



Institute for Cosmos Sciences

REPORT OF ACTIVITIES

2013

FOREWORD

From the scientific point of view, 2013 has been a good year for the Institute of Cosmos Sciences at the University of Barcelona. The research and technological activity has been intense as can be seen in the present report. Once more, the ICCUB has got a very good score (98,5 over 100) in the Severo Ochoa contest for Spanish research institutes and units of excellence. This demonstrates that we are doing well, according to the initial ambitious goal, six years ago, that the ICCUB becomes one of the top research centres in cosmology in the world. Certainly, it would be better that we had been awarded this third call. But we are very well placed anyway. The Ministry has informed us that next year there will be a new version of the prize devoted to institutes/units. Hopefully, this will be our opportunity.

The Severo Ochoa award is quite expected at the ICC not only as an important recognition of the work done, but also because of the additional budget it represents for the

awarded centres. This may be used indeed to afford new Master and PhD grants. As can be seen in the information quoted in the item “ICCUB in Figures” below, there is a clear decline of the total number of students since 2012 at the Institute as a consequence of the economical crisis affecting the country. More specifically, this is the direct result of the marked decrease in grants offered by the Spanish Ministries of Education and Economy and Innovation. We are very worried about this trend. As current Master and PhD students are next generation researchers, it seriously threatens the future of the Institute. Either we manage to enlarge the resources, from the Severo Ochoa award or from technological developments and knowledge transfer also promoted at the ICCUB, or the big effort made in the last years will have no continuity.

Eduard Salvador Solé
Director

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THE ICCUB

The Institute of Cosmos Sciences of the University of Barcelona (ICCUB) is an interdisciplinary center which is devoted to fundamental research in the field of cosmology, as well as to the technological applications of the sciences of the cosmos in general. It gathers researchers from the departments of Astronomy and Meteorology, Structure and Constituents of Matter, Fundamental Physics, Applied Mathematics, Organic Chemistry and Electronics.

It was created in 2006 as the instrument of the University of Barcelona for the active support of research in these fields, paying special attention to their synergies, as well as to promote experimental and instrumental activity, enabling a significant participation of the UB in large international collaborations, and to attract highly qualified scientific personnel.



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2013 - THE ICCUB IN FIGURES

Staff

57	Permanent Staff
7	Ramon y Cajal Members
4	Juan de la Cierva Members
22	Postdoc Fellows
51	PhD Students
21	Engineers and Technicians
5	Services and Administration Personnel
9	Visiting Scholars

Projects and Funds

18	European Projects
39	National Projects
6	Consolidated Groups
10	Contracts
15	Other Funds

Publications

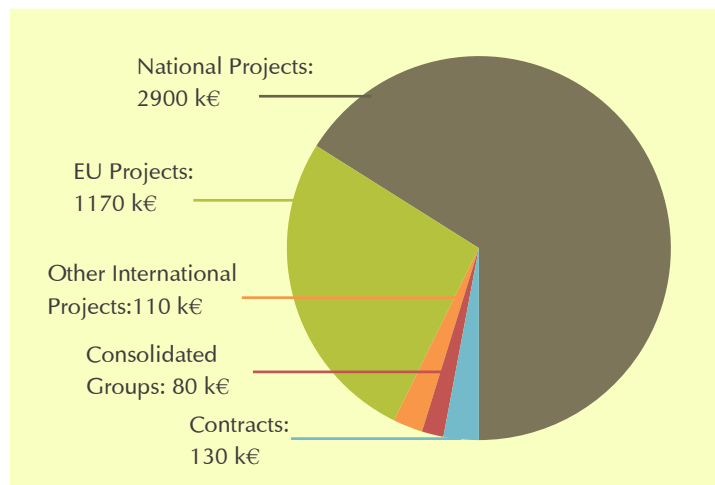
293	SCI Publications
90	Non SCI-Publications
119	Technical Reports

Theses

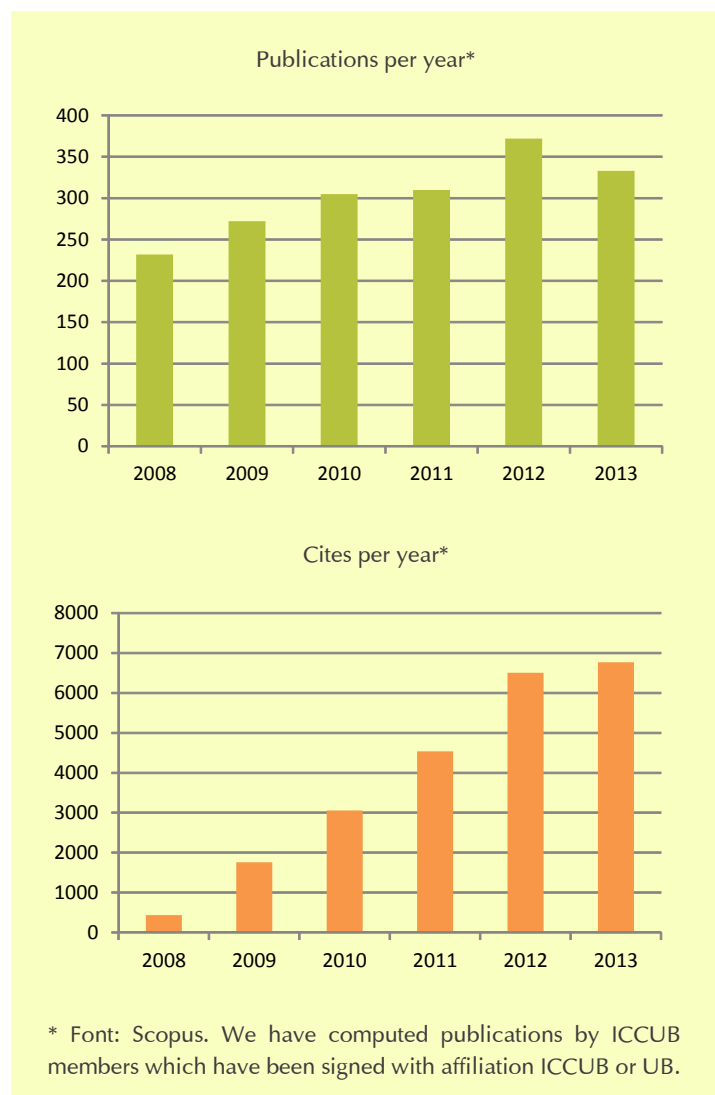
11	Finished PhD Theses
42	Ongoing PhD Theses
32	Finished Master Theses

Activities

7	Event Organization
10	ICCUB Colloquia
30	Outreach Activities
4	Exhibitions



PROJECTS AND FUNDS 2013: BUDGET



PUBLICATION EVOLUTION 2008-2013

ICCUB STAFF

2

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 Casajús, Adrià
 Casanova, Raimon
 Casas, Albert
 Clotet, Marcial
 Comerma-Montells, Albert

Gallardo, Eva
 Garralda, Nora
 Gascón, David
 González, Juan José
 Julbe, Francesc
 Lazovski, Nikola
 Molina, Daniel

Pérez, Gabriel
 Picatoste Olloqui, Eduard
 Roma, David
 Sabater, Josep
 Sagristà, Antoni
 Sanuy, Andreu
 Trenado, Juan

SERVICES AND ADMINISTRATION PERSONNEL**ICCUB Secretariat**

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 Moreno, Ana Belén

Group Support

Macduff, Kayla
 Olarte, Surinye

Collaborating Students

Anglada, Mariona

Research at ICCUB, a center devoted to Cosmology, Particle Physics and Astrophysics, contributes to the most recent and relevant developments in the study of the Universe. It is conducted with the aim of answering some of the most intriguing and fundamental questions:

What are the origin and fate of the Universe?

An early phase of accelerated expansion of the Universe, known as inflation, not unlike the one currently taking place due to dark energy, seems a strong possibility. Are these two phenomena related? Can they be derived from a fundamental theory?

Which are the ultimate constituents of the Universe?

Dark matter apparently accounts for most of the matter density of the universe, but it cannot be accommodated within the currently accepted Standard Model of Particle Physics. What is dark matter, and how could the Standard Model be extended to accommodate it?

Why does the Universe have its present appearance?

The accelerated flat cold dark matter Universe model is in good agreement with the large-scale properties of the Universe, but its associated hierarchical galaxy formation scenario seems to be in contradiction with various galaxy properties. Is there something wrong with the models of galaxy formation? Is dark matter warm instead of cold?

These questions reveal the intimate connection between particle physics and astrophysics and therefore demand a multidisciplinary approach. Research at ICCUB intends to tackle them from the theoretical, observational and experimental viewpoints.

The main areas of research at ICCUB are:

- Cosmology and Large Scale Structure.
- Experimental Particle Physics.
- Galaxy Structure and Evolution.
- Gravitation and Cosmology.
- High Energy Astrophysics.
- Nuclear and Hadron Physics.
- Particle Physics Phenomenology.
- Star Formation.
- Theoretical Physics.
- Additional lines of research.

These areas are complemented with the following transversal technological lines:

- Electronic and Instrumentation Development.
- Very Large Data Processing and Analysis.

Which induce large participation in:

- Knowledge Transfer and Innovation.

Research in particle physics and astrophysics involve the use of data collected by means of sophisticated instrumentation that cannot be afforded by individual research centres. ICCUB researchers are currently participating in the following projects:

- **Space Missions:** Gaia Mission, Euclid Mission, Solar Orbiter, CORe.
- **Ground-based observatories and telescopes:** Sloan Digital Sky Survey (SDSS), Large Synoptic Survey Telescope (LSST), MAGIC and CTA.
- **Accelerators and particle detectors:** LHCb detector, BABAR detector, SuperB detector.

COSMOLOGY AND LARGE SCALE STRUCTURE

LINES OF RESEARCH

- Large scale structure of galaxies and the intergalactic medium.
- Microwave background radiation anisotropies.
- Baryonic acoustic oscillations.
- Supernova cosmology.
- Dark matter and dark energy.
- Lyman- α emission from galaxies at high redshifts.
- Reionization of the intergalactic medium.

ICCUB MEMBERS

Ariño, Andreu • Canal, Ramon • Cuesta, Antonio José • Gontcho A Gontcho, Satya • Jimenez, Raul • Juan, Enric • Manrique, Alberto • Mas, Lluís • Miralda-Escudé, Jordi • Noreña, Jorge • Pérez, Ignasi • Prieto, Joaquín • Sala, Ferran • Salvador-Solé, Eduard • Verde, Licia.

VISITING SCHOLARS

Ruiz-Lapuente, Pilar.

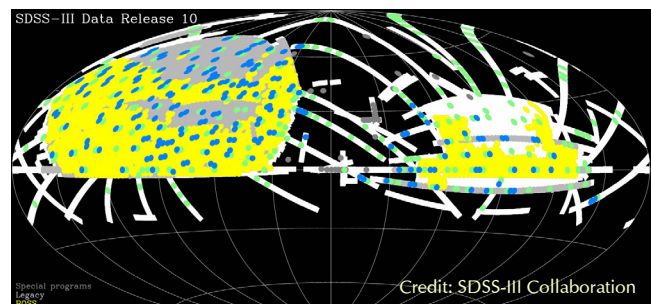
One of the main interests at ICCUB is the study of the connection between cosmological observations and the physics behind the standard cosmological model, hoping to shed some light on the “open questions” in Cosmology. Cosmology is tackled at ICCUB through both an observational and a theoretical approach.

Research in this area ranges from the inflationary model, the Cosmic Microwave Background and the epoch of reionization, to the formation and evolution of galaxies and the distribution of gas in space, including statistical applications and data analysis. Research is also being carried out into the nature of dark matter and the primordial fluctuations that gave rise to galaxies and larger structures in the Universe. The observational tools available for these studies are gravitational lensing by galaxies, clusters of galaxies and large-scale structure, microlensing of stars or quasars by any kind of compact object, the spatial distribution of galaxies and of matter in intergalactic space that is measured from absorption signatures in spectra of background sources, and the structure of dark matter halos studied through the dynamics of galaxies in clusters.

The Institute of Cosmos Sciences is also involved in several cosmological projects of ground-based and space surveys, such as SDDS-III, EUCLID, CORE and LSST.

2013 Activity

Regarding SDSS-III, in collaboration with scientists from other institutions, a study was presented which determined the most precise restriction to date for neutrino masses, based on data obtained from 900.000 bright galaxies



THE TENTH SDSS DATA RELEASE

In tenth Data Release (DR10), released in July 2013, BOSS has increased its sample of galaxy and quasar spectra to 1.515.000 (from 831.000 released in DR9) ICCUB researchers have used BOSS data to determine the most precise restriction to date for neutrino masses.

analyzed by BOSS, reaching the principal conclusion neutrinos do not account for more than 6 % of the total energy content of the cosmos. Another study obtained the first measure of the Universe expansion rate 11 billion years ago, using the technique of Baryon Acoustic Oscillations in the distribution of hydrogen along the line of sight to the quasars that are observed by BOSS. Recent results that have updated this measurement using nearly the full BOSS dataset have determined this expansion rate to within 2%, which is the best accuracy that has been reached at any epoch (except the much earlier epoch of recombination when the Cosmic Microwave Background was produced). The ICCUB has also been strongly involved in other relevant studies of the intergalactic medium and protogalactic clouds, where the spatial distribution and metal content of gas clouds in the process of forming galaxies has been analyzed in innovative ways that are made possible by the large number of quasar spectra observed in BOSS.

EXPERIMENTAL PARTICLE PHYSICS

LINES OF RESEARCH

- Physics of beauty and charm mesons.
- Charge-Parity symmetry violation.
- Search for deviations from the Standard Model in rare B and charm meson decays.
- Quarkonium.
- Development of distributed calculation methods using grid and cloud computing.
- Design of Geiger mode avalanche photodiodes for tracking detectors of future accelerators.
- Simulation and study of the radiation hardness of avalanche photodetectors.
- Design, construction and operation of instrumentation for high energy, astrophysics and medical imaging experiments.

ICCUB MEMBERS

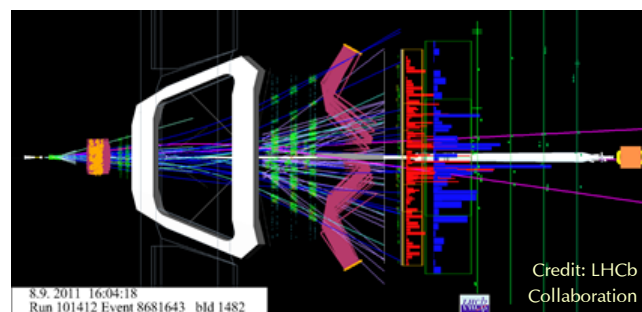
Camboni, Alessandro • Casajús, Adrià • Casanova, Raimon • Comerma, Albert • Diéguez, Ángel • Garrido, Lluís • Gascón, David • Graciani, Ricardo • Graugés, Eugeni • Lazovski, Nikola • Marín, Carla • Mauricio, Joan • Mazorra, José • Picatoste, Eduard • Potterat, Cédric • Rives, Vicente • Ruiz, Hugo • Sanuy, Andreu • Trenado, Juan • Vázquez, Ricard.

ICCUB's experimental particle physicists are specialized in the study of flavor physics. Specifically in measuring charge-parity (CP) violation effects and rare decays of particles containing b or c quarks.

Their long track record in this field go back into the design, construction and exploitation in the Hera-B experiment at the DESY lab, in Hamburg, and the participation in the BaBar experiment at the SLAC National lab, at Stanford, CA. Currently the group is fully involved in LHCb experiment data analysis and on its upgrade project.

The LHCb detector, one of the four detectors of the Large Hadron Collider (LHC) in CERN (Geneva, Switzerland), is designed to study this asymmetry through the b and anti-b particle pairs produced in proton collisions. The Institute of Cosmos Sciences, aside from its participation at a scientific level, undertook the design, production and installation of the electronics of the SPD (Scintillator Pad Detector) part of the calorimeter. In addition, the ICCUB participated in the development of the Data-GRID computer network and the DIRAC software, which are essential in the data analysis and simulation processes, not only in LHCb, but also in all High Energy Physics experiments nowadays.

An updated LHCb detector is currently being designed and scheduled for 2018 to start operation. ICCUB researchers participate in the design of the readout electronics of both the calorimeter and the new central tracker, which will be based on scintillating fibers.



A TIPCAL $B_s^0 \rightarrow \mu^+ \mu^-$ DECAY IN LHCb

In July 2013, the LHCb Collaboration presented improved measurements for the rare decays $B_s^0 \rightarrow \mu^+ \mu^-$ and $B^0 \rightarrow \mu^+ \mu^-$. This put the standard model of particle physics to one of its most stringent tests to date, since it highly constricts the possible SUSY models. ICCUB researchers contributed on the data analysis and on the electronics in the LHCb Collaboration.

2013 Activity

In 2013 the research in this area has focused on the study of the violation of CP symmetry in the meson B systems of the LHCb experiment. On one hand the ICCUB has contributed to the data analysis, and on the other hand to the electronics of particle detectors. The generated knowledge in electronics of particle detectors has been extended to high energy astrophysics (CTA experiment), and now this technology is being also transferred to more applied fields such as medical physics, where two patents have been made and contacts with different companies are maintained. See the lines *Electronic and Instrumentation Development*, *Very Large Data Processing and Analysis* and *Knowledge Transfer and Innovation* for more details about these activities.

GALAXY STRUCTURE AND EVOLUTION

LINES OF RESEARCH

- Semianalytical and numerical modeling of galaxy formation and evolution.
- Dark matter clustering and halo structure and kinematics.
- Galaxy evolution in groups and clusters.
- Kinematics and structure of the galaxy.
- Data reduction of the Gaia mission.

ICCUB MEMBERS

Abedi, Hoda • Balaguer-Núñez, Dolores • Carrasco, José M. • Casamiquela, Laia • Castañeda, Javier • Darriba, Laura • Fabricius, Claus V. • Figueras, Francesca • Jordi, Carme • Luri, F. Xavier • Masana, Eduard • Miralda-Escudé, Jordi • Monguió, Maria • Morales, Juan Carlos • Palmer, Max • Roca, Santiago • Romero, Mercè • Solanes, José M. • Torra, Jordi • Voss, Holger • Weiler, Michael.

