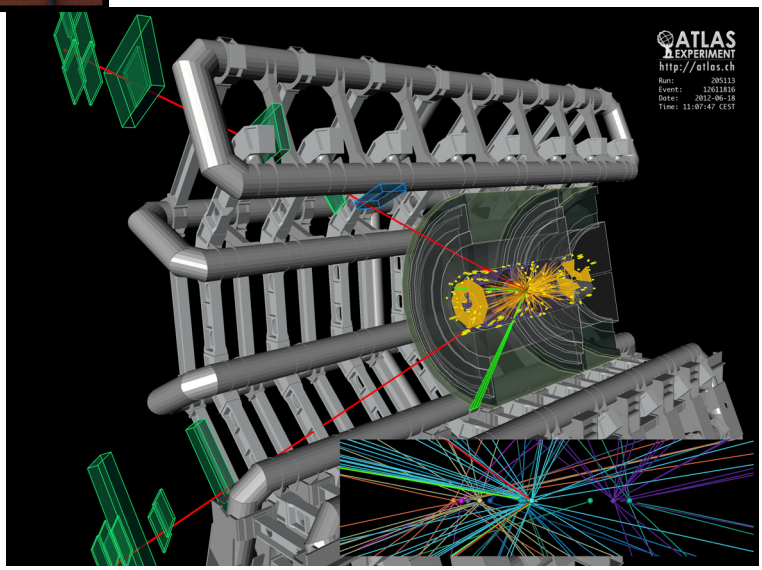


INSTITUT DE FÍSICA CORPUSCULAR

ANNUAL REPORT 2012

ific.uv.es

CSIC
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

VNIVERSITAT DE VALÈNCIA

CONTENTS

BIENVENIDA – BENVINGUDA – WELCOME

Por primera vez el IFIC elabora una memoria anual para ser presentada a la sociedad en general y a la comunidad científica internacional en particular (en inglés). El IFIC es un centro mixto del CSIC y de la Universidad de Valencia: agradecemos, pues, a ambas instituciones el apoyo que nos han dado en los últimos años. El Instituto se ha dotado recientemente de un Comité Científico Asesor que sitúa al IFIC en los estándares internacionales. Los miembros de este comité, nombrado por la Universidad, son los profesores: Guido Altarelli, William Gelletly, Fabiola Gianotti, Francis Halzen, Cecilia Jarlskog, Antonio Masiero, Tatsuya Nakada y Bing-Song Zou.

El año 2012 ha sido muy fructífero. El Instituto ha participado destacadamente en el descubrimiento de la partícula de tipo Higgs. Nuestra participación ha sido a través de los subdetectores *Silicon Tracker* y *TileCal* (calorímetro hadrónico) del gran detector ATLAS, así como en el cálculo científico GRID. El IFIC también ha liderado en el detector BaBar el descubrimiento de la rotura de la simetría de Inversión temporal en la evolución en el tiempo de los mesones B. La correspondiente propuesta teórica también ha surgido del IFIC. Estos dos acontecimientos han merecido ocupar los puestos primero y tercero, respectivamente, entre los *top ten* del IOP.

La situación económica ha empeorado notablemente y especialmente la política de plazas está comprometiendo el futuro de nuestros mejores investigadores: los científicos del programa Ramón y Cajal. Hemos de trasmitir a las autoridades que el incumplimiento del carácter *tenure track* del programa va a ser una catástrofe científica en España de extraordinaria magnitud. Desde la dirección del Instituto haremos todo lo posible para salvar la situación temporalmente en espera de que se pongan en marcha programas de contratación indefinida. Así mismo hay que recuperar programas predoctorales a la mayor brevedad posible.

Per primera volta l'IFIC elabora una memòria anual per a ser presentada a la societat en general i a la comunitat científica internacional en particular (en anglés). L'IFIC és un centre mixt del CSIC i de la Universitat de València: agraïm per tant a les dos institucions el suport que ens han donat en els últims anys. L'Institut s'ha dotat recentment d'un Comité Científic Assessor que situa l'IFIC en els estàndards internacionals. Els membres d'aquest comité, nomenat per la Universitat, són els professors: Guido Altarelli, William Gelletly, Fabiola Gianotti, Francis Halzen, Cecilia Jarlskog, Antonio Masiero, Tatsuya Nakada i Bing-Song Zou.

L'any 2012 ha estat molt fructífer. L'Institut ha participat destacadament en el descobriment de la partícula de tipus Higgs. La nostra participació ha estat a través dels subdetectors *Silicon Tracker* i *TileCal* (calorímetre hadrònic) del gran detector ATLAS, així com en el càlcul científic GRID. L'IFIC també ha liderat al detector BaBar el descobriment del trencament de la simetria d'inversió temporal en l'evolució en el temps dels mesons B. La corresponent proposta teòrica també ha sorgit de l'IFIC. Aquests dos esdeveniments han merescut ocupar els llocs primer i tercer, respectivament, entre els *top ten* de l'IOP .

La situació econòmica ha empitjorat notablement i especialment la política de places està comprometent el futur dels nostres millors investigadors: els científics del programa Ramón y Cajal. Hem de transmetre a les autoritats que l'incompliment del caràcter *tenure track* del programa serà una catàstrofe científica a Espanya d'extraordinària magnitud. Des de la direcció de l'Institut farem tot el possible per salvar la situació temporalment en espera que es posen en marxa programes de contractació indefinida. Així mateix cal recuperar programes predoctorals el més aviat possible.

En medio de esta situación complicada felicitamos a la colaboración NEXT, un experimento de búsqueda de la desintegración doble beta sin neutrinos, porque ha sido financiado por la Unión Europea con una *Advanced Grant* (AdG) del *European Research Council*. Es la primera AdG que se concede en España en el campo de la Física Experimental de Partículas.

Finalmente queremos agradecer, en estos momentos tan difíciles, a todos los miembros del Instituto por la extraordinaria labor que están haciendo. Esta memoria pretende precisamente dar a conocer la ingente cantidad de resultados que se han producido este año en el Instituto, así como todas las actividades satélites incluyendo aquellas que han sido necesarias para llevar a cabo nuestra investigación: la captación de recursos financieros, los resultados científicos, las actividades de formación, etc.

Enmig d'aquesta situació complicada felicitem a la col·laboració NEXT, un experiment de recerca de la desintegració doble beta sense neutrins, perquè ha estat finançat per la Unió Europea amb una *Advanced Grant* (AdG) del *European Research Council*. És la primera AdG que es concedeix en el camp de la Física Experimental de Partícules a Espanya.

Finalment volem agrair, en aquests moments tan difícils, a tots els membres de l'Institut per l'extraordinària tasca que estan fent. Aquesta memòria pretén precisament donar a conéixer la ingent quantitat de resultats que s'han produït enguany a l'Institut , així com totes les activitats satèl·lits incloent aquelles que han estat necessàries per dur a terme la nostra investigació: la captació de recursos financers, els resultats científics, les activitats de formació, etc.

Prof. Francisco J. Botella Olcina

For the first time IFIC prepares an annual report to be presented to the public in general and to the international scientific community in particular. IFIC is a joint venture of CSIC and University of Valencia: we thank thus to both institutions for the support they have given us in recent years. The Institute got recently a Scientific Advisory Comittee thus placing IFIC at international standards. The members of this committee, appointed by the University, are professors: Guido Altarelli, William Gelletly, Fabiola Gianotti, Francis Halzen, Cecilia Jarlskog, Antonio Masiero, Tatsuya Nakada and Bing-Song Zou.

The year 2012 has been very fruitful. The Institute has participated in the discovery of the Higgs particle type. Our involvement has been through the subdetectors: Silicon Tracker and TileCal (hadronic calorimeter) of the large ATLAS detector, as well as in scientific computing - GRID. IFIC also led in the BaBar detector the discovery of the breaking of time reversal symmetry in the time evolution of B mesons. The corresponding theoretical proposal has also emerged from IFIC. These two breakthroughs have deserved the first and third positions, respectively, among the top ten of the IOP.

The economic situation has deteriorated and actually the policy of research positions is compromising the future of our best researchers: the scientists of the *Ramón y Cajal* program. We should convey to

the authorities that the failure of the tenure track character of the program is going to be a scientific catastrophe in Spain. From the directorate of the Institute we will do everything possible to save the situation temporarily while permanent recruitment programs are put in place. The predoctoral programs must be also recovered as soon as possible.

In the middle of this complicated situation we congratulate the NEXT collaboration - an experiment to search for neutrinoless double beta decay - because it has been funded by the European Union with an Advanced Grant (AdG) of the European Research Council. This is the first AdG to be granted in Spain in the field of Experimental Particle Physics.

Finally we want to thank, in these difficult times, to all members of the Institute for the outstanding work they are doing. This report is specifically intended to raise awareness of the huge amount of results that have occurred this year at the Institute, as well as all activities including those satellites that have been necessary to carry out our research: attracting financial resources, scientific results, training activities, etc.

1. STRUCTURE AND ORGANIZATION

WHAT IFIC IS

The Institute for Corpuscular Physics (**Institut de Física Corpuscular, IFIC**) of Valencia is a joint research institute belonging to two institutions: the Spanish National Research Council (Consejo Superior de Investigaciones Científicas, CSIC) and the University of Valencia (Universitat de València – Estudi General, UVEG). The synergies between the two institutions make IFIC a reference center, both providing personnel and infrastructures.

IFIC's origins date back to 1950, when Prof Joaquín Catalá formed a group in Valencia to study atomic nuclei and elementary particles using the nuclear emulsion technique, a research activity not previously developed in Spain. Hence, IFIC is one of the oldest Spanish institutes in Experimental Physics and the first studying particle and nuclear physics.

The mission of IFIC covers a wide range of subjects. In a broad sense, we study the fundamental interactions (gravitational, electroweak and strong) and the building blocks of matter, considering both the theoretical and experimental aspects. Our aim is to understand the nature of these interactions and their phenomenological consequences in the laboratories, to predict the behaviour in future experiments and, as a final goal, to search for a unified theory of all of them. In parallel, we wish to know which physical processes occur in the Universe, and how it has evolved from its initial conditions.

It is our aim to keep our level as an international reference centre in Particle, Astroparticle and Nuclear Physics both in the theory and experimental domains. Although IFIC is clearly oriented towards basic research, we are open to support applications that may derive from our activities on fundamental physics, such as advanced instrumentation, distributed computing and medical physics. In addition, we want to maintain and improve IFIC's training capabilities at the PhD and postdoctoral level. Last but not least, we plan to strengthen our connection with society through our outreach activities.

IFIC is structured in two scientific divisions: experimental and theoretical physics. Both divisions present an excellent research record and impact at the international level. The balance between these two divisions, a situation that is not very common in Spain, is one of the main strengths of IFIC and the close collaboration among their members is extremely fruitful. In addition, the support and managing services provide the adequate administrative and technical help for our research.

In 2005 IFIC was officially classified by the Spanish Ministry of Education and Science as a Class A institute in the list of CSIC research centres.

A bit of history

In the autumn of 1950 Prof Joaquín Catalá formed a group at Valencia to study atomic nuclei and elementary particles using the nuclear emulsion technique[1], after working with Prof Cecil F. Powell at Bristol. This technique had been successfully employed to detect particles in cosmic rays and fixed target experiments leading to the discovery of the pion in 1947 by Powell, who was awarded the Nobel Prize in Physics in 1950. Prof Catalá's group first operated as a local division of the Instituto de Óptica Daza de Valdés belonging to CSIC and specialized in photo-nuclear studies. The group's research program is considered the birth of institutional research in experimental nuclear and particle physics in Spain. One of Catalá's students, Fernando Senent, who became later professor and director of IFIC, was the author in 1954 of the first Spanish thesis in experimental particle and nuclear physics, whose title was: *Distribuciones angulares de los protones producidos en el bombardeo del carbono 12 por deuterones*. Another of his students, Eugenio Villar, obtained his PhD in 1957 and was later the person leading the particle physics group in Santander, now known as Instituto de Física de Cantabria (IFCA).

It was at the beginning of 1960 when the Institute got its present name, Instituto de Física Corpuscular (IFIC). During many years, the Institute shared the building, offices and facilities with the department of Atomic, Molecular and Nuclear Physics (FAMN) of the University of Valencia, which has been the traditional link with the University. The first observation of the exotic nucleus ^{8}He was performed by IFIC researchers in 1971 through the reaction $^{8}\mathrm{He} \rightarrow {}^{4}\mathrm{He} + {}^{4}\mathrm{He} + 2e^{-}$.

The international impact of our research activities has been closely related to the political Spanish situation. In the period 1950-1984 IFIC survived having modest, but heroic, contributions to the physics performed at the international scale. However, after Spain re-entered CERN in 1984 the scientific activity of IFIC was boosted in both quantitative and qualitative aspects at the national and international scales.

Around the year 1985 most of the researchers of the department of Theoretical Physics of the University of Valencia joined the Institute and configured its final structure which benefits from the knowledge of both fields: theory and experiment. This provides an excellent atmosphere for scientific cooperation, in particular in the phenomenological and experimental areas. During the last years, it is worth mentioning the participation of IFIC in experiments at CERN (Geneva-Switzerland), GSI (Darmstad-Germany), Stanford (California-USA), FERMILAB (Chicago-USA), etc.

[1] An excellent review article about the birth of experimental nuclear and particle physics in Spain, written by Agustín Ceba, Víctor Navarro y Jorge Velasco, was published in *Revista Española de Física* 25-2 (2011).

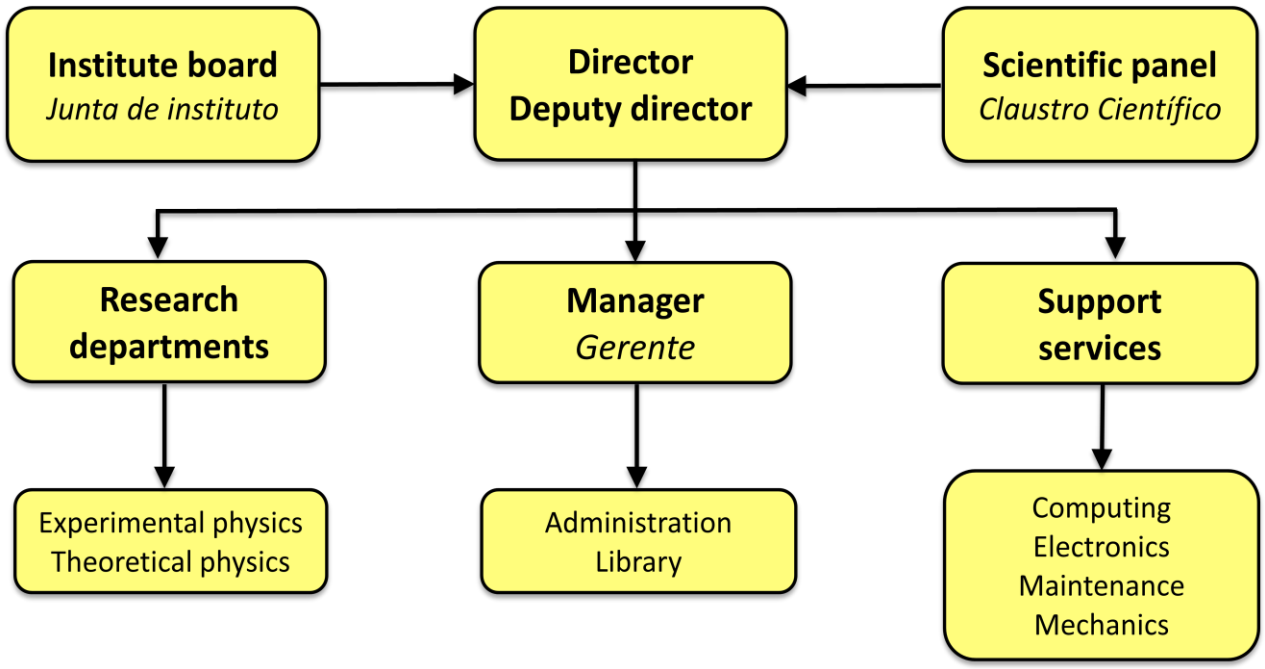
ORGANIZATION, SCIENTIFIC DEPARTMENTS AND SUPPORT UNITS

GOVERNING BOARD

The **Scientific Panel** (Claustro Científico) is the discussion forum for scientific matters of the institute. Chaired by the director, the Panel consists of the CSIC scientific personnel and the UVEG researchers affiliated to IFIC.

The **Institute Board** (Junta de Instituto) is the governing board of IFIC. It is composed by the **Director**, the **Deputy Director**, the **Heads** of the two scientific departments and two **representatives** of the IFIC personnel. The **Manager** of IFIC acts as secretary of the Institute Board.

