



Institute of Cosmos Sciences

REPORT OF
ACTIVITIES

2014

FOREWORD

In 2014 the directing body of the Institute of Cosmos Sciences was renovated. I was honored to be elected its Director, along with Vice Director Dra. Francesca Figueras and Secretary Dr. Bartomeu Fiol.

I would like to use these lines to gratefully acknowledge Dra. Figueras and Dr. Fiol for the invaluable help and support they offered me from the very beginning. I would also like to express my deep gratitude to our former Director Dr. Eduard Salvador and to our current Scientific Director Dr. Josep Maria Paredes, for laying the foundations that allowed our Institute to be recognized as a Center of Excellence. The joint effort of all ICCUB members has enabled the institution to be awarded in 2015 the distinction *Unidad de Excelencia Maria de Maeztu* in the first call organized by the Ministry of Economy and Competitiveness (MINECO).

Since 2011 the ICCUB has been participating in the successive calls of the *Severo Ochoa* program for Spanish Research Centers/Units of Excellence, obtaining an increasingly high score over time. It was in 2014 when a

new modality named Maria de Maeztu was announced in order to have a specific, better suited call for centers and institutions that belong to universities. The requisites, required levels, demands and procedures of evaluation set by the Ministry were exactly the same as for the previous Severo Ochoa calls. In this first edition of the *Maria de Maeztu* call organized at the end of 2014, the ICCUB finally received the distinction of belonging to the reputable group of Units of Excellence.

This award represents an important recognition to the hard work done so far, and it is a unique opportunity to enhance the research conducted at the Institute and to take it to higher levels of excellence. It is now our responsibility to properly use this recognition and the additional financial support associated to it in order to increase our scientific achievements during the next four years.

Lluís Garrido Beltrán
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.



PHYSICS FACULTY, HEADQUARTERS OF THE
INSTITUTE OF COSMOS SCIENCES

C. Martí i Franquès, 1 • 08028 Barcelona
Tel: +34 93 402 15 88
secretaria@icc.ub.edu • <http://icc.ub.edu>

ORGANIZATION CHART

Executive Board

Director: Lluís Garrido
Deputy Director: Francesca Figueras
Secretary: Bartomeu Fiol

Council of the Institute

Domènec Espriu
Bartomeu Fiol (Secretary)
Francesca Figueras (Deputy Director)
Lluís Garrido (Director)
Eugeni Graugés
David Mateos
Simone Migliari
Jordi Miralda
Josep Maria Paredes
Àngels Ramos
Blai Sanahuja
Joan Soto

Scientific Board

Francesca Figueras (Deputy Director)
Bartomeu Fiol
Lluís Garrido (Director)
Ricardo Graciani
Simone Migliari
Josep M. Paredes (Scientific Director)

International Advisory Council

Felix Aharonian, Dublin Institute for Advanced Studies and Max Planck Institute für Kernphysik, Heidelberg (Chair)
Alan Heavens, Imperial Centre for Inference and Cosmology, Imperial College, London.
Slava Mukhanov, ASC, Physics Department, LMU, Munich.
Tatsuya Nakada, LPHE, École Polytechnique Fédérale de Lausanne, Lausanne.

2014 - THE ICCUB IN FIGURES

Staff

- 59 Permanent Staff
- 6 Ramon y Cajal Members
- 3 Juan de la Cierva Members
- 29 Postdoc Fellows
- 44 PhD Students
- 20 Engineers and Technicians
- 5 Services and Administration Personnel
- 11 Visiting Scholars

Projects and Funds

- 16 European Projects
- 3 Other international projects
- 35 National Plan & Consolider Projects
- 10 Consolidated Groups
- 13 Contracts with the industry
- 15 Other Funds

Publications

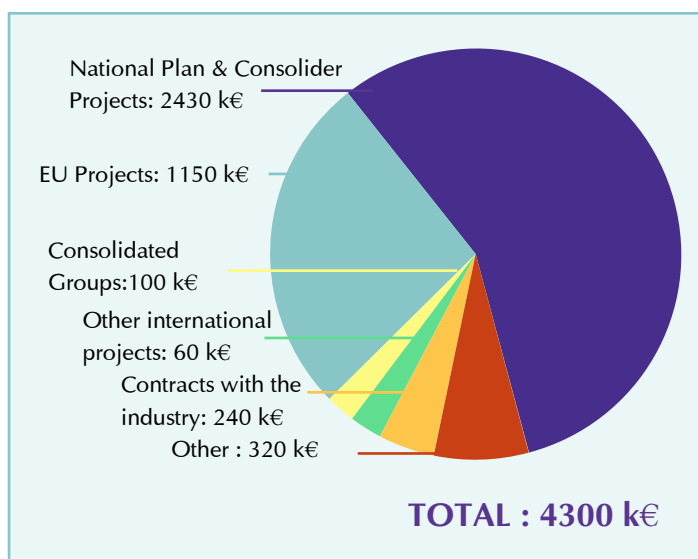
- 281 SCI Publications
- 44 Non SCI-Publications
- 95 Technical Reports

Theses

- 10 Finished PhD Theses
- 64 Ongoing PhD Theses
- 21 Finished Master Theses

Activities

- 7 ICCUB Colloquia
- 83 Group Seminars
- 9 Event Organization
- 40 Public Talks
- 4 Exhibitions



PROJECTS AND FUNDS 2014: BUDGET

For projects with an execution period of more than one year, only the proportional amount has been considered.

ICCUB STAFF

2

RESEARCHERS*

Permanent Staff

Canal, Ramon (UB)
Centelles, Mario (UB)
Crusats, Joaquim (UB)
D'Enterría, David (ICREA, leave of absence)
Diéguez, Ángel (UB)
El-Hachemi, Zoubir (UB)
Emparan, Roberto A. (ICREA)
Espriu, Domènec (UB)
Estalella, Robert (UB)
Fabricius, Claus Vilhelm (IEEC)
Fernández, José M. (UB)
Figueras, Francesca (UB)
Fiol, Bartomeu (UB)
Garrido, Lluís (UB)
Garriga, Jaume (UB)
Gómez, Gerard (UB)
Gómez, Jose M. (UB)
Gomis, Joaquín (UB)
González, María Concepción (ICREA)
Graciani, Ricardo (UB)
Graugés, Eugeni (UB)
Guasch, Jaume (UB)
Guzmán, Rafael (UB & U. Florida)
Iwasawa, Kazushi (ICREA)
Jimenez, Raúl (ICREA)
Jordi, Carme (UB)
Latorre, José I. (UB)
Llosa, Josep (UB)
López, Rosario (UB)
Luri, F. Xavier (UB)
Magas, Volodymyr (UB)
Manrique, Alberto (UB)
Mateos, David (ICREA)
Mescia, Federico (UB)
Miralda, Jordi (ICREA)
Molina, Alfred (UB)
Núñez, Jorge C. (UB)
Padoan, Paolo (ICREA)