Galactic Astronomy

Research in galactic astronomy at the ICCUB includes three main lines of research: galaxy modeling, the study of stellar constituents and stellar luminosity calibration. At present, this research is highly influenced by the preparation of the scientific exploitation of the Gaia mission, in which ICCUB researchers are deeply involved (see the *Very Large Data Processing and Analysis* section).

ICCUB's contribution to galaxy modeling is directed towards a better understanding of the origin and evolution of the large structures in the galactic disk—bar, spirals and warp—and the archaeology of the Milky Way—missing satellites—, through an in-depth investigation of the dynamics and chemistry of the system.

The study of the stellar constituents of the galactic disk and halo focuses on two aspects: where do the stars form and what are their astrophysical properties. ICCUB's contribution is organized around two central goals: to provide new insights into the popular scenario that all stars have formed in clusters, i.e. to investigate cluster formation and evolution, and to capitalize on the opportunities that Gaia brings to the study of variable stars' data. ICCUB is also involved in the Gaia-ESO Spectroscopic survey to acquire complementary data for Gaia stars.

The Gaia satellite will also have a dramatic impact on the definition of the cosmic distance scale, providing a direct measurement, via parallaxes, of the local primary distance indicators and, in turn, a direct re-calibration of

the secondary distance indicators. This will significantly improve our estimate of the Hubble constant. At the same time Gaia will offer a unique opportunity to assess the systematics affecting the various indicators contributing to the cosmic distance scale as well as to establish new standard candles. ICCUB is working on stellar luminosity calibration in order to develop the necessary tools to achieve these goals.

Extragalactic Astronomy

ICCUB's interest in galactic astrophysics extends beyond the Milky Way and is concerned also with the formation of the first galaxies, which were formed from pristine matter. They comprised population III stars, which reionised the intergalactic medium, polluted it with metals and left behind the seeds of supermassive black holes. These are processes currently being modeled at ICCUB.

Detailed analytical models and huge numerical simulations are being developed, which make use of the most powerful computational tools presently available. The resulting predictions are confronted with the latest, progressively complete, observations drawn from huge wide angle (all-sky) nearby galaxy surveys (e.g. SDSS, 2dF) as well as very deep, high-redshift ones (e.g. Hubble Deep Field, GROTH, DEEP2), carried out by means of the new generation of very large ground-based telescopes and sophisticated detectors on board of satellites covering the whole electromagnetic spectrum, from gamma to radio wavelengths.

2013 Activity

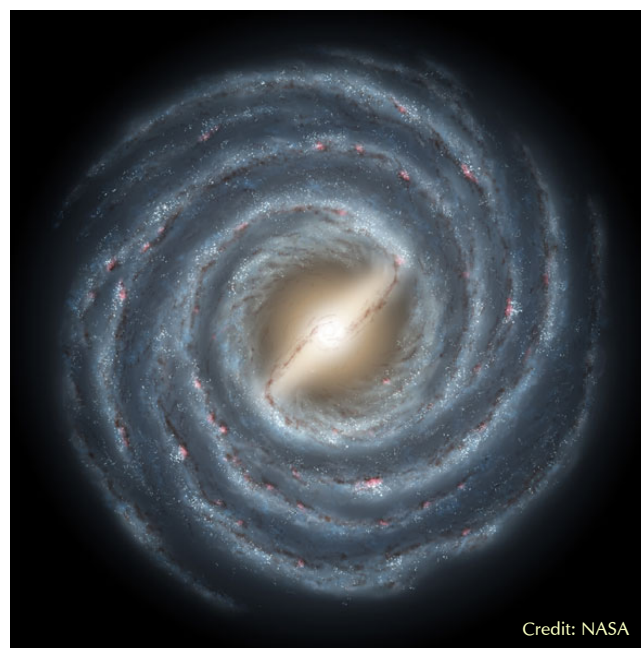
Galactic Astronomy

With the launch of Gaia at the end of 2013, much effort was dedicated to improve the tools developed to analyze scientific data. The expected Gaia Catalogue was simulated including the effect of observational errors. A statistical analysis of this simulated Gaia data was performed in order to better understand the potential yield in astrometric, photometric and spectroscopic information, and the extent and effect of observational errors on the true Gaia Catalogue. An improved method for estimating distances to open clusters was also developed and applied to Hipparcos data for the Pleiades and the Hyades. This improved method could be especially useful for the Gaia results.

Concerning galaxy modeling, ICCUB researchers developed a new version of the Besançon Galaxy Model. A new strategy for the generation of thin disc stars, which assumes the IMF, SFR and evolutionary tracks as free parameters is used. Most of the ingredients for the star count production have been updated and, for the first time, binary stars are generated in a consistent way. The local dynamical self-consistency is maintained in this new scheme. Moreover, simulations from the new model with Tycho-2 data have been compared with the local luminosity function, as a first test to verify and constrain the new ingredients.

On the study of stellar constituents, during 2013 there has been a collaboration involving the Gaia-ESO Survey, which is using FLAMES to target $\sim 10^5$ stars, systematically covering all the major components of the Milky Way, from halo to star-forming regions, providing the first homogeneous overview of the distributions of kinematics and elemental abundances. First internal release took place in August 2013. Several collaborations have been developed to exploit those results in the field of open clusters, and a complementary survey from Spanish observatories has been awarded with a Long Term Project at the Roque de los Muchachos. The observations of 6 clusters have been completed.

The activity signatures of low mass stars have been characterized as a function of an immaculate photosphere, spots and faculae through a simulator StarSim developed by the ICCUB researchers team. The astrometric, photometric and spectroscopic jitter produced by the activity signatures in the stellar surface have been analyzed for several FGKM dwarfs and the impact on optic, NIR and IR observations has been assessed.



Credit: NASA

THE MILKY WAY

The Milky Way is described at present as being a spiral galaxy dominated by just two arms wrapping off the ends of a central bar of stars. Galaxy modelling is one of the research fields at ICCUB.

Extragalactic Astronomy

In 2013, ICCUB researchers continued their study on galactic spiral arms both in test particle and collisionless N-body simulations. At the same time, in collaboration with researchers in the UNAM (México), a new realistic high resolution N-body plus hydrodynamics simulation has been developed and nowadays it is one of the best simulations to study properties of Milky Way-like galaxies.

Efforts have also been made in improving our understanding of the very complex process of galaxy formation and the possible physical mechanisms that play a role in the making of the galaxies. Powerful computers have been used to simulate with detail and accuracy from galaxy pairs to group and cluster-sized portions of the universe and to explore swiftly a broad dynamical range of the parameters that govern the physics of the matter interactions. Hundreds of simulations of both binary and multiple galaxy collisions have been analyzed in order to shed light in several topics such as the characterization of the merger timescales of galaxies and its dependence on the orbital parameters, the structure and internal dynamics of merger remnants, the formation of the brightest group/cluster galaxies, the role of gravity in shaping the luminosity function of galaxies, or the formation and evolution of the intergalactic light.

GRAVITATION AND COSMOLOGY

LINES OF RESEARCH

- Dark matter and dark energy in cosmology and in particle physics.
- Quantum and semiclassical gravity.
- AdS/CFT correspondence and holography.
- Black holes.

ICCUB MEMBERS

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 Mateos, David • Molina, Alfred • Notari, Alessio •
 Solà, Joan • Tanabe, Kentaro • Tarrío, Luis Javier •
 Torrents, Genís • Triana, Miquel • Verdaguer, Enric.

ICCUB researchers carry out research in the areas of gravity and the gauge/gravity correspondence. In the area of gravity, research is focused on the study of black holes in string theory and in higher-dimensional spacetimes, inflationary models and quantum gravity in de Sitter spaces. In the area of gauge/gravity correspondence is applied to the study of the quark-gluon plasma and the computation of observables in gauge theories.

2013 Activity

The 2013 activity in gravitation and cosmology can be divided in three main areas:

Gravity and Black Holes: The limit of large number of dimensions in General Relativity has been investigated, revealing universality properties that allow to perform analytic computations that previously had to be done numerically. Exact models of continuously flowing horizons have also been studied.

Holography: Holographic collisions have been studied, and it has been shown how they can be efficiently computed by linearizing Einstein's equations around the final, equilibrium state. A holographic model for longitudinal coherence in heavy ion collisions has also been developed. ICCUB researchers have used the AdS/CFT duality to study fluctuations of accelerated quarks and exact results for supersymmetric Wilson loops in arbitrary representations.



Credit: Slim Films

ARTIST CONCEPTION OF A MULTIVERSE

String theory together with the theory of eternal inflation suggest the possibility of an infinite number of universes making up a "multiverse." While the multiverse inflates without end, pockets of space stop inflating and give rise to isolated "bubble universes". ICCUB researchers have investigated the nucleation of bubble universes and quantum tunnelling transitions in models of the multiverse.

Cosmology: ICCUB researchers have extended their investigations of the effects of bubble nucleation and tunnelling transitions in models for the multiverse. They have explored the possibility that the wave function of an inflationary universe be given by the partition function of a dual quantum field theory. The stability of de Sitter space including vacuum polarization effects has been analyzed. ICCUB researchers have also investigated aberration effects in the CMB and their consequences for non-gaussianities and asymmetries in the power spectrum.

HIGH ENERGY ASTROPHYSICS

LINES OF RESEARCH

- High-Energy and Very-High-Energy gamma-ray sources in the Galaxy.
- Multi-wavelength observations and theoretical modeling.
- Microquasars.
- Gamma-ray binaries.
- Pulsar wind nebulae.
- Active galactic nuclei.
- MAGIC and Cherenkov Telescope Array.

ICCUB MEMBERS

Bosch-Ramon, Valentí • Galindo, Daniel • Iwasawa, Kazushi • Marcote, Benito • Migliari, Simone • Moreno, Víctor • Munar, Pere • Paredes, Xavier • Paredes, Josep Maria • Ribó, Marc • Sestayo, Yolanda • Zanin, Roberta.

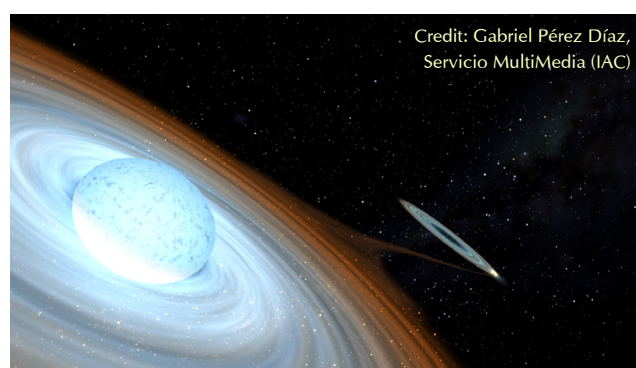
A general aim of ICCUB researchers working on this field is to achieve a better understanding of the high-energy galactic sources, gathering data over a large wavelength range (from radio to TeV energies) as well as modeling emission processes in different scenarios (jets, shocks, interaction with the interstellar medium, etc.).

In particular, ICCUB researchers are interested in the study of microquasars, as objects which exhibit the characteristic accretion disc and perpendicular jets of relativistic matter of quasars, both thereby being governed by essentially the same physical processes, while being subject to a timescale which is much more amenable to observations.

Moreover, the ICCUB high energy astrophysicists are members of the MAGIC Collaboration since February 2006, and are now participating, together with experimental physicists and engineers of the ICCUB, in the Cherenkov Telescope Array (CTA) project, an initiative to build the next generation ground-based gamma-ray instrument.

2013 Activity

With the goal of identifying the counterpart of the unidentified gamma-ray source AGL J2241+4454, ICCUB researchers have discovered the first binary system (MWC 656) consisting of a black hole orbiting a Be star. This is a high impact discovery: despite the models of stellar evolution predicted the existence of Be/BH systems, they had not been observed until now. The ray emission from this system has also been discovered, which



Credit: Gabriel Pérez Díaz, Servicio MultiMedia (IAC)

MWC 656 SYSTEM

A team of researchers from different Spanish centers, including ICCUB researchers, located in 2013 the MWC 656 system, the first known binary system consisting of a black hole and a Be kind star. This discovery was published in Nature in January 2014.

allows its classification as a high-mass X-ray binary. The MAGIC telescopes have observed this new X-ray binary, and upper-limits have been derived for its very high-energy emission.

The possibilities to study with the Cherenkov telescope array (CTA) the non-thermal physics of gamma-ray binary systems have been explored. This study requires the observation of high-energy phenomena at different temporal and spatial scales. The capability of CTA has been analysed under different configurations of the instrument to probe the spectral, temporal and spatial behaviour of gamma-ray binaries under the context of the known or the expected physics of these systems.

NUCLEAR AND HADRONIC PHYSICS

LINES OF RESEARCH

- Nuclear structure. Nuclear symmetry energy.
- Dense and hot nuclear matter and applications in nuclear astrophysics.
- Hadronic physics. Strangeness and charm in the nuclear medium.
- Lattice QCD of low-energy hadronic interactions.
- Radiation transport and interactions of radiation with matter.
- Relativistic heavy ion collisions.

ICCUB MEMBERS

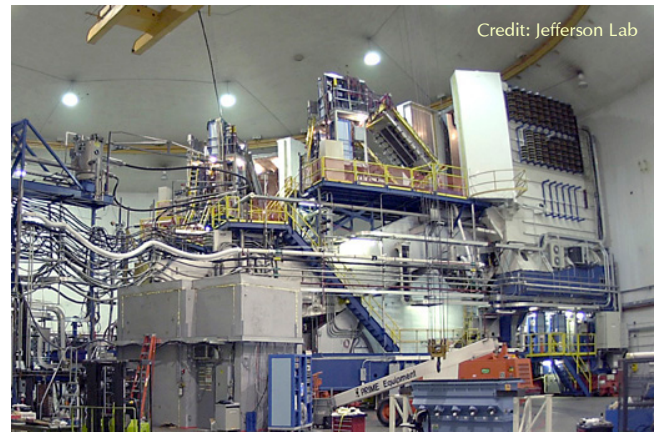
Carbone, Arianna • Centelles, Mario • Feijoo, Albert • Fernández, José M. • Julià, Bruno • Magas, Volodymyr • Parreño, Assumpta • Pérez-Obiol, Axel • Polls, Artur • Ramos, Àngels • Salvat, Francesc • Sharma, Bharat K. • Vidaña, Isaac • Viñas, Xavier.

Nuclear physicists at ICCUB are actively participating in studies of neutron-rich nuclei, a research which is closely related to that conducted on the topics of nuclear equation of state and its astrophysical applications. They are also benefited from the computational power offered by the most modern supercomputers (Tungsten, Hopper, Curie, Mare Nostrum, etc.). This is allowing them to perform large dynamical simulations of light nuclei and hypernuclei.

Activity 2013

In 2013 an intense activity has been maintained contributing to several topics. On one hand improvements have been made in the characterization of exotic and highly asymmetric nuclei (in properties like pairing and polarization) and to the microscopic description of nuclear matter with three-body effective interactions.

On the other hand, some properties of the nuclear interaction have been extracted with calculations of QCD in finite volume, using lattice QCD techniques, and an effective weak interaction to describe hypernuclei desintegrations has been constructed. ICCUB researchers have also studied the construction of meson-baryon effective interactions up to second order, and the simulation of relativistic collisions of heavy ions at LHC energies.



HALL A OF JEFFERSON LAB (USA)

The Lead Radius Experiment (PREX) housed in Hall A at Jefferson Lab (shown in the picture) uses the parity-violating weak interaction to measure the neutron radius of the ^{208}Pb nucleus in elastic scattering of polarized electrons. By calculating the predictions of nuclear models for the results of experiments performed on neutron-rich nuclei, such as PREX, ICCUB researchers aim to constrain the properties of the nuclear symmetry energy. Understanding the nuclear symmetry energy has important consequences for a variety of phenomena at widely different scales, from the structure of atomic nuclei to the structure of neutron stars.

PARTICLE PHYSICS PHENOMENOLOGY

LINES OF RESEARCH

- Standard Model and beyond at the LHC.
- B-physics, with an emphasis on the analysis and physical reach of the LHCb detector.
- Phenomenology of supersymmetric theories.
- String phenomenology.
- Unification of the fundamental forces.
- Heavy quark effective theory and other effective theories of QCD
- Lattice QCD.
- Perturbative QCD: parton distribution functions.
- QCD in extreme conditions: heavy ion experiments at the LHC, FAIR and other accelerators.
- Studies of the physics of future colliders.
- Physics of neutrinos, with an emphasis on astrophysics and cosmology.
- Axions and other dark matter candidates.

ICCUB MEMBERS

Bergström, Johannes • Casallerrey, Jorge • Cerutti, Francesco • D'Enterria, David • Espriu, Domènec • González, Juan • González-García, M.C. • González, Pablo A. • Guasch, Jaume • Latorre, José I. • Mescia, Federico • Niro, Viviana • Pablos, Daniel • Planells, Xumeu • Renau, Albert • Solà, Joan • Soto, Joan • Taron, Josep M. • Tarrús, Jaume • Tywoniuk, Konrad • Yenko, Brian M.

VISITING SCHOLARS

Andrianov, Alexander • Labraña, Pedro A. • Lizzi, Fedele.

The ICCUB has a wide spectrum of interests in the phenomenological and calculational aspects of particle physics, including many aspects of the areas reported in the hep-ph, hep-th and hep-lat archives.

Recently, its activity has been influenced to a large extent by the LHC results from the first run. In this sense, the studies are being focused on effective theories of the symmetry breaking sector of the Standard Model, some aspects of supersymmetric theories, string phenomenology, flavour physics (particularly b-physics) and physics beyond the standard model that the LHC will continue to explore in the years to come.

ICCUB researchers are also active in heavy-quark effective theories and other effective theories of QCD. Several key features of heavy ion collisions and the properties of QCD under extreme conditions are also receiving attention.