IFIC organization chart



Members of the Institute Board (31 Dec 2012)

Director: Francisco J. Botella Olcina

Deputy director: Juan José Hernández Rey

Manager: Ana Fandos Lario

Heads of the research departments: Berta Rubio Barroso (Experimental Physics), José W. Furtado Valle (Theoretical Physics)

Personnel representatives: José Bernabéu Verdú (non-doctoral members), Sergio Pastor Carpi (doctoral members)

The Institute is situated in the **Burjassot-Paterna Campus** of the University of Valencia, a few km from the centre of Valencia. IFIC personnel are distributed at the Scientific Park of the UVEG in Paterna (PCUV) and at the University departments (Atomic, Molecular & Nuclear Physics and Theoretical Physics) in Burjassot, within walking distance of each other. At the PCUV, IFIC is one of the research institutes with offices in the main University building and owns the CSIC building where all the laboratories and infrastructures are located.

IFIC buildings at the Scientific Park

Faculty of Physics (UVEG campus in Burjassot)

SCIENTIFIC DEPARTMENTS

EXPERIMENTAL PHYSICS

Several groups of our institute participate in many of the most relevant experiments in Particle, Astroparticle and Nuclear Physics, as well as in the applications of these disciplines to other fields of Science and Technology. For instance, IFIC members are part of the international collaborations that manage the ATLAS and LHCb detectors of the Large Hadron Collider (LHC) at CERN, and participate in the preparation for the future Linear Collider (ILC and CLIC) under the framework of the Linear Collider Collaboration (LCC). The group of e-Science participates in the GRID for the LHC and in other activities of distributed computing. In Astroparticle Physics the work is focused on the neutrino telescope ANTARES and its future extension KM3NeT, while the Neutrino Physics group is involved in the NEXT and T2K experiments. In Nuclear Physics, we participate in the AGATA project, in the future accelerator Facility for Antiproton and Ion Research (FAIR), in the nTOF experiment at CERN and in the HADES experiment at Darmstadt GSI. Finally, the group of Medical Physics carries out several activities mainly related to medical imaging and accelerator developments.

The research lines in Experimental Physics are:

Accelerator-based Experimental High Energy Physics

This research line takes advantage of large particle accelerators to study the elementary components of matter. At present, this line is focused on two large projects: the LHC at CERN and the LCC. IFIC members have participated in the construction of several systems of the ATLAS detector of the LHC, in the computing and data management related to the data supplied by this detector and in beam instrumentation for test facilities of the LCC. In the past, the scientists of this research line participated

in the DELPHI experiment at the LEP accelerator of CERN, the CDF experiment at the Tevatron in Fermilab and in the BaBar experiment at the PEP-II accelerator of SLAC. Recently, IFIC researchers became members of the LHCb and Belle II collaborations.

Astroparticle Physics

Astroparticle Physics studies the particles coming from the cosmos in order to investigate both their properties and the Universe. The group at IFIC participates in the neutrino telescopes ANTARES and KM3NeT. The former is installed at a depth of 2500 metres in the Mediterranean seabed in the coast near Toulon (France) and it has been in operation since 2008. The latter, KM3NeT, will also be deployed in the Mediterranean Sea with an effective detection volume of several cubic kilometres.

Neutrino Physics

This research line studies the intrinsic properties of neutrinos, in particular the phenomenon of flavour neutrino oscillations through the measurement of the mixing parameters. It also tries to elucidate the nature of the neutrino, i.e. if it is a Majorana or a Dirac fermion. IFIC participates in several projects, such as the long-baseline T2K experiment in Japan or SciBooNE in the United States. In addition, the IFIC group is leading the NEXT experiment which will look for neutrinoless double beta decays, a rare nuclear process whose detection would imply that neutrinos are Majorana particles. In the past, the scientists of this line participated in the experiments K2K (Japan) and NOMAD (CERN).

Nuclear Physics

After more than a century of their discovery, atomic nuclei still keep many secrets and there is a wide variety of phenomena not fully understood yet. IFIC researchers in this line work in a broad range of studies in nuclear physics and its applications, such as gamma spectroscopy, extreme nuclear states, nuclear waste incineration or stellar nuclear reactions. Likewise, they are involved in the AGATA project and in the construction of the detectors for the large European infrastructure FAIR. Some IFIC members have participated in the HADES experiment, designed to study di-electron emission in heavy ion reactions.

GRID and e-Science

In order to satisfy the computing needs of particle physics experiments such as those of the LHC, which are providing an enormous amount of data that must be recorded and analyzed, a series of initiatives at CERN and the European Union have been carried out to set up a world network of computing nodes (GRID) communicating among themselves through a series of software protocols. IFIC participates in several of them with the aim of developing a model of distributed computing in Spain and in Europe. This type of development can also be interesting for the local industry and has a straightforward application to other research fields where distributed computing and communication are needed.

Medical Physics

The activities of the Medical Physics group are devoted to the biomedical applications of particle and nuclear physics. Its research includes the development of instrumentation for medical imaging, image

science (image reconstruction and algorithmics, modelling of image formation and degradation phenomena, Monte-Carlo simulations, etc.), as well as accelerator developments. The group activities also cover developments in particle accelerating techniques, beam instrumentation, detector developments for dose monitoring and imaging for hadron therapy.

THEORETICAL PHYSICS

IFIC researchers cover a wide variety of topics in Theoretical Physics, such as the phenomenological aspects of the Standard Model (SM) and of theories beyond it, aspects of nuclear and many-body physics, or particle physics in astrophysics and cosmology. Both the formal aspects of Quantum Field Theory and the phenomenology of nature's fundamental interactions are investigated in the whole range of available energies both in present and future experiments.

The research lines in Theoretical Physics are:

High-Energy Physics Phenomenology

The main goals of high-energy physics phenomenology are the study of the SM of the strong and electroweak interactions and the search for deviations from its predictions that could arise from new interactions expected in several of its extensions, such as supersymmetric models. This strategy includes the precise determination of the SM parameters, couplings, masses and mixing angles, as well as the phenomenological study of possible modifications from its predictions and of new signals arising from novel processes beyond the SM, with emphasis on the potential consequences for present and future high-energy experiments. Some aspects of Quantum Information are also developed.

High-energy Theoretical and Mathematical Physics: Gravity, Black Holes, and Supersymmetry

This line investigates quantum processes in intense gravitational fields and the appearance of new spatiotemporal symmetries. The combination of Quantum Field Theory with General Relativity is studied, as well as its application to black holes (Hawking radiation) and to Cosmology (primitive universe, inflation, etc.). The classical and quantum aspects of the modification of einstenian gravity are also considered, as well as the use of supersymmetry and non-commutative geometries in the search for a quantum theory of gravity.

Nuclear Physics and Many-Body Theory

This line studies the interactions between hadrons and of these with the nuclear medium, using effective theories built from symmetries of Quantum Chromodynamics, perturbative and non-perturbative methods. Special emphasis is put on topics related to the scientific programme of PANDA and CBM of the European Laboratory FAIR and on the study of the neutrino-nucleus cross sections that are used in neutrino oscillation experiments (MiniBooNE, T2K…). Some aspects of Non-linear Dynamics and Complex Systems are also treated.

Quantum Chromodynamics (QCD) and Strong Interactions

Here we study both the perturbative and non-perturbative aspects of the strong interaction, the fundamental force describing the interactions between quarks and gluons. Several approaches are used: lattice gauge theories, effective field theories, chiral perturbation theory or phenomenological lagrangians, such as that of the resonance chiral theory. A variety of goals are pursued, for instance, the theoretical and phenomenological study of QCD in hadron colliders, the study of the hadronic phenomenology in the resonance region, such as in the hadron decays of the tau lepton or in the semileptonic decays of the D mesons and others.

Theoretical Astroparticle Physics and Cosmology

This line covers several interdisciplinary aspects of astroparticle physics and cosmology. Among others it is worth mentioning the basic properties of neutrinos and the future experiments in this field, the origin of neutrino mass and their mixing angles, neutrinos as messengers in astrophysics and cosmology, baryogenesis and leptogenesis, ultra high-energy cosmic rays and others. Although driven by phenomenology which is thriving on the neutrino front as well as cosmology, there is space for theoretical ideas on aspects such as inflation, dark matter or dark energy.

SUPPORT UNITS

Administration and Management

The Administration Service is located on the first floor of the main building. A total of 14 people, belonging to CSIC and UVEG, manage the ordinary performance of IFIC, as well as the budgets of many research grants. These funds are provided by different agencies at different levels (regional, national and European), each of them with its own special rules and particular conditions to manage.

At any time there are around 50 research projects and grants, which implies to process a wide range of tasks as employment contracts, public calls, invoices, leaves of absence, etc. In addition, this Service deals with all sorts of matters in a community with staff belonging to two different institutions and with many nationalities.

Computing centre

Computing

This Unit provides a wide range of network and computing solutions for IFIC, giving support to users and projects. The service catalogue covers a wide spectrum, ranging from the installation and configuration of desktop and laptop computers to scientific computing, including the operation of computer farms with hundreds of multi-core CPUs. Our Computing Service is more than 20 years old and has pioneered the use and spread of new technologies, such as computer networks (FAENET), the web in the past and the GRID at present.

The computing centre houses several clusters with a total of 200 computer nodes (around 2000 cores) and 1.2 PB of disk storage, some of them using GRID technologies. More than 30 servers are constantly operating to provide email and web services, storage, resource management, user access, monitoring services, printing, databases, etc. The computing centre premises are located in a 150 m^2 hall with air conditioning (240 KW), technical floor and uninterruptible power supply (250 KVA).

Electronics laboratory

Electronics

This Unit provides service to any IFIC research project with demands in electronics. IFIC experiments develop particle detectors that generate as output electronic signals that have to be recorded. The staff and equipment of the Electronics Service is ready to support design, prototypes, manufacturing, testing and validation of electronic systems. In addition, certain detector technologies use microelectronics, as for instance silicon particle detectors. This Unit provides support in testing chips and silicon structures, as well as the connection of their microchannels. It also offers service and developments to external companies through contracts and agreements.

This Service Unit makes use of two infrastructures: the general electronics lab (90 m^2) and the clean room (80 m^2 in two areas, classes 10000 and 1000, ISO7 and ISO6) for support in microelectronics.

Library

IFIC's Library, part of CSIC's Library Network, is located on the first floor of the Research Building and has a collection of 2300 books both in topics of general interest and specific to our research. Its staff is responsible for managing the access to electronic journals and the book loans. The latter can be requested online, except for a selection of titles that are for on-site consultation only. IFIC members may request the purchase of books through an online application. The final decision is competence of the Library Commission.

This Service is also responsible for the inventory of theses and dissertations deposited in the library since 1954, as well as the registration of PhD theses and monographs in the general CSIC catalogue. Finally, the library staff collaborates actively in the preparation of IFIC's annual reports (CSIC and UVEG) and the tasks related to the inclusion of our scientific output in the institutional databases.

IFIC workshop

Mechanics

This Unit provides service to projects with mechanical needs, ranging from the conceptual design phase, calculation and simulation to the development of 3D models and drawings. In addition to manufacturing, we carry out measurements and tests on existing components and assemblies. We have a modest but versatile workshop that allows us to make and modify many of our prototypes in our own facilities, providing great flexibility in their development. We also have a dimensional inspection laboratory with contact and visual measurement machines.

This Service is also responsible for supervision of the design and management of the manufacturing of mechanical parts and assemblies in outside companies when they exceed our capacities.

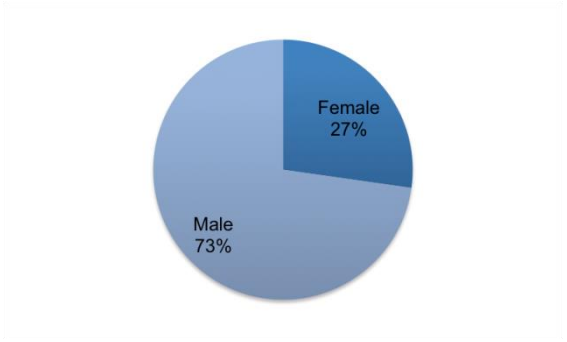
Maintenance

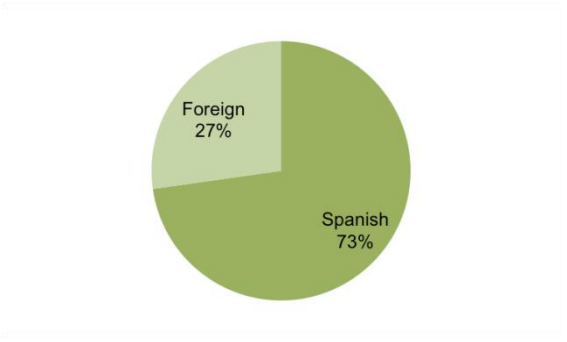
This Unit is an integrated service of maintenance management, occupational safety, radiation protection, environmental and quality management of the shared facilities as well as the research laboratories of the Institute. Its tasks include the preventive and corrective maintenance of facilities and laboratories, the management and logistics of the Clean Room and the Laboratory of Radioactive Sources, and the operation of laboratories. This Unit is also in charge of safety issues at IFIC in collaboration with the corresponding Occupational Health and Safety Services of UVEG and CSIC, including our Radioactive Facility, that depends on the Radiological Protection Area of UVEG, as well as the actions in environmental management (waste disposal and energy efficiency). Finally, this Service is responsible for the implementation of quality standards in the operation of shared facilities, such as the Clean Room, according to the guidelines of our parent institutions.

PERSONNEL (31 DEC 2012)

IFIC employees

TOTAL	MALE	FEMALE	SPANISH	FOREIGN
257	187	70	187	70

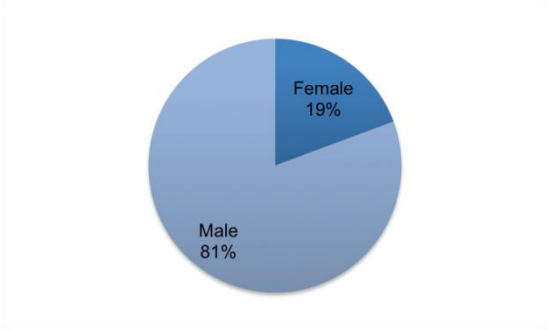


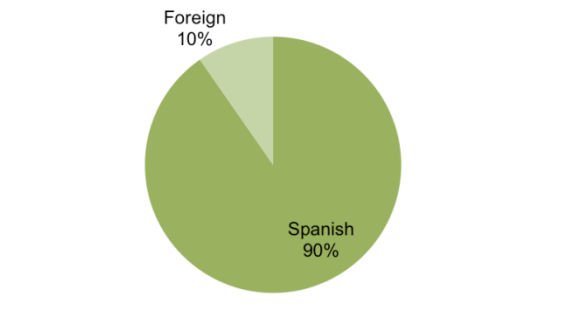


Non-Spanish IFIC employees come from 31 different countries in Europe (44), America (11), Asia (8), Africa (6) and Oceania (1).

Scientific departments

Permanent staff (civil servants)





CATEDRÁTICOS – FULL PROFESSORS (UVEG)

de Azcárraga Feliu, José Adolfo

Bernabeu Alberola, José

Bordes Villagrasa, José Manuel

Botella Olcina, Francisco J.

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Díaz Medina, José

Ferrer Soria, Antonio

Giménez Gómez, Vicent

González Marhuenda, Pedro

Hernández Gamazo, Pilar

Higón Rodriguez, Emilio

Navarro Salas, José

Noguera Puchol, Santiago

Oset Báguena, Eulogio

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Pérez Cañellas, Armando

Pich Zardoya, Antonio

Ros Pallarés, José

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Vidal Perona, Jorge

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Gómez Cadenas, Juan José | Hernández Rey, Juan José | Navarro Faus, Jesús

Rubio Barroso, Berta | Salt Cairols, José | Velasco González, Jorge

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Donini, Andrea | Gadea Raga, Andrés | Hirsch, Martin K.

Lacasta Llácer, Carlos | Martí García, Salvador | Nieves Pamplona, Juan M.

