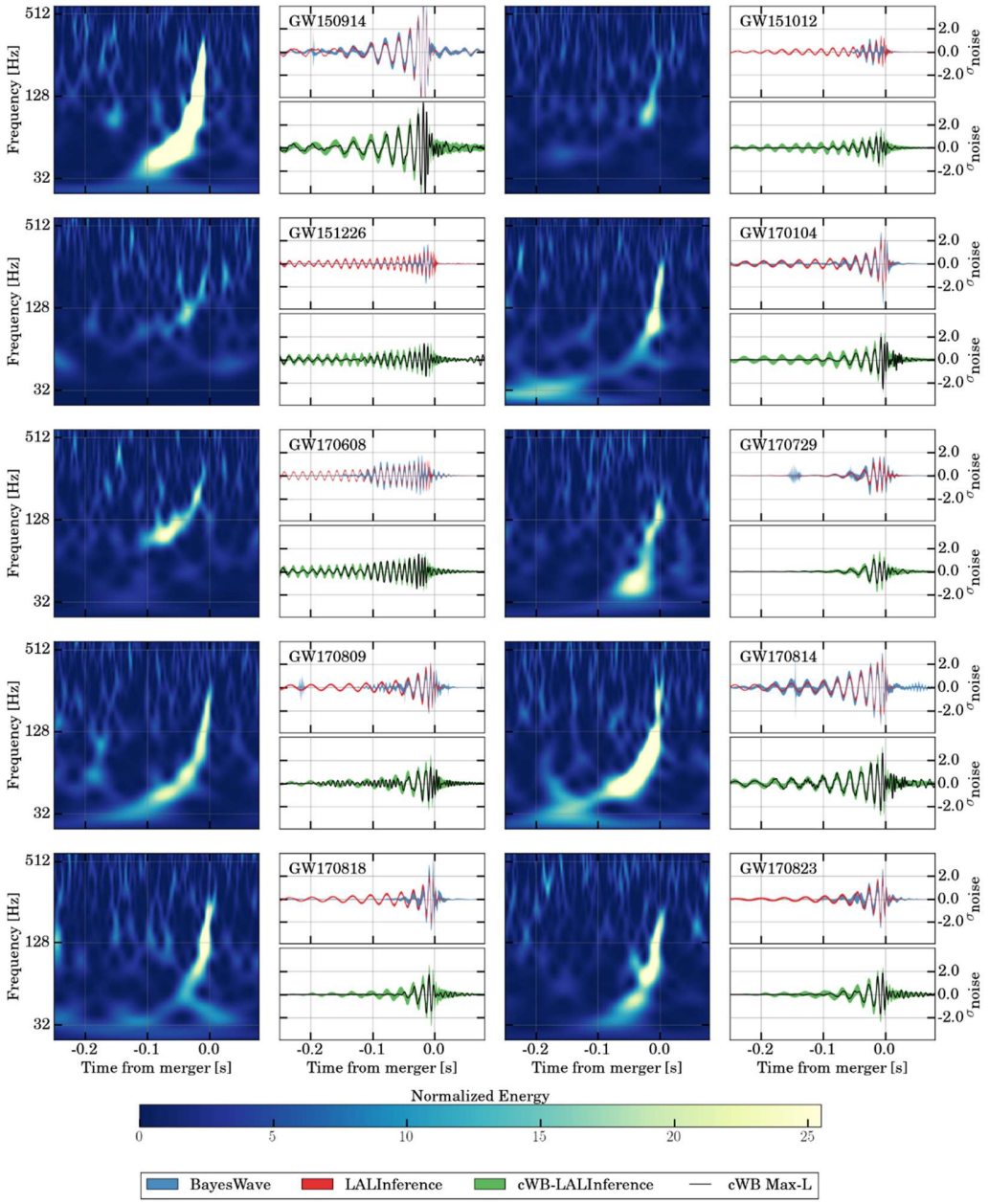


Figure 11: Time-frequency maps and reconstructed signal waveforms for the ten BBH events detected by the LIGO and Virgo observatories in 2015 and 2017. See arXiv:1811.12907.

SA3 Nuclear Physics form lab to people´s health

The strategy of the nuclear physics scientific area at IGFAE covers a broad spectrum of experimental activities from fundamental research, 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 exploitation of the Laser Laboratory for Accelerator and Applications.

During the reporting period, we have participated in 11 conferences and workshops and contributed to 8 SCI publications. We also host an international workshop on (Active Targets and Time Projection Chambers. 17-19/01/2018. Number of participants: 80) and won a Bid to host the International Conference on Direct Reactions with Exotic Beams (DREB) in 2020. Education and training of new researcher is a fundamental piece of our activity. Four PhD students have been working with us in 2018 in the different research programs (2 in RP 6 and 2 in RP 7). In the following we present the scientific highlights of the activity performed in 2018, by research lines:

RP6: The structure of the nuclear many-body systems and its astrophysical and cosmological implication

IGFAE pursuits the study of the structure and dynamics of the nuclear many-body systems. The activity has concentrated on the following topics:

- **Contribution to R3B/FAIR experiment**

IGFAE team continues developing an outstanding scientific program based on the study of nuclear reactions induced by exotic projectiles at relativistic energies together with a relevant contribution to the instrumentation associated to the R3B experiment at FAIR (https://fair-center.eu/)

In particular, we are deeply committed with the construction of the CALIFA calorimeter for the R3B experiment. This calorimeter will detect products emitted from reactions induced by relativistic rare beams that would experience significant forward boosts. The physics cases under study will require the detection of high energy charged particles and γ-rays with energies between 100 keV and 20 MeV, providing good energy resolution of 7% or better at 1 MeV.

CALIFA ensures efficient Doppler correction and enough stopping power for detection of both charged particles and γ-rays at high energy with a highly segmented detector design (more than 2500 channels) based on long tapered detector modules.

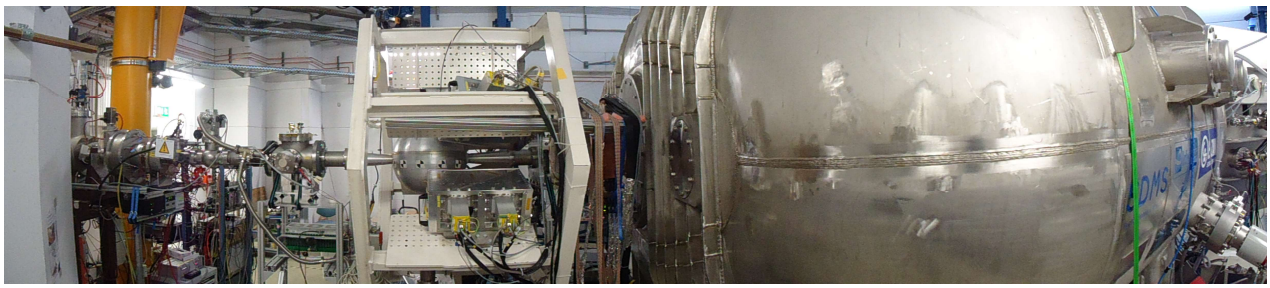


Fig.12: View of the R3B experiment in Cave C (FAIR Phase 0). From left to right we distinguish the incoming detectors, the target area with the CALIFA demonstrator installed and the Large Acceptance magnet GLAD.

During 2018 we have been working on the design and construction of a prototype consisting in 64 CALIFA detection units that corresponds to the crystals that will be located at the CALIFA Forward section (20-40 deg polar angle). This prototype will be tested along 2019.

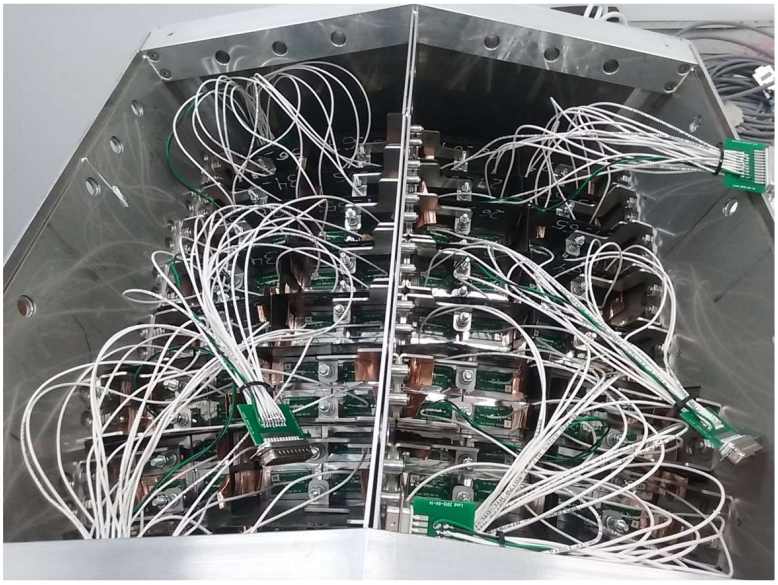


Fig.13: Top view of a double CALIFA petal (128 detection channels) based on tapered Cs I(Tl) scintillation crystals and double LAAPD readout.

Moreover, we have been working on the installation and commissioning of the R3B key detectors, in its demonstrator version: CALIFA, NeuLAND and the large acceptance spectrometer GLAD. 512 detection channels of the CALIFA calorimeter have been installed covering the region from 20-70 deg in the polar angle (but only 10% of 4P). 192 of these detection units (38% of the CALIFA Demonstrator) were mounted and tested at IGFAE laboratories. They were finally transported to GSI in May 2018 and mounted in the experimental cave in July 2018.

The first engineering runs of FAIR where performed in the R3B cave in October 2018. They allowed to cross-check the performance of the new R3B equipment (including the CALIFA prototype) and prepare our detectors for the first FAIR Phase 0 experiments in spring 2019.