This area also includes work on lattice field theory, particularly in connection with b-physics. ICCUB researchers also have relevant activity in the development of parton distribution functions using neural networks.

The scope of future accelerators in the context of some extensions of the Standard Model are studied by ICCUB researchers. Relevant contributions are also being made

in the field of neutrino physics, axion physics and other dark matter candidates as well as dark energy. ICCUB particle physics phenomenologists have close interactions with the experimental particle physicists at the ICCUB and obviously with researchers in other theoretical areas.

2013 Activity

Regarding the LHC results for the Higgs particle, several analysis have been carried out using effective theories to constrain new physics. Namely, the more general lagrangian has been classified either for the linear and non-linear relation. Possible resonances due to unitarity in the extensions of electroweak symmetry break have been investigated. On the other hand researchers at ICCUB have contributed in the results of flavour physics at LHC, showing possible discrepancies with the Standard Model.

Concerning effective theories in QCD, the incorporation of a scalar light particle in the quiral lagrangian has been studied, as well as the properties of heavy quarks systems in relativistic ion collisions (HIC). Observational and theoretical models to point out the presence of a non-parity phase have been studied. Activity in the study of the behaviour of jets in quark-gluon plasma has been significant, including studies from holographic QCD.

STAR FORMATION

LINES OF RESEARCH

- High-angular resolution observations of the first stages of stellar evolution.
- Outflows, jets, and accretion disks in low- and high-mass young stellar objects.
- Jets in planetary nebulae.
- Computational models of star-forming clouds and star formation.

ICCUB MEMBERS

Estalella, Robert • Juárez, Carmen • López, Rosario • Padoan, Paolo.

VISITING SCHOLARS

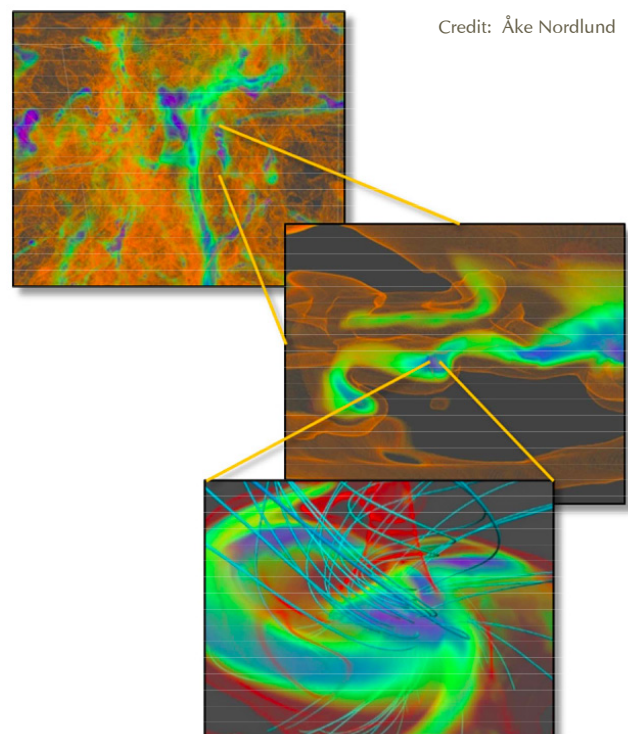
Torrelles, José María.

ICCUB research in the field of star formation focuses on the investigation of the dynamics of star-forming regions in our Galaxy and on the study of the first stages of stellar evolution. ICCUB researchers intend to acquire a perspective as wide as possible by pursuing both an observational approach, ranging from the optical to the radio domain, and a theoretical approach, based on state-of-the-art supercomputer simulations of the evolution of star-forming regions. Observations and simulations are compared through the generation of synthetic observations of the simulations.

Specific areas of research at ICCUB include the characterization of the role of the magnetic field in the star formation process, and in the launching and collimation of the astrophysical jets associated with young stellar objects and planetary nebulae; the investigation of the early stages of the formation of massive stars, with special attention to the timing of the chemical evolution of their environment; the characterization of the gravitational collapse that drives the full process of star formation; the search for signatures of planet formation within the protoplanetary disks; the study of the transition from hot molecular cores to bright HII regions; the numerical modeling of the turbulent fragmentation process to understand the origin of the stellar initial mass function and the star formation rate in molecular clouds; the early protostellar evolution to address the luminosity problem of protostars.

2013 Activity

In collaboration with the STARPLAN center in Copenhagen and the Harvard-Smithsonian Center for Astrophysics, ICCUB's researchers have worked on the formation and early evolution of protoplanetary disks.



AB-INITIO FORMATION OF A CIRCUMSTELLAR DISK.

Simulation of a giant molecular cloud of 40 pc (top panel), where dense star-forming filaments are resolved down to 2 AU (middle panel), and the collapse of a core is followed in order to fully resolve the internal structure of the circumstellar disk with a resolution of 0.01 AU (bottom panel).

The formation of protoplanetary disks has been modeled ab-initio using adaptive-mesh-refinement zoom-in simulations (see above figure) with an unprecedented range of scales, from the giant molecular cloud size of 40 pc, to a scale of 0.01 AU to resolve the internal structure of the disk. In order to study the initial evolution of dust grains, ICCUB's researchers have also studied the role of disk turbulence in regulating the grain collision velocity.

THEORETICAL PHYSICS

LINES OF RESEARCH

- String theory.
- Supersymmetric field theories.
- Applications of the gauge/string duality to QCD.
- Application of the gauge/string duality to condensed matter systems.
- Low energy properties of many-body quantum systems.
- Quantum error correction.
- Topological order.
- Ultra-cold gases.
- Quantum simulations.

ICCUB MEMBERS

Alsina, Daniel • Aprile, Francesco • Barranco, Alejandro • Casalderrey, Jorge • Dector, Aldo • Emparan, Roberto • Espriu, Domènec • Fernández, Daniel • Fiol, Bartomeu • Garolera, Blai • Gomis, Joaquim • González, Pablo Andrés • Iblisdir, Sofyan • Latorre, José I. • Mariño, Mauricio • Mateos, David • Pablos, Daniel • Pons, Josep M. • Puigdomènech, Daniel • Russo, Jorge G. • Solà, Joan • Tarrio, Luis Javier • Tywoniuk, Konrad..

INVITED RESEARCHERS

Lizzi, Fedele • Talavera, Pere.

ICCUB activities cover an ample spectrum of the areas reported in the hep-th and quant-ph archives.

String theory has inspired in recent times enormous activity in the gauge/string duality conjecture that allows a treatment of some strongly coupled theories in terms of a gravity dual. These techniques are being applied to the study of the quark-gluon plasma. In this domain of physics, techniques such as the gauge/string duality meet nuclear phenomenology and effective theories and there is substantial cross-fertilization.

Duality techniques are also applied to a variety of strongly coupled condensed matter systems and in problems of quantum information.

Supersymmetric field theories are studied seeking to understand the ultraviolet behavior of theories with extended supersymmetries and deriving exact results.

In another line, some theories of emergent gravity have been proposed. There are also obvious connections with cosmology and the physics of black holes.

Research in quantum information can be roughly divided into six topics: multiparticle entanglement; low energy

properties of many-body quantum systems; quantum error correction; topological order; ultra-cold gases; and quantum simulation. The Quantum information researchers at the ICCUB are in close collaboration with some of the groups at ICFO.

Activity 2013

Research in Theoretical Physics has been focused in the localization techniques for exact computations in some supersymmetric theories. Notorious improvements have also been made regarding the application of holographic theories in condensed matter models. Also different faces of theoretical models of gravitational theories and branes have been developed.

Regarding cosmology and astroparticle physics, the work has been focused in: investigation of the influence of the cosmological constant in the propagation of gravitational waves, axion physics, variation of fundamental constants and its implication in cosmology (particularly considering the possibility of a non-constant cosmological constant), and neutrino physics in cosmology, as well as in experiments with accelerators.

ADDITIONAL AREAS OF RESEARCH

- Astrodynamics and Celestial Mechanics.
- Astronomical Image Processing and High Angular Resolution Techniques.
- Chirality and Prebiotic Chemistry.
- Heliospheric Physics and Space Weather.
- Microgravity and Biphasic Fluxes.

ASTRODYNAMICS AND CELESTIAL MECHANICS

LINES OF RESEARCH

- Develop tools to explain in a natural way different astronomical patterns.

ICCUB MEMBERS

Gómez, Gerard • Olikara, Zubin P. •
Paita, Fabrizio • Pérez, Daniel.

VISITING SCHOLARS

Jorba, Àngel.

ICCUB researchers on Astrodynamics are devoting their efforts to addressing some fundamental issues concerning formation flying for multiple spacecraft. These include: the transfer of a set of spacecraft to either an Earth orbit or to a libration zone, the deployment of formations from stacks of satellites and the proximity manoeuvring for pointing and reconfiguration.

The main goal of the ICCUB's researchers is to develop and implement algorithms based on recent advances obtained by them and other collaborating teams. The proposed methodology will enable the transfer of spacecraft to tactical locations by developing a strategy that mimics those of flocks of birds.

Further developments will incorporate collision avoidance algorithms currently under development in the area of complexity science, that have evolved from the principles of molecular dynamics. The implications of developing these methodologies are far reaching and

could potentially impact on path planning methodologies throughout the physical sciences.

Activity 2013

During 2013 ICCUB researchers have focused their research in four main topics. First, they have continued with their activities related to the end of life disposal of spacecraft at the libration point regions. Second, they worked on the computation of Lagrangian Coherent Structures for the determination of invariant manifolds and long term stability regions in Celestial Mechanics and Astrodynamics. In third place, in collaboration with CNES, they started a research plan about parameter identification of space debris and accurate estimation of collision probabilities. Lastly, ICCUB researchers have continued their research in spacecraft formation flight control based both on behavioural and minimum relative radial accelerations structures.

ASTRONOMICAL IMAGE PROCESSING AND HIGH ANGULAR RESOLUTION TECHNIQUES

LINES OF RESEARCH

- Image deconvolution by means of multi-resolution analysis (wavelet transform).
- Image superresolution by means of multi-resolution analysis (wavelet transform).
- Image fusion by means of multi-resolution analysis (wavelet and curvelet transforms).
- Submilliarcsecond resolution of infrared sources by high time resolution lunar occultations techniques.

ICCUB MEMBERS

Baena, Roberto • Fors, Octavi • Merino, M. Teresa • Núñez, Jorge C.

ICCUB researchers in the field of image reconstruction are focused on exploiting the use of the wavelet transform to improve the ability of image sensors to detect faint stars and moving objects. The effects of the curvelet transform over interferometric images are also being studied, differential photometry is being estimated in adaptive optics observations using a wavelet-based maximum likelihood estimator.

ICCUB researchers are also working on obtaining super-resolution using additive-substitutive wavelets techniques on remotely sensed images, as well as in obtaining new high-sensitivity, milliarcsecond resolution results from

observations of lunar occultations at Very Large Telescope (VLT) of the European Southern Observatory (ESO).

2013 Activity

During 2013 the main activities were focused in the study of the deconvolution by multiresolution of images obtained using adaptive optics and the comparison of classical, myopic and blind algorithms. An effort was also devoted to increase the limiting magnitude of images obtained for space debris detection. Studies of image fusion and superresolution also continued.

CHIRALITY AND PREBIOTIC CHEMISTRY

LINES OF RESEARCH

- Effect of mechanical forces (flows with gradient of shear rates) on the emergence of chirality in soft matter.
- Mirror symmetry breaking in crystallizations and aggregations showing critical phenomena.

ICCUB MEMBERS

Crusats, Joaquim • El-Hachemi, Zoubir • Ribó, Josep M.

The experimental expertise in this area is the study of the stereo and enantioselective effect of hydrodynamic flows in the formation of supramolecular systems by self-assembly as well as the phase transitions from achiral building blocks to chiral supramolecules. The substances under research are amphiphilic porphyrins. The general objective of these works is the understanding of unusual chiral polarizations in the spontaneous emergence of chirality during the chemical evolution that eventually lead to living systems. This implies the definition thermodynamical scenarios in applied chemistry where such a transition to chirality is possible.

2013 Activity

The theoretical discussion of experimental results on spontaneous mirror symmetry and their concordance with possible Earth prebiotic scenarios has been reported.

Specific efforts have been made and partially reported in the discussion of chemical scenarios that justify, in the frame of linear thermodynamics of irreversible processes, a bias from the racemic composition in the absence of any external chiral polarization.

HELIOSPHERIC PHYSICS AND SPACE WEATHER

LINES OF RESEARCH

- Solar energetic particle (SEP) events, interplanetary shocks and related solar activity.
- Modeling gradual proton events: magnetohydrodynamic shock simulations plus particle transport simulations and applications.
- Modeling near-relativistic electron events: inversion methods and applications.
- Space weather: Engineering models for prediction of peak flux and fluences of solar energetic particle events.

ICCUB MEMBERS

Àgueda, Neus • Aran,
Àngels • Sanahuja, Blai.

ICCUB's lines of research in heliospheric physics mainly focuses in SEP events triggered by solar activity and by interplanetary disturbances, i.e. energetic protons and near relativistic electrons. Solar flares and coronal mass ejections, the main agents of SEP-acceleration, together with proxies of solar activity (radioemission, H-alpha, X-ray, etc.), the solar wind plasma and the interplanetary magnetic field, are the background components of the SEP scenario. Similarly, ICCUB researchers are working both on data analysis and the study of SEP events, both individual and multispacecraft events. They also model energetic particle events and give scientific support to the participation of technological groups of the UB in ESA's Solar Orbiter project.

2013 Activity

In 2013 ICCUB researchers modeled the directional intensity of three large near-relativistic electron events observed in 2001 by both the ACE and the Ulysses spacecraft and the variation of the shape of the proton intensity-time profiles in simulated gradual proton events with the relative observer's position in space with respect to the main direction of propagation of an interplanetary shock.

The three-year collaborative project SEPserver, FP7-SPACE programme of the European Union, arrived to its end, and the participation in the one-year project IPRAM was completed.

MICROGRAVITY AND TWO-PHASE FLOWS

LINES OF RESEARCH

- Bubble formation and dynamics in turbulent flows in microgravity.
- Controlled nucleate boiling in confined geometries in microgravity.

INVITED RESEARCHERS

Casademunt, Jaume • Ruiz, Josep
Xavier.

The ICCUB's invited researchers have focused on the formation and management of small bubbles under microgravity conditions, an area of fundamental interest in two phase-flows, with important applications in space technology, from life support systems to thermal control of satellites.

Experiments are conducted in the ESA Drop Tower facility at ZARM (Bremen) and include the study of the interaction of bubbles and turbulence, and the formation of vapor bubbles by nucleate boiling. Researchers have obtained for the first time turbulent monodisperse bubble suspensions, and also for the first time, bubbles of controlled size by nucleate boiling.

2013 Activity

In 2013 the activity was focused on the design, optimization and characterization of a new device to generate controlled formation of bubbles through nucleation of an over-heated liquid at a prescribed location. The device produces regular slug flows that can then be injected to other two-phase devices for heat exchange. The performance of the device has been shown to be independent of gravity, conducting systematic microgravity test in the ZARM Drop Tower facility. Exploration of possible applications to more efficient thermal control systems for space vehicles have been initiated.

ELECTRONIC AND INSTRUMENTATION DEVELOPMENT

ACTIVITIES

- Electronics for CTA, LHCb and PET.
- Contribution to GTC instrumentation program.
- Solar Orbiter.
- Montsec Astronomical Observatory.

ICCUB MEMBERS

Comerma, Albert • Fors, Octavi • Garrido, Lluís •
 Gascón, David • Gómez, Jose M. • Graciani, Ricardo •
 Graugés, Eugeni • Núñez, Jorge C. • Oriol, Pablo •
 Picatoste, Eduard • Ruiz, Hugo • Sabater, Josep •
 Sanuy, Andreu • Trenado, Juan.

A large part of the realization of a successful research project is due to the instrumentation that is used to bring it about. A careful design, specifically tailored to the needs of a project, and the construction of the different components that constitute telescopes, cameras and similar tools, are the aim of this line of research.

ICCUB is currently participating in the development of the following electronics and instrumentation:

Electronics for CTA, LHCb upgrade and PET

ICCUB researchers and engineers have more than ten years of experience in the design of instrumentation and radiation-tolerant application-specific integrated circuits (ASICs) for high speed photodetectors like photomultiplier tubes (PMTs) or Silicon photomultipliers (SiPM, MPPC, GAPDs, etc.). Nowadays they are working in different ASICs for the Cherenkov Telescope Array (CTA), in the design of an ASIC for the calorimeter and the new Scintillating Fiber Tracker of the upgraded LHCb, and in the development of ASICs for new PET (Positron Emission Tomography) systems based in silicon photomultipliers.

Contribution to GTC instrumentation program

The ICCUB is nowadays involved in two projects of the *Gran Telescopio de Canarias* (GTC): the control software for the deployable probe arms for MIRADAS and the design of the central plaque of the positioner of MEGARA.

The MIRADAS instruments will include up to twelve arms that will patrol de focal plane to get the spectrum of the different objects. As the space is small, it is necessary

to have software able to choreograph the arms in order to reach the desired objects avoiding the possible collisions.

Solar Orbiter

The ICCUB is part of the Polarimetric and Helioseismic Imager instrument for the Solar Orbiter mission (SO/PHI). The ICCUB responsibility is the development and implementation of an Image Stabilization System (ISS) that includes a camera, a controller for a piezo-electric based Tip-Tilt mirror, and the control firmware for the FPGA that controls the whole system.