Paredes, Josep M. (UB)
Parreño, Assumpta (UB)
Polls, Artur (UB)
Pons, Josep M. (UB)
Ramos, Àngels (UB)
Ribó, Josep M. (UB)
Ribó, Marc (UB)
Ruiz, Hugo (UB)
Russo, Jorge G. (ICREA)
Sala, Ferran (UB)
Salvador, Eduard (UB)
Salvat, Francesc (UB)
Sanahuja, Blai (UB)
Solà, Joan (UB)
Solanes, José M. (UB)
Soto, Joan (UB)
Taron, Josep M. (UB)
Torra, Jordi (UB)
Verdaguer, Enric (UB)
Verde, Licia (ICREA)
Viñas, Xavier (UB)

Ramon y Cajal Members

Bosch, Valentí
Casalderrey, Jorge
Iblisdir, Sofyan
Julià, Bruno
Migliari, Simone
Notari, Alessio

Juan de la Cierva Members

Tarrio, Luis Javier
Tywoniuk, Konrad
Zanin, Roberta

Postdoc Fellows

Àgueda, Neus
Aliu, Ester
Aran, Àngels
Attems, Maximilian
Balaguer, Dolores
Bellini, Emilio
Bergström, Johannes
Carrasco, José M.
Cuesta, Antonio José
Fernández, Antón
García, Miguel Ángel
Gracia, Gonzalo
Haibo, Qiu
Kundu, Arnab
Masana, Eduard
Niro, Viviana
Pantelidou, Christiana
Portell, Jordi
Roca, Santi
Romero, Mercè
Sestayo, Yolanda
Simpson, Fergus Rae Goalen
Tanabe, Kentaro
Tarrio, Luis Javier
Tywoniuk, Konrad
Voss, Holger
Weiler, Michael
Zanin, Roberta
Zilhao, Miguel

Visiting Scholars

Andrianov, Alexander
Ballesteros, Guillermo
Casademunt, Jaume
Jorba, Àngel
Lizzi, Fedele
Prieto, Joaquin

Ruiz, Josep Xavier
 Ruiz, M. Pilar
 Talavera, Pere
 Torrelles, José María
 Yun, Joao

PhD Students

Abedi, Hoda
 Alsina, Daniel
 Ariño, Andreu
 Barranco, Alejandro
 Camboni, Alessandro
 Carbone, Arianna
 Casamiquela, Laia
 Cheng, Yu
 Dector, Aldo

Di Dato, Adriana
 Feijoo, Albert
 Fröb, Markus
 Gabbanelli, Luciano
 Galindo, Daniel
 Garolera, Blai
 Gómez, Adrià
 Gontcho A Gontcho, Satya
 González, Juan
 Juan, Enric
 Juárez, Carmen
 Maneu, Jordi
 Marcote, Benito
 Marín, Carla
 Mariño, Mauricio
 Martínez, Marina
 Mas, Lluís
 Merino, M. Teresa

Moreno, Víctor
 Munar, Pere
 Olikara, Zubin Philip
 Oriol, Pablo
 Pablos, Daniel
 Paita, Fabrizio
 Palmer, Max
 Paredes, Xavier
 Pérez, Daniel
 Pérez, Ignasi
 Pérez-Obiol, Axel
 Planells, Xumeu
 Renau, Albert
 Rives, Vicente
 Torrents, Genís
 Triana, Miquel
 Vilella, Eva

ENGINEERS AND TECHNICIANS

Antiche, Erika
 Borrachero, Raúl
 Casajús, Adrià
 Casanova, Raimon
 Casas, Albert
 Castañeda, Javier
 Clotet, Marcial

Comerma, Albert
 Garralda, Nora
 Gascón, David
 González, Juan José
 Julbe, Francesc
 Mauricio, Joan
 Molina, Daniel

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

SERVICES AND ADMINISTRATION PERSONNEL

ICCUB Secretariat

Frutos, Ariadna
 Moreno, Ana Belén

Group Support

Macduff, Kayla
 Olarte, Surinye

Collaborating Students

Ortiz, Elisenda

RESEARCH ACTIVITY

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, Euclid, Solar Orbiter, CORe.
- **Ground-based observatories and telescopes:** Sloan Digital Sky Survey (SDSS), Large Synoptic Survey Telescope (LSST), MAGIC Cherenkov Telescopes, Cherenkov Telescope Array (CTA), Dark Energy Spectroscopic Instrument (DESI), CAHA, ORM.
- **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 • Bellini, Emilio • Canal, Ramon • Cuesta, Antonio José • Gontcho A Gontcho, Satya • Guzmán, Rafael • Jimenez, Raúl • Juan, Enric • Manrique, Alberto • Mas, Lluís • Miralda, Jordi • Pérez, Ignasi • Sala, Ferran • Salvador, Eduard • Simpson, Fergus R.G. • Verde, Licia.

VISITING SCHOLARS

Prieto, Joaquin • Ruiz-Lapuente, Pilar.

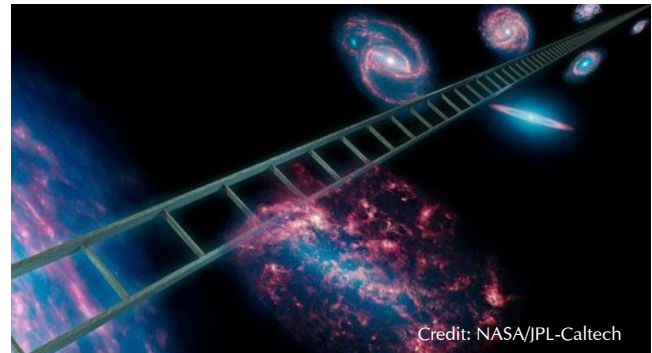
One of the main interests at ICCUB is the study of the connection between cosmological observations and the physics behind the standard cosmological model. This research effort aims at answering the big open questions of modern cosmology: what makes up the Universe? What is dark matter? What is dark energy? What powered inflation? What lights up the Universe? In the Cosmology and Large Scale Structure group researchers follow both a theoretical and observational approach.

Activitiy 2014

The SDSS3 survey finished data taking, data releases 10 and 11 were made public along with their cosmological interpretation. New measurements of the BAO (barion acoustic oscillations) scale from Lyman- α forest correlations were published. ICCUB researchers also focused on measurements of average metal line strengths of DLAs and correlations of MgII absorbers with galaxies using the BOSS data. The theory of the non-linear effects and the impact of radiation fluctuations on the Lyman- α forest power spectrum was also developed.