- Data sorting and scientific activity

The strategy of the R3B experimental campaign for 2018, the status of the on-going data sorting and the advancement of the new detector was deeply discussed during the R3B collaboration meeting (Dubrovnik 15-20 May 2018) with strong participation of the USC group.

Fig: Participants in the R3B collaboration meeting held in Dubrovnic in May 2018

Along 2018 IGFAE group has also concentrated on the finalization of several data sorting and interpretation of experiments performed within the last years at the R3B precursor in GSI. These experiments, dedicated to determine accurate cross-sections of single nucleon removal in the n-rich Tin isotopes and study of quasi-free scattering reactions induced by n-deficient oxygen isotopes correlations (Javier Diaz, defended in December 2018, Juan M. Boillos defended in May 2019). These works have allowed to stress the important role of NN correlations.

We have also worked on the study of the fission dynamics in inverse kinematics and high excitation energy regime (Manuel Feijoo PhD expected in December 2021). We also kept our development activity in software and simulation environments in particular R3BRoot (Elisabeth Galiana PhD expected in February 2021).

In this activity, we have published 5 papers and participated in whorkshops dedicated to the study of reaction mechanisms with invited contributions (NUPRASEN Warsaw February 2018 , D. Cortina and J. Benlliure), national workshops (X Jornadas CPAN, Salamanca May 2018) and international

conferences (Dynamics of nuclear fussion and fission processes, Mumbai February 2018 J. Benlliure).

We have also been participated in the preparation of a European Proposal for the H2020 frame Program for Nuclear Physics.

- **Experiments with stable and radioactive nuclei at low-energy facilities**

This activity focuses on the use of the low-energy regime to understand the nuclear structure and dynamics of the atomic nuclei from the underlying strong force described by QCD. Our methodology uses reactions of stable and radioactive nuclei produced at international facilities such as SPIRAL/GANIL, HIE-ISOLDE/CERN, RCNP-Osaka to investigate the structure of exotic-systems at the dripline and the fission process from first principles.

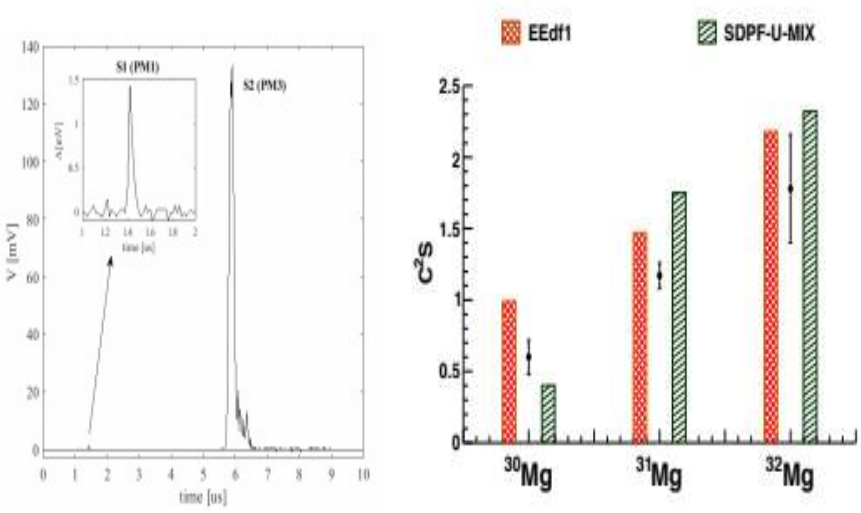
In 2018, we worked in several projects:

One of the most striking features in the evolution of shell structure is the existence of islands of inversion, regions where the intruder configurations become dominant in the ground state of nuclei. In the case of the Mg chain, the well-known N=20 island of inversion was considered to start in ^{31}Mg leaving the previous isotope, ^{30}Mg, outside this island. However, in an experiment performed at GANIL , we demonstrated that the low-lying structure of ^{30}Mg is dominated by cross-shell excitations proving that the transition to the N=20 island of inversion appears to be smoother than originally considered. In view of this result, new island of inversions in the proton-rich side are also foreseen to appear.

Concerning fission, in a recent study we have measured the fissioning systems from U to Cf through inelastic scattering, transfer, and fusion reactions, with excitation energies that range from a few MeV up to 46 MeV.. This work reports on new data on fission-fragment yields of the heavy actinides U238, Np239, Pu240, Cm244, and Cf250, which are of interest from both fundamental and application points of view.

In 2018 another significant progress has been made in the development of our Optical TPC. We have completed the design of all the elements of the Optical TPC and the detector is now fully assembled. First studies of the primary and secondary scintillation have been performed and the results obtained are very promising.

In this activity, we have published 3 papers and participated in several workshops (AGATA at SPE Bormio February 2010 B. Fernández, and SSNET'18 Gif-sur-Yvette November 2018, Nuclear Physics for the Next Generation London September 2018 , Nuclear Structure and Reactions for the 2020s Caen July 2018, Multifacets of Eos and Clustering IWM-EC Catania May 2018) .



RP 7: Exploitation of the Laser Laboratory for Accelerator and Applications

The scientific program led by IGFAE at the Laser Laboratory for Acceleration and Applications (L2A2) focuses on the development of technologies related to laser-particle acceleration and their used in medical applications. In particular we are working in two initiatives: new laser-driven X-ray sources to develop advanced imaging techniques (LaseX), and the laser-driven production of radioisotopes for PET imaging (LaserPET). The main achievements in these two projects along 2018 are the following:

- **LaseX**

The aim of this project is to develop new applications of micrometric X-ray sources produced by laser-electron acceleration. For this purpose, we take advantage of the low-energy laser pulses produced at L2A2 (1 mJ, 25 fs, 1kHz). These pulses, efficiently focused (~ 10 m^2) 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.

Fig.15. X-ray source

The X-ray source was designed and built by the IGFAE's team along 2017. The main achievements in 2018 were the following:

- The X-ray source was commissioned and fully characterized.
- An experimental setup for radiographic and tomographic imaging was built.
- First radiographic and tomographic images were obtained.
- Image treatment software for phase-contrast imaging was developed.

  These results were presented at the "Nuclear Photonics International Conference" (Brasov, Rumania, June 2018) being awarded with the best poster price. Two papers will be submitted soon for publication.

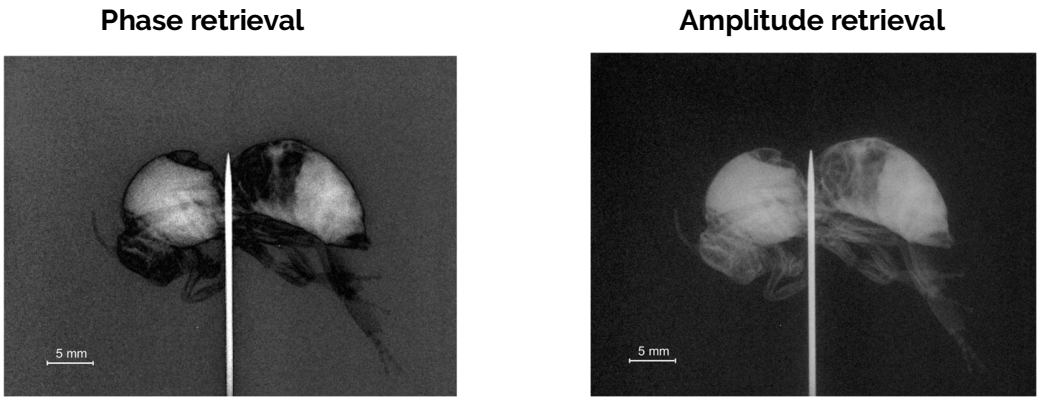


Fig.16 First X-ray images

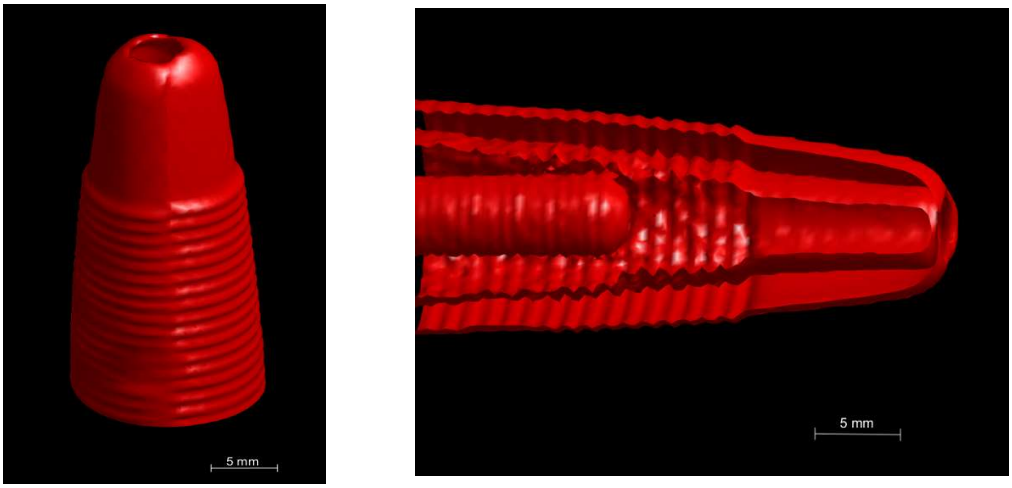


Fig..17 Phase retrieval tomography

- **LaserPET**:

The aim of this project is to develop a new technology to produce the 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 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 ^{11}C, ^{13}N or ^{15}O, 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 10^{19} W/cm^2, enough for the acceleration of protons at the above-mentioned energies.