Montsec Astronomical Observatory

ICCUB researchers are working since more than ten years ago in the Telescope Fabra-ROA Montsec (TFRM) located at the *Observatori Astronomic del Montsec* (OAdM). The TFRM is a 0.5m aperture f/0.96 optically modified Baker-Nunn Camera, which offers a unique combination of instrumental specifications: fully robotic and remote operation, wide-field of view (4.4°x4.4°), moderate limiting magnitude (V=19.5 mag), ability of tracking at arbitrary right ascension and declination rates, as well as opening and closing CCD shutter at will during an exposure. Nearly all kind of image survey programs can benefit from those specifications. Apart from other less time consuming programs, since the beginning of science TFRM operations ICCUB researchers have been conducting two specific and distinct surveys: super-Earths transiting around M-type dwarfs stars and geostationary debris in the context of Space Situational Awareness / Space Surveillance and Tracking (SSA/SST) programs. In parallel other programs as the search for near earth objects (NEO) and the observations of high energy sources are carried out regularly.

Activity 2013

Electronics for CTA, LHCb upgrade and PET

In 2013 a complete analog signal processing channel for the upgrade of the LHCb calorimeter has been designed, produced and tested, both in commercial on the shelf and ASIC (ICECAL-V2) versions. A first prototype for the input stage of the PACIFIC ASIC has been designed for SiPM readout in the new Scintillating Fiber Tracker planned for the LHCb upgrade. A new ASIC for SiPM readout in medical imaging (PET Time-of-Flight) has been developed. The level 0 trigger signal processing for CTA cameras has been implemented in a dedicated ASIC.

Contribution to GTC instrumentation program

During 2013, the probe arm mechanical characteristics were modeled. Based on that, an analysis of the trajectories that a single probe arm could follow was performed. The results probed that it was not possible to make one arm independent of the others. As a result, all the probe arms must be choreographed, requiring some kind of optimization based on a meta-heuristic approach.

In parallel, a controlling system for the motors of the MEGARA positioner was developed. It is based on an ARM microcontroller that provides multiple interfaces to simplify the interconnection between the different arms.

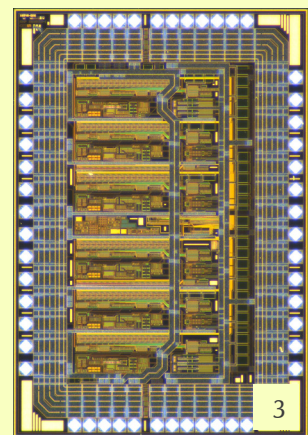
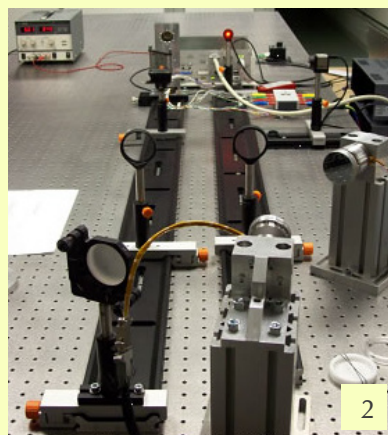
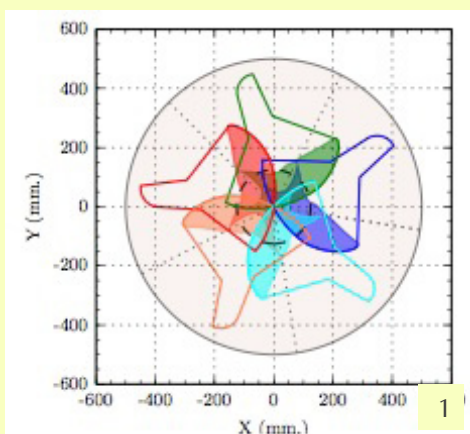
Solar Orbiter

During year 2013, the ICCUB team closed the loop of the ISS, reaching the required filtering of mechanical noise. The SO/PHI instrument passed the Critical Design Review. Finally, the industry contract for the manufacturing of the ISS hardware for the different models was signed.

Montsec Astronomical Observatory

During 2013, in the context of space debris, the TFRM was collaborating in the ISON network, in the CO-VIII SSA/SST campaign of the ESA and participated in the contract Test-Bed for the Remote Control of an Automated Follow-Up Telescope. The total number of observations reported was 96.397, corresponding to 14.143 tracks. A total of 7 new objects was discovered during the survey.

Regarding the exoplanet survey, during 2013 ICCUB researchers continued to observe 48 selected fields detecting hundreds of new variable stars and studying the possibility of new exoplanets in them using newly implemented algorithms. Also, the optical counterparts of four high energy sources were systematically observed to establish the variations of their light curves and the models to explain them.



- 1: Intersection of the patrol areas of 5 probes of the MIRADAS instrument. The focal plane is the dashed internal circle.
 2: Bread-Board Model of the ISS on the optical testbench, closing the loop.
 3: ASIC for the Cherenkov Telescope Array (CTA)

VERY LARGE DATA PROCESSING AND ANALYSIS

ACTIVITIES

- Gaia Data Processing and Analysis Consortium (DPAC)
- Distributed Infrastructure with Remot Agent Control (DIRAC)

ICCUB MEMBERS

Antiche, Erika • Balaguer, Dolores • Borrachero, Raúl • Carrasco, José M • Casajús, A • Castañeda, Javier • Clotet, Marcial • Fabricius, Claus Vilhelm • Figueras, Francesca • Graciani-Díaz, R. • Fries, Aidan Dermot • Gallardo, Eva • Garralda, Nora • González, Juan J. • Jordi, Carme • Julbe, Francesc • Lazovsky, Nikola • Luri, F. Xavier • Masana, Eduard • Molina, Daniel • Portell, Jordi • Sagristà, Antoni • Torra, Jordi • Voss, Holger • Weiler, Michael.

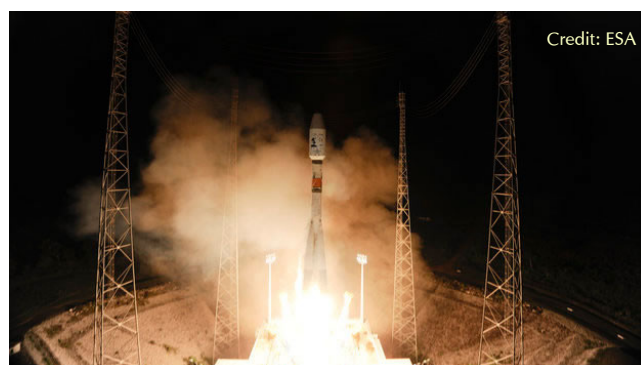
Gaia DPAC

The ICCUB researchers are engaged since 1998 in the Gaia Data Processing and Analysis Consortium (DPAC) in charge of designing, implementing, managing and running the whole data reduction of the Gaia mission, from the storage of the telemetry to the production of the final catalogue. The ICCUB has important responsibilities in four out of nine coordination units in DPAC: CU2 (simulations), CU3 (core processing), CU5 (photometric processing), CU9 (Catalogue Access) and in the Data Processing Center of Barcelona.

In this framework, the ICCUB leads the EU FP7 funded initiative named GENIUS (2013–2016), aimed to significantly contribute to the development of the Gaia Archive: use the best state-of-the-art archive system; provision of exploitation tools to maximize the scientific return; ensuring the interoperability with future astronomical archives; and last but not least, the archive facilities outreach activities. The ICCUB team has one representative in the Gaia Scientific Team, one in the DPAC Executive, two deputy managers in CU2 and CU3, and leads the CU9. Based on the expertise of our team on efficient compression systems for space, DAPCOM was created as a spin-off Company dedicated to efficient data compression systems

DIRAC

The DIRAC (Distributed Infrastructure with Remote Agent Control) project is a complete Grid solution for a community of users developed by CERN, CNRS and ICCUB. It was created to handle the distributed computing of the LHCb experiment, and now other communities, such as CTA, have started to use it. The ICCUB is now responsible of the continuous updates.



Credit: ESA

GAIA LAUNCH

ESA's Gaia mission blasted on a Soyuz rocket from Europe's Spaceport in Kourou, French Guiana, on the 23. December 2013. ICCUB researchers have been involved in the project since the very beginning, in 1998.

Activity 2013

Gaia DPAC

During 2013, the main activities in this field have been to deliver a new version of software for the Initial Data Treatment, several simulated datasets, ultimate photometric calibrations, and prepare for the launch and commissioning phases. Also, many public outreach activities have taken place on the event of the launch of Gaia (see the *Activities* section for more details).

DIRAC

The CERN–CNRS–UB agreement for the creation of the DIRAC Consortium has been signed to support, develop and disseminate the usage of the DIRAC software.

KNOWLEDGE TRANSFER AND INNOVATION

SERVICES

- DAPCOM Data Services)
- Ideas Service (SiUB)

ICCUB MEMBERS

Casajús, Adrià • Castañeda, Javier • Clotet, Marcial • Garrido, Lluís • Gascón, David • Gaciani-Díaz, Ricardo • Graugés, Eugeni • Julbe, Francesc • Luri, Xavier • Picatoste, Eduardo • Portell, Jordi • Sanuy, Andreu • Torra, Jordi • Trenado, Juan.

DAPCOM Data Services (ESA BIC Barcelona)

DAPCOM Data Services S.L. is a spin-off company participated by the University of Barcelona (UB) and the Technical University of Catalonia (UPC). It provides software engineering solutions and high-performance data compression strategies, including proprietary implementations, for both general and specific cases and sectors. The company is specialized on the handling and processing of large amounts of data. It was created in February 2013 by researchers of the ICCUB, the UPC and the IEEC as a result of their research in the Gaia project, which allowed them to acquire expertise on the handling and processing of large amounts of data.

DAPCOM commercializes FAPEC (Fully Adaptive Prediction Error Coder), a patented lossless data compression algorithm originally created for space communications. FAPEC offers an optimum compromise between resources consumption and compression ratio, offering good performance even with noise and outliers present in the data. It has multiple applications in data processing and transport of large data sets, such as in scientific research, supercomputers or in companies dealing with Big Data scenarios.

DAPCOM Data Services has been one of the first companies selected to benefit from the ESA Business Incubation programme in the new ESA Business Incubation centre of Barcelona due to the potential of its space technology (FAPEC) to be transferred from space sector to terrestrial applications. The incubation program will allow DAPCOM to continue its R&D activities on data compression techniques for multiple terrestrial applications, which will reinforce the company as a reference in data compression technologies and techniques. The incubation will have a duration of two years and the company will be incubated in the RDIT

building of the UPC Campus of Castelldefels (Baix Llobregat, Barcelona).

<http://www.dapcom.es>

Ideas Service (SiUB)

The IDEAS Service (*Servei per la Innovació del Disseny Electrònic Avançat de Sistemes a la UB*), or **SiUB**, is an instrumentation service of the Physics Faculty of the University of Barcelona which provides a service on electronics and microelectronics instrumentation design, development and test to research groups of the UB and other research institutions, by the one hand, and enhances the industry technology transfer on the other.

It was created in 2013 after a proposal of three research groups at the UB, among them the Experimental Particle Physics group of the ICCUB, focused on both the field of research and the transfer of services. The objectives of the service are enable and enhance the participation of groups and institutions involved in projects that involve development of advanced electronic instrumentation, create a technological center to allow the transfer of academic knowledge to industry and taking a step further to provide a professional service to research activities and strengthen collaboration with other research centers.

As explained above in the *Electronic and Instrumentation Development* transversal line, SiUB staff and associate members hold more than ten years of experience developing instrumentation at different levels: Design and test of Application-Specific Integrated Circuits (ASICs), Design and test of cards and PCBs and Development of equipment and systems. SiUB is making use of this experience.

<http://siub.ub.edu>

PROJECTS AND FUNDS

4

NATIONAL PLAN PROJECTS

Propiedades de la luz intragrupal y de las galaxias en grupos galaxias.

Reference: AYA2010-18605

PI: José M. Solanes

Agency: MICINN

Period: 2011-2013

Contribución al desarrollo científico y tecnológico de la misión Gaia.

Reference: AYA2009-14648-C02-01

PI: Jordi Torra

Agency: MICINN

Period: 2010-2013

High-energy phenomena in stellar objects. Theory and multi-wavelength observations.

Reference: AYA2010-21782-C03-01

PI: Josep M. Paredes

Agency: MICINN

Period: 2011-2014

Participación española en la fase de preparación del “Cherenkov Telescope Array” (CTA).

Reference: FPA2010-22056-C06-02

PI: Marc Ribó

Agency: MICINN

Period: 2011-2013

Optimización del retorno científico de la observación astronómica. Nuevos desarrollos y aplicaciones.

Reference: AYA2008-01225

PI: Jorge Núñez

Agency: MICINN

Period: 2009-2013

Auto-organización en materiales blandos y materia viva: II) Fluidos complejos, células y tejidos.

Reference: FIS2010-21924-C02-02

PI: Jaume Casademunt

Agency: MICINN

Period: 2011-2013

Sucesos de partículas solares energéticas: modelos. Aplicaciones para meteorología espacial.

Reference: AYA2010-17286

PI: Blai Sanahuja

Agency: MICINN

Period: 2011-2013

Diseño detallado de SOLAR ORBITER/PHI.

Reference: AYA2011-29833-C06-05

PI: Josep M. Gómez-Cama

Agency: MINECO

Period: 2012-2013

Interstellar medium at high-angular resolution: preparing for the ALMA era.

Reference: AYA2011-30228-C03-03

PI: Robert Estalella

Agency: MINECO

Period: 2012-2014

Cosmology and the Origin of Matter. Sabor y Origen de la Materia (COM SOM).

Reference: FPA2011-29678-C02-02

PI: Licia Verde

Agency: MINECO

Period: 2012-2014

Mantenimiento y operación de Tier2 español para LHCb y contribuciones al core computing de LHCb.

Reference: FPA2010-21885-C02-01

PI: Ricardo Graciani Díaz

Agency: MICINN

Period: 2011-2013

Desarrollo de nuevos detectores para los futuros colisionadores en Física de Partículas.

Reference: FPA2010-21549-C04-01

PI: Ángel Diéguez

Agency: MICINN

Period: 2011-2014

Estudio de la violación de CP con el detector LHCb.

Reference: FPA2011-30163-C02-01

PI: Eugeni Graugés

Agency: MICINN

Period: 2012-2014

Teoría y fenomenología de las interacciones fundamentales: Gravitación y cosmología.

Reference: FPA2010-20807-C02-02

PI: Roberto Emparan

Agency: MICINN

Period: 2011-2013

Información cuántica: entrelazamiento, redes de tensores y gases fríos.

Reference: FIS2010-16185

PI: José Ignacio Latorre

Agency: MICINN

Period: 2011-2014

Simulación Monte Carlo del transporte de radiación. Física, métodos numéricos y aplicaciones.

Reference: FPA2009-14091-C02-01

PI: Francesc Salvat

Agency: MICINN

Period: 2010-2013

Teorías efectivas de las interacciones fuertes: aplicaciones a quarkonium pesado y a QCD bajo condiciones extremas.

Reference: FPA2010-16963

PI: Joan Soto

Agency: MICINN

Period: 2011-2013

Teoría y fenomenología de las interacciones fundamentales: Física de partículas y la unificación de las fuerzas.

Reference: FPA2010-20807-C02-01

PI: Domènec Espriu

Agency: MICINN

Period: 2011-2014

Sistemas de Fermi fuertemente correlacionados: átomos, núcleos y hadrones.

Reference: FIS2011-24154

PI: Xavier Viñas

Agency: MICINN

Period: 2012-2014

Las componentes del Universo.

Reference: AYA2012-36353

PI: M. Pilar Ruiz Lapuente

Agency: MCOC

Period: 2013-2015

Diseño detallado, fabricación e integración de SO/PHI.

Reference: AYA2012-39636-C06-02

PI: J. M^a Gómez-Cama

Agency: MCOC

Period: 2013

Contribución al desarrollo científico y tecnológico de la misión Gaia II.

Reference: AYA2012-39551-C02-01

PI: Jordi Torra Roca

Agency: MICINN

Period: 2013

Estructura a gran escala, cúasares y las primeras estrellas con los espectros de absorción de cúasares de BOSS.

Reference: AYA2012-33938

PI: Jordi Miralda-Escudé

Agency: MICINN

Period: 2013-2015

Modelado de la reionización del universo y de las galaxias que la causan.

Reference: AYA2012-39168-C03-02

PI: Eduard Salvador-Solé

Agency: MCOC

Period: 2013-2015

CONSOLIDER INGENIO PROJECTS

Supercomputación y eCiencia.

Reference: CSD2007-00050

PI: Mateo Valero, BSC (ICCUB: Jordi Torra)

Agency: MEC

Period: 2007-2013

Primera ciencia con el GTC: la astronomía española en vanguardia de la astronomía europea.

Reference: CSD2006-00070

José Miguel Rodríguez Espinosa, IAC
(ICCUB: Eduard Salvador)

Agency: MEC

Period: 2007-2013

Centro Nacional de Física de Partículas, Astropartículas y Nuclear.

Reference: CSD2007-00042

PI: Antonio Pich, IFIC
(ICCUB: Lluís Garrido)

Agency: MEC

Period: 2007-2015

Canfranc Underground Physics.

Reference: CSD2008-00037

PI: M. Concepción González-García

Agency: MICINN

Period: 2008-2013

OTHER NATIONAL GRANTS

Ampliación de actividades de la misión GAIA.

Reference: AYA2010-12176-E

PI: Jordi Torra

Agency: MICINN

Period: 2011-2013

Participación española en la fase preparatoria del Cherenkov Telescope Array (CTA).

Reference: AIC-A-2011-0660

PI: Manuel Martínez, IFAE (ICCUB: Marc Ribó)

Agency: MINECO

Period: 2011-2014

Participación en el Computing resources Scrutiny Group del CERN.

Reference: FPA2011-13440-E

PI: Domènec Espriu

Agency: MICINN

Period: 2011-2013

Ruptura de simetría en física de partículas: el Higgs y más allá.

Reference: AIC-D-2011-0815

PI: Domènec Espriu

Agency: MICINN

Period: 2012-2013

Año dual España-Rusia: Física de Partículas, Física Nuclear y Astropartículas.

Reference: FPA2011-14321-E

PI: Domènec Espriu

Agency: MICINN

Period: 2011-2013

Conferencia Internacional "International Conference on Hypernuclear and Strange Particle Physics".