Rodrigo García, Germán | Ros Martínez, Eduardo | Taín Enríquez, José Luis

PROFESORES TITULARES – ASSOCIATE PROFESSORS (UVEG)

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Martínez Vidal, Fernando | Papavassiliou, Ioannis | Rafecas López, Magdalena

Rius Dionis, Nuria | Vicente Vacas, Manuel | Vijande Asensio, Javier

Vives Garcia, Oscar | Zúñiga Román, Juan

CIENTÍFICOS TITULARES – TENURED SCIENTISTS (CSIC)

Algora, Alejandro | Cabrera Urbán, Susana | Cervera Villanueva, Anselmo

Costa Mezquita, María José | Faus Golfe, M. Ángeles | Mena Requejo, Olga

Pastor Carpi, Sergio | Peña Garay, Carlos | Portolés Ibáñez, Jorge

Valls Ferrer, Juan Antonio

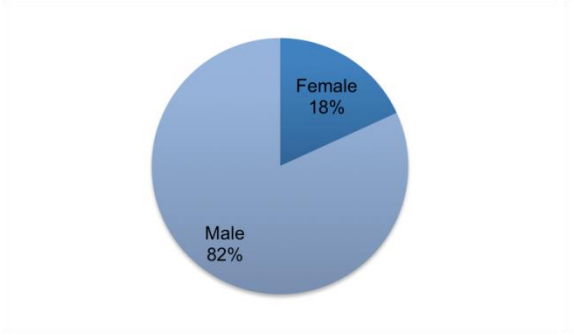
PROFESOR CONTRATADO DOCTOR – ASSISTANT PROFESSOR (UVEG)

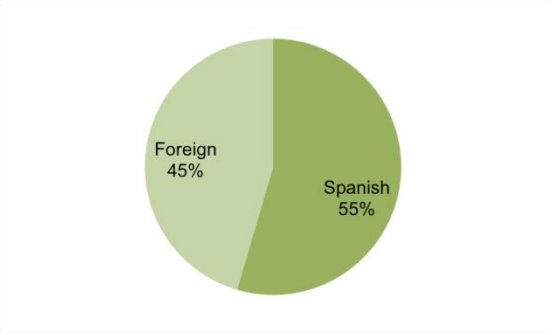
Gonzalez de la Hoz, Santiago

DOCTOR VINCULADO

Fabbri, Alessandro | Rosell Escribá, Ignasi

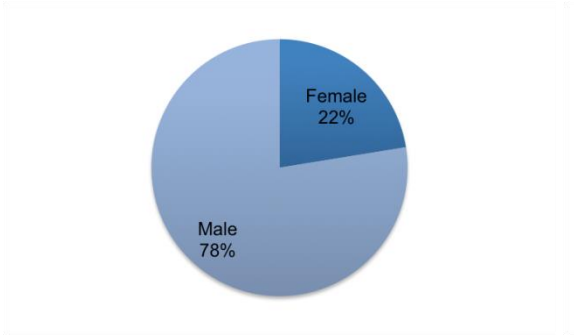
RAMÓN Y CAJAL RESEARCHERS

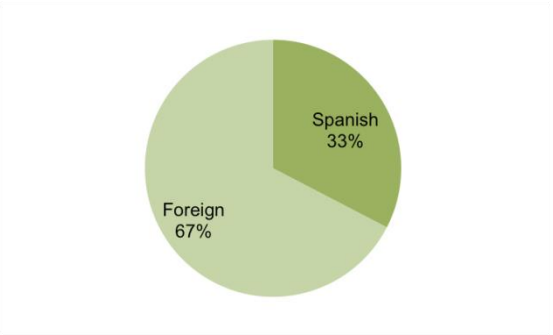




Álvarez Ruso, Luis (CSIC)
Della Morte, Michele (CSIC)
Domingo Pardo, César (CSIC)
Fiorini, Luca (UVEG)
García Navarro, J. Enrique (CSIC)
Oyanguren Campos, Arantza (UVEG)
Mitsou, Vasiliki (CSIC)
Palomares Ruiz, Sergio (CSIC)
Ruiz de Austri Bazán, Roberto (CSIC)
Sorel, Michel (CSIC)
Vos, Marcel (CSIC)

POSTDOCTORAL RESEARCHERS





Agarwalla, Sanjib K.
Baker, Michael J.
Bigongiari, Ciro
Cabello Velasco, Jorge
Chachamis, Grigorios
Deak, Michal
Emanuele, Umberto
Esperante Pereira, Daniel
Fassi Imlahi, Farida
Fernández García, Avelina
Ferrario, Paola
Ghosh, Tapasi
Gillam, John
Izmaylov, Alexander
Jones Pérez, Joel
Jordán Martín, M. Dolores
Kaci, Mohammed
Lambard, Guillaume
Ledwig, Tim
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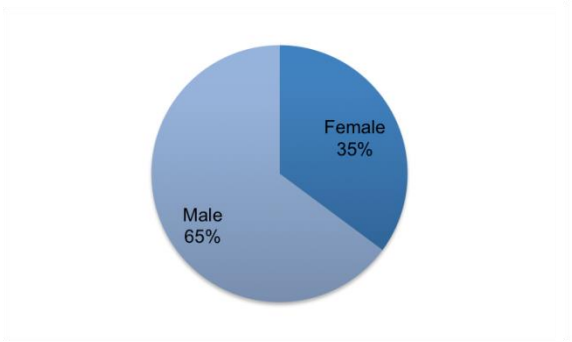
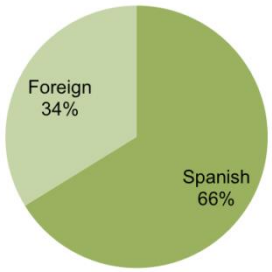
Liubarsky, Igor
Llosá Llácer, Gabriela
Lu, Jie
Malamos, Ioannis
Mangano, Salvatore
March Ruiz, Luis

Mateu Barreda, Vicent	Nebot Gómez, Miguel	Ozpineci, Altug
Oliver Guillén, Josep F.	Olmo Alba, Gonzalo	Orrigo, Sonja E.A.
Pereira dos Santos, Fabio Álex	Pimikov, Alexandr	Qin, Gang
Racker, Jean Jacques	Resta López, Javier	Ruiz Femenia, Pedro D.
Serodio, Hugo	Stamoulis, Panagiotis	Torres Espallardo, Irene
Tórtola Baixauli, M. Amparo	Vincent, Aaron	Vulvert, Gregory
Yahlali Haddou, Nadia	Zornoza Gómez, Juan de Dios	

PhD STUDENTS





Aceti, Francesca	Álvarez Piqueras, Damián	Aparici Benages, Alberto
Barrientos Turrión, Diego	Barrio Toala, John	Barrios Martí, Javier
Belver Aguilar, Carolina	Boronat Arévalo, Marçà J.	Boucenna, M. Sofiane
Brzezinski, Karol	Buchta, Sebastian	Carrasco Vela, Nuria
Celis Alas, Alejandro	Cerdà Sevilla, María	De Carvalho Amaral García, Jose M.
De Romeri, Valentina	Doramé Ceceña, Luis H.	Escudero Sánchez, Lorena
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Herrero García, Juan Andrés	Hidalgo Duque, Carlos	Hinarejos Domenech, Margarida
Hosekova, Lucia	Hüyük, Tayfun	Hyaya, Mohamed Amine

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Toufique, Yassine
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Valencia Marín, Ebhelixes
Villanueva Pérez, Pablo
Wang, En
Yepes Ramírez, Harold
Zahiri Abyaneh, Mehran

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Álvarez Puerta, Vicente
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Blanch Gutiérrez, César
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Carrión Burguete, J. Vicente
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García Argos, Carlos
García Ortega, Pablo
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Lorca Galindo, David
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Mazorra de Cos, José
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Villarejo Bermúdez, M. Ángel

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Fillol Ricart, Amparo	Gracia Vidal, M. José (CPAN)	Hernando Recuero, M. Luisa (CPAN)
Llorens Sebastià, Amparo (LHC Phenonet)	Pastor Clérigues, Elena (IVICFA)	Pérez García, José (CUP)
Pous Cuñat, Elena M. (Library)	Sifre García, Francisca	

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Lacruz Lacruz, Amparo	Martínez Sáez, Carlos	Nadal Durà, Joaquín
Sánchez Martínez, F. Javier		

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Bernabeu Verdú, José	Cámara García, Teresa	González González, Francisco
Marco Hernández, Ricardo	Nácher Arándiga, Jorge	Valero Biot, J. Alberto

Maintenance

Carrasco de Fez, Rosa	Estruells Monedero, Juan José

Mechanics

Civera Navarrete, J. Vicente	San Eustaquio Tarazona, M. Vicenta

3. RESEARCH ACTIVITIES

EXPERIMENTAL PHYSICS

Experimental astroparticle physics

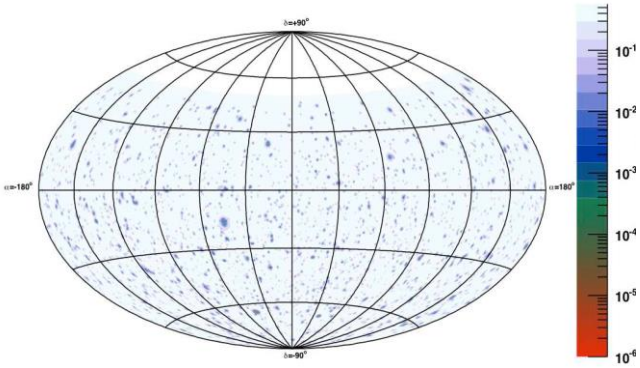
ANTARES

2012 has been a very fruitful year from the physics production point of view, showing the wide potential of neutrino telescopes. These results include the search for point sources, diffuse fluxes, correlation with transient sources, dark matter, neutrino oscillations, monopoles, correlation with gravitational waves and nuclearites. The IFIC group has led the effort in several of these analyses.

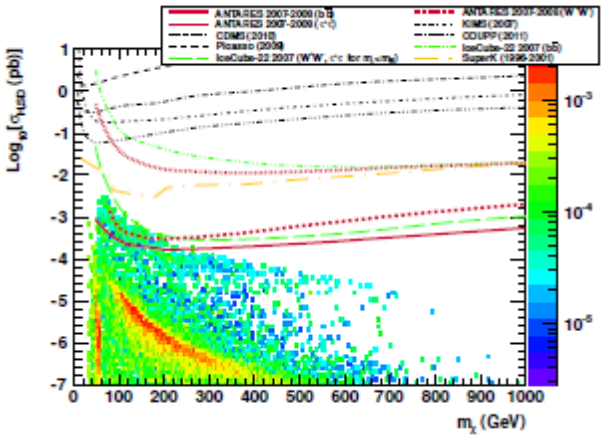
We have set the best limits of the world on the cosmic neutrino flux from the Southern Hemisphere. Moreover, we have looked for correlations with flaring blazars detected by FERMI. Concerning dark matter, we have searched for neutralino annihilation in the Sun, which has led to competitive limits on the spin-dependent WIMP-proton scattering cross section.

KM3NeT

This year the IFIC group has built the optical time calibration system of the NEMO TOWER Phase II and we have been leading the design of the Control Logic Board (CLB) for the acquisition system of the Pre-Production Model (PPM) of KM3NeT.



Sky map in equatorial coordinates showing the p-values obtained for the point-like clusters evaluated in the full-sky scan.



Experimental limits on the spin-dependent cross-section $\sigma_{H;SD}$ compared to the theoretical parameter space allowed by the experimental constraints for the CMSSM model.

Selected publications:

ANTARES Collaboration (Adrián-Martínez, S. et al), *Search for Cosmic Neutrino Point Sources with Four Years of Data from the ANTARES Telescope*, Astrophys. J. 760, 53 - 10pp, DOI: 10.1088/0004-637X/760/1/53 [arXiv:1207.3105]

ANTARES Collaboration (Adrián-Martínez, S. et al), *Search for neutrino emission from gamma-ray flaring blazars with the ANTARES telescope*, Astropart Phys. 36, 204-210, DOI: 10.1016/j.astropartphys.2012.06.001 [arXiv:1207.3105]

J.D. Zornoza and G. Lambard, *Dark matter searches with the ANTARES neutrino telescope: constraints to CMSSM and mUED models*, Proc. of the International Conference on High Energy Physics 2012, Melbourne, PoS (ICHEP2012) 448

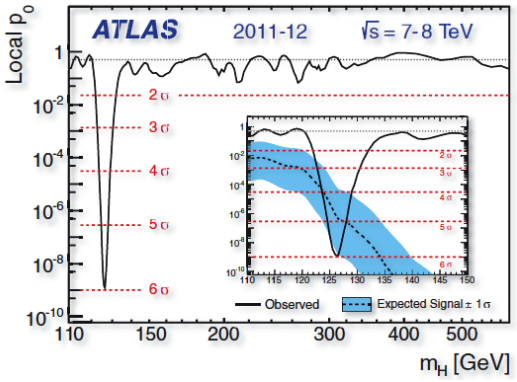
Main research grants (National Plan):

PARTICIPATION OF IFIC IN THE ANTARES AND KM3NET NEUTRINO TELESCOPES (ref. FPA2009-13983-C02-01)

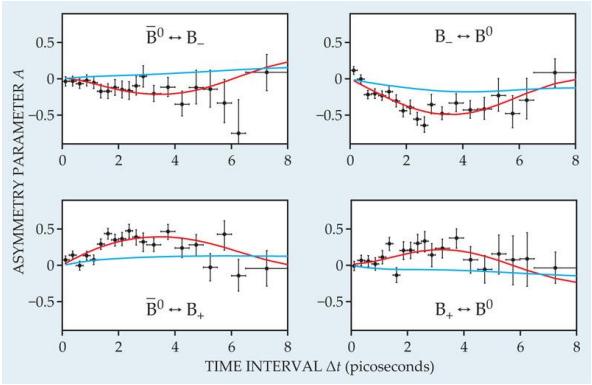
Accelerator-based experimental high energy physics

The year 2012 was dominated by the superb performance of the LHC, as the machine energy was increased to 8 TeV and the luminosity ramped up until the detectors of the ATLAS experiment had received hundreds of trillions of p-p collisions. The corresponding analysis of the data, where many IFIC researchers were involved, led to numerous and interesting physics results, but none as spectacular as the discovery of a new particle at a mass around 125 GeV. On July 4, in a joint seminar, both ATLAS and CMS unveiled that the data bore sufficient evidence to declare the discovery of a new boson that could be the particle predicted in 1964 by theorists Peter Higgs and François Englert, among others.

IFIC members Fernando Martínez Vidal and José Bernabeu led the analysis of other important measurement in a different accelerator, SLAC in the USA. Using data collected by the BaBar experiment on the decays of entangled neutral B mesons, they presented the first direct observation of time-reversal asymmetries that are not also CP asymmetries. This important result is an excellent example of the collaboration between the two scientific departments of IFIC.



Combined results of Higgs searches at the ATLAS detector: the observed (solid) local P and the expectation (dashed) for the hypothesis of a SM Higgs boson signal at the given mass. The shaded band indicates the expected ±1σ variation of the signal prediction.



The four independent T-violating asymmetries for transitions of B mesons. The points with error bars represent the data, the red solid and dashed blue curves represent the projections of the best fit results with and without time-reversal violation, respectively.

Selected publications:

ATLAS Collaboration (Aad, G. et al), *Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC*, Phys. Lett. B 716, 1-29, DOI: 10.1016/j.physletb.2012.08.020 [arXiv:1207.7214]

ATLAS Collaboration (Aad, G. et al), *A Particle Consistent with the Higgs Boson Observed with the ATLAS Detector at the Large Hadron Collider*, Science 338, 1576-1582, DOI: 10.1126/science.1232005

BaBar Collaboration (Lees, J.P. et al), *Observation of Time-Reversal Violation in the B-0 Meson System*, Phys. Rev. Lett. 109, 211801 - 8pp, DOI: 10.1103/PhysRevLett.109.211801 [arXiv:1207.5832]

Main research grants (National Plan):

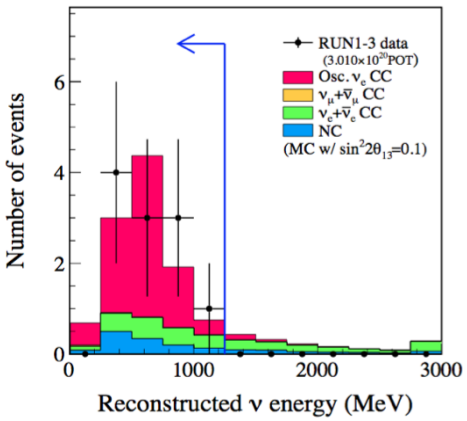
CONTRIBUTIONS TO THE ATLAS EXPERIMENT AT THE LARGE HADRON COLLIDER (ref. FPA2009-13234-C04-01)
CONTRIBUTIONS TO THE HADRONIC TILE CALORIMETER OF THE ATLAS DETECTOR (ref. FPA2009-13234-C04-03)
SPANISH DISTRIBUTED TIER2 FOR THE ATLAS EXPERIMENT (ref. FPA2010-21919-C03-01)
DEVELOPMENT OF NEW ACCELERATOR TECHNOLOGIES FOR FUTURE COLLIDERS (ref. FPA2010-21456-C02-01)
DEVELOPMENT OF NEW DETECTORS FOR FUTURE COLLIDERS IN PARTICLE PHYSICS (ref. FPA2010-21549-C04-04)

Experimental neutrino physics

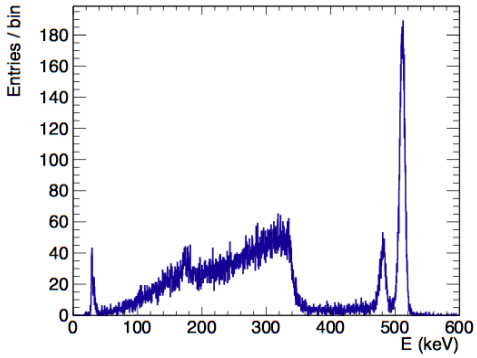
The T2K long-baseline oscillation experiment successfully recovers after the March 2011 earthquake and observes electron neutrino appearance at the 3.2σ level. It also presents results on muon neutrino disappearance, the first of this kind in an off-axis beam.