Proton source

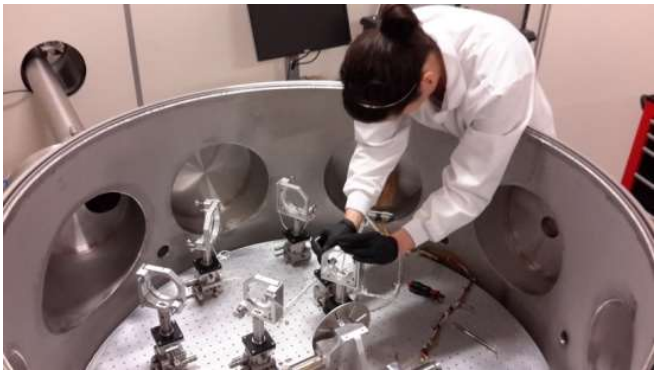


Fig.18 Laser pulses transport and focusing system

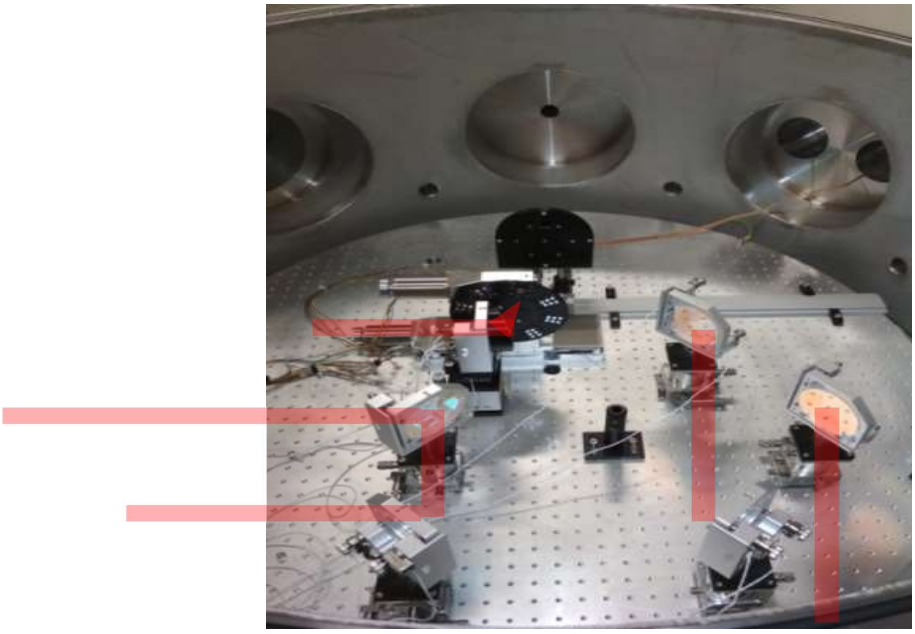


Fig.20 Time-of-flight detector

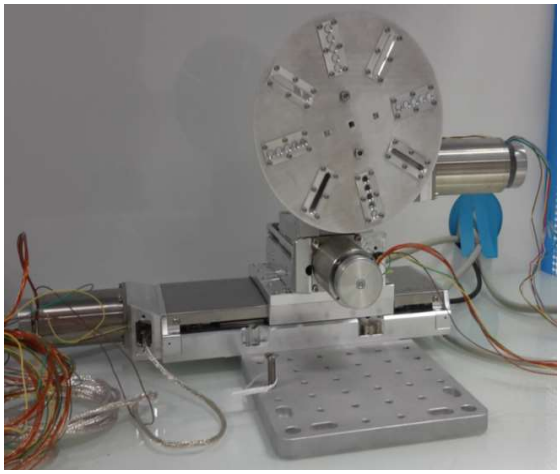


Fig.19 Acceleration target assembly

The main achievements in 2018 were:

- Design and construction of an acceleration target to be used in single-shot and multi-shot modes.
- Design and construction of a time-of-flight sensor to measure the energy spectra and flux of the laser-accelerated protons.
- First experiments for the production of protons in single-shot irradiation mode producing protons with energies up to around 1 MeV.

  The production of the first protons at L2A2 was reported at the "Nuclear Photonics International Conference" (Brasov, Rumania, June 2018).

  In parallel, the IGFAE team continued with the design of a high repetition rate plasma mirror for the ELI-ALPS facility. The main milestone of this project was the acceptance of the Conceptual Design Report in March 2018.

First protons April 2018

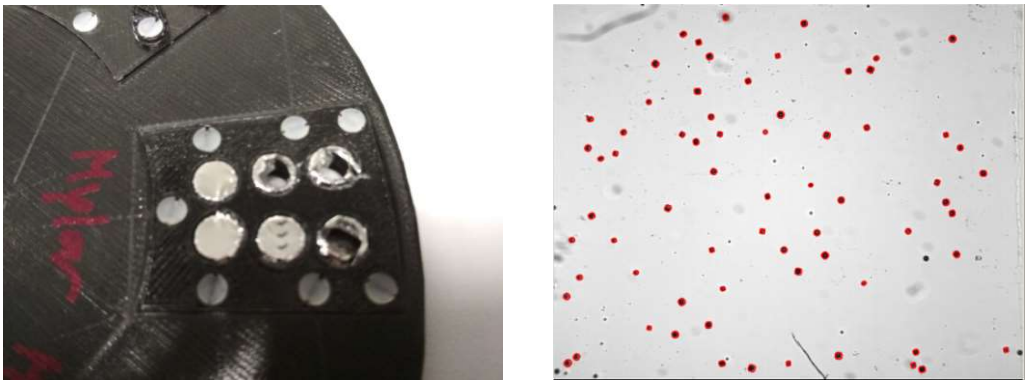
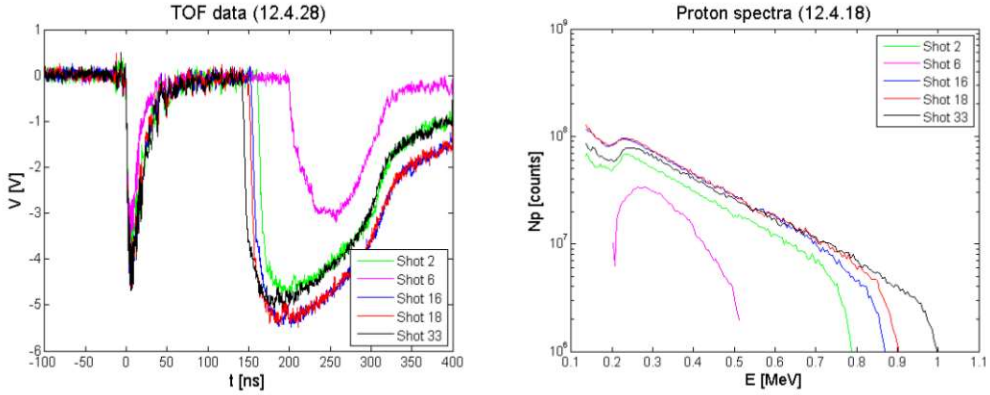


Fig. 21 First time-of-flight spectra November 2018



HL: Strategies for new facilities

During 2018, the activities of the LabCAF group have been mainly related to the TRASGO project which aims at developing a new family of cosmic-ray detectors with improved capabilities for monitoring, reconstruction, calibration, as well as better tools for data analysis.
Currently, there are three TRASGO detectors operative:
1) Tragaldabas, installed at the Univ. of Santiago de Compostela (see Figure),
2) MuTT, installed at a industrial hangar in Porriño, near Vigo, and
3) Tristan, a device designed to complement other detectors which are part of the ORCA (Observatorio de Rayos Cósmicos Antártico), now being installed in the J. Carlos I base, on the Livingston island, Antárctica.

This equipment is intended for performing activities in several research fields:
a) solar and space-weather physics,
b) study the atmospheric effect on cosmic rays,
c) muon tomography, and d) the analysis of the short-range structure on the front-side of Extended Air Showers, EAS.

During the first six months of 2018, the Tragaldabas detector was gathering cosmic-ray data with a new trigger system (based on FPGAs and developed at LIP-Coimbra). This system allows for a more flexible choice of the trigger logic, using any combination of planes and the possibility of an external trigger provided by other device. All monitoring programs have been improved as to allow better data quality. Concerning Tristan, this detector has taken cosmic-ray data during a four-week period (Nov-Dec 2018) while onboard the oceanographic vessel 'Sarmiento de Gamboa', navigating between Vigo/Spain and Punta Arenas/Chile over the Atlantic Ocean. Data will be mainly used for atmospheric and Earth's magnetic field studies. This detector will be installed next year at one of the Spanish bases in the Antarctic, being part of a permanent observatory for cosmic-rays, ORCA.

During 2018 we also deployed 4 Salla antennas on the roof of the Physics Faculty building, and just above the Tragaldabas detector lab. All these equipment working together will allow us to study correlations between the radio signals produced by high energy cosmic-ray particles, and the composition of the extended air shower (EAS) fronts, with the aim of improving the estimation of the primary cosmic-ray properties.

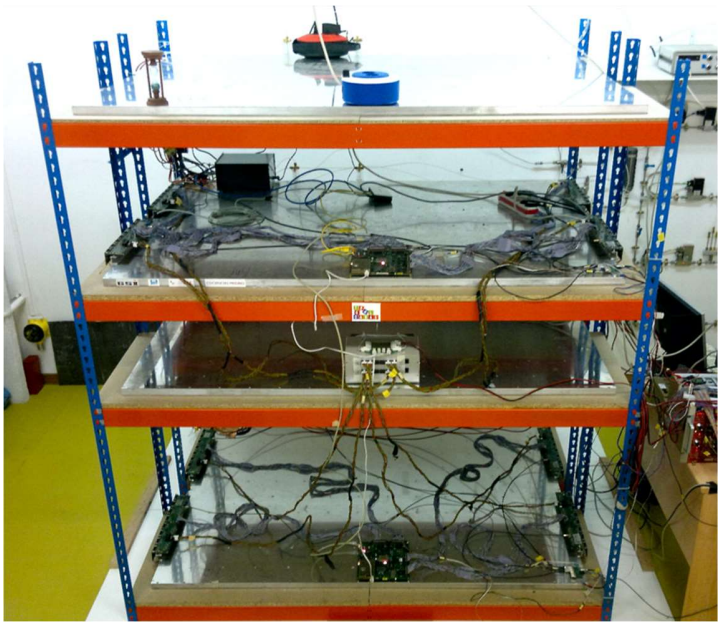


Fig.23 The Tragaldabas detector at the LabCaF of the IGFAE, Univ. of Santiago de Compostela.