Reference: FIS2011-15579-E

PI: Àngels Ramos

Agency: MICINN

Period: 2011-2013

Hacia pruebas holográficas de la materia caliente en el LHC.

Reference: FPA2013-40360-ERC

PI: Jorge Casallerrey Solana

Agency: MCOC

Period: 2013-2014

Creación de la Red Española Gaia.

Reference: AYA2009-08488-E

PI: Francesca Figueras Siñol

Agency: MICINN

Period: 2010-2013

GaiaApp.

Reference: FCT-13-7148

PI: Jordi Torra Roca

Agency: FECYT

Period: 2013-2014

PTA Mod. Impulso a la Participación Internacional.

Reference: PTA2012-7891-A

PI: Jordi Torra Roca, M.Dolores Balaguer Nuñez

Agency: MINECO

Period: 2013-2016

PTA Mod. Infraestructuras científico-tecnológicas: Gaia.

Reference: PTA2010-3704-I

PI: Jordi Torra Roca

Agency: MINECO

Period: 2011-2014

CONSOLIDATED GROUPS***Maximizing the scientific return of future galaxy surveys.***

Reference: 2009SGR1280

PI: Licia Verde

Agency: AGAUR

Period: 2009-2014

Astronomía i Astrofísica.

Reference: 2009SGR217

PI: Eduard Salvador-Solé

Agency: AGAUR

Period: 2009-2013

Grup de Física Experimental d'Altes Energies.

Reference: 2009SGR1268

PI: Lluís Garrido

Agency: AGAUR

Period: 2009-2013

Gravitation, Particles and Strings.

Reference: 2009SGR168

PI: David Mateos

Agency: AGAUR, Generalitat de Catalunya

Period: 2009-2013

Dosimetria i Radiofísica Mèdica.

Reference: 2009SGR0276

PI: Francesc Salvat

Agency: AGAUR

Period: 2009-2013

Grup de Física Teòrica d'Altes Energies.

Reference: 2009SGR502

PI: Joan Solà

Agency: AGAUR

Period: 2009-2013

Laboratori de física matemàtica.

Reference: 2009SGR417

PI: Josep Llosa

Agency: AGAUR

Period: 2009-2013

EUROPEAN PROJECTS AND FUNDS

Cosmological physics with future large scale.

Structure surveys (PHYSS.LSS)

Reference: 240117 (FP7-IDEAS-ERC)

PI: Licia Verde

Agency: European Research Council (ERC)

Period: 2009–2014

Gaia Research for European Astronomy

Training (GREAT).

Reference: **08-RNP-118**

PI: Nick Walton, University of Cambridge

(ICCUB: Carme Jordi)

Agency: European Science Foundation (ESF)

Period: 2010–2015

Gaia Research for European Astronomy

Training (GREAT-ITN).

Reference: 264895 (FP7-PEOPLE)

PI: Nick Walton, University of Cambridge

(ICCUB: Francesca Figueras)

Agency: European Community (EC)

Period: 2011–2015

The Preparatory Phase for the Cherenkov Telescope Array (CTA-PP).

Reference: 262053 (FP7-INFRASTRUCTURES)

PI: Werner Hofmann, Max Planck Gesellschaft

(ICCUB: Josep M. Paredes)

Agency: European Community (EC)

Period: 2010–2013

Star Formation in the Turbulent

Interstellar Medium.

Reference: PIRG07-GA-2010-261359

(FP7-PEOPLE).

PI: Paolo Padoan, Eduard Salvador Solé

Agency: European Community (EC)

Period: 2011–2014

Data Services and Analysis Tools for Solar

Energetic Particle Events and Related

Electromagnetic Emissions (SEPserver).

Reference: SPA.2010.2.1-03 (262773) (FP7-SPACE)

PI: Rami Vainio, Univ. of Helsinki

(ICCUB: Blai Sanahuja)

Agency: European Community (EC)

Period: 2010–2013

Protecting Space Assets from High Energy Particles by Developing European Dynamic Modelling and Forecasting Capabilities (SPACECAST).

Reference: SPA.2010.2.3-01 (262468) (FP7-SPACE)

PI: Richard Horne, British Antarctic Survey

(ICCUB: Blai Sanahuja)

Agency: European Community (EC)

Period: 2011–2014

The Astrodynamics Network (ASTRONET-II).

Reference: PITN-GA-2011-289240

(FP7-PEOPLE)

PI: Gerard Gómez

Agency: European Community (EC)

Period: 2012–2015

Holography for the LHC era.

Reference (HoloLHC)

Reference: 306605 (FP7-IDEAS-ERC)

PI: David Mateos

Agency: European Research Council (ERC)

Period: 2012–2017

Advanced European Infrastructures for Detectors at Accelerators (AIDA).

Reference: 262025 (FP7-INFRASTRUCTURES)

PI: Laurent Serin, CERN

(ICCUB: Ángel Diéguez)

Agency: European Community (EC)

Period: 2011–2015

Study of Strongly Interacting Matter

(HADRONPHYSICS3).

Reference: INFRA-2011-1-1-20 (283286)

(FP7-INFRASTRUCTURES)

PI: Carlo Guaraldo, INFN Frascati

(ICCUB: Àngels Ramos)

Agency: European Community (EC)

Period: 2012–2014

Multi-hadron interactions in Lattice QCD:

27,1 Mh in Mare Nostrum.

Reference: MHILQCD

PI: Assumpta Parreño

Agency: Partnership for Advanced Computing in

Europe (PRACE)

Period: 2012–2013

European Particle Physics Latin America Network (EPLANET).

Reference: PIRSES-GA-2009-246806 (FP7-PEOPLE)
 PI: Luciano Maiani, CERN (ICCUB: Domènec Espriu)
 Agency: European Community (EC)
 Period: 2011-2015

INVISIBLES.

Reference: PITN-GA-2011-289442 (FP7-PEOPLE)
 PI: B. Gavela, UAM (ICCUB: M. Concepción González-García)
 Agency: European Community (EC)
 Period: 2012-2016

Gaia European Network for Improved User Services (GENIUS).

Reference: 606740 - GENIUS
 PI: Xavier Luri Carrascoso
 Agency: European Community (EC)
 Period: 2013-2017

Studying at high energies the dynamical and non-thermal processes in astrophysical outflows (ASTFLOW).

Reference: PCIG11-GA-2012-321520
 PI: Josep Maria Paredes, Valentí Bosch-Ramon
 Agency: European Community (EC)
 Period: 2013-2017

Probing strongly coupled deconfined matter at the LHC (DECOLHC).

Reference: PCIG12-GA-2012-333786
 PI: Joan Soto, Jorge Casalderrey
 Agency: European Community (EC)
 Period: 2013-2016

The String Theory Universe.

Reference: MP1210
 PI: Silvia Penati (ICCUB: Roberto Emparan)
 Agency: European Cooperation in Science and Technology (COST Action)
 Period: 2013-2017

INTERNATIONAL PROJECTS

Preconditioning of the interplanetary medium as responsible for large intense SEP events: Radial and longitudinal effects.

Reference: NNX11AO83G
 PI: David Lario, APL, Johns Hopkins University (ICCUB: Neus Àgueda)
 Agency: NASA
 Period: 2011-2015

Contract for the preliminary design of the MIRADAS Spectrograph Probe Motion Control Software System for the Gran Telescopio de Canarias.

Reference: MIRADAS Contract
 PI: Jordi Torra
 Agency: University of Florida
 Period: 2012-2013

The Gaia DPAC Interface Management in the Gaia Project Office.

Reference: GAIA-CT-12000-178-CN
 PI: Jordi Torra
 Agency: Centre National d'Études Spatiales (CNES)
 Period: 2009-2013

Injection of nucleate-boiling slug flows into a heat exchange chamber in microgravity.

Reference: FA8655-12-1-2060
 PI: Jaume Casademunt
 Agency: Air Force Office of Scientific Research (Dept. of Defense USA) through the European Office of Aerospace Research and Development
 Period: 2012-2015

CONTRACTS WITH THE INDUSTRY

Interplanetary and Planetary Radiation Model for Human Spaceflight.

Reference: FBG 307130

PI: Daniel Heynderickx (ICCUB: Àngels Aran, Blai Sanahuja)

Company: DH Consultancy/ESA

Period: 2012-2013

Asesoramiento sobre el desarrollo y prueba de circuitos electrónicos para discriminación de señales en detectores de partículas.

Reference: FBG 306720

PI: Lluís Garrido

Company: Scientifica Internacional

Period: 2012-2014

Analysis with Penelope.

Reference: FBG 306890

PI: Francesc Salvat

Company: Hamamatsu Photonics K.K.

Period: 2012-2013

Advanced electronics for Hamamatsu detectors (I).

Reference: FBG 307548

PI: Ricardo Graciani

Company: Hamamatsu Photonics France S.A.R.L.

Period: 2013-2014

Advanced electronics for Hamamatsu detectors (II).

Reference: FBG 307550

PI: Ricardo Graciani

Company: Hamamatsu Photonics France S.A.R.L.

Period: 2013-2014

Miniaturization of the controller for an endoscopic screening capsule, Phase 5.

Reference: FBG 307148

PI: Àngel Diéguez

Company: Ovesco Endoscopy AG

Period: 2013

Miniaturization of the controller for an endoscopic screening capsule, Phase 6.

Reference: FBG 307237

PI: Àngel Diéguez

Company: Ovesco Endoscopy AG

Period: 2013

Miniaturization of the controller for an endoscopic diagnosis capsule.

Reference: FBG 307319

PI: Àngel Diéguez

Company: Ovesco Endoscopy AG

Period: 2013-2014

Optimització de recursos en entorns sostenibles.

Reference: FBG 307429

PI: Lluís Garrido

Company: WeeDooCare Business Solutions GmbH

Period: 2013-2014

Contract for intellectual services relative to Penelope course 2013.

Reference: FBG 307398

PI: Francesc Salvat

Company: Organisation for Economic Co-operation and Development

Period: 2013

Joint research agreement:

Further development of the modification and/or customization of PENELOPE

Reference: FBG 307269

PI: Francesc Salvat

Company: Hamamatsu Photonics K.K.

Period: 2013-2015

SCI PUBLICATIONS

Abellan Beteta, C.; Calvo Gomez, .; Camboni, A.; Comerma-Montells, A.; Domingo Bonal, F.; Garrido, L.; Gascon, D.; Grabalosa Gándara, M.; Graciani Diaz, R.; Grauges, E.; Lopez Asamar, E.; Pérez-Calero Yzquierdo, A.; Picatoste Olloqui, E.; Pie Valls, B.; Potterat, C.; Puig Navarro, A.; Rosello, M.; Ruiz, H.; Vazquez Gomez, R.; Vilasis-Cardona, X., *Measurement of the ratio of branching fractions $\beta(B^0 \rightarrow K^0 \gamma) / \beta(B_s^0 \rightarrow \phi \gamma)$ and the direct CP asymmetry in $B^0 \rightarrow K^0 \gamma$* , Nuclear Physics B, Vol. 867, p. 1-18 (2013).

Abellan Beteta, C.; Calvo Gomez, M.; Camboni, A.; Comerma-Montells, A.; Domingo Bonal, F.; Garrido, L.; Grabalosa Gandara, M.; Graciani Diaz, R.; Grauges, E.; Gui, B.; Lopez Asamar, E.; Perez-Calero Yzquierdo, A.; Picatoste Olloqui, E.; Potterat, C.; Rives Molina, V.; Ruiz, H.; Vazquez Gomez, R.; Vilasis-Cardona, X., *Observation of $D^0 - \bar{D}^0$ oscillations*, Physical Review Letters, Vol. 110, p. 101802 (2013).

Abellan Beteta, C.; Calvo Gomez, M.; Camboni, A.; Comerma-Montells, A.; Domingo Bonal, F.; Garrido, L.; Grabalosa Gandara, M.; Graciani Diaz, R.; Grauges, E.; Lopez Asamar, E.; Perez-Calero Yzquierdo, A.; Picatoste Olloqui, E.; Pie Valls, B.; Potterat, C.; Rives Molina, V.; Ruiz, H.; Vazquez Gomez, R.; Vilasis-Cardona, X., *A study of the Z production cross-section in pp collisions at $\sqrt{s} = 7$ TeV using τ final states*, Journal of High Energy Physics, Vol. 1301, p. 111 (2013).

Abellan Beteta, C.; Calvo Gomez, M.; Camboni, A.; Comerma-Montells, A.; Domingo Bonal, F.; Garrido, L.; Grabalosa Gandara, M.; Graciani Diaz, R.; Grauges, E.; Lopez Asamar, E.; Perez-Calero Yzquierdo, A.; Picatoste Olloqui, E.; Pie Valls, B.; Potterat, C.; Rives Molina, V.; Ruiz, H.; Vazquez Gomez, R.; Vilasis-Cardona, X., *Measurement of the CP asymmetry in $B^0 \rightarrow K^0 \mu^+ \mu^-$ decays*, Physical Review Letters, Vol. 110, p. 031801 (2013).

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Grabalosa Gandara, M.; Graciani Diaz, R.; Grauges, E.; Lopez Asamar, E.; Perez-Calero Yzquierdo, A.; Picatoste Olloqui, E.; Pie Valls, B.; Potterat, C.; Rives Molina, V.; Ruiz, H.; Vazquez Gomez, R.; Vilasis-Cardona, X., *Differential branching fraction and angular analysis of the $B^+ \rightarrow K^+ \mu^+ \mu^-$ decay*, Journal of High Energy Physics, Vol. 1301, p. 105 (2013).

Abellan Beteta, C.; Calvo Gomez, M.; Camboni, A.; Comerma-Montells, A.; Domingo Bonal, F.; Garrido, L.; Grabalosa Gandara, M.; Graciani Diaz, R.; Grauges, E.; Lopez Asamar, E.; Perez-Calero Yzquierdo, A.; Picatoste Olloqui, E.; Pie Valls, B.; Potterat, C.; Rives Molina, V.; Ruiz, H.; Vazquez Gomez, R.; Vilasis-Cardona, X., *First evidence for the annihilation decay mode $B^+ \rightarrow D_s^+ \phi$* , Journal of High Energy Physics, Vol. 1302, p. 043 (2013).

Abellan Beteta, C.; Calvo Gomez, M.; Camboni, A.; Comerma-Montells, A.; Domingo Bonal, F.; Garrido, L.; Grabalosa Gandara, M.; Graciani Diaz, R.; Grauges, E.; Lopez Asamar, E.; Perez-Calero Yzquierdo, A.; Picatoste Olloqui, E.; Pie Valls, B.; Potterat, C.; Rives Molina, V.; Ruiz, H.; Vazquez Gomez, R.; Vilasis-Cardona, X.; et al., *Measurement of the $B^0 - \bar{B}^0$ oscillation frequency Δm with the decays $B^0 \rightarrow D^- \pi^+$ and $B^0 \rightarrow J/\psi K^0$* , Physics Letters B, Vol. 719, p. 318-325 (2013).

Abellan Beteta, C.; Calvo Gomez, M.; Camboni, A.; Comerma-Montells, A.; Domingo Bonal, F.; Garrido, L.; Grabalosa Gandara, M.; Graciani Diaz, R.; Grauges, E.; Lopez Asamar, E.; Perez-Calero Yzquierdo, A.; Picatoste Olloqui, E.; Potterat, C.; Rives Molina, V.; Ruiz, H.; Vazquez Gomez, R.; Vilasis-Cardona, X., *First evidence for the decay $B_s^0 \rightarrow \mu^+ \mu^-$* , Physical Review Letters, Vol. 110, p. 021801 (2013).

Abellan Beteta, C.; Calvo Gomez, M.; Camboni, A.; Comerma-Montells, A.; Domingo Bonal, F.; Garrido, L.; Grabalosa Gandara, M.; Graciani Diaz, R.; Grauges, E.; Lopez Asarnar, E.; Perez-Calero Izquierdo, A.; Picatoste Olloqui, E.; Pie Valls, B.; Potterat, C.; Rives Molina, V.;

Ruiz, H.; Vazquez Gomez, R.; Vilasis-Cardona, X., *Search for the rare decay $K_s^0 \rightarrow \mu^+ \mu^-$* , Journal of High Energy Physics, Vol. 1301, p. 090 (2013).

Abellan Beteta, C.; Calvo Gomez, M.; Camboni, A.; Comerma-Montells, A.; Domingo Bonal, F.; Garrido, L.; Graciani Diaz, R.; Grauges, E.; Lopez Asamar, E.; Perez-Calero Yzquierdo, A.; Picatoste Olloqui, E.; Pie Valls, B.; Potterat, C.; Rives Molina, V.; Ruiz, H.; Vazquez Gomez, R.; Vilasis-Cardona, X., *Measurement of the cross-section for $Z \rightarrow e^+ e^-$ production in pp collisions at $\sqrt{s} = 7$ TeV*, Journal of High Energy Physics, Vol. 1302, p. 106 (2013).