The implications of the latest cosmological observations for neutrino properties (neutrino mass scale and number of effective species) were elucidated. Current data do not imply non-standard neutrino properties and tightly constrain deviations from these.

The cosmic distance ladder, traditionally interpreted as a way to calibrate cosmological distances using observations of our local Universe, has been found to work also the other way round. We can use the standard ruler set up at high redshift by the Cosmic Microwave Background



Credit: NASA/JPL-Caltech

ARTIST VIEW OF THE COSMIC DISTANCE LADDER

The cosmic distance ladder, traditionally interpreted as a way to calibrate cosmological distances using observations of our local Universe, has been found to work also the other way round.

to measure local distances using as intermediate rungs supernova and baryon acoustic oscillation distance measurements. Moreover, current data on cosmic distances are powerful enough to allow one to drop the general relativity (GR) assumption and still measure the universe expansion history, the universe geometry, and constrain early Universe physics and neutrino properties. We only have to assume the copernican principle, metric theory of gravity, a smooth expansion history and the existence of standard rulers (baryon acoustic oscillations), candles (supernovae) and clocks (early type galaxies). Even without GR the Universe looks a lot like LCDM.

Finally, it was also shown that gamma ray bursts might be responsible for past extinctions on Earth, and for limiting the possibility of life on planets near the center of galaxies.

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.
- Development of distributed calculation methods using grid and cloud computing.
- Simulation and study of the radiation hardness of avalanche photodetectors.
- Design, construction and operation of instrumentation for high energy, astrophysics and medical imaging experiments.
- Design of Geiger mode avalanche photodiodes for tracking detectors of future accelerators.
- Simulation and study of the radiation hardness of avalanche photodetectors.

ICCUB MEMBERS

Camboni, Alessandro • Casajús, Adrià • Comerma, Albert • Garrido, Lluís • Gascón, David • Graciani, Ricardo • Graugés, Eugeni • Marín, Carla • Mauricio, Joan • Picatoste, Eduard • Rives, Vicente • Ruiz, Hugo • Sanuy, Andreu • Trenado, Juan.

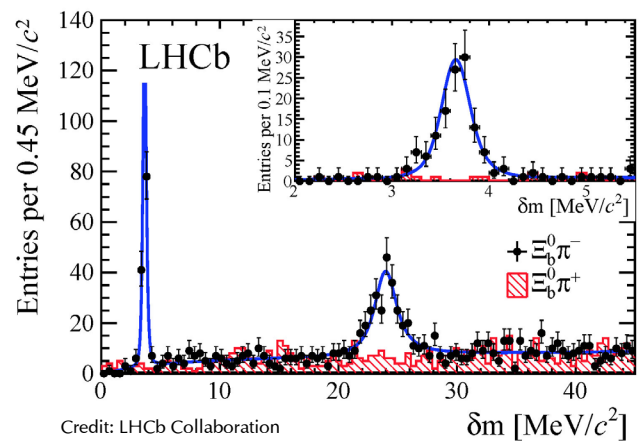
ICCUB's experimental particle physicists are specialized in the study of flavor physics. Specifically in measuring charge-parity (CP) violation effects and rare decays of particles containing b or c quarks. Currently the group is fully involved in LHCb experiment data analysis and on its upgrade project.

The LHCb detector, one of the four detectors of the Large Hadron Collider (LHC) in CERN, is designed to study this asymmetry through the b and anti-b particle pairs produced in proton collisions. The ICCUB, 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, and participated in the development of the Worldwide LHC Computing Grid (WLCG) computer network and the DIRAC software.

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.

Activity 2014

In 2014 the research has focused on study of the radiative B meson decays in the LHCb experiment. This kind of decays offer a unique exploration window to look for new physics beyond the Standard Model (SM) by precisely measuring the photon polarization of such decays, analyzing either the B meson decay time or the angular distribution of its decay products. Moreover, the



Credit: LHCb Collaboration

FIRST OBSERVATION OF TWO NEW PARTICLES IN THE LHCb

In November 2014, the LHCb Collaboration presented a paper reporting the discovery of two new particles. The particles, known as the $\Xi_b^{\prime-}$ and Ξ_b^{*-} , were predicted to exist by the quark model but had never been seen before. The two peaks are clear observation of the $\Xi_b^{\prime-}$ (left) and Ξ_b^{*-} (right) baryons above the hatched red histogram representing the expected background.

ICCUB has contributed to the design and development of the readout (RO) electronics for the calorimeter and the Scintillating Fiber Tracking of the LHCb experiment upgrade. The cross-application of the LHCb-generated knowledge in photo-sensor RO electronics has generated several service contracts with semiconductor companies and several medical applications (PET devices). Improvements in the DIRAC software have also been made. See sections *Electronic and Instrumentation Development* and *Very Large Data Processing and Analysis* for more information. .

GALAXY STRUCTURE AND EVOLUTION

LINES OF RESEARCH

- The stellar constituents of the galactic disk and halo.
- The stellar luminosity calibration.
- Modelling of galaxy aggregations.
- Formation and evolution of galaxies.

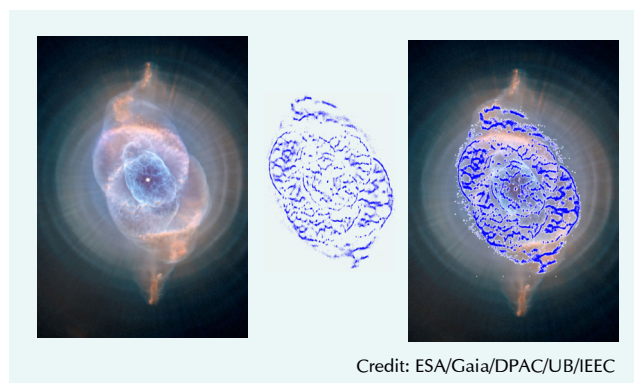
ICCUB MEMBERS

Abedi, Hoda • Balaguer, Dolores • Carrasco, José M. • Casamiquela, Laia • Castañeda, Javier • Fabricius, Claus Vilhelm • Figueras, Francesca • Gracia, Gonzalo • Jordi, Carme • Luri, F. Xavier • Masana, Eduard • Miralda, Jordi • Palmer, Max • Roca, Santi • Romero, Mercè • Solanes, José M. • Torra, Jordi • Voss, Holger • Weiler, Michael.

Gaia is an important world-class scientific mission that will provide fundamental data for almost all fields of Astrophysics. The satellite was successfully launched on 19th Dec 2013. Gaia is designed to provide key information on the formation and evolution of our Galaxy. At present, the research in Galactic Astronomy at the ICCUB is highly influenced by the preparation of the scientific exploitation of this mission, in which ICCUB researchers are deeply involved (see *Very Large Data Processing and Analysis* section). Research at the ICCUB includes: galaxy modelling, the study of stellar constituents and stellar luminosity calibration. Members are also devoting their efforts to address the very complex process of galaxy formation and to explore the broad dynamical range of parameters that govern the physics of matter interactions. ICCUB members coordinate the *Red Española de Explotación Científica de Gaia* and are active members of the international networks created for the scientific exploitation of Gaia.