The SciBooNE and MiniBooNE Collaborations join efforts to produce two-detector searches for muon neutrino and muon antineutrino disappearance, yielding no indication for neutrino oscillations at short baselines.

The NEXT experiment completes the technical design report for NEXT-100, the 100 kg scale detector now under construction at the Underground Laboratory in Canfranc (Spanish Pyrenees). In parallel, first results obtained from NEXT prototypes are published, most notably from the NEXT-DEMO detector at IFIC. The prototypes validate the NEXT detection concept and serve as a technology test-bed for NEXT-100 solutions.



Reconstructed neutrino energy for the electron neutrino candidates. 11 events are observed by T2K while 10.71 are expected for $\sin^2 2\vartheta_{13}$ =0.1.



The energy spectrum for ^{22}Na gamma-ray events in NEXT-DEMO. The photoelectric peak indicates an energy resolution of 1.75% FWHM at 511 keV.

Selected publications:

T2K Collaboration (Abe, K. et al), *First muon-neutrino disappearance study with an off-axis beam*, Phys. Rev. D 85, 031103 - 8pp, DOI: 10.1103/PhysRevD.85.031103 [arXiv:1201.1386]

Gómez-Cadenas, J.J.; Martín-Albo, J.; Mezzetto, M.; Monrabal, F.; Sorel, M., *The search for neutrinoless double beta decay*, Riv. Nuovo Cimento 35, 29-98, DOI: 10.1393/ncr/i2012-10074-9 [arXiv:1109.5515]

SciBooNE and MiniBooNE Collaborations (Mahn, K.B.M. et al), *Dual baseline search for muon neutrino disappearance at 0.5 eV^2 < Δm^2 < 40 eV^2*, Phys. Rev. D 85, 032007 - 10pp, DOI: 10.1103/PhysRevD.85.03207 [arXiv:1106.5685]

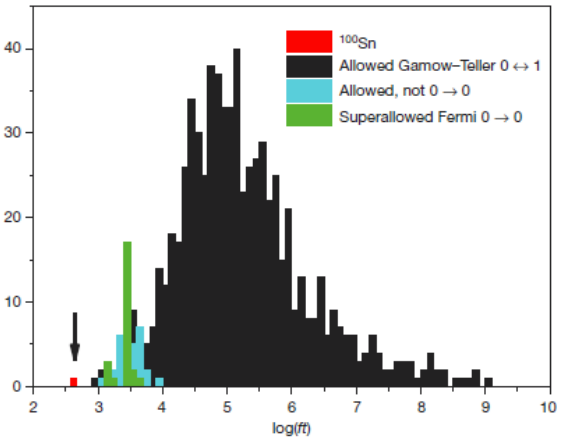
NEXT Collaboration (Álvarez, V. et al), *NEXT-100 Technical Design Report (TDR). Executive summary*, J. Instrum. 7, T06001 - 34pp, DOI: 10.1088/1748-0221/7/06/T06001 [arXiv:1202.0721]

Main research grants (National Plan):

EXPERIMENTAL NEUTRINO PHYSICS: THE NEXT PROJECT (ref. FPA2009-13697-C04-01)
EXPERIMENTAL NEUTRINO PHYSICS AT IFIC (ref. FPA2009-13697-C04-04)
PARTICIPATION IN THE T2K EXPERIMENT (ref. FPA2011-29823-C02-01)

Experimental nuclear physics

A Gamow-Teller (GT) transition in β^+ decay transforms a proton into a neutron in a previously not fully occupied orbital emitting a positron-neutrino pair with parallel spins. The strength of such transitions depends sensitively on the underlying nuclear structure and represents, therefore an excellent "laboratory" for testing nuclear models, like the shell-model of the nucleus. Recently, the β-decay of the ^{100}Sn nucleus has been studied in great detail (Hinke, C.B. et al) at the GSI facility (Germany) using the FRS fragment separator in combination with the RISING γ-ray spectrometer. This experiment yielded the largest GT strength ever measured in allowed nuclear β-decay, thus establishing the "superallowed" nature of this GT transition. State-of-the-art, large-scale shell model calculations are able to reproduce fairly well this experimental result.



Log(ft) values of allowed nuclear β-decays. The decay of ^{100}Sn is unique because it shows the smallest known log(ft) value (red) of any nuclear β-decay.

Nuclear physics can contribute to a better understanding of the primary neutrino spectrum from a reactor (M. Fallot et al). There is only one direct measurement of the neutrino spectrum from the fissile isotopes ^{235}U, ^{239,241}Pu. An alternative is to perform summation calculations of the neutrino spectrum from each fission product from a precise knowledge of the β-decay probability distribution. The key point here is to use the adequate technique to measure this distribution free from systematic effects. The total absorption spectroscopy technique, perfected by the IFIC group, is the only one that can guarantee accurate results. Summation calculations of the reactor neutrino spectrum are fundamental for the application for non-proliferation control. The International Atomic Energy Agency (IAEA) has a working group devoted to the development of small neutrino detectors, which could allow monitoring nuclear reactors from the distance.

Selected publications:

Hinke, C.B. et al, *Superallowed Gamow-Teller decay of the doubly magic nucleus Sn-100*, Nature 486, 341-345, DOI: 10.1038/nature11116

Fallot, M. et al, *New Antineutrino Energy Spectra Predictions from the Summation of Beta Decay Branches of the Fission Products*, Phys. Rev. Lett. 109, 202504 - 5pp, DOI: 10.1103/PhysRevLett.109.202504 [arXiv:1208.3877]

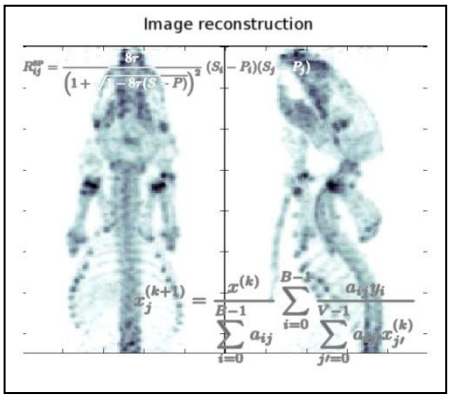
Main research grants (National Plan):

HIGH-RESOLUTION GAMMA SPECTROSCOPY: THE PATH TO AGATA (ref. FPA2011-29854-C04-02)
NUCLEAR STRUCTURE, APPLICATIONS AND ASTROPHYSICS: THE PATH TO FAIR (ref. FPA2011-24553)

Medical application of nuclear and particle physics

The medical physics research activities at IFIC in 2012 were mainly focused on the development and enhancement of innovative imaging devices and techniques, including instrumentation, simulation and image reconstruction. The main lines and results were

- Development of a high resolution PET prototype with continuous crystals and silicon photomultipliers.
- Development and improvement of image reconstruction algorithms.
- Accurate modeling of the physics involved in the image formation processes.
- Specific image reconstruction software for imaging devices, such as proof-of-concept prototypes.
- Development of a LaBr3 Compton telescope for treatment monitoring in hadron therapy and associated readout electronics.
- Application of novel imaging techniques for treatment monitoring in hadron therapy.
- Use of silicon detectors for high resolution PET and Compton prototypes.



The quality of the final images is improved when the models of the processes involved in the image formation are included in the reconstruction algorithm

Compton telescope composed of two LaBr3 detectors connected to the readout electronics

Selected publications:

Bolle, E et al, *AX-PET: A novel PET concept with G-APD readout*, Nucl. Instrum. Methods Phys. Res. A 695, 129-134, DOI: 10.1016/j.nima.2011.12.114

Cabello, J.; Rafecas, M., *Comparison of basis functions for 3D PET reconstruction using a Monte Carlo system matrix*, Phys. Med. Biol. 57, 1759-1777, DOI: 10.1088/0031-9155/57/7/1759

Llosá, G.; Barrio, J.; Cabello, J.; Crespo, A.; Lacasta, C.; Rafecas, M.; Callier, S.; de la Taille, C.; Raux, L., *Detector characterization and first coincidence tests of a Compton telescope based on LaBr3 crystals and SiPMs*, Nucl. Instrum. Methods Phys. Res. A 695, 105-108, DOI: 10.1016/j.nima.2011.11.041

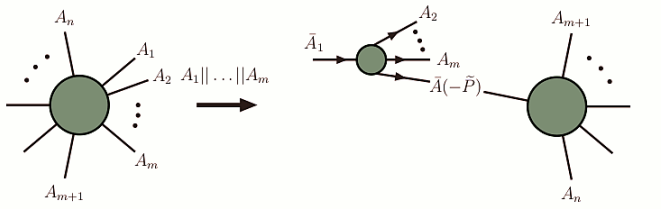
Main research grants (National Plan):

IMAGE QUALITY AND QUANTIFICATION IN POSITRON EMISSION TOMOGRAPHY (ref. FPA2010-14891)

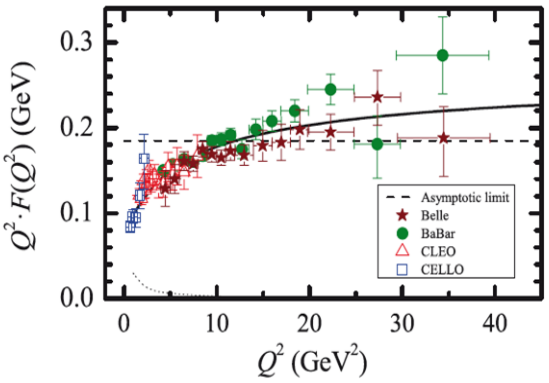
QCD and strong interactions

The main lines and results in 2012 were

- Analyses of eta- and pion-photon*-photon form factors.
- Studies on multi-quark hadron spectroscopy: tetra- and hexa-quarks.
- Unquenched lattice QCD applied to the study of neutral meson mixing.
- Dynamical generation of gluon mass at low-energy QCD.
- Characterization of universality and factorization breaking effects at higher orders in perturbative QCD and proof of a generalized collinear factorization theorem for hard scattering amplitudes at all orders.
- Study of the spectra of high-energy strongly-coupled resonances in the Standard Model of electroweak interactions with and without a light Higgs boson.
- Implementation in TAUOLA of the QCD currents, relevant for hadronic tau decays, as given by the Resonance Chiral Theory.



Factorization of scattering amplitudes in the space-like region



Vector form factor of the pion. Inclusion of higher twist effects at 1 GeV allows a good quantitative description of data

Selected publications:

Catani, S.; de Florian, D.; Rodrigo, G., *Space-like (vs. time-like) collinear limits in QCD: is factorization violated?*, J. High Energy Phys. 07, 026 - 88pp, DOI: 10.1007/JHEP07(2012)026 [arXiv:1112.4405]

Pich, A.; Rosell, I.; Sanz-Cillero, J.J., *One-loop calculation of the oblique S parameter in higgsless electroweak models*, J. High Energy Phys. 08, 106 - 34pp, DOI: 10.1007/JHEP08(2012)106 [arXiv:1206.3454]

Aguilar, A.C.; Ibáñez, D.; Mathieu, V.; Papavassiliou, J., *Massless bound-state excitations and the Schwinger mechanism in QCD*, Phys. Rev. D 85, 014018 - 21pp, DOI: 10.1103/PhysRevD.85.014018 [arXiv:1110.2633]

Noguera, S.; Vento, V., *Model analysis of the world data on the pion transition form factor*, Eur. Phys. J. A 48, 143 - 4pp, DOI: 10.1140/epja/i2012-12143-1 [arXiv:1205.4598]

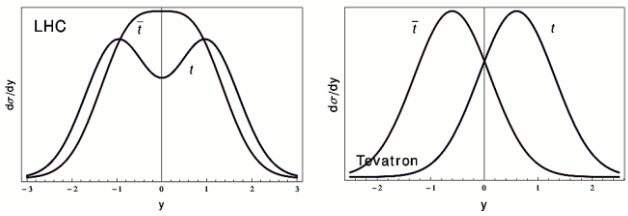
Main research grants (National Plan):

FLAVOUR AND ORIGIN OF MATTER (ref. FPA2011-29678-C02-01)
FUNDAMENTAL INTERACTIONS AND THEIR EXPERIMENTAL IMPLICATIONS (ref. FPA2011-23596)
HADRONIC MODELS, FUNDAMENTAL INTERACTIONS AND NUCLEAR PHYSICS (ref. FPA2010-21750-C02-01)
PARTICLE PHYSICS PHENOMENOLOGY AT THE LHC AND FLAVOUR FACTORIES (ref. FPA2011-23778)
PARTICLES AND INTERACTIONS: FLAVOUR AND COLOUR PHENOMENOLOGY (REF. FPA2007-60323)
PERTURBATIVE AND NON-PERTURBATIVE STUDIES OF THE STANDARD MODEL AND ITS EXTENSIONS (ref. FPA2011-23897)

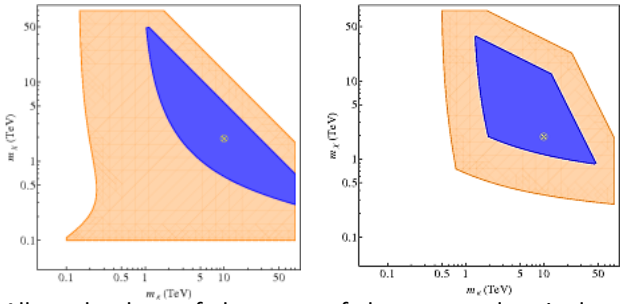
High-energy physics phenomenology

The main lines and results in 2012 were

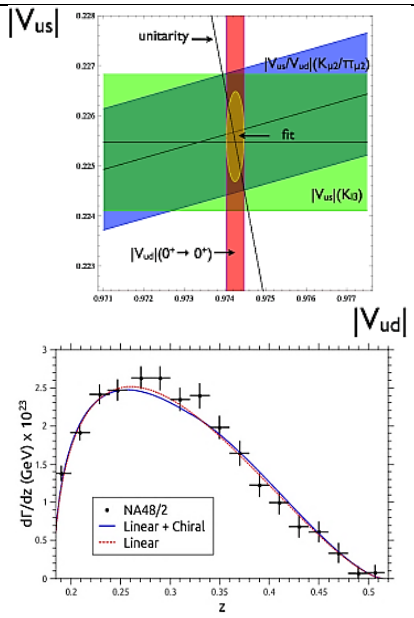
- High precision predictions for the top-antitop quark charge asymmetry at hadron colliders and comparison with experimental measurements. Puzzling disagreement with the SM at the Tevatron leading to theoretical speculations on new physics scenarios.
- A comprehensive review on kaon physics that summarizes the status of theoretical predictions for leptonic, semileptonic and nonleptonic kaon decays including rare and radiative modes.
- Scan of the parameter space of the cMSSM supersymmetric model using Bayesian techniques.
- Phenomenology of the minimal supersymmetric $U(1)_{B\text{-}L} \times U(1)_R$ extension of the Standard Model. Discussion on low-energy and accelerator constraints from Z' searches at the LHC and upper limits on lepton flavour violation.
- Detailed analysis of recent flavour data in the framework of a model with a vector-like isosinglet up-quark added to the spectrum of the SM, and precise predictions for selected rare processes.
- A realistic model for neutrino masses with potential discovery effects at the LHC.