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PHD THESES

Finished Theses***The use of Java in large scientific data processing applications in HPC environments***

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Defense date: 21/01/2013

Inclusive b-jet production cross-section measurement at LHCb

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Feasibility of Geiger-mode avalanche photodiodes in standard CMOS technologies for tracker detectors

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Tracing the Perseus spiral arm in the anticenter direction

Author: Maria Monguió
Supervisor/s: Francesca Figueras; Preben Grosbøl (ESO, Garching)
Institution: Universitat de Barcelona
Defense date: 22/11/2013

Cosmological perturbations including matter loops: A study in de Sitter

Author: Markus B. Fröb
Supervisor/s: Enric Verdaguier, Albert Roura
Institution: Universitat de Barcelona
Defense date: 09/12/2013

Study of adaptative optics images by means multiscalar transforms

Author: Roberto Baena
Supervisor/s: Jorge C. Núñez
Institution: Universitat de Barcelona
Defense date: 09/12/2013

Ongoing theses

Development of a multichannel integrated circuit for Silicon Photo-Multiplier arrays readout

Author: Albert Comerma
 Supervisor/s: David Gascón, Atilà Herms
 Institution: Universitat de Barcelona
 Tentative defense date: January 2014

Non-mesonic weak decay of hypernuclei in effective field theory

Author: Axel Pérez-Obiol
 Supervisor/s: Assumpta Parreño, Bruno Julià
 Institution: Universitat de Barcelona
 Tentative defense date: February 2014

Gamma ray emission from young stellar massive stars

Author: Pere Munar
 Supervisor/s: Josep M^a Paredes
 Institution: Universitat de Barcelona
 Tentative defense date: March 2014

Fuerzas a tres cuerpos con funciones de Green autoconsistentes

Author: Arianna Carbone
 Supervisor/s: Artur Polls, Arnau Ríos (University of Surrey)
 Institution: Universitat de Barcelona
 Tentative defense date: April 2014

Contribució dels grups mòbils a la modelització del potencial galàctic: Avançant cap a l'explotació científica de GAIA

Author: Santiago Roca
 Supervisor/s: Francesca Figueras
 Institution: Universitat de Barcelona
 Tentative defense date: September 2014

On the origin of masses at the LHC

Author: Juan González Fraile
 Supervisor/s: M^a Concepción González-García
 Institution: Universitat de Barcelona
 Tentative defense date: September 2014

Symmetry breaking and its restoration in QCD. Hadron physics in extreme conditions

Author: Xumeu Planells
 Supervisor/s: Domènec Espriu
 Institution: Universitat de Barcelona
 Tentative defense date: September 2014

Applications of Supersymmetry: Exact Results, Gauge/Gravity Duality and Condensed Matter

Author: Alejandro Barranco
 Supervisor/s: Jorge Russo
 Institution: Universitat de Barcelona
 Tentative defense date: October 2014

100.000 espectros de cúasars y perturbaciones primordiales

Author: Andreu Ariño
 Supervisor/s: Jordi Miralda-Escudé
 Institution: Universitat de Barcelona
 Tentative defense date: October 2014

Caracterización de estrellas con planetas extrasolares

Author: Enrique Herrero
 Supervisor/s: Carme Jordi, Ignasi Ribas
 Institution: Universitat de Barcelona
 Tentative defense date: October 2014

An absolute stellar luminosity atlas

Author: Max Palmer
 Supervisor/s: Xavier Luri, Eduard. Masana, Frederic Arenou (Observatoire de Paris)
 Institution: Universitat de Barcelona
 Tentative defense date: Autumn 2014

Física del sabor e incertidumbres hadrónicas

Author: Albert Renau
 Supervisor/s: Federico Mescia
 Institution: Universitat de Barcelona
 Tentative defense date: January 2015

Modelització de sistemes fortament acoblats mitjançant la dualitat entre teoria de camps i gravetat

Author: Blai Garolera
 Supervisor/s: Tomeu Fiol
 Institution: Universitat de Barcelona
 Tentative defense date: March 2015

Very-low frequency and gamma-ray emission of gamma-ray binaries and transient sources

Author: Benito Marcote
 Supervisor/s: Josep M^a Paredes
 Institution: Universitat de Barcelona
 Tentative defense date: September 2015

Dinámica efectiva de agujeros negros y branas negras

Author: Adriana Di Dato
 Supervisor/s: Roberto Emparan
 Institution: Universitat de Barcelona
 Tentative defense date: September 2015

tba

Author: Daniel Pablos
 Supervisor/s: Jorge Casalderrey
 Institution: Universitat de Barcelona
 Tentative defense date: September 2015

Radiative B decays at LHCb

Author: Vicente Rives
 Supervisor/s: Hugo Ruiz
 Institution: Universitat de Barcelona
 Tentative defense date: November 2015

Disseny d'algoritmes de control per posicionadors multiobjectes per instrumentació de telescopis terrestres

Author: Pablo Oriol Bitaubé
 Supervisor/s: Josep M. Gómez-Cama, Jordi Torra
 Institution: Universitat Politècnica de Catalunya
 Tentative defense date: December 2015

Strongly correlated states and exotic phases in quantum many-body systems

Author: Mauricio Mariño
 Supervisor/s: Sofyan Iblisdir (Co-advisor: J. Ignacio Latorre)
 Institution: Universitat de Barcelona
 Tentative defense date: 2015

Nonlinear procedures applied to formation flight strategies for spacecrafts

Author: Fabrizio Paita
 Supervisor/s: Gerard Gómez, Josep J. Masdemont (UPC)
 Institution: Universitat Politècnica de Catalunya
 Tentative defense date: 2015

Mecanismes dinàmics de transport i agregació de massa en el Sistema Solar

Author: Daniel Pérez
 Supervisor/s: Gerard Gómez
 Institution: Universitat de Barcelona
 Tentative defense date: 2015

Moving groups and Dynamical Galaxy Model

Author: Hoda Abedi
 Supervisor/s: Francesca Figueras, Luís A. Aguilar (UNAM)
 Institution: Universitat de Barcelona
 Tentative defense date: 2015

High performance computing of massive Astrometry and Photometry data from Gaia

Author: Javier Castañeda
 Supervisor/s: Claus V. Fabricius; Jordi Torra
 Institution: Universitat de Barcelona
 Tentative defense date: 2015

Contaminació lumínica

Author: Salvador Ribas
 Supervisor/s: Francesca Figueras, Jordi Torra
 Institution: Universitat de Barcelona
 Tentative defense date: 2015

tba

Author: Marina Martínez
 Supervisor/s: Roberto Emparan
 Institution: Universitat de Barcelona
 Tentative defense date: June 2016

Meson-Baryon interactions in free space and in the medium from effective Chiral Lagrangians

Author: Albert Feijoo
 Supervisor/s: Volodymyr Magas, Angels Ramos
 Institution: Universitat de Barcelona
 Tentative defense date: July 2016

Interaction of relativistic winds from young pulsars with circumstellar envelopes in gamma-ray binaries

Author: Xavier Paredes
 Supervisor/s: Marc Ribó, Valentí Bosch-Ramon
 Institution: Universitat de Barcelona
 Tentative defense date: October 2016

Coupling fluid-dynamics and non-thermal processes to study sources of high energy emission

Author: Víctor Moreno
 Supervisor/s: Valentí Bosch-Ramon
 Institution: Universitat de Barcelona
 Tentative defense date: October 2016

Estudi de sistemes fortament acoblats mitjançant holografia

Author: Genís Torrents
 Supervisor/s: Tomeu Fiol
 Institution: Universitat de Barcelona
 Tentative defense date: 2016

Estudi de la polarització del fotó en desintegracions radiatives d'hadrons B amb el detector LHCb

Author: Carla Marín
 Supervisor/s: Ricardo Graciani, Lluís Garrido
 Institution: Universitat de Barcelona
 Tentative defense date: September 2017

Lyman- α autocorrelation, small scales structures and fluctuations of the radiation background

Author: Satya Gontcho A Gontcho
 Supervisor/s: Jordi Miralda-Escudé
 Institution: Universitat de Barcelona
 Tentative defense date: Fall 2017

tba

Author: Ignasi Pérez Ràfols
 Supervisor/s: Jordi Miralda-Escudé
 Institution: Universitat de Barcelona
 Tentative defense date: 2017

Estudi espectroscòpic de cúmuls oberts per a l'anàlisi de la metal·licitat de la galàxia

Author: Laia Casamiquela
 Supervisor/s: Carme Jordi, Dolores Balaguer-Núñez, Ricardo Carrera (IAC)
 Institution: Universitat de Barcelona
 Tentative defense date: 2017

Super-resolució de imàgenes astronòmiques y teledetecció

Author: M^a Teresa Merino
 Supervisor/s: Jorge C. Núñez
 Institution: Universitat de Barcelona

Properties of WDM Halos

Author: Enric Juan

Supervisor/s: Eduard Salvador-Solé
 Institution: Universitat de Barcelona

tba

Author: Zubin Philip Olikara
 Supervisor/s: D. Scheeres
 Institution: Universitat de Colorado a Boulder

tba

Author: Lluís Mas
 Supervisor/s: Jordi Miralda-Escudé
 Institution: Universitat de Barcelona

tba

Author: Daniel Galindo
 Supervisor/s: Roberta Zanin
 Institution: Universitat de Barcelona

tba

Author: Aldo Dector
 Supervisor/s: Jorge Russo
 Institution: Universitat de Barcelona

MASTER THESES***Alignment of the Scintillator Pad Detector from the LHCb experiment at CERN***

Author: César Redón
 Supervisor/s: Ricardo Graciani
 Defense date: 09/01/2013

Primordial nucleosynthesis versus LHC constraints on Z' properties

Author: Ana Solaguren-Beascoa
 Supervisor/s: M.C. González-García
 Defense date: 09/01/2013

Cluster and target selection in Gaia-ESO Survey

Author: Ramon Padullés
 Supervisor/s: Carme Jordi, Dolores Balaguer-Núñez
 Defense date: 18/01/2013

Dust extinction in distant galaxies

Author: Emin Karabal
 Supervisor/s: Alberto Manrique
 Defense date: 18/01/2013

Optical photometric monitoring of gamma-ray binaries

Author: Xavier Paredes
 Supervisor/s: Marc Ribó
 Defense date: 18/01/2013

Acoblaments del camp de Higgs en el lagrangia efectiu electrofeble

Author: Jordi Borràs
 Supervisor/s: Domènec Espriu
 Defense date: 27/06/2013

 $B \rightarrow \omega$ gamma and $B \rightarrow \phi$ gamma event selection in LHCb

Author: Carla Marín
 Supervisor/s: Ricardo Graciani
 Defense date: 27/06/2013

Energy resolution analysis of the multi APD readout in an HPTPC-Xe

Author: Alfonso García
 Supervisor/s: Lluís Garrido
 Defense date: 27/06/2013

Study of $b \rightarrow s$ transitions in the decays $B \rightarrow K\ell\ell$ and $B \rightarrow K\nu\nu$

Author: Adrià Gómez Valent
Supervisor/s: Federico Mescia
Defense date: 27/06/2013

Assessing the accuracy in exoplanets' transit parameter estimation using two fitting algorithms: optimized Box Least Squares and a Wavelet-Based method

Author: Laura Ruiz
Supervisor/s: Jorge Núñez, Octavi Fors
Defense date: 08/07/2013

Canonical halo mass definition and universal mass function

Author: Guillem Domènech
Supervisor/s: Eduard Salvador
Defense date: 08/07/2013

On the path of transiting Earths in the Habitable Zone of White Dwarfs. An approach from Telescope Fabra ROA at Montsec (TFRM)

Author: Albert Rosich
Supervisor/s: Jorge Núñez, Octavi Fors
Defense date: 08/07/2013

Solar Energetic Particle Event Selection for Simulation-based analyses with SEPServer

Author: M. Montserrat Subirà
Supervisor/s: Neus Àgueda
Defense date: 08/07/2013

Strömgren photometry to derive physical parameters of stars

Author: Laia Casamiquela
Supervisor/s: Carme Jordi, Dolores Balaguer-Núñez
Defense date: 08/07/2013

The cross-correlation of MgII absorption and galaxies in BOSS

Author: Ignasi Pérez
Supervisor/s: Jordi Miralda
Defense date: 09/09/2013

A Bayesian approach to open cluster distance determination

Author: Max Palmer
Supervisor/s: Xavier Luri
Defense date: 09/09/2013

An assessment of the current kinematic models for the galactic disk

Author: Alba Fernández
Supervisor/s: Francesca Figueras
Defense date: 09/09/2013

Estudi de l'eix d'oscil·lació vertical del cinturó de Gould

Author: Maria Àngela Rossell
Supervisor/s: Francesca Figueras
Defense date: 09/09/2013

Evolution of nuclear obscuration in active galactic nuclei

Author: Víctor Moreno
Supervisor/s: Kazushi Iwasawa
Defense date: 09/09/2013

Modeling dust absorption of high-redshift galaxies

Author: Daniel Pacheco
Supervisor/s: Alberto Manrique
Defense date: 09/09/2013

Reflectance properties of asteroids and meteorites: testing Gaia's spectral capabilities for asteroid taxonomic classification purposes

Author: Jordi Cortés
Supervisor/s: Xavier Luri, Josep M. Trigo-Rodríguez
Defense date: 09/09/2013

Statistical Validations for GOG Simulations

Author: Horacio Baquero
Supervisor/s: Xavier Luri
Defense date: 09/09/2013

The TFRM-PSES survey: error analysis and preliminary observational results

Author: Daniel del Ser
Supervisor/s: Jorge Núñez, Octavi Fors
Defense date: 09/09/2013

A few exactly solvable examples of Feshbach resonances

Author: Roc Aràjol
Supervisor/s: Josep Taron
Defense date: 12/09/2013

Astroparticle physics with neutrino telescopes

Author: Andrea Rodríguez
Supervisor/s: M.C. González-García
Defense date: 12/09/2013

Corrections to the Higgs-Goldstone bosons interactions

Author: Maria Jorba
Supervisor/s: Domènec Espriu
Defense date: 12/09/2013

Critical phenomena in gravitational collapse in different scenarios

Author: Daniel Santos
Supervisor/s: Roberto Emparan
Defense date: 12/09/2013

Long term burn-in tests of IBL 3D pixel modules

Author: Ivan López
Supervisor/s: Eugeni Graugés
Defense date: 12/09/2013

Neutralino dark matter, implications of the 125 GeV Higgs Boson measured at the LHC

Author: Óscar Frias
Supervisor/s: Joan Solà
Defense date: 12/09/2013

Passing the boundary between the parity breaking medium and vacuum by vector particles

Author: Sergey Kolevatov
Supervisor/s: Domènec Espriu
Defense date: 12/09/2013

Phenomenology of the Standard Model Higgs

Author: Marc Riembau Saperas
Supervisor/s: Jaume Guasch Inglada
Defense date: 12/09/2013

Tidal force singularity of gravitational shock waves in asymptotically AdS5

Author: Daniel Farré
Supervisor/s: David Mateos
Defense date: 12/09/2013

Baryon-baryon-meson couplings for the weak decays of the negative cascade hyperon in the medium

Author: Jordi Maneu
Supervisor/s: Assumpta Parreño
Defense date: 14/11/2013

Magnetic susceptibility of neutron matter

Author: Victòria Durant
Supervisor/s: Artur Polls
Defense date: 14/11/2013

Strong decay of the $\Psi(3770)$ in dense matter

Author: Víctor López
Supervisor/s: Àngels Ramos, Laura Tolós (ICE)
Defense date: 14/11/2013

ACTIVITIES

ICCUB COLLOQUIA

Each year the ICCUB hosts a number of seminars and colloquia to foster collaboration among its members and with the rest of the scientific community.

The ICCUB Colloquium Series are organized each year by the Colloquia Commission and consist of institute-wide talks given by invited speakers. These talks are directed to a diverse audience, including not only ICCUB members and external researchers but also graduate students.

Colloquia Commission

- Bartomeu Fiol
- Bruno Julià
- Federico Mescia
- Paolo Padoan

2013 ICCUB Colloquia

Anders Johansen (Lund Observatory, Sweden)
Formation of planets around the Sun and other stars
14/01/2013

David Kirkby (University of California, Irvine)
Baryon Acoustic Oscillations in the Lyman- α forest of BOSS quasars
14/03/2013

Joan Solà (ICCUB)
Subtle is the Lord: Higgs bosons, vacuum energy and the cosmological constant problem, three fundamental puzzles of our Universe. Three rings in one?
16/04/2013

Wolfram Weise (ECT Trento, TU München)
Phases of Strongly Interacting Matter - from quarks and gluons to atomic nuclei and neutron stars
22/04/2013

Misao Sasaki (Yukawa I. for Theoretical Physics, Kyoto University)
Inflation and cosmological perturbations (from fantasy to precision cosmology)
08/05/2013

Urs Wiedemann (CERN)
The Standard Model of Relativistic Heavy Ion Collisions
13/05/2013

Peter Goldreich (California Institute of Technology & Institute for Advanced Study)
Reading the record of ancient impacts
28/10/2013

Mark Heyer (University of Massachusetts, Amherst)
Imaging the molecular interstellar medium of the Milky Way
04/11/2013

Harald Fritzsch
(NITheP, Ludwig-Maximilians-Universität & Visiting Professor with the BKC excellence program.)
History of Quantum Chromodynamics
25/11/2013

SEMINARS

Seminars are more specialized talks given by either ICCUB members or visitors.

We distinguish those seminars organized directly by the institute (ICCUB Seminars), and group seminars organized in collaboration with UB departments: High Energy Physics Group (HEP), Atomic, Molecular and Nuclear Physics Group (FAN) and Department of Astronomy and Meteorology (DAM).