Fig.24 The Tristan detector onboard the oceanographic vessel 'Sarmiento de Gamboa'

4. SCIENTIFIC AND TRAINING PRODUCTION

4.1. Projects

Increasing our budget, the new funding is:

"Consolidación e estruturación 2018 GRC GI-1490 Grupo de Física de Altas Enerxías (GAES)"

Juan José Saborido Silva

2019-01-01 - 2021-11-30

CONSELLERÍA DE EDUCACIÓN E ORDENACIÓN UNIVERSITARIA

ED431C 2018/15

400,000 euros

"Proxectos de excelencia, axudas de consolidación e estruturación de unidades de investigación"

Xabier Cid Vidal

2018-01-01 - 2022-12-31
CONSELLERÍA DE EDUCACIÓN E ORDENACIÓN UNIVERSITARIA
ED431F 2018/01
115,000 euros

"Refuerzo del papel LHCb como uno de los principales experimentos actuales en física de partículas. Trabajo en el área de Machine Learning. Realización de actividades de docencia y divulgación".
Xabier Cid Vidal
2018-01-01 - 2021-12-31
Agencia Estatal de Investigación
RYC-2016-20073
40,000 euros

"Taller mecánico de alta precisión para desarrollo y fabricación de instrumentación del IGFAE"
Carlos Alberto Salgado López
P.R. 2018-10-23
EQC2018-004931-Proyectos Adquisición Equipamiento Científico Técnico.
84.063€

"Laboratorio de microelectrónica para instrumentación en Física de Partículas y Astrofísica"
P.R. 2018-10-23
Carlos Alberto Salgado López
EQC2018-004932-P
376.828€

"**Equipo de espectroscopía gamma de alta resolución para la determinación radiológica de muestras ambientales sólidas**"

P.R. 2018-10-23

Carlos Alberto Salgado López

EQC2018-004994-P

121.548€

4.2. Others/ Outreach.

"*Convenio de colaboración Consellería de Cultura, Educación e Ordenación Universitaria: Accións IGFAE*"

2018 – 06- 04

2018-AD013

40.000€

INPhINIT "LA CAIXA" Doctoral Fellowship Programme

2018 – 12-27

345.276€

4.3. Publications

A total of 132 articles have been published, during 2018. Most in relation and collaboration with the LHCb experiment (52 articles). See Annex.

4.4. PhD Thesis

Characterisation and optimisation of radiation-tolerant silicon sensors with intrinsic gain

Sofía Otero Ugobono

2018-11-21

Director: Abraham Antonio Gallas Torreira

Single-nucleon knockout and total reaction cross sections in medium-mass neutron-rich nuclei

Javier Díaz Cortés

2018-12-20

Director: José Fernando Benlliure Anaya

Simulation and reconstruction algorithms for a commercial muon tomography

José Javier Cuenca García

2018-12-20

Director: Juan Antonio Garzón Heydt

Low-energy calibration, reconstruction software and light-collection efficiency parametrization of the NEXT-White detector

Gonzalo Martínez Lema

2018-12-17

Director: José Angel Hernando Morata

High energy scattering and emission in QED&QCD

Xabier García Feal

2018-11-29

Director: Ricardo Antonio Vázquez López

Search for flavour anomalies at LHCb: decay-time-dependent CP violation in Bs0 -> (K+ pi-) (K- pi+) and Lepton Universality in anti-B0 -> D(*)+ l anti-nu_l

Julián García Pardiñas

2018-06-11

Director: Juan José Saborido Silva, Máximo Tomás Pló Casasús

5. SCIENCE AND SOCIETY

Communication and scientific dissemination are our priorities since the foundation of the institute. One of our main objectives is to foster STEM careers (science, technology, engineering and mathematics) among students, especially in Physics, as well as return to society the knowledge generated in our scientific activity, largely financed by public funding.

In recent years, the outreach activities in which the IGFAE research staff participated increased and diversified, using all available channels and means to reach society. Thus, apart from the dozens of articles published in magazines and newspapers, talks in school and high school throughout Galicia, public lectures, summer camps and appearances in the media, the center focused on social networks in 2018, opening a Twitter account on November 13, 2017, which at the end of 2018 reached 103 followers. What is remarkable is that more than half of the followers (53) occurred in just one month due to the visibility and dissemination produced by the great outreach event organized by in 2018: the Science Week. At present, our aim is to further strengthen this effort by setting up a new communication unit since May 2019.

International Masterclasses in Particle Physics (LHCMC18)

On April 6, IGFAE hosted a Masterclass in Particle Physics on 6 April 2018, inviting around 80 Galician high school students to participate. The students took a day off from school to analyze data of the CMS experiment at the Large Hadron Collider (LHC) under the supervision of IGFAE scientists. At the end of the day, the students discussed the obtained results in a video conference with Fermilab, USA, and the other participating institutes from around the world, giving the experience of working in an international collaboration, which is part of CERN's everyday life.

The Masterclass at IGFAE is part of an annual program called International Masterclasses. Scientists at about 210 universities and laboratories host Masterclasses at their home institutions. The Masterclasses this year are organized from February until April in more than 50 countries worldwide.

Fig. 25 IGFAE researcher Cibrán Santamiran during the masterclass.

Scientific Summer Campus 2018

Every year in July, members of the Department of Particle Physics of the University of Santiago de Compostela (USC) and the Galician Institute of High Energy Physics (IGFAE) participate in the Summer Scientific Campus through the program **"A Ponte entre o Ensino Medio a USC".** The campus is organized by the Spanish Foundation for Science and Technology (FECYT) and the Ministry of Education, Culture and Sports, with the support of the Obra Social "la Caixa".

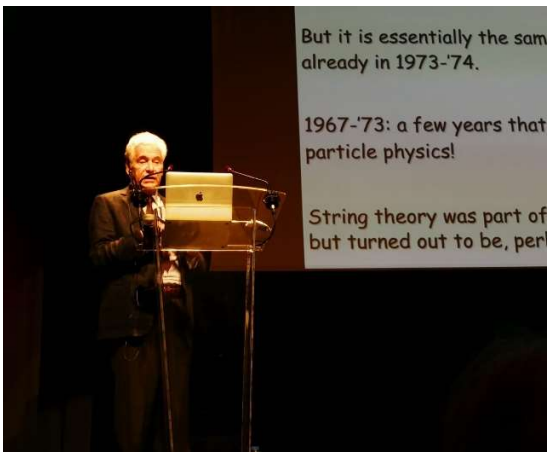
The purpose of this program is to promote the interest of students in 4th ESO and 1st year of Bachillerato in Spain for science, technology and innovation, and encourage access to scientific-technical qualifications. The project presented is "Looking for the particles produced in the greatest accelerator in history", aimed to put students in contact with the science developed at the Large Hadron Collider (LHC) at CERN (Geneva, Switzerland), the largest particle accelerator in the world. In the campus, 28 students carry out tasks like those of the scientists working in the LHC

experiments: particle detection, data collection and analysis or interpretation and presentation of results.

Science Week 2018

IGFAE organized its first Science Week (Semana da ciencia) from 12th to 16th November 2018, which included various outreach and educational events in Santiago de Compostela:

- Public talk "String theory: Life, death and miracles" by Gabriele Veneziano .
- Contest of scientific communication (IGFAE C3), with three different categories: Scientific monologue competition; Experiment, demonstration or web or mobile application contest; and Outreach article competition.
- More than 30 high school talks around Galicia by IGFAE researchers.
- Stringy NerdNite at Nave de Vidán, an informal gathering to learn and discuss about String Theory in a short tall format and relax environment.
- Communicaction course for IGFAE members given by the La Rioja University mathematician and monologuist Eduardo Sáenz de Cabezón, also member of the renowned group "Big Van Ciencia", and the storyteller Héctor Urién.



USC-ABANCA Innovation Faire

On November 27 and 28, IGFAE participated in the first edition of the USC-ABANCA Innovation Faire, and outreach event in which various IGFAE researchers gave talks to students about CERN and Machine Learning with the aim of promoting research and entrepreneurship in society

Regueifas da ciencia

IGFAE researcher Bernardo Adeva participated in the Regueifa da ciencia about the segurity of using nuclear energy, celebrated in the USC Faculty of Communication Sciences in September 27. In the debate, funded by the FECYT, two teams oppose their opinions in turns and the public vote pro or againt the question that opens the act.

Impact in Media

In 2018, our presence in the media, either online or in print, was quite continuous and remarkable, taking into account that and communication unit or officer did not exist during the year. IGFAE activities caught the attention of several radio and television programs.