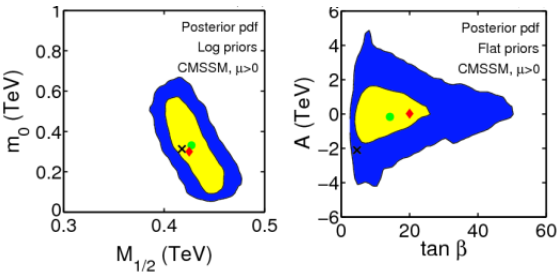
Rapidity distribution of top versus antitop quarks at Tevatron (left) and the LHC (right)



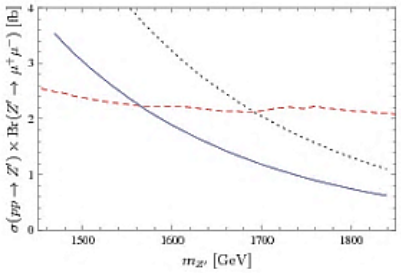
Allowed values of the mass of the new scalar singlet and electroweak triplet introduced in a model for neutrino masses.



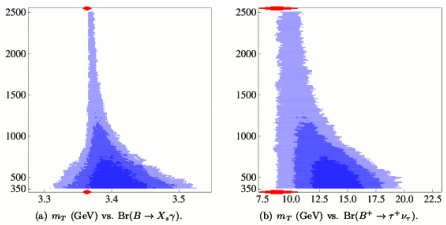
Current status of |Vud|, |Vus| and the CKM unitarity test from kaon decays (upper panel). Spectra for $K^+ \to \pi^+\mu^+\mu^-$ in the dilepton invariant mass (lower panel).



Parameter space of the supersymmetric model cMSSM.



Cross-section of $pp \to Z' \to \mu^+\mu^-$ near the Z' peak as function of $m_{Z'}$ in the supersymmetric $U(1)_{B\text{-}L} \times U(1)_R$ model. The red line shows the ATLAS exclusion limit.



Correlation between the mass of the new isosinglet vector-like up-quark and B meson decay branching ratios.

Selected publications:

Kühn, J.H.; Rodrigo, G., *Charge asymmetries of top quarks at hadron colliders revisited*, J. High Energy Phys. 01, 063 - 25pp, DOI: 10.1007/JHEP01(2012)063 [arXiv:1109.6830]

Cirigliano, V.; Ecker, G.; Neufeld, H.; Pich, A.; Portolés, J., *Kaon decays in the standard model*, Rev. Mod. Phys. 84, 399-447, DOI: 10.1103/RevModPhys.84.399 [arXiv:1107.6001]

Cabrera, M.E.; Casas, J.A.; Mitsou, V.A.; Ruiz de Austri, R.; Terrón, J., *Histogram comparison tools for the search of new physics at LHC. Application to the CMSSM*, J. High Energy Phys. 04, 133 - 27pp, DOI: 10.1007/JHEP04(2012)133 [arXiv:1109.3759]

Hirsch, M.; Reichert, L.; Porod, W.; Staub, F., *Phenomenology of a supersymmetric $U(1)_{B-L}$ x $U(1)_R$ extension of the Standard Model with inverse seesaw mechanism*, Phys. Rev. D86, 093018-26pp, DOI: 10.1103/PhysRevD.86.093018 [arXiv:1206.3516]

Botella, F.J.; Branco, G.C.; Nebot, M., *The hunt for New Physics in the Flavour Sector with up vector-like quarks*, J. High Energy Phys.12, 040 - 34pp, DOI: 10.1007/JHEP12(2012)040 [arXiv:1207.4440]

del Águila, F.; Aparici, A.; Bhattacharya, S.; Santamaria, A.; Wudka, J., *A realistic model of neutrino masses with a large neutrinoless double beta decay rate,* J. High Energy Phys. 05, 133 - 30pp, DOI: 10.1007/JHEP05(2012)133 [arXiv:1111.6960]

Main research grants (National Plan):

ASTROPARTICLE AND HIGH ENERGY PHYSICS (ref. FPA2011-22975)
FLAVOUR AND ORIGIN OF MATTER (ref. FPA2011-29678-C02-01)
FUNDAMENTAL INTERACTIONS AND THEIR EXPERIMENTAL IMPLICATIONS (ref. FPA2011-23596)
PARTICLE PHYSICS PHENOMENOLOGY AT THE LHC AND FLAVOUR FACTORIES (ref. FPA2011-23778)
PARTICLES AND INTERACTIONS: FLAVOUR AND COLOUR PHENOMENOLOGY (REF. FPA2007-60323)
PERTURBATIVE AND NON-PERTURBATIVE STUDIES OF THE STANDARD MODEL AND ITS EXTENSIONS (ref. FPA2011-23897)

Mathematical and theoretical high energy physics. Gravity, Black Holes, and Supersymmetry

Selected publications:

Agulló, I.; Navarro-Salas, J.; Parker, L., *Enhanced local-type inflationary trispectrum from a non-vacuum initial state*, J. Cosmol. Astropart. Phys. 05, 019 - 13pp, DOI: 10.1088/1475-7516/2012/05/019 [arXiv:1112.1581]

Coutant, A.; Fabbri, A.; Parentani, R.; Balbinot, R.; Anderson, P.R., *Hawking radiation of massive modes and undulations*, Phys. Rev. D 86, 064022 - 17pp, DOI: 10.1103/PhysRevD.86.064022 [arXiv:1206.2658]

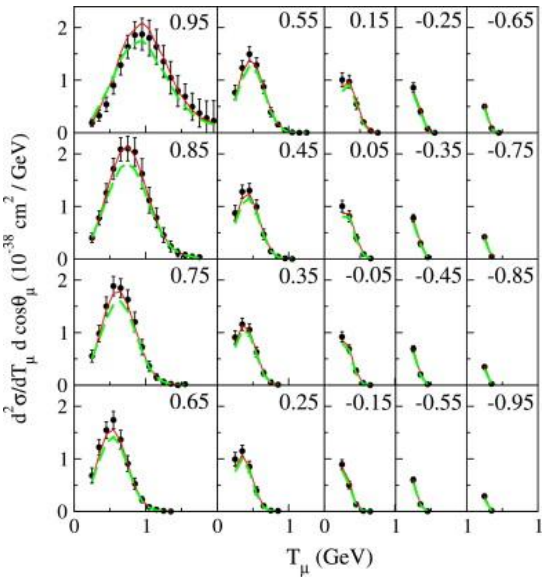
Harko, T.; Koivisto, T.S.; Lobo, F.S.N.; Olmo, G.J., *Metric-Palatini gravity unifying local constraints and late-time cosmic acceleration*, Phys. Rev. D 85, 084016 - 5pp, DOI: 10.1103/PhysRevD.85.084016 [arXiv:1110.1049]

de Azcárraga, J.A.; Izquierdo, J.M., *D=3 (p, q)-Poincaré supergravities from Lie algebra expansions*, Nucl. Phys. B 854, 276-291, DOI: 10.1016/j.nuclphysb.2011.08.020 [arXiv:1107.2569]

Main research grants (National Plan):

GEOMETRY, GROUPS, FIELD THEORY AND SUPERSYMMETRY (ref. FIS2008-01980)
QUANTUM BLACK HOLES, SUPERGRAVITY AND COSMOLOGY (ref. FIS2011-29813-C02-02)

Nuclear and many body theory



In 2012 we have studied several Effective Theories in finite boxes. We aimed both at predicting the level energies that should be measured in lattice QCD simulations and at designing strategies to extract the maximum physical information from these calculations. In parallel, we have predicted that the DNN system is bound and its width is smaller than its binding energy, eventually allowing its experimental observation.

We have also made significant progress in the study of neutrino interactions with nucleons and nuclei, showing that the contribution from nucleon pairs must be taken into account in order to achieve a realistic description of the MiniBooNE data for quasielastic scattering on nuclear targets (see figure). Its impact on the neutrino energy reconstruction in experiments with broad-energy fluxes was also investigated. Furthermore, we developed theoretical models for weak particle production, such as weak pion production in nuclei, antikaon production induced by antineutrinos, weak coherent (anti)kaon production and photon emission in neutral-current interactions.

In the context of complex systems, we have studied structural and spectrum properties of isotopically pure and mixed helium droplets doped with one magnesium atom. Our findings are useful to better interpret the experimental observations of super-fluidity in these finite systems. We have also worked on the tensor interaction effects on the stability, spin susceptibility and linear response of isotropic and neutron rich nuclear matter. Finally, the Magnus expansion has been used to build a perturbation theory in Quantum Mechanics which is unitary in any order of truncation, and a type of order-to-chaos transition and plateaux in Lyapunov exponents has been also studied in a population model.

Selected publications:

Döring, M.; Meissner, U.G.; Oset, E.; Rusetsky, A., *Scalar mesons moving in a finite volume and the role of partial wave mixing*, Eur. Phys. J. A 48, 114 - 18pp, DOI: 10.1140/epja/i2012-12114-6 [arXiv:1205.4838]

Nieves, J.; Ruiz Simó, I.; Vicente Vacas, M.J., *The nucleon axial mass and the MiniBooNE quasielastic neutrino-nucleus scattering problem*, Phys. Lett. B 707, 72-75, DOI: 10.1016/j.physletb.2011.11.061 [arXiv:1106.5374]

Navarro, J.; Mateo, D.; Barranco, M.; Sarsa, A., *Mg impurity in helium droplets*, J. Chem. Phys. 136, 054301 - 9pp, DOI: 10.1063/1.3675919 [arXiv:1112.4654]

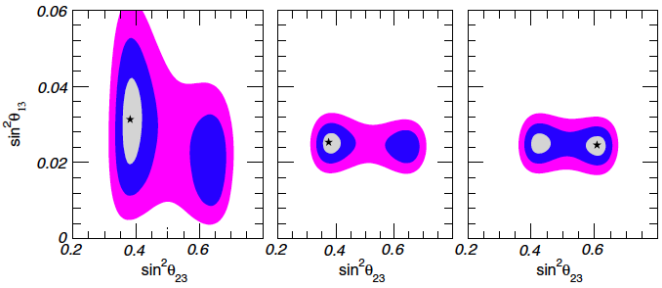
Casas, F.; Oteo, J.A.; Ros, J., *Unitary transformations depending on a small parameter*, Proc. R. Soc. A 468, 685-700, DOI: 10.1098/rspa.2011.0388

Main research grants (National Plan):

EFFECTIVE THEORIES IN NUCLEAR AND HADRON PHYSICS (ref. FIS2011-28853-C02-02)
NUCLEAR AND HADRON PHYSICS AT INTERMEDIATE ENERGIES (ref. FIS2011-28853-C02-01)
STUDIES ON QUANTUM STRUCTURE AND DYNAMICS OF ATOMIC, NUCLEAR AND ELECTRONIC SYSTEMS (ref. FIS2011-28617-C02-02)

Theoretical astroparticle physics and cosmology

The research topics of this line include cosmic rays, neutrinos, dark matter and dark energy theory and phenomenology. Some members are involved in international collaborations that study high-energy cosmic rays (Pierre Auger Observatory), solar neutrinos (Borexino) and the role of dark matter or dark energy in the cosmological large-scale structure (BOSS).

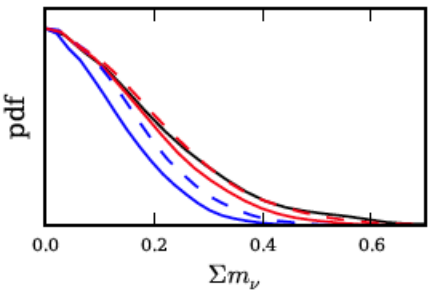


Allowed values of the three neutrino mixing angles from the analysis of experimental data: long-baseline + solar + KamLAND (left), previous + reactor experiments (middle) and the global combination (right) for the normal mass

Concerning neutrinos, we have updated a previous global analysis of experimental data, including the recent measurements of reactor antineutrino disappearance and the latest appearance and disappearance results from long-baseline experiments. The results show that a zero value of the mixing angle θ_{13} is excluded at more than 10σ. Neutrino models with extra sterile neutrino species have also been analyzed, as well as the potential of future long-baseline facilities for extracting the three-neutrino mass ordering.

Other works by IFIC researchers were devoted to some aspects of the detection of dark matter. For instance, in one work it was computed the synchrotron radiation from the interaction with the galactic magnetic field of relativistic electrons and positrons from dark matter annihilations in the galactic halo. A different analysis focused on a novel method for direct dark matter detection based on the annual modulation of the signal. The observational consequences of asymmetric dark matter models and the complementarity of collider and indirect dark matter searches were also studied.

Related to theoretical cosmology, a number of IFIC publications were devoted to the implications of a possible dark radiation component, which could be made of sterile neutrinos or other light particles. Neutrino masses have a profound impact in different cosmological observables, and using galaxy clustering information from 900000 luminous galaxies from the BOSS experiment, IFIC researchers found an upper limit on the sum of the three active neutrino masses of 0.26 eV at 95% C.L.



Probability distribution function of the sum of neutrino masses from the analysis of cosmological data, including CMB anisotropies and information on galaxy clustering from the BOSS experiment

Selected publications:

Forero, D.V.; Tórtola, M.A.; Valle, J.W.F., *Global status of neutrino oscillation parameters after Neutrino-2012*, Phys. Rev. D 86, 073012 - 8pp, DOI: 10.1103/PhysRevD.86.073012 [arXiv:1205.4018]

Fornengo, N.; Lineros, R.A.; Regis, M.; Taoso, M., *Galactic synchrotron emission from WIMPs at radio frequencies*, J. Cosmol. Astropart. Phys. 01, 005 - 25pp, DOI: 10.1088/1475-7516/2012/01/005 [arXiv:1110.4337]

Herrero-García, J.; Schwetz, T.; Zupan, J., *Astrophysics independent bounds on the annual modulation of dark matter signals*, Phys. Rev. Lett. 109, 141301 - 5pp, DOI: 10.1103/PhysRevLett.109.141301 [arXiv:1205.0134]

de Putter, R. et al; Mena, O.; Giusarma, E., *New Neutrino Mass Bounds from SDSS-III Data Release 8 Photometric Luminous Galaxies*, Astrophys. J. 761, 12 - 12pp, DOI: 10.1088/0004-637X/761/1/12 [arXiv:1201.1909]

Main research grants (National Plan):

ASTROPARTICLE AND HIGH ENERGY PHYSICS (ref. FPA2011-22975)
FLAVOUR AND ORIGIN OF MATTER (ref. FPA2011-29678-C02-01)
FUNDAMENTAL INTERACTIONS AND THEIR EXPERIMENTAL IMPLICATIONS (ref. FPA2011-23596)
PARTICLES AND INTERACTIONS: FLAVOUR AND COLOUR PHENOMENOLOGY (REF. FPA2007-60323)

4. PUBLICATIONS

We present the list of the 424 **scientific papers** published by IFIC authors in journals indexed in ISI Web of Science, that are also available at the IFIC publication database (http://references.ific.uv.es/refbase) Here we include all records of type paper, letter or review, but not proceeding papers.

In each case, only the first 20 authors are listed (but we do include all authors with IFIC affiliation), and there is a link to the published and electronic preprint version, if available. In the publications of experimental collaborations, all IFIC authors that appear at least in one paper in 2012 are indicated. Some papers appear twice if they were authored by researchers from both IFIC departments.

EXPERIMENTAL PHYSICS

AGATA Collaboration

IFIC authors: Algora, A.; Barrientos, D.; Domingo-Pardo, C.; Egea, J.; Gadea, A.; Hüyük, T.; Kaci, M.; Mendez, V.; Rubio, B.; Salt, J.; Taín, J.L.

Akkoyun, S. et al, *AGATA-Advanced GAmma Tracking Array*, Nucl. Instrum. Methods Phys. Res. A 668, 26-58, DOI: 10.1016/j.nima.2011.11.081 [arXiv:1111.5731]

Domingo-Pardo, C. et al, *Conceptual design and performance study for the first implementation of AGATA at the in-flight RIB facility of GSI*, Nucl. Instrum. Methods Phys. Res. A 694, 297-312, DOI: 10.1016/j.nima.2012.08.039

Söderström, P.A. et al, *High-spin structure in K-40*, Phys. Rev. C 86, 054320 - 9pp, DOI: 10.1103/PhysRevC.86.054320 [arXiv:1211.4069]

ANTARES Collaboration

IFIC authors: Aguilar, J.A.; Bigongiari, C.; Dornic, D.; Emanuele, U.; Gómez-Gónzalez, J.P.; Hernández-Rey, J.J.; Lambard, G.; Mangano, S.; Real, D.; Ruiz-Rivas, J.; Salesa, F.; Sánchez-Losa, A.; Toscano, S.; Yepes, H.; Zornoza, J.D.; Zúñiga, J.