2013 Seminars

Rafael Ballabriga (CERN)

Medipix 3: un chip de 65K píxels per lectura de detectors semiconductors per imatge de rajos X
07/01/2013

Girish Kulkarni (Max-Planck-Institut für Astronomie)

Chemical enrichment of Damped Lyman- α systems as a direct constraint on Population III star formation
14/02/2013

Marcel Vos (IFIC, València)

Tools for discovery: detector R&D for collider experiments
17/04/2013

Carlos Hernández Monteagudo (Centro de Estudios de Física del Cosmos de Aragón)

Using Planck's secondary temperature anisotropies of the Cosmic Microwave Background to constrain Dark Energy
06/05/2013

Jordi Casanellas (CENTRA, Physics Dep. Instituto Superior Técnico Lisbon, Portugal)

Stars as cosmological tools: from dark matter to modified gravity
16/05/2013

Claudio Llinares (Univ. of Oslo)

Shape of clusters of galaxies as a probe of screening mechanisms in modified gravity
16/09/2013

Carlos Peña-Garay (IFIC, València)

Searching for Dark Matter with radiotelescopes
19/09/2013

Layne Price (Univ. of Auckland)

Multifield Inflation: initial conditions and predictions
26/09/2013

Subodh Patil (CERN)

Correlating features in the primordial spectra, or, what was the inflaton?
09/10/2013

Luca Salasnich (Univ. Padova)

Condensate fraction in ultracold Fermi atoms and in neutron matter
FAN Seminar
09/01/2013

Leonardo Modesto (Fudan Univ., China)

Finite quantum gravity and M-theory
HEP Seminar
10/01/2013

Leo Patiño (UNAM, Mexico)

Brighter branes, a consequence of anisotropy
HEP Seminar
17/01/2013

Eduardo Guendelman (Ben Gurion Univ., Israel)

Stabilizing scale invariant and tachyonic theories in a two measures framework and dark energy-dark matter unification
HEP Seminar
21/01/2013

Pablo G. Camara (ICCUB)

The NMSSM with F-theory unified boundary conditions
HEP Seminar
22/01/2013

Alessandro Lovato (Argonne National Laboratory)

Weak response of cold symmetric nuclear matter at three-body cluster level
FAN Seminar
22/01/2013

David d'Enterria (CERN & ICCUB)

Photons and diphotons at the LHC: QCD, Higgs and searches of new physics
HEP Seminar
25/01/2013

Diego Rodríguez Gómez (Univ. de Oviedo)

5d gauge and their AdS(6) duals

HEP Seminar

31/01/2013

Ikuo Sogami (Maskawa Institute, Kyoto)

Multi-Spinor Field Theory for Extended Standard Model

HEP Seminar

04/02/2013

Daniel Fernández (ICCUB)

New transport properties of holographic superfluids

HEP Seminar

08/02/2013

Pedro Labraña (Biobio Univ., Chile & ICCUB)

Emergent Universe by Tunneling

HEP Seminar

14/02/2013

Arkady Tseytlin (Imperial College)

Wilson loops T-dual to Short Strings

HEP Seminar

15/02/2013

Konstantin Zarembo (NORDITA, Stockholm)

Applied localization

HEP Seminar

21/02/2013

Tomeu Fiol (ICCUB)

Probing Conformal Field Theories

HEP Seminar

22/02/2013

Arnau Ríos (Univ. Surrey)

Why is lead so kinky?

FAN Seminar

26/02/2013

Diederik Roest (Univ. of Groningen)

The periodicity of maximal supergravity

HEP Seminar

28/02/2013

Sofyan Iblisdir (ICCUB)

Classical Ising models realised in optical lattices

HEP Seminar

01/03/2013

Federico Mescia (ICCUB)

b → s transitions and Lattice QCD

HEP Seminar

07/03/2013

Jean-Francois Schaff (TU Wien)

Integrated Mach-Zehnder interferometer with Bose-Einstein condensates

FAN Seminar

07/03/2013

Pere Munar-Adrover (ICCUB)

High-energy emission from protostars

DAM Seminar

08/03/2013

Antonio Pich (IFIC, Univ. Valencia)

LHC and flavour constraints on two-Higgs doublet models

HEP Seminar

08/03/2013

Josep M. Pons (ICCUB)

Palatini formalism, Levi-Civita truncations and Lovelock gravities

HEP Seminar

15/03/2013

Misao Sasaki (Kyoto Univ.)

Violating non-Gaussianity consistency relation in single field inflation

HEP Seminar

22/03/2013

Josep Llosa (ICCUB)

Ricci collineations

HEP Seminar

22/03/2013

Juan Rojo (CERN)

Parton Distributions in the Higgs Boson Era

HEP Seminar

02/04/2013

Prem Kumar (Swansea Univ.)

Thermodynamics of higher spin black holes in AdS₃

HEP Seminar

04/04/2013

J. A. Oller (Univ. Murcia)

Nucleon-Nucleon scattering from the dispersive N/D method: Next-to-leading study

FAN Seminar

09/04/2013

Kentaro Tanabe (ICCUB)

Large D gravity

HEP Seminar

11/04/2013

Raúl Arias (Univ. La Plata)

Quantum correction to Wilson loops

HEP Seminar

12/04/2013

Patrick Peter (IAP France)

The anisotropy problem in a regular bounce

HEP Seminar

18/04/2013

J. Gillet (Univ. Okinawa)

Tunneling, self trapping and manipulation of higher modes of a BEC in a double well

FAN Seminar

18/04/2013

Alessio Notari (ICCUB)

CMB distortions due to our peculiar motion and its consequences for the Planck satellite observations

HEP Seminar

19/04/2013

J.M. Torres-Rincon (IEEC-UAB)

Heavy flavor diffusion in a hot hadronic gas

FAN Seminar

25/04/2013

Eugeni Graugés (ICCUB)

Testing the SM with Rare decays @ the LHCb

HEP Seminar

26/04/2013

Marta Abad (BEC / Univ. Trento)

A study of coherently coupled two-component condensates

FAN Seminar

30/04/2013

Giovanni Villadoro (ICTP)

To Split or Not To Split

HEP Seminar

03/05/2013

Rodrigo Alonso (Univ. Autónoma de Madrid)

Non-linear electroweak symmetry breaking with a light Higgs

HEP Seminar

09/05/2013

Enric Verdaguer (ICCUB)

Semiclassical stability of de Sitter spacetime

HEP Seminar

10/05/2013

Alexandros Kechagias (NTUA, Athens)

The Standard Model of Relativistic Heavy Ion Collisions

HEP Seminar

16/05/2013

José Edelstein (Santiago de Compostela Univ.

& CECS Valdivia)

Lovelock theory and AdS/CFT

HEP Seminar

17/05/2013

Oriol Pujolas (IFAE)

Emergent Lorentz Invariance from Strong Dynamics

HEP Seminar

24/05/2013

Phil Cole (Univ. Idaho, USA)

Nucleon Resonance Structure from Exclusive

Meson Electroproduction

FAN Seminar

24/05/2013

Daniel Watts (Univ. Edinburgh)

Illuminating the neutron skin

FAN Seminar

27/05/2013

Anastasios Taliotis (Vrije Univ. &

Intl. Solvay Inst., Brussels)

Black holes and fireballs at the LHC

HEP Seminar

30/05/2013

Daniel Grumiller (Vienna Univ.)

Cosmic phase transition of flat space in three dimensions

HEP Seminar

06/06/2013

J.M. Torres-Rincon (IEEC-UAB)

Heavy flavor diffusion in a hot hadronic gas

FAN Seminar

06/06/2013

Joaquim Gomis (ICCUB)

Exotic particles in AdS3

HEP Seminar

07/06/2013

Rafael Sorkin (Perimeter Institute)

A formula for the entropy of a spacetime region

HEP Seminar

13/06/2013

Gabriela Vila (IAR - CONICET)

Radiative models for jets in X-ray binaries

DAM Seminar

18/06/2013

Veselin Filev (Dublin Inst., Ireland)

Magnetic Catalysis in compact spaces

HEP Seminar

20/06/2013

R. Bishop (Feenberg Medal, Univ. Manchester)

Confronting the quantum many-body problem: an overview of the coupled cluster method and its applications in physics

FAN Seminar

20/06/2013

Nan Su (Bielefeld Univ.)

Stabilizing Perturbative Yang-Mills Free Energy with Gribov Quantization

HEP Seminar

25/06/2013

Albert Ferrando (Univ. Valencia)

Symmetry in linear and nonlinear waves

FAN Seminar

27/06/2013

Thomas Busch (Okinawa Inst. of Science and Technology)

Ultracold Atoms and Optical Nano-fibres

FAN Seminar

04/07/2013

José Daniel Madrigal (Univ. Autónoma de Madrid)

QCD and $N=4$ SYM in the high-energy limit and the effective action approach

HEP Seminar

05/07/2013

Jennifer Nebreda (Univ. Complutense de Madrid)

One and two-loop ChPT low energy constants from π - π scattering threshold parameters

FAN Seminar

11/07/2013

Gustavo E. Romero (IAR - CONICET)

Gamma-ray burst as sources of neutrinos and gravitational waves

DAM Seminar

18/07/2013

Marios Karouzos (Center for the Exploration of the Origin of the Universe, Seoul National University Research Institute)

The interesting lives of radio-AGN: their environment and host galaxies

DAM Seminar

30/07/2013

Raju Vegunopalan (Brookhaven National Laboratory)

Discovery of a turbulent attractor in an off-equilibrium strongly correlated non-Abelian plasma

HEP Seminar

06/09/2013

Micha Berkooz (Weizmann Institute)

A strongly coupled Zig-Zag transition

HEP Seminar

19/09/2013

Xavier Roca-Maza (Univ. Milano, INFN Milano)

Unraveling the dependence of the Electric Dipole Polarizability on the isovector properties of the nuclear effective interaction

FAN Seminar

19/09/2013

Craig McNeile (Wuppertal Univ.)

Using lattice QCD to search for novel bound states in QCD

HEP Seminar

20/09/2013

Stefan Vandoren (Utrecht Univ.)

Phase transitions of magnetic AdS4 black holes with scalar hair

HEP Seminar

26/09/2013

Kishor Kumar (Bharathidasan Univ., India)

Study on the properties of dipolar Bose-Einstein condensates from mean-field description

FAN Seminar

01/10/2013

Diego Guadagnoli (LAPTh Annecy)

Hot topics in heavy-flavor physics

HEP Seminar

03/10/2013

Poul H. Damgaard (Bohr Institute, Copenhagen)

Lattice Simulations of $N=4$ Super Yang-Mills Theory

HEP Seminar

10/10/2013

Takahiro Tanaka (Kyoto Univ.)

Graviton Oscillation in a viable bigravity model

HEP Seminar

11/10/2013

Christiana Pantelidou (Imperial College)

p-wave superconductors and spatial modulation

HEP Seminar

17/10/2013

J.I. Latorre (ICCUB)

Tensor Networks get frustrated

HEP Seminar

18/10/2013

Jay Armas (Univ. of Bern)

Hydrodynamics on Embedded Surfaces and Black Hole Elasticity

HEP Seminar

21/10/2013

Eric Bergshoeff (Groningen Univ.)

Newton-Cartan Supergravity

HEP Seminar

23/10/2013

Ines Aniceto (Lisboa IST)

Resurgent Analysis in Quantum Theories:

Perturbative Theory and Beyond

HEP Seminar

24/10/2013

Albert Bosma (Laboratoire d'Astrophysique de Marseille
(CNRS-INSU, Université d'Aix-Marseille))

*Recent results from the Spitzer Survey of Stellar Structure
in Galaxies (S4G)*

DAM Seminar

31/10/2013

Valeri Frolov (Univ. of Alberta)

Charged particle motion in magnetized black holes

HEP Seminar

07/11/2013

Tobias Grass (ICFO)

Topological states of bosons with spin in an external gauge field

FAN Seminar

07/11/2013

Joaquim Matias (UAB)

*$B \rightarrow K^*l+l-$ a portal for New Physics?*

HEP Seminar

08/11/2013

Dmitry Vlasenko

(Bogoliubov Laboratory, Dubna)

On the amplitudes in $N=(1,1)$ $D=6$ SYM

HEP Seminar

14/11/2013

Harald Fritzsch (LMU Munich)

Composite Weak Bosons and the New Boson at the LHC

HEP Seminar

14/11/2013

Joan Solà (ICCUB)

Fundamental "Constants" and Vacuum Energy

HEP Seminar

15/11/2013

Jegors Korovins (Amsterdam Univ.)

Lifshitz as a continuous deformation of Anti-de Sitter

HEP Seminar

21/11/2013

Àngels Ramos (ICCUB)

*Interaction of vector mesons with baryons: role
of coupled-channels and resonances*

FAN Seminar

21/11/2013

Niall Macpherson (Swansea U.)

Non-abelian T-duality and Holography

HEP Seminar

28/11/2013

Johannes Bergström (ICCUB)

Bayesian inference and applications to neutrino physics

HEP Seminar

29/11/2013

Gennaro Corcella (INFN Frascati)

*Bottom Fragmentation in Top Decays and Impact
on the Top Mass Reconstruction*

HEP Seminar

05/12/2013

Andrzej A. Zdziarski (Centrum Astronomiczne im. M. Kopernika, Warszawa, Poland)
Contribution from jets and accretion to broad-band spectra of black-hole binaries
 DAM Seminar
 11/12/2013

M. Concepción González-García (ICCUB)
Effective lagrangians for Higgs Analysis
 HEP Seminar
 12/12/2013

Jaume Garriga (ICCUB)
Schwinger effect in de Sitter space
 HEP Seminar
 13/12/2013

Kostas Skenderis (Southampton)
Towards holography for asymptotically flat spacetimes
 HEP Seminar
 18/12/2013

EVENT ORGANIZATION

Zanin, R.; Paredes, J.M.
 Participation in the organizing committee
3rd MAGIC Stereo Software School
 Faculty of Physics, UB
 21/01/2013–25/01/2013

Paredes, J.M.; Bosch-Ramon, V.
 Participation in the organizing committee
Workshop on variable galactic gamma-ray sources
 Faculty of Physics, UB
 16/04/2013–18/04/2013

Luri, X.; Jordi, C.; Figueras, E; Torra, J.; Fabricius, C.; Masana, E.; Carrasco, J.M.; Romero-Gómez, M.; Balaguer-Núñez, D.
 Organizing committee
Gaia CU9 Access Catalogue Kick Off Meeting in Barcelona
 Faculty of Physics, UB
 03/06/2013–04/06/2013

Ribó, M.
 Participation in the organizing committee
CTA Calibration Meeting
 Faculty of Physics, UB
 23/07/2013 – 25/07/2013

Ribó, M.
 Participation in the organizing committee
MAGIC Galactic meeting 2013
 Faculty of Physics, UB
 12/09/2013 – 13/09/2013

Ribó, M.
 Participation in the organizing committee

CTA NectarCAM F2F Meeting
 Faculty of Physics, UB
 17/09/2013 – 19/09/2013

Andrianov, A.; Espriu, D.
 Participation in the organizing committee
I Russian-Spanish Congress. Particle and Nuclear Physics at all scales, Astroparticle Physics and Cosmology
 Saint Petersburg Scientific Center, Russian Academy
 01/10/2013 – 04/10/2013

Ribó, M.
 Organization
MAGIC Cycle 9 TAC meeting
 Faculty of Physics, UB
 08/10/2013 – 10/10/2013

Mescia, E; Pujolas, O.
 Participation in the organizing committee
13a Trobada de Nadal de Física Teòrica
 Faculty of Physics, UB
 18/12/2013 – 19/12/2013

At other institutions

Jordi, C.; Figueras, E; Torra, J.; Balaguer-Núñez, D.
 Participation in the organizing committee
III Reunión de la Red Española Gaia
 Sitges, Barcelona
 23/01/2013 – 25/01/2013

Iblisdir, S.

Principal organiser
*Benasque Symposium on Topological Quantum
 Information*
 Centro de Ciencias de Benasque Pedro Pascual, Spain
 12/02/2013 – 16/02/2013

Julià-Díaz, B.

Presidence of the organizing committee
Half day meeting on ultracold atoms @BCN
 Barcelona
 13/03/2013 – 13/03/2013

Miralda-Escudé, J.

Chair of the Scientific Organizing Committee
*Cosmo-RENATA 2013 Spanish Cosmology
 Surveys Conference*
 IFIC, Universitat de València
 03/06/2013 – 05/06/2013

Paredes, J.M.

Participation in the scientific organizing committee
*The Innermost Regions of Relativistic Jets and
 Their Magnetic Fields*
 Hotel Nazaries (Granada)
 10/06/2013 – 14/06/2013

Verdaguer-Oms, E.

Member of the organizing committee
*Peyresq Physics-18 International Workshop:
 “Micro and Macro Structure of Spacetime”*
 Peyresq, Alpes de Haute-Provence (France)
 15/06/2013 – 21/06/2013

Paredes, J.M.

Participation in the organizing committee
Spanish X-ray Astronomy 2013
 Residencia de Investigadores, Barcelona
 17/06/2013 – 19/06/2013

Emparan, R.

Organizer of the conference
Gravity - New perspectives from strings and higher dimensions
 Centro de Ciencias de Benasque
 Pedro Pascual
 14/07/2013 – 26/07/2013

Paredes, J.M.

Participation in the organizing scientific committee
*4th High Energy Phenomena in Relativistic
 Outflows (HEPRO IV)*
 Max Planck Haus Heidelberg, Germany
 23/07/2013 – 26/07/2013

Verdaguer-Oms, E.; Garriga, J.; Emparan, R.

Organizing committee secretariat
Spanish-Portuguese Relativity meeting 2013
 Centro de Ciencias de Benasque Pedro Pascual, Spain
 08/09/2013 – 13/09/2013

Mateos, D.

Participation in the organizing committee
*International Conference on the Initial Stages in
 High-Energy Nuclear Collisions (IS2013)*
 Hotel Louxo, Galicia
 08/09/2013 – 14/09/2013

Solà, J.

Member of the organizing committee
*International Advisory Committee of the 11th International
 Symposium on Radiative Corrections (RADCOR 2013)*
 Univ. of Durham, England
 22/09/2013 – 27/09/2013

Latorre, J.I.

Participation in the organizing committee
Quantum Simulations
 Centro de Ciencias de Benasque Pedro Pascual, Spain
 29/09/2013 – 04/10/2013

PUBLIC OUTREACH

The divulgation activities organized by the ICCUB in 2013 were highly influenced, by the launch of the Gaia satellite the last 19th of December. Gaia researchers and engineers at ICCUB have been very active creating an exhibition, an iPhone App, a calendar, several brochures, some videos, a webpage, a giant placard and giving many public talks (see below for detailed information).

Moreover, the ICCUB has continued with the organization of two activities of some tradition at the institute: the Masterclass on Particle Physics and two projects from the program CiMs-Cellex. Other activities conducted by different ICCUB members do not lack of relevance and their details appear in the following lines.

Courses and Workshops

Masterclass on Particle Physics 2013

The *Masterclass on Particle Physics*, known in Catalonia as *Taller de Física de Partícules*, is an activity aimed at students from the second course of baccalaureate. It is part of the international program *Hands on Particle Physics*, organized by the International Particle Physics Group (IPPOG).

The workshop, which has been held at the University of Barcelona since 2005, lasts one day, during which students attend to several talks about particle physics and they have the opportunity of studying real data from the LHC. During the day there is also a presentation about the degrees offered by the UB at the Faculty of Physics and, additionally, it is possible to visit the laboratories.