In an increasingly competitive information environment, some of the scientific news items produced at IGFAE made the headlines in the leading media outlets in Spain and other countries:

En la estela de Albert Einstein

El Instituto Galego de Física de Altas Enerxías entra en LIGO, para estudiar las ondas gravitacionales

Un detector gallego para analizar los rayos cósmicos

El desarrollo de la USC "Tristan" viaja a la Antártida para recoger datos de alta precisi sobre radiación

«Casualidad y mecánica cuántica» para todos los públicos

El IES Eduardo Blanco Amor acogió una ponencia del ex rector de la USC, Carlos Pajares

El ex rector de la USC, Carlos Pajares, ofreció una ponencia en el instituto Eduardo Blanco Amor de Ourense titulada «Casualidad y mecánica cuántica». Lo hizo en representación del Instituto Galego de Física das Altas Enerxías y a escucharlo se acercaron

«Hacemos una especie de mini Big Bang para acelerar partículas»

La Sociedad Europea de Física premia la tesis de un investigador de la USC

La fuente de partículas fantasma en el cosmos lejano, al descubierto

Joaquín Sánchez Guillén: «La Universidade tenía muy buena fama, pero al principio la vida aquí nos costó»

El catedrático de Física pasó por Harvard y la Academia Austriaca antes de llegar a la USC

Gabriele Veneziano: «Combinar la mecánica cuántica y la relatividad ha sido un dolor de cabeza»

Cincuenta años después de publicar un artículo que cambió la física, el físico italiano explica en Santiago el renacer de su teoría de las cuerdas

Un detector gallego para analizar los rayos cósmicos

El desarrollo de la USC "Tristan" viaja a la Antártida para recoger datos de alta precisión sobre radiación

Según informa la USC, el equipo encargado del desarrollo de 'Tristan' espera con esta campaña reunir una gran cantidad de **datos de alta precisión en dos épocas del año distintas (otoño y primavera)**, lo que permitirá profundizar en la forma de corregir en tierra el efecto de la temperatura de la atmósfera en los rayos cósmicos, problema que está sin resolver desde su descubrimiento a comienzos de los siglo XX

El proyecto 'Tristan' está dirigido por el profesor Juan A. Garzón, del LabCAF del Instituto Galego de Física de Altas Enerxías y forma parte de la colaboración ORCA (Observatorio de Rayos Cósmicos Antártico), que coordina el profesor de la Universidad de Alcalá Juan José Blanco. Esta última aporta al

6. ANNEX: PERSONNEL

Surname	Name	Category	Research Line
Adam	Christoph	Scientific staff	RL2
Adeva Andany	Bernardo	Scientific staff	RL1
Agostini Infante	Pedro Augusto	Students	RL2
Ajoor	Marwaan Yassir Kamel	Students	RL5
Álvarez Muñiz	Jaime	Scientific staff	RL4
Álvarez Pol	Héctor	Scientific staff	RL6
Armesto Pérez	Nestor	Scientific staff	RL2
Attems	Maximilian	Postdocs	RL2
Benlliure Anaya	José Fernando	Scientific staff	RL6, RL7
Boente García	Óscar	Students	RL1
Boillos Betete	Juan Manuel	Students	RL6
Borsato	Riccardo	Scientific staff	RL3
Brea Rodríguez	Alexandre	Students	RL1
Caamaño Fresco	Manuel	Scientific staff	RL6
Cabanelas Eiras	Pablo	Postdocs	RL6
Cabo landeira	Cristina	Administrative and Technical staff	RL5
Casais Vidal	Adrián	Students	RL1
Chobanova	Veronika	Postdocs	RL1
Cid Vidal	Xabier	Scientific staff	RL1
Cortina Gil	Dolores	Scientific staff	RL6, RL7
Dalseno	Jeremy Peter	Postdocs	RL1
Davies	Gareth	Postdocs	RL8
Dent	Thomas	Scientific staff	RL8
Díaz López	Gonzalo	Students	RL5
Durán Escribano	Ignacio	Scientific staff	RL6
Edelstein Glaubach	José Daniel	Scientific staff	RL3
Escobedo Espinosa	Miguel Ángel	Postdocs	RL2
Fariña Biasi	Anxo	Students	RL3
Feijoo Rodríguez	Manuel	Students	RL6
Fernández Domínguez	Beatriz	Scientific staff	RL6
Fernández Fernández	Daniel	Students	RL5
Fernández Morales	Miguel Angel	Students	RL6
Fernández Prieto	Antonio	Students	RL1
Fontenla Barba	Yanis	Students	RL6
Galiana Baldó	Elisabet	Students	RL6
Gallas Torreira	Abraham Antonio	Scientific staff	RL1
Garbayo Peón	Ana	Students	RL3
García Castro	Damián	Students	RL6

García Feal	Xabier	Students	RL2
García Plana	Beatriz	Students	RL1
Garzón Heydt	Juan Antonio	Scientific staff	RL6
Gioventú	Alessandra	Students	RL1
González Caamaño	David	Administrative and Technical staff	
González Díaz	Diego	Scientific staff	RL5
González Ferreiro	Elena	Scientific staff	RL2
Hernando Morata	José Angel	Scientific staff	RL5
Jurukovic	Filip	Students	RL3
LLerena Cristobo	Juan José	Administrative and Technical staff	
Lomba Castro	Julián	Students	RL1
López Casado	Aida	Students	RL4
Lourenço Henriques Barata	Joao	Students	RL2
Luo	Tan	Postdocs	RL2
Mariño Lavía	Berta	Administrative and Technical staff	
Martín Blanco	Lucía	Students	RL6
Martínez Lema	Gonzalo	Students	RL5
Martínez Santos	Diego	Scientific staff	RL1
Mas Solé	Javier	Scientific staff	RL3
Merino Gayoso	Carlos Miguel	Scientific staff	RL2
Miramontes Antas	José Luis	Scientific staff	RL3
Mora Cuesta	Elena	Administrative and Technical staff	
Moscoso Rial	Alexis	Students	RL2
Musso	Daniele	Postdocs	RL3
Nimo Fernández	Vanessa	Administrative and Technical staff	
Otero Ugobono	Sofía	Students	RL1
Pajares Vales	Carlos	Emeritus	RL2
Palmeiro Pazos	Brais	Students	RL5
Parente Bermúdez	Gonzalo	Scientific staff	RL4
Pazos Álvarez	Antonio	Administrative and Technical staff	RL1
Pedreira Giralda	Francisco	Students	RL4
Peñas Nadales	Juan	Students	RL6
Penín Ascariz	José Manuel	Students	RL2
Pérez Trigo	Eliseo	Administrative and Technical staff	RL1
Pló Casasús	Máximo Tomás	Scientific staff	RL1
Prouve	Claire	Postdocs	RL1
Ramírez Cancino	Jhony Eredi	Postdocs	RL2
Ramos Pernas	Miguel	Students	RL1
Riádigos Sánchez	Irma	Students	RL6
Rodríguez Calvo	Manoel	Students	RL2

Rodríguez Fernández	Ricardo Julio	Administrative and Technical staff	
Rodríguez Moldes	Manoel Anxo	Students	RL2
Rodríguez Sánchez	José Luis	Postdocs	RL6
Romero Lamas	Marcos	Students	RL1
Romero Vidal	Antonio	Postdocs	RL1
Saborido Silva	Juan José	Scientific staff	RL1
Salgado López	Carlos Alberto	Scientific staff	RL2
Sánchez de Santos	José Manuel	Scientific staff	RL3
Sánchez Guillén	José Joaquín	Emeritus	RL2
Santamarina Ríos	Cibrán	Scientific staff	RL1
Seco Miguélez	Marcos Antonio	Administrative and Technical staff	
Vázquez Fidalgo	Ana Belén	Administrative and Technical staff	
Vázquez López	Ricardo Antonio	Scientific staff	RL4, RL2
Vázquez Ramallo	Alfonso	Scientific staff	RL3
Vázquez Regueiro	Pablo	Scientific staff	RL1
Vázquez Rodríguez	David	Students	RL3
Vila Pérez	Víctor	Students	RL2
Vilar López	Alejandro	Students	RL3
Zas Arregui	Enrique	Scientific staff	RL4

7. ANNEX: PUBLICATIONS

Search for CP violation in Λb 0→pK− and Λb 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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Lett. B, 787, 124

RL1

DOI: 10.1016/j.physletb.2018.10.039

BPS property and its breaking in 1+1 dimensions

Adam C., Wereszczynski A.

IGFAE authors: Adam, C.

Phys. Rev. D, 98, 116001

RL2

DOI: 10.1103/PhysRevD.98.116001

Search for lepton-flavour-violating decays of Higgs-like bosons

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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Eur. Phys. J. C, 78, 1008

RL1

DOI: 10.1140/epjc/s10052-018-6386-8

Evidence for an ηc(1 S) π- resonance in B0→ ηc(1 S) K+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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Eur. Phys. J. C, 78, 1019

RL1

DOI: 10.1140/epjc/s10052-018-6447-z

Measurement of Antiproton Production in p-He Collisions at sNN =110 GeV

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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Rev. Lett., 121, 222001

RL1

DOI: 10.1103/PhysRevLett.121.222001

Large-scale Cosmic-Ray Anisotropies above 4 EeV Measured by 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.

Astrophys. J., 868, 4

RL4, RL2

DOI: 10.3847/1538-4357/aae689

Measurement of the time-integrated CP asymmetry in D 0 → KS 0 KS 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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 11, 48

RL1

DOI: 10.1007/JHEP11(2018)048

Study of ϒ production 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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 11, 194

RL1

DOI: 10.1007/JHEP11(2018)194

First Observation of the Doubly Charmed Baryon Decay Ξcc + + → Ξc+ 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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Rev. Lett., 121, 162002

RL1

DOI: 10.1103/PhysRevLett.121.162002

Deformed band structures in neutron-rich Pm 152-158 isotopes

Bhattacharyya, S. et al.

IGFAE authors: Caamano, M.

Phys. Rev. C, 98, 044316

RL6

DOI: 10.1103/PhysRevC.98.044316

Observation of inclined EeV air showers with the radio 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.

J. Cosmol. Astropart. Phys., 10, 026

RL4, RL2

DOI: 10.1088/1475-7516/2018/10/026

Helium–Xenon mixtures to improve the topological signature in high pressure gas xenon TPCs

Felkai, R. et al.