A method for detection of muon induced electromagnetic showers with the ANTARES detector, Nucl. Instrum. Methods Phys. Res. A 675, 56-62, DOI: 10.1016/j.nima.2012.01.060 [arXiv:1106.0426]

Measurement of atmospheric neutrino oscillations with the ANTARES neutrino telescope, Phys. Lett. B 714, 224-230, DOI: 10.1016/j.physletb.2012.07.002 [arXiv:1206.0645]

The ANTARES telescope neutrino alert system, Astropart Phys. 35, 530-536, DOI: 10.1016/j.astropartphys.2011.11.011 [arXiv:1103.4477]

Search for relativistic magnetic monopoles with the ANTARES neutrino telescope, Astropart Phys. 35, 634-640, DOI: 10.1016/j.astropartphys.2012.02.007 [arXiv:1110.2656]

Measurement of the group velocity of light in sea water at the ANTARES site, Astropart Phys. 35, 552-557, DOI: 10.1016/j.astropartphys.2011.12.003 [arXiv:1110.5184]

The positioning system of the ANTARES Neutrino Telescope, J. Instrum. 7, T08002 - 20pp, DOI: 10.1088/1748-0221/7/08/T08002 [arXiv:1202.3894]

Search for neutrino emission from gamma-ray flaring blazars with the ANTARES telescope, Astropart Phys. 36, 204-210, DOI: 10.1016/j.astropartphys.2012.06.001 [arXiv:1207.3105]

Search for Cosmic Neutrino Point Sources with Four Years of Data from the ANTARES Telescope, Astrophys. J. 760, 53 - 10pp, DOI: 10.1088/0004-637X/760/1/53 [arXiv:1207.3105]

ATLAS Collaboration

IFIC authors: Amorós, G.; Cabrera Urbán, S.; Castillo Giménez, V.; Costa, M.J.; Escobar, C.; Fassi, F.; Ferrer, A.; Fiorini, L.; Fuster, J.; García, C.; García Navarro, J.E.; González de la Hoz, S.; Hernández Jiménez, Y.; Higón-Rodríguez, E.; Irles Quiles, A.; Kaci, M.; Lacasta, C.; Lacuesta, V.R.; March, L.; Martí-García, S.; Miñano, M.; Mitsou, V.A.; Moles-Valls, R.; Moreno Llacer, M.; Oliver García, E.; Pedraza López, S.; Pérez García-Estañ, M.T.; Romero Adam, E.; Ros, E.; Salt, J.; Sánchez Martínez, V.; Solans, C.A.; Soldevila, U.; Sánchez, J.; Torró Pastor, E.; Valero, A.; Valladolid Gallego, E.; Valls Ferrer, J.A.; Villaplana Pérez, M.; Vos, M.; Wildauer, A.

Measurement of the isolated diphoton cross section in pp collisions at root s=7 TeV with the ATLAS detector, Phys. Rev. D 85, 012003 - 28pp, DOI: 10.1103/PhysRevD.85.012003 [arXiv:1107.0581]

Search for the Higgs boson in the H -> WW -> lvjj decay channel at root s=7 TeV with the ATLAS detector, Phys. Lett. B 718, 391-410, DOI: 10.1016/j.physletb.2012.10.066 [arXiv:1206.6074]

Measurement of the W -> tau nu(tau) cross section in pp collisions at root s=7 TeV with the ATLAS experiment, Phys. Lett. B 706, 276-294, DOI: 10.1016/j.physletb.2011.11.057 [arXiv:1108.4101]

Performance of the ATLAS Trigger System in 2010, Eur. Phys. J. C 72, 1849 - 61pp, DOI: 10.1140/epjc/s10052-011-1849-1 [arXiv:1110.1530]

Electron performance measurements with the ATLAS detector using the 2010 LHC proton-proton collision data, Eur. Phys. J. C 72, 1909 - 46pp, DOI: 10.1140/epjc/s10052-012-1909-1 [arXiv:1110.3174]

Measurement of the cross-section for b-jets produced in association with a Z boson at root s=7 TeV with the ATLAS detector, Phys. Lett. B 706, 295-313, DOI: 10.1016/j.physletb.2011.11.059 [arXiv:1109.1403]

Performance of missing transverse momentum reconstruction in proton-proton collisions at root s=7 TeV with ATLAS, Eur. Phys. J. C 72, 1844 - 35pp, DOI: 10.1140/epjc/s10052-011-1844-6 [arXiv:1108.5602]

Measurement of the pseudorapidity and transverse momentum dependence of the elliptic flow of charged particles in lead-lead collisions at root s(NN)=2.76 TeV with the ATLAS detector, Phys. Lett. B 707, 330-348, DOI: 10.1016/j.physletb.2011.12.056 [arXiv:1108.6018]

Search for displaced vertices arising from decays of new heavy particles in 7 TeV pp collisions at ATLAS, Phys. Lett. B 707, 478-496, DOI: 10.1016/j.physletb.2011.12.057 [arXiv:1109.2242]

Search for strong gravity signatures in same-sign dimuon final states using the ATLAS detector at the LHC, Phys. Lett. B 709, 322-340, DOI: 10.1016/j.physletb.2012.02.049 [arXiv:1111.0080]

Measurement of the centrality dependence of the charged particle pseudorapidity distribution in lead-lead collisions at root s(NN)=2.76 TeV with the ATLAS detector, Phys. Lett. B 710, 363-382, DOI: 10.1016/j.physletb.2012.02.045 [arXiv:1108.6027]

Measurement of the polarisation of W bosons produced with large transverse momentum in pp collisions at root s=7 TeV with the ATLAS experiment, Eur. Phys. J. C 72, 2001 - 30pp, DOI: 10.1140/epjc/s10052-012-2001-6 [arXiv:1203.2165]

Measurement of the cross section for the production of a W boson in association with b-jets in pp collisions at root s=7 TeV with the ATLAS detector, Phys. Lett. B 707, 418-437, DOI: 10.1016/j.physletb.2011.12.046 [arXiv:1109.1470]

Search for new physics in the dijet mass distribution using 1 fb(-1) of pp collision data at root s=7 TeV collected by the ATLAS detector, Phys. Lett. B 708, 37-54, DOI: 10.1016/j.physletb.2012.01.035 [arXiv:1108.6311]

Measurement of the top quark pair production cross section in pp collisions at root s=7 TeV in dilepton final states with ATLAS, Phys. Lett. B 707, 459-477, DOI: 10.1016/j.physletb.2011.12.055 [arXiv:1108.3699]

Search for light scalar top-quark pair production in final states with two leptons with the ATLAS detector in root s=7 TeV proton-proton collisions, Eur. Phys. J. C 72, 2237 - 20pp, DOI: 10.1140/epjc/s10052-012-2237-1 [arXiv:1208.4305]

Measurement of the top quark mass with the template method in the t(t)over-bar -> lepton plus jets channel using ATLAS data, Eur. Phys. J. C 72, 2046 - 30pp, DOI: 10.1140/epjc/s10052-012-2046-6 [arXiv:1203.5755]

Measurement of tau polarization in W -> tau nu decays with the ATLAS detector in pp collisions at root s=7 TeV, Eur. Phys. J. C 72, 2062 - 21pp, DOI: 10.1140/epjc/s10052-012-2062-6 [arXiv:1204.6720]

Search for second generation scalar leptoquarks in pp collisions at root s=7 TeV with the ATLAS detector, Eur. Phys. J. C 72, 2151 - 21pp, DOI: 10.1140/epjc/s10052-012-2151-6 [arXiv:1203.3172]

Jet mass and substructure of inclusive jets in root s=7 TeV pp collisions with the ATLAS experiment, J. High Energy Phys. 05, 128 - 47pp, DOI: 10.1007/JHEP05(2012)128 [arXiv:1203.4606]

Search for charged Higgs bosons decaying via H-+/- -> tau nu in t(t)over-bar events using pp collision data at root s=7 TeV with the ATLAS detector, J. High Energy Phys. 06, 039 - 50pp, DOI: 10.1007/JHEP06(2012)039 [arXiv:1204.2760]

Measurements of the electron and muon inclusive cross-sections in proton-proton collisions at root s=7 TeV with the ATLAS detector, Phys. Lett. B 707, 438-458, DOI: 10.1016/j.physletb.2011.12.054 [arXiv:1109.0525]

Measurement of the W(+/-)Z production cross section and limits on anomalous triple gauge couplings in proton-proton collisions at root s=7 TeV with the ATLAS detector, Phys. Lett. B 709, 341-357, DOI: 10.1016/j.physletb.2012.02.053 [arXiv:1111.5570]

Search for lepton flavour violation in the e-mu continuum with the ATLAS detector in root s=7 TeV pp collisions at the LHC, Eur. Phys. J. C 72, 2040 - 19pp, DOI: 10.1140/epjc/s10052-012-2040-z [arXiv:1205.0725]

Measurement of the transverse momentum distribution of W bosons in pp collisions at root s=7 TeV with the ATLAS detector, Phys. Rev. D 85, 012005 - 30pp, DOI: 10.1103/PhysRevD.85.012005 [arXiv:1108.6308]

Measurement of t(t)over-bar production with a veto on additional central jet activity in pp collisions at root s=7 TeV using the ATLAS detector, Eur. Phys. J. C 72, 2043 - 24pp, DOI: 10.1140/epjc/s10052-012-2043-9 [arXiv:1203.5015]

Search for heavy neutrinos and right-handed W bosons in events with two leptons and jets in pp collisions at root s=7 TeV with the ATLAS detector, Eur. Phys. J. C 72, 2056 - 22pp, DOI: 10.1140/epjc/s10052-012-2056-4 [arXiv:1203.5420]

Search for TeV-scale gravity signatures in final states with leptons and jets with the ATLAS detector at root s=7 TeV, Phys. Lett. B 716, 122-141, DOI: 10.1016/j.physletb.2012.08.009 [arXiv:1204.4646]

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BOOKS

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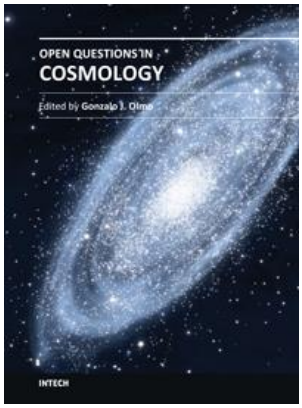

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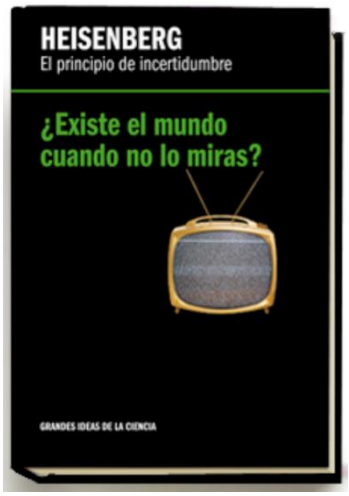


5. TRAINING

TEACHING ACTIVITIES

IFIC members with positions at the University of Valencia are mainly involved in its **Degree in Physics**, although they also teach in Chemistry and Engineering. At the postgraduate level, IFIC participates in two of the Master's Degrees offered by the UVEG: **Master in Advanced Physics** and **Master in Medical Physics**. In the first of them, we are responsible of two of the four specialities: Theoretical Physics and Nuclear & Particle Physics. Finally, a large number of PhD students carry out their research work in our institute, many of them from abroad.

In addition, IFIC researchers often teach at **international schools for PhD students**. Some of the series include the International Doctorate Network in Particle Physics, Astrophysics and Cosmology (IDPASC), the International School of AstroParticle Physics (ISAPP), the European School of High-Energy Physics or the Taller de Altas Energías (TAE).

PH.D. THESES

In 2012 a total of 15 doctoral theses were presented with IFIC advisors. For those granted by Spanish Universities we include a link to the TESEO database.

Experimental Physics

Ground-state shape determination of N~Z nuclei via beta decay studies
Ana Belén Pérez Cerdán
Advisor: Berta Rubio Barroso
3 April, University of Valencia
TESEO: 969408

TAS measurements for neutrino physics and nuclear structure: study of the beta decays of ^{150}Er, ^{152,156}Yb and ^{188,190,192}Pb
María Esther Estévez Aguado
Advisor: Alejandro Algora
4 June, University of Valencia
TESEO: 979725

Design, development and implementation of readout system for microstrip silicon sensors. Upgrade for test beam measurements
Ricardo Marco Hernández
Advisors: Carlos Lacasta Llácer, Salvador Martí García
14 September, University of Valencia
TESEO: 993144

Irradiated silicon detectors for HL-LHC: Characterization and simulations
Mercedes Miñano Moya
Advisor: Salvador Martí García
18 July, University of Valencia
TESEO: 982791

Optimización y caracterización de la calidad de la imagen en Tomografía por Emisión de Positrones
Montserrat Carles Fariña
Advisors: María José Rodríguez Álvarez, Christoph W. Lerche
25 June, University of Valencia
TESEO: 980973

Optimización de cristales centelleadores para la determinación de la DOI en tomografía de rayos γ
Ana Ros García
Advisors: Filomeno Sánchez Martínez, Christoph W. Lerche
19 July, University of Valencia
TESEO: 985728

Progress in the conceptual design of future gamma-tracking arrays with imaging capabilities. Lifetime measurement in neutron-rich nuclei in the region of the double magic ^{78}Ni with the AGATA demonstrator
María Doncel Monasterio
Advisors: Begoña Quintana Arnés, Andrés Gadea Raga
27 April, University of Salamanca
TESEO: 973560

Theoretical Physics

Charmed meson and baryon resonances in the hidden gauge formalism and meson modifications in the nuclear medium
Raquel Molina Peralta
Advisor: Eulogio Oset Baguena
9 January, University of Valencia
TESEO: 957216

Neutrino and antineutrino charged current interactions with nuclei and nucleons
Ignacio Luis Ruiz Simó
Advisor: Manuel Vicente Vacas
1 March, University of Valencia
TESEO: 964614

Scaled chiral quark-solitons for nuclear matter
Valentina Mantovani Sarti
Advisors: Alessandro Drago and Vicente Vento Torres
15 March, University of Ferrara

Impact of a (sub)dominant non-cold dark matter component on the large scale structure of the universe
Francisco Antonio Villaescusa Navarro
Advisor: Carlos Peña Garay
25 May, University of Valencia
TESEO: 977991

Cosmological implications of some nonstandard particle physics scenarios
Urbano Lopes França
Advisor: Sergio Pastor Carpi
3 October, University of Valencia
TESEO: 995085

Jerarquies de models sigma: aplicacions a teories de Supergravetat i a teories conformes
Felip Aláez Nadal
Advisor: María Antonia Lledó Barrena
5 October, University of Valencia
TESEO: 992514

Beyond Standard Model phenomenology with or without a light Higgs
Alberto Filipuzzi
Advisor: Jorge Portolés Ibáñez
11 December, University of Valencia
TESEO: 1001205

Dynamical gluon mass generation in pure Yang-Mills theories
David Ibáñez Gil de Ramales
Advisor: Ioannis Papavassiliou
20 December, University of Valencia
TESEO: 1006005

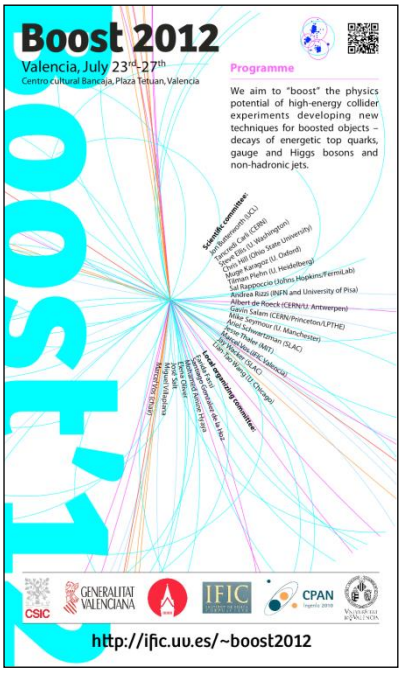
6. CONFERENCES, COLLOQUIA AND SEMINARS

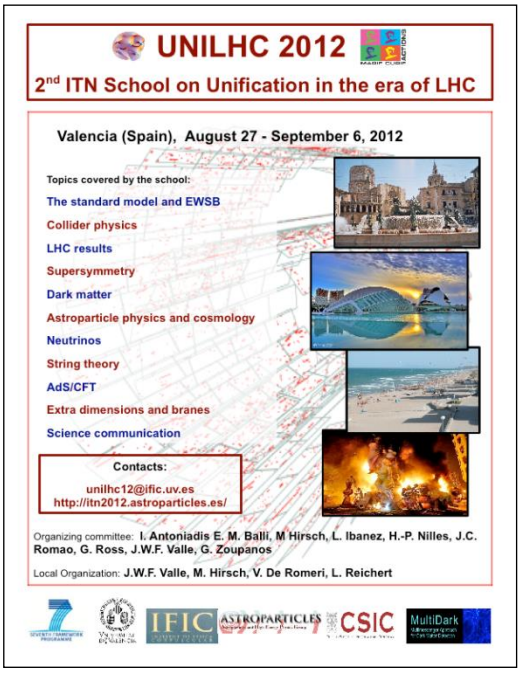
CONFERENCES AND MEETINGS

IFIC researchers present their results in the main international conferences and workshops. A total of 353 contributions were presented in 2012: **296 talks** (181 plenary or invited, 115 parallel) and **57 posters**.