Activitiy 2014

New tools for the scientific exploitation of Gaia —innovative and far from traditional— have been proposed. Furthermore, ICCUB members take part of the Gaia-ESO survey, the Open Clusters OCCASO survey and the WEAVE@WHT consortium to complement Gaia data with high-resolution spectroscopy from ground. ICCUB members have also been working in the definition of synergies with large present and future surveys. Work developed in Galaxy modelling include, among others, the characterization of the central bar, the development of novel methods to unveil the nature of the spiral structure and a new kinematic model to describe the galactic warp. High-resolution cosmological N-body with hydrodynamics simulations for Milky Way like galaxies has allowed to provide new insights in the disk large scale structures and baryonic content. Work done in the characterization of the Milky Way constituents



THE CAT'S EYE NEBULA AS DETECTED BY GAIA

Gaia's on-board detection algorithms registered more than 84,000 detections in the Cat's Eye Nebula. Left: HST image of the nebula (the image is ~1 by ~1 arcminute). Middle: the ~84,000 Gaia detections that were made in this area from 25 July to 21 August 2014. Right: a superposition of the two images, showing that Gaia is actually able to detect not only stars but also high surface brightness filamentary structures.

has been, among others, the astrometric and photometric analysis of open clusters and the first detection of the stellar and dust over-densities associated to the Perseus arm. The team has been working in the characterization of low-mass stars activity, in the improvement of robust statistical tools for the stellar luminosity calibration, new planetary nebulae detection and binarity. The availability of the Gaia Object Generator (GOG) has now been used for scientific analysis and work is in progress to continuous improving the Besançon-Barcelona Population Synthesis Galaxy Model. Besides, by means of controlled collisionless simulations of the previrialization stage of galaxy groups, it has been possible to demonstrate that the multiple mergers that take place during the hierarchical build-up of these systems are able to create fully realistic first-ranked galaxies, without the additional consideration of a dissipative component.

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

Di Dato, Adriana • Emparan, Roberto A. • Fernández, Antón • Fiol, Bartomeu • Fröb, Markus • Garolera, Blai • Garriga, Jaume • Guasch, Jaume • Kundu, Arnab • Llosa, Josep • Martínez, Marina • Molina, Alfred • Mateos, David • Notari, Alessio • Pantelidou, Christiana • Solà, Joan • Tanabe, Kentaro • Tarrío, Luis Javier • Torrents, Genís • Triana, Miquel • Verdaguer, Enric • Zilhao, Miguel.

VISITING SCHOLARS

Ballesteros, Guillermo.

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 the ICCUB is devoted to the study of the quark-gluon plasma and the computation of observables in gauge theories.

Activity 2014

The 2014 activity in gravitation and cosmology can be divided in three main areas:

Gravity and Black Holes: ICCUB researchers have developed the inverse-dimensional expansion for black holes, solving for quasinormal spectra and instabilities of rotating black holes. They have also investigated numerically the properties of six-dimensional black holes with *bumpy horizons*.

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 combined the AdS/CFT duality and supersymmetric localization to make exact predictions for string perturbation theory.



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 research about the effects of bubble nucleation and tunnelling transitions in multiverse models. They have explored the possibility that the wave function of an inflationary universe is 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 the possibility of realizing Inflation using the Higgs field in a metastable vacuum in non-minimal gravity models and in extensions of the Standard Model.

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

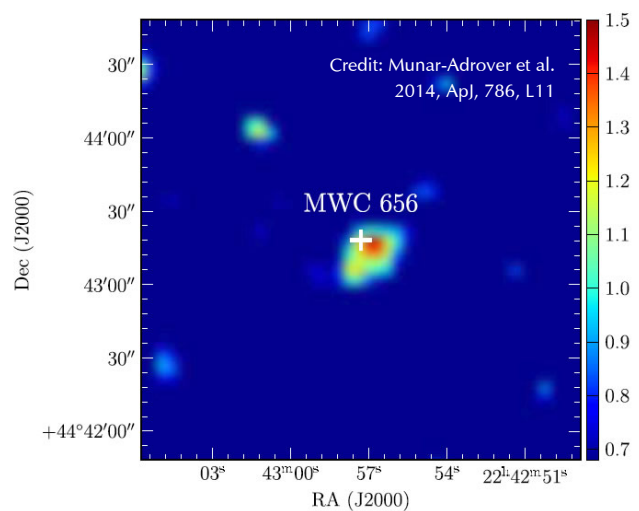
Aliu, Ester • Bosch, Valentí • Galindo, Daniel • Iwasawa, Kazushi • Marcote, Benito • Migliari, Simone • Moreno, Víctor • Munar, Pere • Paredes, Xavier • Paredes, Josep Maria • Ribó, Marc • Sestayo, Yolanda • Zanin, Roberta.

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 as well as being subject to a timescale which is much more amenable to observations. They are also interested in the study of gamma-ray binaries, which are able to accelerate particles up to TeV energies. Moreover, the ICCUB high energy astrophysicists are members of the MAGIC Collaboration since February 2006, and are currently participating, together with experimental physicists and engineers from the ICCUB, in the Cherenkov Telescope Array (CTA) project, an initiative to build the next generation of ground-based gamma-ray instrument.

Activitiy 2014

Research in High Energy Astrophysics has been focused on observations, theoretical modelling and numerical simulations to understand the physics of astrophysical outflows. Semi-analytical and numerical calculations of the radiation processes taking place in the sources have been developed to enable predictions of observable features in the different scenarios under investigation (small and large scales, galactic and extragalactic sources of outflows),



X-RAY COUNTERPART OF THE FIRST BE/BLACK HOLE SYSTEM

XMM-Newton EPIC-pn camera image at the position of MWC656 in the 0.3–5.5 keV energy band smoothed using a Gaussian interpolation with a 2" kernel

which can be tested observationally. In another line, multi-wavelength observations of MWC 656, the first Be/black hole system, have revealed its X-ray counterpart and allowed to predict that the radio/X-ray correlation found in black hole Low Mas X-ray binaries might also be valid for black hole High Mas X-ray binaries. In addition, it has been revealed the coupling between the thermal and non-thermal processes in the gamma-ray binary LSI+61303. Finally, there have been improvements on the knowledge of absorption mechanisms and on wind mixing in gamma-ray binaries through low frequency observations with LOFAR and GMRT.