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

Nucl. Instr. Meth. Phys. Res. A, 905, 82

RL5

DOI: 10.1016/j.nima.2018.07.013

Intensity of gluon bremsstrahlung in a finite plasma

Feal X., Vazquez R.A.

IGFAE authors: Vazquez, R.A.; García Feal, X

Phys. Rev. D, 98, 074029

RL2, RL4

DOI: 10.1103/PhysRevD.98.074029

Is bottomonium suppression in proton-nucleus and nucleus-nucleus collisions at LHC energies due to the same effects?

Ferreiro E.G., Lansberg J.P.

IGFAE authors: Ferreiro, E.G.

JHEP, 10, 94

RL2

DOI: 10.1007/JHEP10(2018)094

Observation of the decay Bs0 → D¯0K+K- OBSERVATION of the DECAY ... R. AAIJ et al.

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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Rev. D, 98, 072006

RL1

DOI: 10.1103/PhysRevD.98.072006

Central exclusive production of J/ψ and ψ(2S) mesons 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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 10, 167

RL1

DOI: 10.1007/JHEP10(2018)167

Observation of Bs0 → D¯*0ϕ and search for B0 → D¯0ϕ decays OBSERVATION of Bs0 → D¯*0ϕ and ... R. AAIJ et al.

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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Rev. D, 98, 071103

RL1

DOI: 10.1103/PhysRevD.98.071103

Search for beautiful tetraquarks in the ϒ(1S)μ + μ − invariant-mass spectrum

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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 10, 86

RL1

DOI: 10.1007/JHEP10(2018)086

Measurement of radon-induced backgrounds in the NEXT double beta decay experiment

Novella, P. et al. **[NEXT** collaboration**]**

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

JHEP, 10, 112

RL5

DOI: 10.1007/JHEP10(2018)112

Observation of the decay Λb 0→Λc +pp¯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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Lett. B, 784, 101

RL1

DOI: 10.1016/j.physletb.2018.07.033

Double and triple inclusive gluon production at mid rapidity: quantum interference in p-A scattering

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

IGFAE authors: Armesto, N.

Eur. Phys. J. C, 78, 702

RL2

DOI: 10.1140/epjc/s10052-018-6186-1

Search for a dimuon resonance in the ϒ mass region

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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 9, 147

RL1

DOI: 10.1007/JHEP09(2018)147

Measurement of Z → τ + τ − production in proton-proton 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.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 9, 159

RL1

DOI: 10.1007/JHEP09(2018)159

Angular moments of the decay Λb 0 → Λμ + μ − at low hadronic recoil

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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 9, 146

RL1

DOI: 10.1007/JHEP09(2018)146

Measurement of the c0 Baryon Lifetime

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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Rev. Lett., 121, 092003

RL1

DOI: 10.1103/PhysRevLett.121.092003

Measurement of Angular and CP Asymmetries in D0 →π+π-μ+μ- and D0 →k+K-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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Rev. Lett., 121, 091801

RL1

DOI: 10.1103/PhysRevLett.121.091801

Constraining the Λ -nucleus potential within the Liège intranuclear cascade model

Rodríguez-Sánchez J.L., David J.-C., Hirtz J., Cugnon J., Leray S.

IGFAE authors: Rodriguez-Sanchez, J.L.

Phys. Rev. C, 98, 021602

RL6

DOI: 10.1103/PhysRevC.98.021602

Observation of a New Ξb- Resonance

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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Rev. Lett., 121, 072002

RL1

DOI: 10.1103/PhysRevLett.121.072002

Structure of Be 13 studied in proton knockout from B 14

Ribeiro, G. et al.

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

Phys. Rev. C, 98, 024603

RL6, RL7

DOI: 10.1103/PhysRevC.98.024603

Observation of the decay B¯s0→χc2K+ K− in the φ mass region

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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 8, 191

RL1

DOI: 10.1007/JHEP08(2018)191

Observation of the decay Λ b 0 → ψ(2S)pπ−

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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 8, 131

RL1

DOI: 10.1007/JHEP08(2018)131

Measurement of CP asymmetries in two-body B (s)0 -meson decays to charged pions and kaons

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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Rev. D, 98, 032004

RL1

DOI: 10.1103/PhysRevD.98.032004

Measurement of Ds ± production asymmetry 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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 8, 8

RL1

DOI: 10.1007/JHEP08(2018)008

Measurement of forward top pair production in the dilepton channel 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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 8, 174

RL1

DOI: 10.1007/JHEP08(2018)174

Measurement of the CKM angle γ using B ± → DK ± with D → K S 0 π + π −, K S 0 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.; Saborido, J.; Borsato, M.; Santamarina Rios, C.; Chobanova, V.; Plo, M.; Ramos Pernas, M.; Vieites Diaz, M.; Lucio Martinez, M.; Garcia Pardinas, J.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 8, 176

RL1

DOI: 10.1007/JHEP08(2018)176

Search for CP violation using triple product asymmetries in Λb 0 → pK − π + π −, Λb 0 → pK − K + K − and Ξb 0 → pK − K − 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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 8, 39

RL1

DOI: 10.1007/JHEP08(2018)039

Measurement of the Lifetime of the Doubly Charmed Baryon Ξcc + +

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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Rev. Lett., 121, 052002

RL1

DOI: 10.1103/PhysRevLett.121.052002

Be 7 (n,p) Li 7 Reaction and the Cosmological Lithium Problem: Measurement of the Cross Section in a Wide Energy Range at n-TOF at CERN

Damone, L. et al. **[nTOF** collaboration**]**

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

Phys. Rev. Lett., 121, 042701

RL6

DOI: 10.1103/PhysRevLett.121.042701

Broken mirror symmetry in S 36 and Ca 36

Valiente-Dobón J.J., Poves A., Gadea A., Fernández-Domínguez B.

IGFAE authors: Fernandez-Dominguez, B.

Phys. Rev. C, 98, 011302

RL6

DOI: 10.1103/PhysRevC.98.011302

Preparation and characterization of micro-nano engineered targets for high-power laser experiments

Zaffino, R. et al.

IGFAE authors: Benlliure, J.; Martín Blanco, L

, 194, 67

RL6, RL7

DOI: 10.1016/j.mee.2018.03.011

Toward initial conditions of conserved charges. Part I. Spatial correlations of quarks and antiquarks

Martinez M., Sievert M.D., Wertepny D.E.

IGFAE authors: Wertepny, D; Lucio Martinez, M.

JHEP, 7, 3

RL2, RL1

DOI: 10.1007/JHEP07(2018)003

Demonstrator Detection System for the Active Target and Time Projection Chamber (ACTAR TPC) project

Roger, T. et al.

IGFAE authors: Fernandez-Dominguez, B.; Caamano, M.; Alvarez, H.

Nucl. Instr. Meth. Phys. Res. A, 895, 126

RL6

DOI: 10.1016/j.nima.2018.04.003

Exactly solvable gravitating perfect fluid solitons in (2 + 1) dimensions

Adam C., Romanczukiewicz T., Wachla M., Wereszczynski A.

IGFAE authors: Adam, C.

JHEP, 7, 97

RL2

DOI: 10.1007/JHEP07(2018)097

Evidence for the decay $B^0_s \to \bar{K}^{*0} \mu^+ \mu^-$

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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 7, 20

RL1

DOI: 10.1007/JHEP07(2018)020

Measurement of Υ production in pp collisions at $\sqrt{s}$=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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 7, 134

RL1

DOI: 10.1007/JHEP07(2018)134

Amplitude Analysis of the Decay B 0 → KS0 π+π- and First Observation of the CP Asymmetry in B 0 →k∗ (892)-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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Rev. Lett., 120, 261801

RL1

DOI: 10.1103/PhysRevLett.120.261801

Σ0 production in proton nucleus collisions near threshold

Adamczewski-Musch, J. et al.

IGFAE authors: Garzon, J.A.

Phys. Lett. B, 781, 735

RL6

DOI: 10.1016/j.physletb.2018.02.043

First measurement of Ξc 0 production in pp collisions at s=7 TeV

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

IGFAE authors: Ferreiro, E.G.

Phys. Lett. B, 781, 8

RL2

DOI: 10.1016/j.physletb.2018.03.061

Probing the Time Structure of the Quark-Gluon Plasma with Top Quarks

Apolinário L., Milhano J.G., Salam G.P., Salgado C.A.

IGFAE authors: Salgado, C.A.

Phys. Rev. Lett., 120, 232301

RL2

DOI: 10.1103/PhysRevLett.120.232301

Measurement and resonance analysis of the S 33 (n,α) Si 30 cross section at the CERN n-TOF facility in the energy region from 10 to 300 keV

Praena, J. et al. **[nTOF** collaboration**]**

IGFAE authors: Duran, I.

Phys. Rev. C, 97, 064603

RL6

DOI: 10.1103/PhysRevC.97.064603

T-duality and high-derivative gravity theories: the BTZ black hole/string paradigm

Edelstein J.D., Sfetsos K., Sierra-Garcia J.A., López A.V.

IGFAE authors: Edelstein, J.D.; Vilar López, A

JHEP, 6, 142

RL3

DOI: 10.1007/JHEP06(2018)142

Studies of the resonance structure in D0→ K∓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.; 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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Eur. Phys. J. C, 78, 443

RL1

DOI: 10.1140/epjc/s10052-018-5758-4

Measurement of CP violation in B 0 → D ∓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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 6, 84

RL1

DOI: 10.1007/JHEP06(2018)084

Evidence for the Rare Decay Σ+ →pμ+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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Rev. Lett., 120, 221803

RL1

DOI: 10.1103/PhysRevLett.120.221803

Noncommutative massive unquenched ABJM

Bea Y., Jokela N., Pönni A., Ramallo A.V.