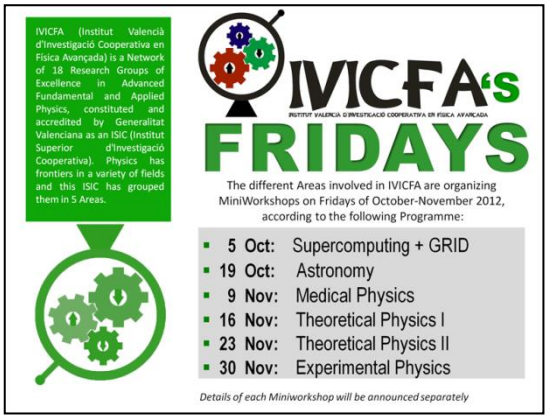
Here we highlight the main conferences and workshops organized by IFIC members in Valencia:

II PCI2010 workshop & PCI 2011 kick off meeting, 10-12 January
Second workshop on Flavor Physics in the LHC Era, 17-18 January
BOOST 2012, 23-27 July
2nd ITN School on Unification in the era of LHC (UNILHC 2012), 27 August – 6 September
IX Jornadas de futuros colisionadores, 18-19 December





IVICFA'S Fridays, series of MiniWorkshops in October - November



IFIC COLLOQUIA

Colloquia are **review talks** about a research topic for a general audience of IFIC members

Organizers: Germán Rodrigo and José Luis Taín

Explorando la fascinante región donde no valen las hipótesis de la mecánica estadística de Boltzmann-Gibbs
Constantino Tsallis (CBPF Rio de Janeiro)
17 January

Double Beta Decay
Steve Elliott (Los Alamos National Laboratory)
10 September

Dark matter: new results from direct detection
Laura Baudis (Universität Zürich)
26 April

IFIC SEMINARS

Seminars are more **specific research talks** given by an invited speaker, usually connected to one of the IFIC research groups. Some of these seminars are more informal talks followed by a discussion session, such as those within La Trobada series. In 2012 we hosted a total of **50 seminars**. The complete list can be found in the IFIC's Indico webpage http://indico.ific.uv.es

Coordinator: Jorge Portolés

7. TECHNOLOGY TRANSFER AND OUTREACH

TECHNOLOGY TRANSFER

Spin-off

Alibava Systems, S.L.
IFIC & Instituto de Microelectrónica de Barcelona
CIF: B65653677. Since Dec 2012
www.alibavasystems.com

Patents

In 2012 there were two patents with participation of IFIC members (one granted and one application).

OUTREACH ACTIVITIES

We present a selection of outreach activities with contribution of IFIC members. These activities are coordinated by the Outreach committee.

International Masterclasses: hands on particle physics

Session at IFIC on March 6th with high-school students from Valencia and Godella, who performed an excercise with real ATLAS data and presented their results via videoconference with other European institutions. Coordinated by Santiago González de la Hoz.

Guided tours to IFIC for high-school and university students

After a short presentation about IFIC and its research lines, the students visit three laboratories among the seven possibilities (ANTARES/Km3NET, NEXT, ATLAS-Silicon, ATLAS-TiCal, Medical Physics, GRID-Computing centre and Nuclear Physics). In November we also hosted a group of senior people. Coordinated by IFIC together with the local delegation of CSIC in the Valencia (for high schools).

- High-school students (con Ciencia Sé): Colegio San José de Calasanz, Valencia (Feb 22); IES La Moreria, Mislata (Mar 23); Colegio D. José Lluch, Alboraia (Mar 26); IES Violant de Casalduch, Benicàssim (Apr 27); Colegio Juan XXIII, Burjassot (Dec 12)
- High-school students (selected by the VLC Campus): Jul 10 & 24
- Students from the University of Valencia: astroparticle and neutrino physics (Apr 20 & May 16)

IFIC members involved: A. Aparici, A. Algora, J. Barrio, C. Domingo, P. Ferrario, Y. Hernández, G. Llosá, F. Monrabal, C. García, I. García, S. Martí, J.F. Oliver, S. Pastor, M.A. Sanchis, M. Sorel, J.L. Taín, A. Valero, J.W.F. Valle and J. Zúñiga.



Open Doors Day of the Scientific Park: Expociència 2012

On May 19th our institute organized a series of outreach activities within the Open Doors Day of the Scientific Park of the University of Valencia. More than 3500 people attended the event, which involved all research institutes in our campus.

IFIC ORGANIZERS	ACTIVITY
J. Gómez, J. Barrrios, J.D. Zornoza, J. Zúñiga	Observa l'univers des de les profunditats del mar. Telescopis de neutrins
F. Monrabal, V. Álvarez, J. Rodríguez	Neutrins: els fantasmes d'OPERA
S. González, E. Romero, J.A. Valero, E. Oliver, R. Moles, E. Torró, L. Fiorini, L. March	Experiment Atlas: Explorant la materia / Identificació de partícules
G. Llosa, J.F. Oliver, J. Barrio, V. Stankova	Física mèdica: fent visible l'invisible
J. Agramunt, A. Algora, E. Valencia, B. Rubio, M.D. Jordán, J.L. Taín, C. Domingo, A. Montaner	Som radioactius?
R. Cases, J. Vijande	La cambra de boira. Radioactivitat natural en directe
A. Aparici, J. Rasero, M. Peña	Què ets ona o partícula?
M.T. Andreu, P. Tuzón	Mira mare sóc un electró
P. Ferrario	Dibuixa un científic
S. Pastor	8 mesos aïllat en recerca de neutrins al Pol Sud: videoconferència (Carlos Pobes)



Public lectures:

Series of talks at High Schools: Física de Partículas en el Instituto (CPAN)

Aplicaciones de la Física Nuclear

A. Algora: Colegio San Enrique (Quart de Poblet), Apr 4; Colegio Yocris (Almàssera), May 15; IES Cid campeador (Valencia), Dec 19

C. Domingo: Colegio Hermanas Mantellate (Valencia), Apr 11; IES Clot del Moro (Sagunt), Apr 19

B. Rubio: Colegio Hermanos Maristas (Valencia), May 4; IES Vallada, May 29

J.L. Taín: IES Ramon Muntaner (Xirivella), Apr 23; Centro Ntra. Señora del Rosario (Valencia), May 8

La búsqueda del bosón de Higgs en el LHC

J. Fuster: IES La Foia (Ibi), Nov 16

J.E. García Navarro: IES Ferrer i Guàrdia (Valencia), Dec 18

J. Salt: IES Ramon Muntaner (Xirivella), Nov 11

Física de Astropartículas: Más allá de la luz

S. Pastor: IES Alcàsser, Apr 24; IES Pere Boïll (Manises), May 7; IES Callosa d'en Sarrià, May 8; Colegio San Enrique (Quart de Poblet), Dec 3; IES Comarcal (Burjassot), Dec 17

M.A. Tórtola: IES Doctor Faustí Barberà (Alaquàs), Apr 20

Other talks at High Schools

Qué hacemos los físicos y cómo se llega a investigar en Física de Altas Energías
E. Oliver and J. Salt: IES Músic Martín i Soler (Mislata), Feb 15

La física médica y el premio IDEA 2011 en tecnologías
G. Llosá: IES Jaume Primer (Ontinyent), Apr 4

El descubrimiento del bosón de Higgs en el LHC
C. García: IES Thader (Orihuela), Nov 16

Other public talks

Física y Matemáticas: los eternos primos
J. Navarro Salas and M.A. Sanchis: Facultad de Matemáticas, Universidad de Valencia, Mar 21

Trobades de Física al Bar de Ciències , Universidad de Valencia, Apr 19 & May 15
- *El buit quàntic i l'acceleració en l'expansió de l'Univers: Energia fosca?*
S. Gandia, M.A. Sanchis and J. Bernabéu
- *Es pot viatjar a més velocitat que la llum en el buit?*
S. Gandia, M.A. Sanchis, M. Portilla and J. Pastor

El bosón de Higgs y el LHC: Historia de una búsqueda
G. Rodrigo and M. Vos: public talk within BOOST 2012, Centro Cultural Bancaixa (Valencia), Jul 25

Descubrimiento de un nuevo bosón (de Higgs?) en el experimento ATLAS del colisionador LHC del CERN
A. Ferrer: Centro Cultural Bancaixa (Valencia), Sep 25

Presentación y Coloquio: El Universo en 30 minutos
U. França: Restaurante Route 66 (Valencia), Oct 10

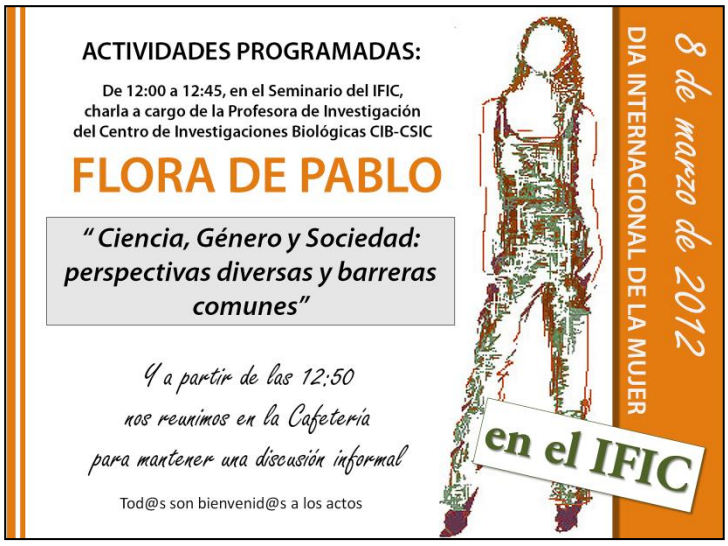
El descubrimiento del bosón de Higgs en el LHC
C. García: Otoño Científico 2012 de la Fundación MUDIC, Universidad Miguel Hernández (Elx), Nov 15

El descubrimiento del bosón de Higgs
J. Fuster and A. Pich: conferencias de la Facultad de Física, Universidad de Valencia, Nov 11

El bosó de Higgs: final o principi d'una història?
A. Santamaria: Llotja del Cànem (Castelló), Dec 12

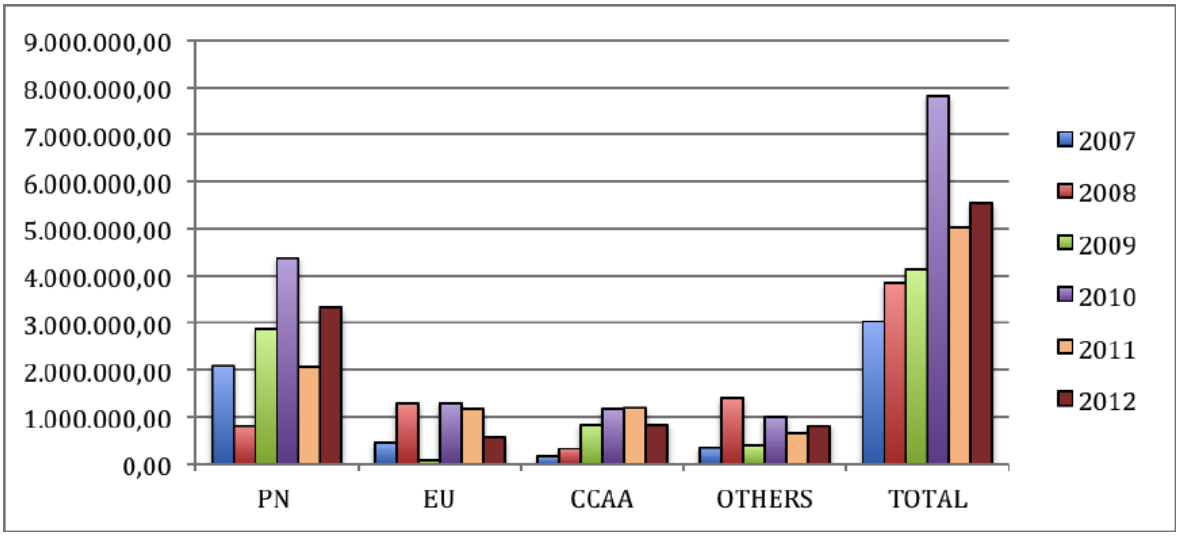
El descubrimiento del bosón de Higgs
C. García and A. Pich: Encuentros de Excelencia del VLC Campus, Univ. Politécnica de Valencia, Dec 13

Public lecture by **Prof Flora de Pablo** in the framework of the International Women's Day, organized jointly with the Instituto de Agroquímica y Tecnología de Alimentos (IATA)



8. FUNDING

In this section we include all research grants that were active during the whole or part of 2012, funded by European (EU), national (PN), regional (CCAA) or other agencies.



Evolution of IFIC funding by financial agencies (in euros, CONSOLIDER projects excluded)

NATIONAL PLAN PROJECTS

Funded by the *Ministerio de Ciencia e Innovación* (MCINN) or *Economía y Competitividad* (MINECO) of the Spanish Government, typically for three years.

Experimental Physics

Contributions to the ATLAS experiment at the Large Hadron Collider
Ref. FPA2009-13234-C04-01
PI: Carmen García García
1.610.510 € (Jan 2010 – Dec 2012)

Contributions to the hadronic tile calorimeter of the ATLAS detector
Ref. FPA2009-13234-C04-03
PI: J. Antonio Valls Ferrer
933.999 € (Jan 2010 – Dec 2012)

Participation of IFIC in the ANTARES and KM3NET neutrino telescopes
Ref. FPA2009-13983-C02-01
PI: Juan J. Hernández Rey
792.550 € (Jan 2010 – Dec 2012)

Image quality and quantification in positron emission tomography
Ref. FPA2010-14891
PI: Magdalena Rafecas López
176.781 € (Jan 2011 – Dec 2013)

Development of new accelerator technologies for future colliders in particle physics
Ref. FPA2010-21456-C01-01
PI: Ángeles Faus Golfe
378.609 € (Jan 2011 – Dec 2013)

Development of new detectors for future colliders in particle physics
Ref. FPA2010-21549-C04-04
PI: Juan Fuster Verdú
361.064 € (Jan 2011 – Dec 2013)

Spanish distributed TIER2 for the ATLAS experiment
Ref. FPA2010-21919-C03-01
PI: José Salt Cairols
861.399 € (Jan 2011 – Dec 2013)

High-resolution gamma spectroscopy: the path to AGATA
Ref. FPA2011-29854-C04-02
PI: Andrés Gadea Raga
356.950 € (Jan 2012 – Dec 2014)

Participation in the T2K experiment
Ref. FPA2011-29823-C02-01
PI: Anselmo Cervera Villanueva
281.325 € (Jan 2012 – Dec 2014)

Nuclear structure, applications and astrophysics: the path to FAIR
Ref. FPA2011-24553
PI: Alejandro Algora
644.930 € (Jan 2012 – Dec 2014)

Theoretical Physics

Particles and interactions: flavour and colour phenomenology (PARSIFAL)
Ref. FPA2007-60323
PI: Antonio Pich Zardoya
532.642 € (Oct 2007 – Oct 2012)

Hadronic models, fundamental interactions and nuclear physics
Ref. FPA2010-21750-C02-01
PI: Pedro González Marhuenda
138.787 € (Jan 2011 – Dec 2013)

Flavour and origin of matter
Ref. FPA2011-29678-C02-01
PI: Pilar Hernández Gamazo
249.260 € (Jan 2012 – Dec 2014)

Particle physics phenomenology at the LHC and flavour factories
Ref. FPA2011-23778
PI: Antonio Pich Zardoya
372.680 € (Jan 2012 – Dec 2014)

Quantum black holes, supergravity and cosmology
Ref. FIS2011-29813-C02-02
PI: M. Antonia Lledó Barrena
100.430 € (Jan 2012 – Dec 2014)

Nuclear and hadron physics at intermediate energies
Ref. FIS2011-28853-C02-01
PI: Manuel Vicente Vacas
212.960 € (Jan 2012 – Dec 2014)