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.
- Relativistic heavy ion collisions.
- Lattice QCD calculations of light nuclear systems.
- Radiation transport and interactions of radiation with matter.
- Ultra-cold atomic gases.
- Bose-Einstein condensates.

ICCUB MEMBERS

Carbone, Arianna • Centelles, Mario • Feijoo, Albert • Fernández, José M. • García, Miguel Ángel • Haibo, Qiu • Julià, Bruno • Magas, Volodymyr • Maneu, Jordi • Parreño, Assumpta • Pérez-Obiol, Axel • Polls, Artur • Ramos, Àngels • Salvat, Francesc • Viñas, Xavier.

Research in this field included the theoretical description of hadronic systems with strangeness and/or charm in the vacuum, in nuclear matter, and in the hot medium generated in relativistic heavy ion collisions; the investigation of the structure of hypernuclei and exotic nuclei far from the valley of stability, the equation of state in nuclear matter and its role in the description of neutron stars, and the modeling and numerical study of the interaction of electrons, photons and ions with matter. ICCUB researchers have also obtained information on the interaction among baryons by solving numerically the underlying theory of the strong force, Quantum Chromo Dynamics, in finite volume. Their research has a direct connection with experiments, either with the programs at world leading physics laboratories (BNL, CERN, ELSA-Bonn, Fz-Jülich, GSI, GANIL, JLAB, JPARC, MAMI-Mainz, RIA and RIKEN) or with astronomical observational data coming from the new generation of X-ray and gamma-ray space observatories, which supply important information about compact stars. Recently, they have directed an important part of their efforts to the study of ultra-cold atomic gases and Bose-Einstein condensates.

Activity 2014

1. Analysis of the values of neutron star radius obtained by performing a global microscopic description of a neutron star, from the core to the crust.
2. Study of the nuclear symmetry energy and identification of observables which can constrain different aspects of this energy, as its density dependence.
3. Study of symmetric and asymmetric nuclear matter, including pure neutron matter, using the self-consistent Green's function method. We have determined the isospin dependence of the momentum distribution, and the formalism has been extended to include three-body forces.
4. Study of strangeness -2 systems through the description of the kaon-induced production of Ξ -hyperons using a chiral Lagrangian up to next-to-leading order, and the theoretical description of the strong and weak decay of $\Lambda\Lambda$ -hypernuclei.
5. First results for the magnetic moments of light nuclei from LQCD calculations.
6. Theoretical description of the stopping of ions in a degenerate electron gas by means of non-linear formalisms.
7. Analysis of quantum phenomena which appear when placing bosons in optical lattices.
8. Determination of the complete phase diagram for one-dimensional binary mixtures of bosonic ultracold atomic gases in a harmonic trap.
9. Study of the properties of three bosons in a one-dimensional parabolic trap at zero temperature.



Credit: NASA/Dana Berry

ARTIST VIEW OF A NEUTRON STAR

A neutron star is the dense, collapsed core of a massive star that exploded as a supernova. The neutron star contains about a Sun's worth of mass packed in a sphere the size of a large city.

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

ICCUB MEMBERS

Attems, Maximilian • Bergström, Johannes • Casalderrey, Jorge • D'Enterria, David • Espriu, Domènec • Gómez, Adrià • González, Juan • González, M. Concepción • Guasch, Jaume • Latorre, José I. • Mescia, Federico • Niro, Viviana • Pablos, Daniel • Planells, Xumeu • Renau, Albert • Solà, Joan • Soto, Joan • Taron, Josep M. • Tywoniuk, Konrad..

VISITING SCHOLARS

Andrianov, Alexander • Lizzi, Fedele.

The ICCUB has a wide spectrum of interests in the phenomenological and calculating aspects of Particle Physics, covering many aspects of the areas reported in the hep-ph, hep-th and hep-lat archives.

The composition of the group reveals this variety of interests, extending to many of the forefront areas of research in Particle Physics. Several members share their activity in phenomenological aspects with their work in more formal parts of theoretical physics and gravitation. Furthermore, they have an ever growing interest in the cosmological and astrophysical implications of particle physics phenomenology.

There is also a considerable overlap of interests in the area of b-physics and the Experimental Particle Physics group members from the LHCb experiment.

Activity 2014

The activity has been influenced to a large extent by the first LHC results. Studies in this area are being focused on effective theories from 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 exploring in the years to come. ICCUB members are also sharpening their theoretical tools to take adequate stock of the next three years of running starting in spring 2015. They are also

preparing for possible new experimental projects now under discussion.

In the area of b-physics ICCUB researchers have continued their pioneering studies of possible new observables and angular distributions that might reveal the presence of new physics.

Effective theories of QCD, especially in the heavy quark sector are being intensively studied by ICCUB researchers. These include resummation techniques and jet physics.

Several features of heavy ion collisions particularly in the domain of hard probes and the study of properties of QCD under extreme conditions have also received considerable attention during 2014. Activity in the study of the behaviour of jets in quark-gluon plasma has been significant, including studies from holographic QCD.

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

Relevant contributions are also being made in the field of neutrino physics, axion physics and other dark matter candidates as well as dark energy in contact with the cosmology and astrophysics groups. ICCUB particle physics phenomenologists have close interactions with the experimental particle physicists at the ICCUB and with researchers in other theoretical areas.

STAR FORMATION

LINES OF RESEARCH

- High-angular-resolution observations of the first stages of stellar evolution.
- Outflows, jets, and accretion disks in young stellar objects, and jets in planetary nebulae.
- Computational models of star-forming regions, from large-scale SN-driven turbulence to individual stars.

ICCUB MEMBERS

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

VISITING SCHOLARS

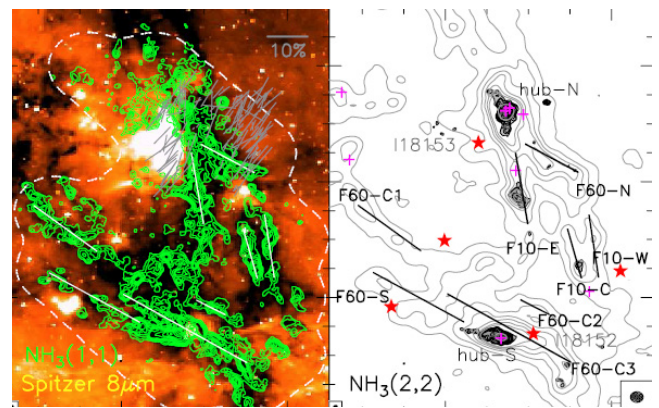
Torrelles, José María • Yun, Joao.

ICCUB research in this field 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 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; 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 numerical modeling of the ISM on very large scale to study the role of supernova explosions in the driving of the ISM turbulence and in the formation and disruption of giant molecular clouds.