IGFAE authors: Ramallo, A.V.

Int. J. Mod. Phys. A, 33, 1850078

RL3

DOI: 10.1142/S0217751X18500781

Measurement and analysis of the Am 241 neutron capture cross section at the n-TOF facility at CERN

Mendoza, E. et al. **[nTOF** collaboration**]**

IGFAE authors: Duran, I.

Phys. Rev. C, 97, 054616

RL6

DOI: 10.1103/PhysRevC.97.054616

Isotopic fission-fragment distributions of U 238, Np 239, Pu 240, Cm 244, and Cf 250 produced through inelastic scattering, transfer, and fusion reactions in inverse kinematics

Farget, F. et al.

IGFAE authors: Benlliure, J.; Cortina-Gil, D.; Fernandez-Dominguez, B.; Caamano, M.; Ramos, D.

Phys. Rev. C, 97, 054612

RL6, RL7

DOI: 10.1103/PhysRevC.97.054612

Preparation and characterization of 33S samples for 33S(n,α)30Si cross-section measurements at the n_TOF facility at CERN

Praena, J. et al. **[nTOF** collaboration**]**

IGFAE authors: Duran, I.; Fernandez-Dominguez, B.

Nucl. Instr. Meth. Phys. Res. A, 890, 142

RL6

DOI: 10.1016/j.nima.2018.02.055

Search for collectivity with azimuthal J/ψ-hadron correlations in high multiplicity p–Pb collisions at sNN=5.02 and 8.16 TeV

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

IGFAE authors: Ferreiro, E.G.

Phys. Lett. B, 780, 7

RL2

DOI: 10.1016/j.physletb.2018.02.039

Correlations and the ridge in the Color Glass Condensate beyond the glasma graph approximation

Altinoluk T., Armesto N., Wertepny D.E.

IGFAE authors: Armesto, N.; Wertepny, D

JHEP, 5, 207

RL2

DOI: 10.1007/JHEP05(2018)207

Probing SUSY effects in KS 0 → μ + μ −

Chobanova V., D'Ambrosio G., Kitahara T., Martínez M.L., Santos D.M., Fernández I.S., Yamamoto K.

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

JHEP, 5, 24

RL1

DOI: 10.1007/JHEP05(2018)024

Search for Bc + decays to two charm mesons

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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Nucl. Phys. B, 930, 563

RL1

DOI: 10.1016/j.nuclphysb.2018.03.015

Measurement of the CP asymmetry in B − → Ds − D 0 and B − → D − D 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.; Boente García, Ó; García Plana, B; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 5, 160

RL1

DOI: 10.1007/JHEP05(2018)160

Search for the rare decay Λc+ →pμ+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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Rev. D, 97, 091101

RL1

DOI: 10.1103/PhysRevD.97.091101

Centrality determination of Au + Au collisions at 1.23A GeV with HADES

Adamczewski-Musch, J. et al.

IGFAE authors: Garzon, J.A.

Eur. Phys. J. A, 54, 85

RL6

DOI: 10.1140/epja/i2018-12513-7

Measurement of the Ratio of the B0 →d∗-τ+ντ and B0 →d∗-μ+νμ Branching Fractions Using Three-Prong τ -Lepton 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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Rev. Lett., 120, 171802

RL1

DOI: 10.1103/PhysRevLett.120.171802

Archimedes meets Einstein: A millennial geometric bridge

Prado X., Area I., Paredes A., Castineiras J.M.D., Edelstein J.D., Mira J.

IGFAE authors: Edelstein, J.D.

Eur. J. Phys., 39, 045802

RL3

DOI: 10.1088/1361-6404/aab12c

Strong Neutron Pairing in core+4n Nuclei

Revel, A. et al.

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

Phys. Rev. Lett., 120, 152504

RL6, RL7

DOI: 10.1103/PhysRevLett.120.152504

Experimental setup and procedure for the measurement of the 7Be(n,p)7Li reaction at n_TOF

Barbagallo, M. et al. **[nTOF** collaboration**]**

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

Nucl. Instr. Meth. Phys. Res. A, 887, 27

RL6

DOI: 10.1016/j.nima.2017.12.025

Re-examining the transition into the N = 20 island of inversion: Structure of 30Mg

Pietras, B. et al.

IGFAE authors: Fernandez-Dominguez, B.; Caamano, M.

Phys. Lett. B, 779, 124

RL6

DOI: 10.1016/j.physletb.2018.02.002

Soft photon and two hard jets forward production in proton-nucleus collisions

Altinoluk T., Armesto N., Kovner A., Lublinsky M., Petreska E.

IGFAE authors: Petreska, E.; Armesto, N.

JHEP, 4, 63

RL2

DOI: 10.1007/JHEP04(2018)063

Floquet scalar dynamics in global AdS

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

IGFAE authors: Mas, J.; Fariña Biasi, A; Musso, D

JHEP, 4, 137

RL3

DOI: 10.1007/JHEP04(2018)137

Test of lepton flavor universality by the measurement of the B0 →d∗-τ+ντ branching fraction using three-prong τ 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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Rev. D, 97, 074012

RL1

DOI: 10.1103/PhysRevD.97.072013

Predictions for cold nuclear matter effects in p+Pb collisions at sNN=8.16 TeV

Albacete, J.L. et al.

IGFAE authors: Paukkunen, H.; Ferreiro, E.G.

Nucl. Phys. A, 972, 18

RL2

DOI: 10.1016/j.nuclphysa.2017.11.015

Fission fragment yields from heavy-ion-induced reactions measured with a fragment separator

Tarasov, O.B. et al.

IGFAE authors: Fernandez-Dominguez, B.

Eur. Phys. J. A, 54, 66

RL6

DOI: 10.1140/epja/i2018-12500-0

MARTA: a high-energy cosmic-ray detector concept for high-accuracy muon measurement

Abreu, P. et al. **[Auger** collaboration**]**

IGFAE authors: Zas, E.

Eur. Phys. J. C, 78, 333

RL4

DOI: 10.1140/epjc/s10052-018-5820-2

Demonstration of Single-Barium-Ion Sensitivity for Neutrinoless Double-Beta Decay Using Single-Molecule Fluorescence Imaging

McDonald, A.D. et al.

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

Phys. Rev. Lett., 120, 132504

RL5

DOI: 10.1103/PhysRevLett.120.132504

Measurement of the Ratio of Branching Fractions B (Bc+ →j ⁄ψτ+ντ)⁄ B (Bc+ →j ⁄ψμ+νμ)

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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Rev. Lett., 120, 121801

RL1

DOI: 10.1103/PhysRevLett.120.121801

Comparison of electromagnetic and nuclear dissociation of Ne 17

Wamers, F. et al.

IGFAE authors: Cortina-Gil, D.; Alvarez, H.

Phys. Rev. C, 97, 034612

RL6, RL7

DOI: 10.1103/PhysRevC.97.034612

Deep sub-threshold φ production in Au+Au collisions

Adamczewski-Musch, J. et al.

IGFAE authors: Garzon, J.A.

Phys. Lett. B, 778, 403

RL6

DOI: 10.1016/j.physletb.2018.01.048

D-Meson Azimuthal Anisotropy in Midcentral Pb-Pb Collisions at s NN=5.02 TeV

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

IGFAE authors: Ferreiro, E.G.

Phys. Rev. Lett., 120, 102301

RL2

DOI: 10.1103/PhysRevLett.120.102301

Lead ions and Coulomb's Law at the LHC (CERN)

Cid-Vidal X., Cid R.

IGFAE authors: Vidal, X.C.

Phys. Educ., 53, 024002

RL1

DOI: 10.1088/1361-6552/aa95d4

Roper resonances and quasi-normal modes of Skyrmions

Adam C., Haberichter M., Romanczukiewicz T., Wereszczynski A.

IGFAE authors: Adam, C.

JHEP, 3, 23

RL2

DOI: 10.1007/JHEP03(2018)023

Likelihood analysis of the pMSSM11 in light of LHC 13-TeV data

Bagnaschi, E. et al.

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

Eur. Phys. J. C, 78, 256

RL1

DOI: 10.1140/epjc/s10052-018-5697-0

Measurement of CP asymmetry in Bs 0 → Ds ∓ 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.; 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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 3, 59

RL1

DOI: 10.1007/JHEP03(2018)059

Measurements of the branching fractions of Λ c + → pπ − π +, Λ c + → pK−K+, and Λ c + → pπ −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.; 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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 3, 43

RL1

DOI: 10.1007/JHEP03(2018)043

First measurement of the CP-violating phase φsdd¯ in Bs 0 → (K + π −)(K − 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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 3, 140

RL1

DOI: 10.1007/JHEP03(2018)140

Search for the lepton-flavour violating decays B (s) 0 → e ± 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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 3, 78

RL1

DOI: 10.1007/JHEP03(2018)078

A measurement of the CP asymmetry difference between Λc + → pK − K + and pπ−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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 3, 182

RL1

DOI: 10.1007/JHEP03(2018)182

Production of 4He and He¯4 in Pb–Pb collisions at sNN=2.76TeV at the LHC

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

IGFAE authors: Ferreiro, E.G.

Nucl. Phys. A, 971, 1

RL2

DOI: 10.1016/j.nuclphysa.2017.12.004

Measurement of CP observables in B± → D(∗)K± and B± → D(∗)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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Lett. B, 777, 16

RL1

DOI: 10.1016/j.physletb.2017.11.070

Constraining the magnitude of the Chiral Magnetic Effect with Event Shape Engineering in Pb–Pb collisions at sNN=2.76 TeV

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

IGFAE authors: Ferreiro, E.G.

Phys. Lett. B, 777, 151

RL2

DOI: 10.1016/j.physletb.2017.12.021

Quasifree (p,pN) scattering of light neutron-rich nuclei near N=14

Diaz Fernandez, P. et al.