Geometry, groups, field theory and supersymmetry
Ref. FIS2008-01980
PI: J. Adolfo de Azcárraga Feliu
129.470 € (Jan 2009 – Dec 2012)

Perturbative and non-perturbative studies of the Standard Model and its extensions
Ref. FPA2011-23897
PI: Vicent Giménez Gómez
152.460 € (Jan 2012 – Dec 2014)

Astroparticle and high energy physics
Ref. FPA2011-22975
PI: José W. Furtado Valle
258.940 € (Jan 2012 – Dec 2014)

Fundamental interactions and their experimental implications
Ref. FPA2011-23596
PI: Francisco J. Botella Olcina
450.120 € (Jan 2012 – Dec 2014)

Studies on quantum structure and dynamics of atomic, nuclear and electronic systems
Ref. FIS2011-28617-C02-02
PI: Jesús Navarro Faus
24.200 € (Jan 2012 – Dec 2014)

Effective theories in nuclear and hadron physics
Ref. FIS2011-28853-C02-02
PI: Juan M. Nieves Pamplona
163.350 € (Jan 2012 – Dec 2014)

CONSOLIDER PROJECTS

Coordinated by IFIC:

Centro nacional de Física de Partículas, Astropartículas y Nuclear (CPAN)
Ref. CSD2007-00042
PI: Antonio Pich Zardoya
10.000.000 € (Oct 2007 – Dec 2014)

Canfranc Undergorund Physics (CUP)
Ref. CSD2008-00037
PIs: M. Concepción González García (ICC Barcelona) / Juan J. Gómez Cadenas
6.000.000 € (Dec 2008 – Dec 2014)

With participation of IFIC groups:

Physics of the Accelerating Universe (PAU)
Ref. CSD2007-00060
PI: Enrique Fernández Sánchez (IFAE Barcelona)
IFIC PIs: Carlos Peña Garay / Olga Mena Requejo
Oct 2007 – Dec 2012

Multimessenger Approach for Dark Matter Detection (MultiDark)
Ref. CSD2009-00064
PI: Carlos Muñoz (Univ Autónoma Madrid)
IFIC PIs: Juan J. Hernández Rey / José W. Furtado Valle
Dec 2009 – Dec 2014

OTHER NATIONAL PROJECTS

Radiation detectors for medical imaging
Ref. SEIC2010-00020
PI: Magdalena Rafecas López
129.447,59 € (Jun 2011 – Jun 2014)

New instrumentation techniques for monitoring the beam position in the Drive Beam of CLIC
Ref. SEIC2010-00028
PI: Ángeles Faus Golfe
129.447,59 € (Jun 2011 – May 2014)

R&D for linear collider detectors: Ultra-thin vertex and tracking detectors
Ref. SEIC2010-00038
PI: Carlos Lacasta Llácer
129.447,59 € (Jul 2011 – Jun 2014)

Contribution to the design of the SuperB final focus region and related studies
Ref. SEIC2010-00052
PI: Ángeles Faus Golfe
129.447,59 € (Jun 2011 – May 2014)

Development of a trigger system and data adquisition for the tileCal upgrade in ATLAS
Ref. EIC-CERN-2011-0005
PI: J. Antonio Valls Ferrer
125.950 € (Feb 2012 – Jan 2015)

R&D for linear collider detectors: Ultra-thin vertex and tracking detectors
Ref. EIC-CERN-2011-0019
PI: Juan Fuster Verdú
125.950 € (Feb 2012 – Jan 2015)

Development of neutron detectors for nuclear structure, astrophysics and applications
Ref. PRI-PIMNUP-2011-1348
PI: Alejandro Algora
70.000 € (Nov 2011 – Nov 2014)

Grid and e-science: data analysis of the ATLAS detector and medical physics
Ref. A1/035250/11 (AECID)
PI: Santiago González de la Hoz
90.000 € (Dec 2011 – Jun 2013)

Participacion en los telescopios de neutrinos ANTARES y KM3NeT
Ref. ACI2009-1020
PI: Juan J. Hernández Rey
66.000 € (Dec 2009 – Dec 2012)

QCD and hard processes at high-energy hadron colliders
Ref. AIC10-D-0576
PI: Germán Rodrigo García
2.300 € (Sep 2011 – Aug 2012)

Neutrinos from astrophysical and cosmological sources
Ref. AIC10-D-0543
PI: Sergio Pastor Carpi
3.150 € (Jun 2011 – May 2012)

Quantum fields and renormalization in the primordial universe
Ref. FIS2010-09399-E
PI: José Navarro Salas
15.000 € (May 2011 – Apr 2012)

Studies of image and accelerators applied to medicine
Ref. FPA2010-11465-E
PI: José Bernabéu Alberola
90.000 € (Mar 2011 – Feb 2012)

2nd International Particle Accelerators conference (IPAC2011)
Ref. FPA2010-12190-E
PI: Ángeles Faus Golfe
15.000 € (Apr 2011 – Mar 2012)

Development of a trigger system and data adquisition for ATLAS at the SLHC project (CERN)
Ref. AIC-A-2011-0775
PI: Luca Fiorini
128.124,50 € (Dec 2011 – Dec 2014)

Contribution to the total absorption spectrometer of the DESPEC Collaboration at NUSTAR (FAIR)
Ref. AIC-A-2011-0696
PI: Alejandro Algora
225.900 € (Dec 2011 – Dec 2014)

Study of new observables to measure the top quark mass at hadron colliders with high precision
Ref. AIC-D-2011-0688
PI: Juan A. Fuster Verdú
2.500 € (Dec 2011 – Dec 2012)

Neutrino telescopes ANTARES and KM3net: calibration and data analysis
Ref. AIC-D-2011-0659
PI: Juan Zúñiga Román
3.000 € (Dec 2011 – Dec 2012)

QCD and hard processes at high-energy hadron colliders
Ref. AIC-D-2011-0715
PI: Germán Rodrigo García
2.000 € (Dec 2011 – Dec 2012)

Construction and installation of the vertex detector of Belle-II
Ref. AIC10-D-0625
PI: Carlos Lacasta Llácer
8.300 € (Jan 2011 – Jan 2012)

Stay at CERN and European representative in the executive commitee of the ILC
Ref. FPA2010-12078-E
PI: Juan A. Fuster Verdú
24.000 € (Jul 2011 – Jul 2012)

Spanish network of flavour physics
Ref. FPA2011-13909-E
PI: Francisco J. Botella Olcina
28.000 € (Jan 2012 – Dec 2013)

Compton telescope for monitorization in hadron therapy
Ref. FIS2011-14585-E
PI: Magdalena Rafecas López
18.000 € (Oct 2012 – Nov 2013)

Construction of the vertex detector of Belle-II
Ref. AIC-B-2011-0723
PI: Marcel A. Vos
5.000 € (Dec 2011 – Dec 2012)

Spanish participation 2011-2012 in particle, astroparticle and nuclear physics experiments
Ref. AIC-B-2011-0640
PI: Antonio Pich Zardoya
3.227.918 € (Aug 2011 – Aug 2013)

Astroparticle and neutrino physics
Ref. AIC-D-2011-0772
PI: José W. Furtado Valle
2.000 € (Dec 2011 – Jun 2013)

Neutrinos from astrophysical and cosmological sources
Ref. AIC-D-2011-0689
PI: Sergio Pastor Carpi
2.000 € (Dec 2011 – Jun 2013)

Structure of nuclei far from stability and tecnological developments for AGATA and its complementary neutron detector NEDA
Ref. AIC-D-2011-0746
PI: Andrés Gadea Raga
4.000 € (Dec 2011 – Dec 2012)

Developments in hadrontherapy instrumentation
Ref. AIC-D-2011-0673
PI: Ángeles Faus Golfe
2.500 € (Dec 2011 – Dec 2012)

Decay studies at LISE
Ref. AIC-D-2011-0782
PI: Berta Rubio Barroso
3.000 € (Dec 2011 – Dec 2012)

CSIC-Japan agreement
Ref. 2011JP0020
PI: Berta Rubio Barroso
3.300 € (Jan 2012 – Dec 2012)

CDTI/INNPACTO PROJECTS

A neutrino experiment with a Xenon TPC
Ref. IDC-20101075
Company: Trinos Vacuum Projects SL
IFIC PI: Juan J. Gómez Cadenas
45.153 € (Jan 2010 – Dec 2012)

INNPACTO project
Ref. IPT-2011-1918-020000
Company: Industrias Jose Tamarit Moreno SL
IFIC PI: Juan J. Hernández Rey
169.784 € (May 2011 – Dec 2014)

New techniques for image guided surgery for colon cancer
Ref. IDC-20101144
Company: General Equipment for Medical Imaging SA
IFIC PI: José M. Benlloch Baviera
25.300 € (Jan 2010 – Dec 2012)

EUROPEAN PROJECTS

EUROnu: A High Intensity Neutrino Oscillation Facility in Europe
FP7 Design Study, Ref. 212372
Project Coordinator: Rob Edgecock
IFIC PI: Pilar Hernández Gamazo
193.992,50 € (Sep 2008 – Aug 2012)

HL-LHC: High Luminosity Large Hadron Collider
FP7 Design Study, Ref. 284404
Project Coordinator: Lucio Rossi
IFIC PI: Ángeles Faus Golfe
162.572,64 € (Nov 2011 – Oct 2015)

Advanced European Infrastructures for Detectors at Accelerators (AIDA)
FP7 Research Infrastructures, Ref. 262025
Project Coordinator: Iván Vila Álvarez
IFIC PI: Marcel A. Vos
127.555 € (Feb 2011 – Jan 2015)

Design of a pan-European Infrastructure for Large Apparatus studying Grand Unification, Neutrino Astrophysics and Long Baseline Neutrino Oscillations
FP7 Design Study, Ref. 284518
Project Coordinator: André Rubbia
IFIC PI: Juan J. Gómez Cadenas
54.000 € (Sep 2011 – Aug 2014)

Study of Strongly Interacting Matter (HadronPhysics3)
FP7 Research Infrastructures, Ref. 283286
Project Coordinator: Carlo Guaraldo
IFIC PI: Santiago Noguera Puchol
51.000 € (Jan 2012 – Dec 2014)

European Grid Initiative: Integrated Sustainable Pan-European Infrastructure for Researchers in Europe
FP7 Research Infrastructures, Ref. 261323
Project Coordinator: Steven Newhouse
IFIC PI: José Salt Cairols
118.709 € (May 2010 – Apr 2014)

European Collaboration for Accelerator Research and Development (EuCARD)
FP7 Research Infrastructures, Ref. 227579
Project Coordinator: Jean-Pierre Koutchouk
IFIC PI: Ángeles Faus Golfe
31.206 € (Apr 2009 – Mar 2013)

Unification in the LHC era (UNILHC)
FP7 Marie Curie Initial Training Network
Ref. PITN-GA-2009-237920
Project Coordinator: Ignatios Antoniadis
IFIC PI: José W. Furtado Valle
38.930,90 € (Oct 2009 – Oct 2013)

Research Training in 3D Digital Imaging for Cancer Radiation Therapy
FP7 Marie Curie Initial Training Network
Ref. PITN-GA-2010-264552
Project Coordinator: Manjit Dosanjh
IFIC PI: Carlos Lacasta Llácer
243.718 € (Feb 2011 – Jan 2015)

European particle Physics Latin American NETwork (EPLANET)
FP7 Marie Curie Int. Research Staff Exchange Scheme
Ref. PIRSES-2009-GA-246806
Project Coordinator: Luciano Maiani
IFIC PI: Antonio Ferrer Soria
104.000 € (Feb 2011 – Jan 2015)

Event shapes in soft-collinear effective theory (ESSCET)
FP7 Marie Curie International Outgoing Fellowship
Ref. PIOF-GA-2009-251174
Fellow: Vicent Mateu Barreda
IFIC PI: Germán Rodrigo García
242.129,10 € (Dec 2010 – Nov 2013)

Tau Decay: Physics of the tau lepton from chiral dynamics to lepton flavour violation phenomena
FP7 Marie Curie Intra-European Fellowship
Ref. PIEF-GA-2009-253329
Fellow: Olga Shekhovtsova
IFIC PI: Antonio Pich Zardoya
153.593 € (Sep 2010 – Aug 2012)

Flavour, unifications and experimental tests (FLUENT)
FP7 Marie Curie Intra-European Fellowship
Ref. PIEF-GA-2009-253119
Fellow: Michal Malinsky
IFIC PI: José W. Furtado Valle
205.854 € (Nov 2010 – Oct 2012)

European NoVel Imaging Systems for ION therapy (ENVISION)
FP7 Health, Ref. 241851
Project Coordinator: Manjit Dosanjh
IFIC PI: Carlos Lacasta Llácer
383.140,48 € (Feb 2010 – Jul 2014)

Advanced particle phenomenology in the LHC era (LHCPhenoNet)
FP7 Marie Curie Initial Training Network
Ref. PITN-GA-2010-264564
Project Coordinator: Germán Rodrigo García
505.765,16 € (Jan 2011 – Dec 2014)

Invisibles: Neutrinos, Dark Matter and Dark Energy Physics
FP7 Marie Curie Initial Training Network
Ref. PITN-GA-2011-289442
Project Coordinator: Belén Gavela
IFIC PI: Pilar Hernández Gamazo
342.307 € (Apr 2012 – Mar 2016)

Application of Silicon Photomultipliers to Imaging Detectors (ASPID)
FP7 Marie Curie European Reintegration Grant
Ref. 239362
Fellow: Gabriela Llosá Llácer
IFIC PI: Carlos Lacasta Llácer
45.000 € (Mar 2009 – Mar 2012)

Innovative software for advanced PET imaging (INSPET)
FP7 Marie Curie Intra-European Fellowship
Ref. PIEF-GA-2009-237620
Fellow: Paola Solevi
IFIC PI: Magdalena Rafecas López
153.535,15 € (Jan 2010 – Jan 2012)

Towards systematization of NNLO theoretical predictions for advanced phenomenology at the LHC (CRUNCHLOOPS)
FP7 Marie Curie Intra-European Fellowship
Ref. PIEF-GA-2011-298582
Fellow: Grigorios Chachamis
IFIC PI: Germán Rodrigo García
168.896,40 € (Oct 2012 – Sep 2014)

REGIONAL PROJECTS

Funded by the *Conselleria d'Educació, Cultura i Esports* of the Generalitat Valenciana (Valencian Government)

From LHC physics to the keys of the primordial Universe
Ref. PROMETEO/2008/004
PI: José Bernabéu Alberola
98.600 € (Jan 2012 – Dec 2012)

LHC physics: search for new interactions in the high-energy frontier
Ref. PROMETEO/2008/069
PI: Antonio Pich Zardoya
74.500 € (Jan 2012 – Dec 2012)

Neutrino telescopes in the Mediterranean
Ref. PROMETEO/2009/026
PI: Juan J. Hernández Rey
74.300 € (Jan 2012 – Dec 2012)

Nuclear and hadron physics at intermediate energies
Ref. PROMETEO/2009/090
PI: Eulogio Oset Báguena
58.800 € (Jan 2012 – Dec 2012)

Astroparticle and high energy physics
Ref. PROMETEO/2009/091
PI: José W. Furtado Valle
39.500 € (Jan 2012 – Dec 2012)

Flavour and origin of matter
Ref. PROMETEO/2009/116
PI: Nuria Rius Dionís
86.600 € (Jan 2012 – Dec 2012)

Perturbative and non-perturbative studies of the Standard Model and its extensions
Ref. PROMETEO/2009/128
PI: Arcadi Santamaria Luna
60.500 € (Jan 2012 – Dec 2012)

Quark structure of matter
Ref. PROMETEO/2009/129
PI: Santiago Noguera Puchol
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Studies of nuclear structure and technology developments associated to gamma-ray and Ge detectors sensitive to position and complementary detectors of charged light particles and neutrons
Ref. PROMETEO/2010/101
PI: Andrés Gadea Raga
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Theoretical and experimental approach to the search for new physics with heavy flavours in the LHC era and other B factories
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PI: Francisco J. Botella Olcina
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Institut Valencià d'Investigació Cooperativa en Física Avançada (IVICFA)
Ref. ISIC/2012/020
PI: José Bernabéu Alberola
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Image quality and quantification in positron emission tomography
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PI: Magdalena Rafecas López
13.000 € (Jan 2012 – Dec 2012)

European NoVel Imaging Systems for ION therapy (ENVISION)
Ref. ACOMP/2012/063
PI: Carlos Lacasta Llácer
7.000 € (Jan 2012 – Dec 2012)

Conference BOOST 2012
Ref. AORG/2012/259
PI: Marcel A. Vos
7.290 € (Jan 2012 – Dec 2012)

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En el año del descubrimiento del bosón de Higgs

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