Activity 2014

The observational study of fragmentation in high-mass star-forming regions has been continued with high angular resolution observations of the 1.3 mm continuum emission carried out with the Submillimeter Array (SMA) toward two hubs, G14.2-hub-N and G14.2-hub-S, in the Infrared Dark Cloud G14.225-0.506 together with observations of the dust emission at 870 and 350 μm obtained with APEX and the CSO single-dish telescopes. It has been studied the density structure of the two hubs by means of a simultaneous fit of the radial intensity profile



THE INITIAL PHASES OF MASSIVE STAR FORMATION

Overview of the large scale structure of the G14.2 complex. White contours represent the 3σ contour level of the $\text{NH}_3(1,1)$ integrated intensity map. The NH_3 synthesized beam is shown in the bottom left corner. Color scale is the $8\mu\text{m}$ Spitzer image. Red stars indicate IRAS sources in the field, and pink crosses mark the position of H_2O masers. Color stars depict the positions of YSOs with colors indicating their evolutionary stage. The SMA field of view of the two regions mosaiced, hub-N and hub-S, are indicated in green..

at 870 and 350 μm and the spectral energy distribution. It was also investigated the interplay between magnetic field, turbulence, gravity and UV radiation feedback.

The numerical study of star-forming regions has resulted into the largest star-formation simulation to date (several million core hours on the NASA/Ames Pleiades supercomputer), where a 4-pc region has been followed for over 3 Myr, describing the formation of 1300 stars, with masses ranging from brown dwarfs to massive stars. Both the stellar mass distribution and the star formation rate are in excellent agreement with the observations. This simulation has been used to solve the long-standing luminosity problem, meaning the origin of the characteristic luminosity (and the large luminosity spread) of protostars.

THEORETICAL PHYSICS

LINES OF RESEARCH

- String and superstring theory.
- Exact results in supersymmetric field theories.
- Applications of the gauge/string duality to QCD and condensed matter systems.
- Properties of many-body quantum systems.
- Quantum error correction.
- Topological order.
- Ultra-cold gases.
- Quantum simulations

ICCUB MEMBERS

Alsina, Daniel • Attems, Maximilian • Barranco, Alejandro • Casalderrey, Jorge • Dector, Aldo • Emparan, Roberto A. • Espriu, Domènec • Fernández, Antón • Fiol, Bartomeu • Gabbanelli, Luciano • Garolera, Blai • Gomis, Joaquím • Iblisdir, Sofyan • Kundu, Arnab • Latorre, José I. • Mariño, Mauricio • Mateos, David • Pablos, Daniel • Pantelidou, Christiana • Pons, Josep M. • Russo, Jorge G. • Solà, Joan • Tarrio, Luis Javier • Tywoniuk, Konrad • Zilhao, Miguel.

VISITING SCHOLARS

Lizzi, Fedele • Talavera, Pere.

ICCUB activities cover a wide spectrum of areas reported in the hep-th and quant-ph archives. Many ICCUB researchers are active in varying proportions in these areas.

String theory has inspired in recent times enormous activity in the gauge/string duality conjecture that allows a treatment of several types of strongly coupled theories in terms of gravity duals.

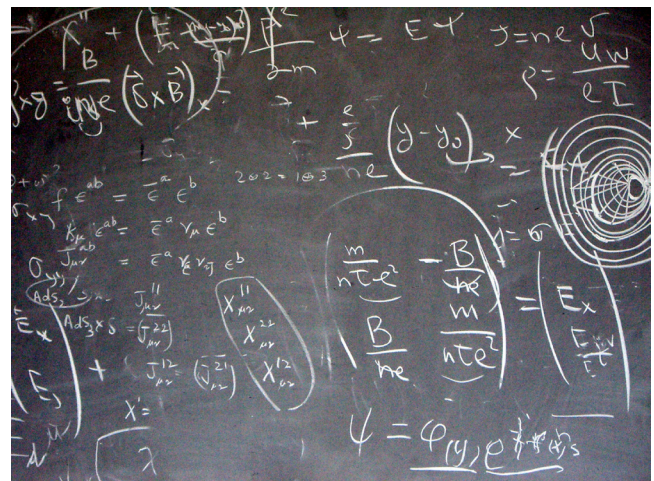
Supersymmetric field theories are studied seeking to understand the ultraviolet behavior of theories with extended supersymmetries and deriving exact results.

Research in quantum information is quite active too focusing in several topics such as entanglement entropy, tensor networks, quantum error correction, many-body quantum systems, 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.

Activitiy 2014

A very active research line at ICCUB concerns exact results in nonabelian gauge theories. Using supersymmetric localization, matrix integrals and resurgence techniques, various aspects of supersymmetric gauge theories in three and four dimensions have been studied, including quantum phase transitions and vacuum expectation values of Wilson operators.



Many aspects of theoretical physics are investigated at the Institute of Cosmos Sciences.

ICCUB researchers have used the AdS/CFT duality to study various Yang-Mills theories at finite heavy-quark density and their renormalization group flows.

ADDITIONAL AREAS OF RESEARCH

The additional areas of research at ICCUB are:

- 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	ICCUB MEMBERS	VISITING SCHOLARS
<ul style="list-style-type: none"> ■ Develop tools to explain in a natural way different astronomical and astrodynamical patterns 	Cheng, Yu • Gómez, Gerard • Olikara, Zubin Philip • Paita, Fabrizio • Pérez, Daniel.	Jorba, Àngel.

ICCUB researchers on Astrodynamics are devoting their efforts to addressing some fundamental issues concerning: the problems related to orbit and attitude control in formation flying of swarms of spacecraft; the development of some dynamical indicators to determine regions and structures that separate different dynamic regimes in autonomous and non-autonomous dynamical systems; the optimal transfer to polar orbits around the Moon; the analysis of the phase space in the vicinity of an irregular asteroid; the study of mass transport mechanisms in the Solar System.

Activity 2014

During 2014 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 have continued their 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	ICCUB MEMBERS
<ul style="list-style-type: none"> ■ Image deconvolution by means of multi-resolution analysis (wavelet and curvelet transform). ■ Image fusion and super-resolution 	Merino, M. Teresa • Núñez, Jorge C.
<ul style="list-style-type: none"> ■ Application of Image deconvolution to Space Debris observation. 	

The group on Image Processing is focused on the use of the wavelet and curvelet transforms to improve the ability of image sensors to detect faint stars and moving objects. Applications to Astronomy and Remote Sensing are developed. The group is studying the effects of the curvelet transform over interferometric images and the effect of deconvolution (using wavelets and curvelets-based maximum likelihood estimator) in adaptive optics observations. ICCUB researchers are also working on obtaining super-resolution using additive-substitutive wavelets techniques on remotely sensed images.