IGFAE authors: Cabanelas, P.; Benlliure, J.; Cortina-Gil, D.; Fernandez-Dominguez, B.; Caamano, M.; Alvarez, H.; Boillos Betete, J

Phys. Rev. C, 97, 024311

RL6, RL7

DOI: 10.1103/PhysRevC.97.024311

Search for Dark Photons Produced in 13 TeV pp 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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Rev. Lett., 120, 061801

RL1

DOI: 10.1103/PhysRevLett.120.061801

Radiative neutron capture on Pu 242 in the resonance region at the CERN n-TOF-EAR1 facility

Lerendegui-Marco, J. et al. **[nTOF** collaboration**]**

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

Phys. Rev. C, 97, 024605

RL6

DOI: 10.1103/PhysRevC.97.024605

Anisotropic D3-D5 black holes with unquenched flavors

Penín J.M., Ramallo A.V., Zoakos D.

IGFAE authors: Ramallo, A.V.; Penin, J.M.

JHEP, 2, 139

RL3, RL2

DOI: 10.1007/JHEP02(2018)139

BPS sectors of the Skyrme model and their non-BPS extensions

Adam C., Foster D., Krusch S., Wereszczynski A.

IGFAE authors: Adam, C.

Phys. Rev. D, 97, 036002

RL2

DOI: 10.1103/PhysRevD.97.036002

Measurement of branching fractions of charmless four-body Λb 0 and Ξb 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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 2, 98

RL1

DOI: 10.1007/JHEP02(2018)098

An Indication of Anisotropy in Arrival Directions of Ultra-high-energy Cosmic Rays through Comparison to the Flux Pattern of Extragalactic Gamma-Ray Sources

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.

Astrophys. J. Lett., 853, L29

RL4, RL2

DOI: 10.3847/2041-8213/aaa66d

Likelihood analysis of the sub-GUT MSSM in light of LHC 13-TeV data

Costa, J.C. et al.

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

Eur. Phys. J. C, 78, 158

RL1

DOI: 10.1140/epjc/s10052-018-5633-3

Evaluation of the Neutron Data Standards

Carlson, A.D. et al.

IGFAE authors: Duran, I.

Nuc. Data Sheets, 148, 143

RL6

DOI: 10.1016/j.nds.2018.02.002

CIELO Collaboration Summary Results: International Evaluations of Neutron Reactions on Uranium, Plutonium, Iron, Oxygen and Hydrogen

Chadwick, M.B. et al.

IGFAE authors: Duran, I.

Nuc. Data Sheets, 148, 189

RL6

DOI: 10.1016/j.nds.2018.02.003

Quasifree (p, 2p) Reactions on Oxygen Isotopes: Observation of Isospin Independence of the Reduced Single-Particle Strength

Atar, L. et al.

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

Phys. Rev. Lett., 120, 052501

RL6, RL7

DOI: 10.1103/PhysRevLett.120.052501

Comprehensive approach to tau-lepton production by high-energy tau neutrinos propagating through the Earth

Alvarez-Muñiz J., Carvalho W.R., Jr., Payet K., Romero-Wolf A., Schoorlemmer H., Zas E. **[Auger collaboration]**

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

Phys. Rev. D, 97, 023021

RL4

DOI: 10.1103/PhysRevD.97.023021

Missing-mass spectroscopy of the C 12 (p,d) reaction near the η′ -meson production threshold

Tanaka, Y.K. et al.

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

Phys. Rev. C, 97, 015202

RL6, RL7

DOI: 10.1103/PhysRevC.97.015202

First observation of forward Z→bb¯ 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.; 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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Lett. B, 776, 430

RL1

DOI: 10.1016/j.physletb.2017.11.066

J/ψ production as a function of charged-particle pseudorapidity density in p–Pb collisions at sNN=5.02TeV

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

IGFAE authors: Ferreiro, E.G.

Phys. Lett. B, 776, 91

RL2

DOI: 10.1016/j.physletb.2017.11.008

First measurement of jet mass in Pb–Pb and p–Pb collisions at the LHC

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

IGFAE authors: Ferreiro, E.G.

Phys. Lett. B, 776, 249

RL2

DOI: 10.1016/j.physletb.2017.11.044

Description of ϕ-meson production in hadronic and nuclear collisions at very high energies

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

IGFAE authors: Merino, C.

Int. J. Mod. Phys. A, 33, 1850202

RL2

DOI: 10.1142/S0217751X18502020

Search for weakly decaying b -flavored pentaquarks

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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Rev. D, 97, 032010

RL1

DOI: 10.1103/PhysRevD.97.032010

Updated determination of D 0 - D 0 mixing and C P violation parameters with D 0 → K + 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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

Phys. Rev. D, 97, 031101

RL1

DOI: 10.1103/PhysRevD.97.031101

Search for excited Bc + 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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 1, 138

RL1

DOI: 10.1007/JHEP01(2018)138

First observation of B + → Ds + K + K − decays and a search for B + → Ds + φ 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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A

JHEP, 1, 131

RL1

DOI: 10.1007/JHEP01(2018)131

Holographic Collisions across a Phase Transition

Attems M., Bea Y., Casalderrey-Solana J., Mateos D., Triana M., Zilhão M.

IGFAE authors: Attems, M

Phys. Rev. Lett., 121, 261601

RL2

DOI: 10.1103/PhysRevLett.121.261601

The NEXT White (NEW) detector

Monrabal, F. et al. **[NEXT** collaboration**]**

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

J. Instrum., 13, P12010

RL5

DOI: 10.1088/1748-0221/13/12/P12010

pt dependence of the flow coefficients for pp collisions in the color string scenario: Monte Carlo simulations

Braun M.A., Pajares C.

IGFAE authors: Pajares, C.

Eur. Phys. J. A, 54, 185

RL2

DOI: 10.1140/epja/i2018-12616-1

Measurement of the inelastic pp cross-section at a centre-of-mass energy of 13TeV

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.; Fernandez Prieto, A.; Dalseno, J; Alves Junior, A; Prouve, C

JHEP, 6, 100

RL1

DOI: 10.1007/JHEP06(2018)100

Resolving the φ 2 (α) ambiguity in B → ρρ

Dalseno J.

IGFAE authors: Dalseno, J

JHEP, 11, 193

RL1

DOI: 10.1007/JHEP11(2018)193

Initial results on energy resolution of the NEXT-White detector

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

IGFAE authors: Rodriguez-Sanchez, J.L.; Hernando Morata, J.A.; Palmeiro Pazos, B; Martinez-Lema, G.; Gonzalez, D.; Díaz Cortés, J

J. Instrum., 13, P10020

RL6, RL5

DOI: 10.1088/1748-0221/13/10/P10020

Study of the loss of xenon scintillation in xenon-trimethylamine mixtures

Trindade, A.M.F. et al.

IGFAE authors: Rodriguez-Sanchez, J.L.; Hernando Morata, J.A.; Palmeiro Pazos, B; Martinez-Lema, G.; Gonzalez, D.; Díaz Cortés, J

Nucl. Instr. Meth. Phys. Res. A, 905, 22

RL6, RL5

DOI: 10.1016/j.nima.2018.07.020

Calibration of the NEXT-White detector using 83m Kr decays

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

IGFAE authors: Rodriguez-Sanchez, J.L.; Hernando Morata, J.A.; Palmeiro Pazos, B; Martinez-Lema, G.; Gonzalez, D.; Díaz Cortés, J

J. Instrum., 13, P10014

RL6, RL5

DOI: 10.1088/1748-0221/13/10/P10014

High voltage insulation and gas absorption of polymers in high pressure argon and xenon gases

Rogers, L. et al.

IGFAE authors: Rodriguez-Sanchez, J.L.; Hernando Morata, J.A.; Palmeiro Pazos, B; Martinez-Lema, G.; Gonzalez, D.; Díaz Cortés, J

J. Instrum., 13, P10002

RL6, RL5

DOI: 10.1088/1748-0221/13/10/P10002

Two infinite families of resonant solutions for the Gross-Pitaevskii equation

Biasi A., Bizoń P., Craps B., Evnin O.

IGFAE authors: Fariña Biasi, A

Phys. Rev. E, 98, 032222

RL3

DOI: 10.1103/PhysRevE.98.032222

PICOSEC: Charged particle timing at sub-25 picosecond precision with a Micromegas based detector

Bortfeldt, J. et al.

IGFAE authors: Gonzalez, D.

Nucl. Instr. Meth. Phys. Res. A, 903, 317

RL5

DOI: 10.1016/j.nima.2018.04.033

Fission in inverse kinematics: A window to new experimental observables

Caamaño M.

IGFAE authors: Caamano, M.

Nuovo Cimento Soc. Ital. Fis. C, 41, 175

RL6

DOI: 10.1393/ncc/i2018-18175-7

Radiation tolerance of proton-irradiated LGADs

Otero Ugobono S., Carulla M., Centis Vignali M., Fernandez Garcia M., Gallrapp C., Hidalgo Villena S., Mateu I., Moll M., Pellegrini G., Vila I.

IGFAE authors: Otero Ugobono, S

, 65, 8337797

RL1

DOI: 10.1109/TNS.2018.2826725

Electron drift properties in high pressure gaseous xenon

Simón, A. et al.

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The non-integrability of strings in massive type IIA and their holographic duals

Núñez C., Penín J.M., Roychowdhury D., van Gorsel J.

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Effective holographic theory of charge density waves

Amoretti A., Areán D., Goutéraux B., Musso D.

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Phys. Rev. D, 97, 086017

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Dc Resistivity of Quantum Critical, Charge Density Wave States from Gauge-Gravity Duality

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Gaseous and dual-phase time projection chambers for imaging rare processes

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Microscopic simulation of xenon-based optical TPCs in the presence of molecular additives

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