This year 2013, the workshop has been held two times, on the 7th and the 13th of March, and 160 students from 150 catalan high schools have attended.

Web: <http://www.lhc.cat/taller.php>

CiMs-CELLEX Program

The CiMs-Cellex is a scholarship program offered by the private foundation Cellex intended for giving to young students with strong motivation on the fields of mathematics and fundamental sciences the chance of coursing the two years of the International Baccalaureate



MASTECLASS ON PARTICLE PHYSICS 2013

Talk given the 7th of March in the Physics Faculty, in the context of the Masterclass on Particle Physics

in two Catalan institutes with well-known reputation for their high academic standards. The CiMs-Cellex program includes stays in some research centers, such as the ICCUB.

This year 2013 the ICCUB received 6 students within the framework of the two projects “Introduction to Theoretical Physics: Quarks, Black holes, Cosmology and Strings”, (from the 8th of June to the 2nd of July) and “Discovering Particle Physics” (from the 23th of June to the 2nd July).

The biggest scientific instrument ever built

Course developed in the framework of the CERN exhibition *The biggest scientific instrument ever built*, held at CosmoCaixa. The talks were addressed to baccalaureate teachers and were focused on learning methods by research procedures. There were held also divulgation sessions on topics related with Particle Physics.

Organizer from ICCUB: H. Ruiz

What is the Universe made of? Introduction to particle physics and cosmology.

ICCUB-IFAE-UAB-Fundació La Caixa Collaboration.
Organizer from ICCUB: H. Ruiz

Editions:

- CosmoCaixa (Barcelona), 08/10/2013–26/11/2013
- CaixaForum (Lleida), 05/11/2013–03/12/2013

Exhibitions

A thousand million eyes for a thousand million stars

Balaguer-Núñez, D.; Figueras, F.; Jordi, C.; Masana, E.; Olarte, B.

An itinerant exhibition about the Gaia mission consisting of 14 information boards has been edited and printed both in Catalan and Spanish.

<http://serviastro.am.ub.edu/twiki/bin/view/ServiAstro/ExpoGaia>

Itinerary in 2013 of the Catalan version:

- Universitat d'Alacant, February-March of 2013.
- Escola d'Enginyeria, UPC, Terrassa, 17/02/2013-03/03/2013.
- Escola Mestral, Igualada, 01/05/2013-13/05/2013.
- Sant Cugat, 18/05/2013-16/06/2013.
- Physics Faculty, Barcelona, December 2013.
- Biblioteca Dos Rius, Torelló, 15/11/2013-24/11/2013.
- Institut Icària, Barcelona, 24/10/2013-11/11/2013.
- INS Secretari Coloma, Barcelona, 23/09/2013-23/10/2013.
- Centre d'Observació de l'Univers, Parc Astronòmic del Montsec, Àger, 01/07/2013-15/09/2013.

Itinerary in 2013 of the Spanish version:

- Faculty of Sciences, Universidad de Granada, 18/11/2013-30/11/2013.
- Universidad Complutense de Madrid, 15/12/2013-15/01/2014.

The biggest scientific instrument ever built

This exhibition, created by CERN and brought to Spain by CPAN, is about the functioning of the Large Hadron Collider (LHC) and its detectors. In Barcelona the exhibition was extended with information about the Catalan contribution to the LHC. ICCUB researchers participated in both the conferences and the organization of the exhibition.

Place: Cosmocaixa, 08/03/2013-23/03/2013

From the Earth to the Universe

Balaguer-Núñez, D.; Figueras, F.; Jordi, C.; Masana, E.; Olarte, B.

This exhibition was translated to Catalan by ICCUB members in 2010 in the occasion of the International Year of Astronomy. Nowadays, the ICCUB is responsible of the explanatory boards and posters, and manages the itinerary of the exhibition.

<http://serviastro.am.ub.edu/twiki/bin/view/ServiAstro/DelaTerra>

Itinerary in 2013:

- Casa de la Cultura, Sant Cugat, 16/04/2013-28/04/2013.
- Museu de Sant Boi de Llobregat, 18/05/2013-02/09/2013.
- Centre Cultural, Martorell, 15/10/2013-11/12/2013.

Amb A d'Astrònoma

Balaguer-Núñez, D.; Figueras, F.; Jordi, C.; Masana, E.; Olarte, B.

This is the Catalan version of the exhibition *Con A de Astrònoma*, dedicated to all woman astronomers from different eras and countries, whose contribution to Astronomy has been relevant in a worldwide scale.

<http://serviastro.am.ub.edu/twiki/bin/view/ServiAstro/AmbA>

Itinerary in 2013:

- Institut de la Pobla de Segur, la Pobla de Segur, 08/01/2013-28/02/2013
- Faculty of Mathematics, UB, Barcelona, 01/03/2013-15/03/2013
- Ajuntament de Molins de Rei, Molins de Rei, 18/03/2013-03/04/2013
- INS Secretari Coloma, Barcelona, 23/10/2013-23/11/2013
- Associació Astronòmica de Sant Cugat-Valldoreix, 15/12/2013-30/01/2014

The cosmic distances

Balaguer-Núñez, D.; Figueras, F.; Jordi, C.; Masana, E.; Olarte, B.

This exhibition, which was fully created by ICCUB members in 2012, shows the methods scientists use to calculate the distances to celestial objects, and how this methods have progressively evolved through the years depending on how far were the objects which were needed to be observed.

Nowadays, the ICCUB is responsible of the explanatory boards and manages the itinerary of the exhibition.

<http://serviastro.am.ub.edu/twiki/bin/view/ServiAstro/DistanciesCosmiques>

Itinerary in 2013:

- Institut de la Pobla de Segur, 08/01/2013–15/03/2013
- Institut Arnau Cadell, Sant Cugat del Vallès, 18/03/2013–08/05/2013
- Institut Bernat Metge, Barcelona, 08/03/2013–15/06/2013
- Institut Maria Rubies, Lleida, 20/06/2013–11/10/2013
- Institut Secretari Coloma (Barcelona) 23/11/2013–23/12/2013.



EXHIBITIONS

- 1: Poster from the exhibition “A thousand million eyes for a thousand million stars”.
- 2: “From the Earth to the Universe” exhibition at the Museum of Sant Boi de Llobregat.
- 3: “With A of Astronomer” exhibition at the Astronomers Association at Sant Cugat-Valldoreix.
- 4: “The biggest scientific instrument ever built” exhibition at Cosmocaixa.

Web Sites

ICCUB Web Site

A new web site of the institute has been created, with a brand new design and functionalities.

To begin with, sections about the ICCUB institutional information, research activity and participation in projects have been created. The sections *news* and *activities* have been extended and also have been developed specific sections for students and postgraduate researchers, containing information about job opportunities and study programmes in which ICCUB is involved. Finally, it is provided some relevant information for visitors such as how to reach the ICCUB.

Authors: Anglada, M.; Frutos, A.; Lazovsky, N., Moreno, A.B.; Pérez, G.; Salvador, A.

<http://iccub.edu>

ServiAstro

Serviastro is the Department's of Astronomy and Meteorology - ICCUB web site devoted to divulge any astronomy topics and news. In 2013 a new section dedicated to the Gaia mission has been created.

<http://www.am.ub.edu/twiki/bin/view/ServiAstro/Gaia>

Authors: Olarte, B.

Descobrint la Física de Partícules amb LHCb

This web site, developed by the ICCUB Experimental Particle Physics Group, contains didactic material produced by the group and information about the activities they organize.

<http://www.lhc.cat>

Authors: Frutos, A.; Ruiz, H.

WEB SITES OF THE ICCUB

1: ICCUB web site: Section showing the participation in projects of the institute.

2: ServiAstro web site: Section dedicated to the Gaia mission.

3: "Descobrint la Física de Partícules amb LHCb" web site, section dedicated to the Masterclass on Particle Physics.

Didactic Material

Gaia cell phone App

A new app for iPhone that allows being up to date about the Gaia mission has been created. With this app you can explore the satellite in 3D, locate its components, experience the science behind Gaia or dive into the science and technology of the project.

Authors: Massana, E., in collaboration with FUSTA. S.L.

Gaia advertisements

The following supporting materials have been designed for the advertising of the launch of the Gaia satellite in December of 2013:

A poster, hold at the Physics Faculty atrium.

A postcard, which has been distributed through the faculties.

A banner for being attached in emails and web sites.

Gaia 2014 calendar

A 2014 wall calendar about the Gaia satellite has been designed, produced and distributed. The calendar includes both images and text about the mission.

Authors: Olarte, B.

Gaia fleet sheet

A brochure about the Gaia Mission has been designed, produced and distributed.

Authors: Olarte, B.

Gaia miniature

The fabrication of a miniature of Gaia by the company k2Ainax has been supervised.

Authors: Carrasco, J.M., Figueras, F.; Luri, X.; Massana,



DIDACTIC MATERIAL

1, 2: Sheets of the Gaia 2014 wall calendar.

3: Gaia fleet sheet.

4: Screenshot of the Gaia Cell phone App.

5: ICCUB members supervising the Gaia miniature made by k2Ainax

Press releases

Eclipse Calculator: a new application to simulate eclipses on your mobile, developed at the UB

Date: 17/01/2013

Authors: Bonmatí, B (UB); Massana, E.

http://www.ub.edu/web/ub/en/menu_eines/noticies/2013/01/041.html

The UB and the UPC create the first joint spin-off: a company devoted to the compression of large data volumes

Date: 22/02/2013

Authors: Luri, X; in collaboration with Fundació Bosch i Gimpera

http://www.ub.edu/web/ub/en/menu_eines/noticies/2013/02/067.html

Opening of the exhibition “The largest scientific instrument ever built”

Date: 25/03/2013

Authors: Bonmatí, B (UB); in collaboration with UAB and Cosmocaixa.

http://www.ub.edu/web/ub/en/menu_eines/noticies/2013/02/067.html

About 160 secondary students attend a research workshop at the UB in which they work with data provided by the Large Hadron Collider of the CERN

Date: 13/03/2013

Authors: Bonmatí, B (UB); Ruiz, H.

http://www.ub.edu/web/ub/en/menu_eines/noticies/2013/03/036.html

The exhibition “One thousand million eyes for one thousand million stars”, organised by UB researchers, describes the Gaia mission

Date: 02/07/2013

Authors: Bonmatí, B (UB)

http://www.ub.edu/web/ub/en/menu_eines/noticies/2013/07/006.html

Gaia’s launch gets closer

Date: 12/09/2013

Authors: Bonmatí, B (UB)

http://www.ub.edu/web/ub/ca/menu_eines/noticies/2013/fotonoticies/09/005.html

Professor Peter Goldreich, from Caltech, visits the Institute of Sciences of the Cosmos of the UB

Date: 21/10/2013

Authors: Bonmatí, B.; Padoan, P.

http://www.ub.edu/web/ub/en/menu_eines/noticies/2013/10/054.html

New data on the composition of relativistic jets from black holes

Date: 14/11/2013

Authors: Bonmatí, B.; Migliari, S.

http://www.ub.edu/web/ub/en/menu_eines/noticies/2013/11/022.html

GAIA Mission: the countdown starts

Date: 10/12/2013

Authors: Bonmatí, B (UB)

http://www.ub.edu/web/ub/ca/menu_eines/noticies/2013/12/012.html

Publications

Jordi, C., *The summer triangle in the night sky*, El muntanyenc,

<http://www.elmuntanyenc.cat/el-triangle-destiu-del-cel-nocturn-2/>

Jordi, C. *The Earth’s clock is being delayed*, Aules, num. 49.

Talks

Marc Ribó, *Forats negres i altres objectes compactes*, 21/01/2013.

Carme Jordi, *L’astrònoma Henrietta Leavitt descobridora de l’univers extragalàctic*, Aules d’extensió Universitària per a la Gent Gran, Universitat de Barcelona, January of 2013.

Francesca Figueras, *Amb A d’AstrònomA: l’extraordinària feina realitzada per les dones en l’astronomia moderna*, Historic Building, Universitat de Barcelona, 06/03/2013.

Jordi Miralda, *El forat negre al centre de la Via Làctia*, Agrupació Astronòmica de Terrassa, 08/03/2013.

Domènec Espriu, *Dimensions desconegudes*, Cosmocaixa (Barcelona), 09/03/2013.

Lluís Garrido, *L’accelerador de partícules LHC: un viatge cap al Big Bang*, Cosmocaixa (Barcelona), 14/03/2013.

Mercè Romero, Santiago Roca, *Mesurant distàncies astronòmiques: de les civilitzacions antigues a l'era moderna*, La Farga de Sant Cugat del Vallès School, 21 and 23/03/2013.

Carme Jordi, *Mesurem l'Univers pam a pam*, Aules d'extensió Universitària per a la Gent Gran (Sabadell), April–May of 2013.

Mercè Romero, *Com es formen i com són els braços espirals de les galàxies*, Associació Astronòmica de Sabadell, 08/05/2013.

Josep M. Solanes, *Activitats de Física per a estudiants no univertaris*, Palau de les Heures, Universitat de Barcelona, 16/07/2013.

Josep Manel Carrasco, *La Missió Gaia*, ApEA 2013 (Lleida), July of 2013.

Jordi Portell, *The Gaia Mission*, Workshop on “Research and Industry: a convenience marriage”, organized by BAIE, September of 2013.

Jordi Torra, *A la recerca d'altres terres*, Sta. Eulàlia de Ronçana Library, 04/10/2013.

Jordi Torra, *Gaia, observant a un milió i mig de quilòmetres*, Agrupació Astronòmica de Sabadell, 09/10/2013.

Jordi Torra, *Mil milions d'ulls per a mil milions d'estrelles*, Casal Font de'n Fargues, 16/10/2013.

Carme Jordi, *Gaia mira amb mil milions d'ulls*, Agrupació Astronòmica de Sabadell, 16/10/2013.

Eduard Masana, *Gaia: el Sistema Solar i planetes extrasolars*, Agrupació Astronòmica de Sabadell, 30/10/2013.

Josep Manel Carrasco, *The Gaia Mission*, Encontres amb el Tercer Cicle, Physics Faculty (UB), 23/10/2013.

Carme Jordi, *Passat, present i futur del nostre Sol*, Aules d'extensió Universitària per a la Gent Gran, Castellar del Vallès, October of 2013.

M. Monguió, *Qüestions d'Astronomia*, Salvador Espriu School, Badalona, 05/11/2013

Jordi Portell, *La missió Gaia: la Galàxia en un Petabyte*, Vic, 05/11/2013.

Josep Manel Carrasco, *Per a què serveix l'astronomia*, COU, (Àger, Lleida), 16/11/2013.

Eduard Masana, *Galileu i el naixement de la ciència moderna*, COU, (Àger, Lleida), 30/11/2013

Xavier Luri, *Gaia, nuestra galaxia en 3D*, Universidad de la Rioja, 11/11/2013.

Carme Jordi, *L'astrònoma Henrietta Leavitt descobridora de l'univers extragalàctic*, Aules d'extensió Universitària per a la Gent Gran, Poble Nou, November of 2013.

Carme Jordi, “*Amb A d'Astrònoma*”, Casa de la Cultura de Sant Cugat, 03/12/2013.

Carme Jordi, *Mil milions d'ulls per a mil milions d'estrelles*, Agrupació Astronòmica de Sant Cugat-Valldoreix, 12/12/2013.

Jordi Portell, *Gaia: després del llançament*, Physics Faculty, UB, 19/12/2013.

Jordi Miralda, *El forat negre al centre de la Via Làctia*, Agrupació Astronòmica de Sabadell, 23/12/2013.

Covering of astronomical events

Eduard Masana, Blanca Olarte, *PanSTARRS Comet appears*, Covering of the new and following the evolution of the comet through the sky with photographs, March 2013.

Eduard Masana, Blanca Olarte, *Comet Ison*, Covering of the new and following of the comet providing graphics, videos and links, November 2013.

Astronomic observations for the general public

J.M. Carrasco, E. Masana, *Public Observation with Telescopes at the Caves Nadal*, nearby the Caves Nadal, February of 2013.

C. Jordi, X. Luri, E. Masana, *Quines estrelles es veuen aquesta nit?*, II Meeting of Science popularizers at the UB, June of 2013.

Participation in TV and radio shows

Experimental Physics Group of High Energy Physics
30 minuts (TV3),
20/01/2013

Jorge Núñez
Lluvia coronal en el Sol, 8 al dia with Josep Cuní (8TV)",
15/02/2013

Josep Manel Carrasco
Para todos la 2 (TVE),
28/02/2013,
<http://vimeo.com/60748820>

Josep Manel Carrasco
Viatge sense retorn a Mart, Migdia de 8TV (8TV),
10/05/2013,
<http://vimeo.com/65920502>

Carme Jordi, "Mapping the Milky Way", Euronews,
24/10/2013,
<http://www.euronews.com/2013/10/24/mapping-the-milky-way/>

Miscellaneous

Carme Jordi, Eduard Masana, Advisors for baccalaureate students on the research paper *Determination of astronomic distances*, IES Angeleta Ferrer School, Sant Cugat del Vallés.

Valentí Bosch-Ramon, Advisor for the baccalaureate on the research paper *Dark holes and compact objects*, Institut Samuel Gili i Gaya, Lleida.

Valentí Bosch-Ramon, Advisor for the baccalaureate on the research paper *Dark holes and compact objects*, Col·legi Maristes la Immacul·lada, Barcelona.

Valentí Bosch-Ramon, advisor for the baccalaureate on the research paper *Dark holes and compact objects*, Institut Montserrat, Barcelona.

Blanca Olarte, Poster about the didactic resources at Serviastro, presented at the X ApeA Meeting, GAIA Group, Support on the diffusion and follow up of the SonCube II competition.



PARTICIPATION IN TV AND RADIO SHOWS

1: Eugeni Graugés at "30 minuts"; 2: Carme Jordi at Euronews;
3: Joan Manel Carrasco at "Para todos la 2" 4: Joan Manel Carrasco at "Migdia de 8 TV"



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