Activitiy 2014

During year 2014 the main activities were focused on the application of deconvolution to increase the limiting magnitude of images obtained for space debris detection. Activities of the group were also devoted to the continuation of the study of the deconvolution by multiresolution of images obtained using adaptive optics and the comparison of classical, myopic and blind algorithms. 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 of thermodynamical scenarios in applied chemistry where such a transition to chirality is possible.

Activitiy 2014

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 to 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 focus on solar energetic particle (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, the solar wind plasma and the interplanetary magnetic field, are the background components of the SEP scenario. In this context, 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 (see section *Electronic and Instrumentation Development*).

Activity 2014

In 2014 ICCUB researchers studied the timing and duration of the release processes of seven near relativistic electrons ($\sim 0.5c$) in the low corona using in situ measure-

ments by both the ACE and the Wind spacecraft and context electromagnetic observations in soft and hard X-rays, radio and white light. The estimate release time has been compared with the results obtained by using a simulation to unfold the interplanetary transport effects.

ICCUB researchers also studied the variation of the shape of the proton intensity-time profiles in gradual SEP events with the relative observer's position in space with respect to the main direction of propagation of an interplanetary shock (heliolongitude and heliolatitude). A three-dimensional magnetohydrodynamic code was used to simulate such a shock and the evolution of the downstream-to-upstream ratios of the plasma variables at its front were determined. This is the first time that the latitudinal dependence of the flux proton peak intensity with the observer's heliocentric radial distance has been quantified, within the framework of gradual SEP event simulations.

The three-year collaborative project SPACECAST, FP7-SPACE programme of the European Union, came to an end.

MICROGRAVITY AND TWO-PHASE FLOWS

LINES OF RESEARCH

- Dynamics of turbulent bubble flows in microgravity.
- Controlled boiling in microgravity.

VISITING SCHOLARS

Casademunt, Jaume • Ruiz, Josep Xavier.

In recent years, ICCUB's visiting scholars have been consistently studying the formation and management of small bubbles under microgravity conditions, in particular in the context of turbulent flows, an area of fundamental interest in multiphase flows and with important applications in space technology, from life support systems to thermal control of space vehicles.

Experiments are conducted in the European Space Agency (ESA) Drop Tower facility at ZARM (Bremen, Germany). The use of the tower is supported by ESA and the research is financially supported by the US Air Force Office of Scientific Research (USA) through the European Office of Aeospace Research and Development. The main objective is to elucidate physical mechanisms that control bubble formation, bubble-flow interactions, and heat exchange in the absence of gravity, in view of improving current designs and searching for new strategies for efficient thermal control in microgravity environments.

Activity 2014

In 2014 the activity has focused on the optimization and characterization of an innovative design for capillary boiling through controlled localized nucleation. The prototype system has proven to work robustly in a gravity-insensitive way and has been fully characterized within a variety of relevant parameters. The device generates regular slug flows that can be used as input for heat-exchange or other devices.

The series of 64 drops in the ZARM Drop Tower facility has been completed. Based on the results obtained, a new design has been proposed for controlled capillary boiling on a (passive) self-sustained closed-loop system.

On the theoretical side, an idealized version of the nucleation device has been solved exactly showing interesting scaling properties of fundamental interest.

ELECTRONIC AND INSTRUMENTATION DEVELOPMENT

ACTIVITIES

- Electronics for CTA, LHCb and PET.
- MIRADAS
- Solar Orbiter (Space-borne instrumentation / Harsh environment electronics / FPGA based image processing.
- Montsec Astronomical Observatory.

ICCUB MEMBERS

Casanova, Raimon • Casas, Albert • Comerma, Albert • Diéguez, Ángel • Garrido, Lluís • Gascón, David • Gómez, Jose M. • Graciani, Ricardo • Graugés, Eugeni • Mauricio, Joan • Núñez, Jorge C. • Oriol, Pablo • Picatoste, Eduard • Ribó, Marc • Roma, David • Ruiz, Hugo • Sabater, Josep • Sanuy, Andreu • Trenado, Juan • Vilella, Eva.

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

Electronics for CTA, LHCb upgrade and PET

ICCUB members 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.

MIRADAS

The ICCUB is responsible of the MIRADAS project of the Gran Telescopio de Canarias (GTC). The basic MIRADAS concept is a near-infrared multi-object echelle spectrograph operating at spectral resolution $R=20,000$ over the 1–2.5 μm bandpass. MIRADAS selects targets using ~20 deployable probe arms with pickoff mirror optics, each feeding a 4.0x1.2-arcsec field of view to the spectrograph. The spectrograph input optics also include a slit slicer which reformats each probe field into 3 end-to-end slices of a fixed 4.0x0.4-arcsec format – combining the advantages of minimal slit losses in any seeing conditions better than 1.2-arcsec, while at the same time providing some (limited) two-dimensional spatial resolution. The spectrograph optics then provide a range of configurations providing the observer with the ability to choose between maximal multiplex advantage and maximal wavelength coverage, with several intermediate options, depending upon the needs of the science program.

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. The ISS has been optimized to minimize the power consumption and to provide the best performance making use of the reduced number of parts available for space applications.

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 2014

Electronics for CTA, LHCb upgrade and PET

Regarding CTA, in 2014 three ASICs developed in 2013 have been successfully tested: PACTAv1.4 (a wideband 16 bit dynamic range current mode PreAmplifier), ACTAf 2Ch F (a wideband pulse amplifier for NECTAr chip) and TL0R1 (a versatile ASIC for L0 triggering in Cherenkov Telescopes). PACTA and TL0R will presumably be used in the Large Size Telescopes (LST) and in the Middle Size Telescopes cameras of CTA, whereas ACTA has been designed only to be used in MST.

Regarding the upgrade of the LHCb calorimeter, the final chip (ICECALv3) of the analog signal processing channel has been designed, produced and tested. A second prototype of the PACIFIC ASIC with the input stage and shaper has been designed for SiPM readout in the new planned Scintillating Fiber Tracker.

Finally, a new version of the ASIC developed in 2013 for SiPM readout in medical imaging (PET Time-of-Flight) has been developed and successfully tested.

MIRADAS

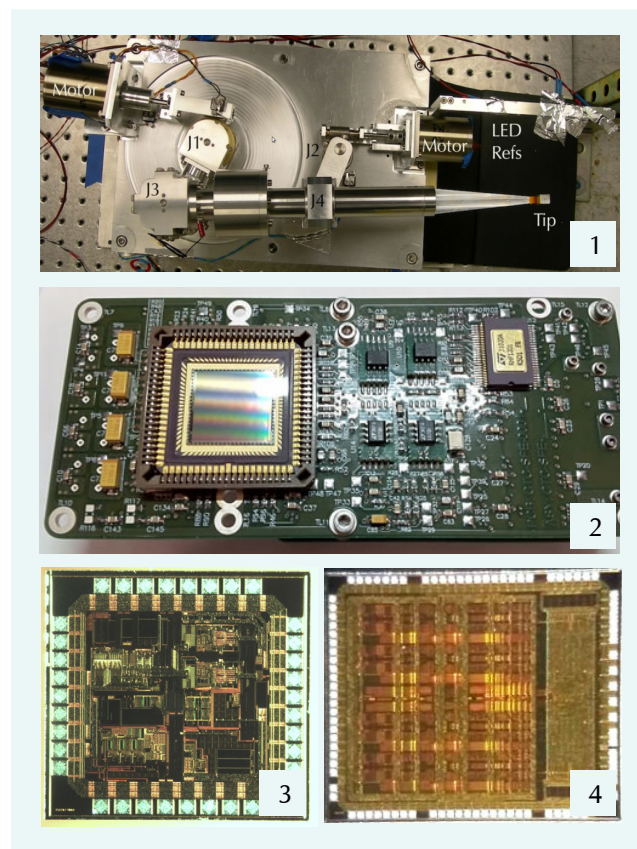
During 2014 the trajectory algorithm has been designed. It has been necessary a thorough analysis of the collisions and possible interferences between the probe arms. The algorithm has been tested with base cases, providing promising results. Part of the results have been presented at the SPIE Astronomical Telescopes & Instrumentation 2014 that took place in Montreal, Canada.

Solar Orbiter

During year 2014, ICCUB researchers have tested the Engineering Model of the ISS, reaching the desired characteristics. An Electronic Ground Support Equipment (EGSE) has been prepared to test the following models (Qualification, Flight and Spare). It has also been started the manufacturing of the Qualification Model of the ISS in collaboration with Sener.

Montsec Astronomical Observatory

During 2014, 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



1: Image of one probe arms prototype being tested at ICCUB laboratory;

2: Bread-Board Model of the Correlation Tracking Camera used at the Polarimetric and Helioseismic Imager of the Solar Orbiter mission. Key elements: STAR 1000 radiation tolerant image sensor (left side) and the 12 bit 50 Msps rad-hard analog-to-digital converter (ADC);

3: PACTAv1.4 2;

4: ICECALv3

observations reported was 129,199, corresponding to 18,723 objects (tracks) with a mean of 247 objects per night (1520 positions per night). A mean of 24.6 objects per night without TLE (not in the Space-Track catalog) were observed.

Regarding the exoplanet survey, during 2014 ICCUB researchers continued observing 48 selected fields detecting hundreds of new variable stars and studying the possibility of new exoplanets around 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.

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, Adrià • Castañeda, Javier • Clotet, Marcial • Fabricius, Claus Vilhelm • Figueras, Francesca • Garralda, Nora • González, Juan José • Graciani, Ricardo • Jordi, Carme • Julbe, Francesc • Luri, F. Xavier • Masana, Eduard • Molina, Daniel • Portell, Jordi • Torra, Jordi • Voss, Holger • Weiler, Michael.

Gaia DPAC

ICCUB researchers have been deeply involved in the Gaia Mission since the very beginning, with an important contribution within the Gaia Data Processing & Analysis Consortium (DPAC). They maintain the leading role of the Spanish groups in Gaia at the highest technological, scientific and management levels. The group has important responsibilities in the Coordination Units CU2 (simulations), CU3 (core processing), DPCB (Data Processing Center of Barcelona), CU5 (photometry) and leads the CU9 (Gaia Archive).

The ICCUB leads an EU FP7-funded project named GENIUS (2014-2017) to contribute to the development of the Gaia Archive, and participates in an EU FP7-funded initiative (GREAT-ITN, 2011-2015) and in a research network (GREAT-RNP, 2010-2015) funded by the European Science Foundation, both aiming to form the next generation of experts in the scientific use of Gaia data. Furthermore, ICCUB has one representative in the Gaia Scientific Team and one in the DPAC Executive Committee. It also has deputy managers in CU2 and CU3.

The knowledge gained on data compression tools has allowed the ICCUB to register a patent for one of its SW/HW solutions and to create a spin-off, DAPCOM.

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 begun to use it. The ICCUB is now responsible of the continuous updates.

Activity 2014

Gaia DPAC

Since the Gaia launch the main activities have concentrated in understanding and analyzing the data received during commissioning and during the first months of scientific operations to precisely evaluate the performances of the payload and the satellite. Several problems were encountered, the most important being the mirror's contamination, the high level of background and the variations on the basic angle.

Several patches have been introduced in the Initial Data Treatment system (IDT), developed at ICCUB, in order to cope with the real telemetry as well as with the on-board detection levels, changes in the control electronics etc. Testing in parallel of new IDT versions still continue. The tasks of development of other mission critical software packages like the Intermediate Data Update (IDU), which has to be operative at the end of 2015, or the completion of the photometric calibration model, are important commitments of the group. At present the large telemetry simulations have been completed by producing very large datasets mocking the final Gaia catalogue. These datasets will be used to prepare the final catalogue and database, containing more than one billion objects. This task is, by ESA decision, led by the ICCUB group. The ICCUB team is developing and coordinating the ongoing processing tasks to fully deploying the new ones associated to the Gaia Archive.

DIRAC

In 2014 the DIRAC software has been extended for better integration of Cloud resources with Grid. This integration ensures that DIRAC will still be a competitive project as the trend in distributed computing evolves.

KNOWLEDGE TRANSFER AND INNOVATION

SERVICES

- DAPCOM Data Services).
- Ideas Service (SiUB).

ICCUB MEMBERS

Casajús, Adrià • Castañeda, Javier • Clotet, Marcial • Comerma, Albert • Garrido, Lluís • Gascón, David • Gaciani-Díaz, Ricardo • Graugés, Eugeni • Guzmán, Rafael • Julbe, Francesc • Luri, Xavier • Mauricio, Joan • Picatoste, Eduardo • Portell, Jordi • Salvador, Eduard • 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), specialized on the handling and processing of large amounts of data. It provides software engineering solutions and high-performance data compression strategies including proprietary implementations.

DAPCOM commercializes FAPEC (Fully Adaptive Prediction Error Coder), a patented lossless data compression algorithm originally created for satellite payloads. Besides being resilient to outliers in the data, it offers an optimum compromise between resources consumption and compression ratio. It can be applied to scientific research projects, supercomputing, or companies dealing with Big Data scenarios.

<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 UB which, by the one hand, provides a service on electronics and microelectronics instrumentation design, development and test to research groups of the UB and other research institutions, and by the other hand, enhances the industry technology transfer. 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>

Activity 2014

Dapcom

DAPCOM has been one of the first companies selected for the new ESA Business Incubation Centre (BIC) of Barcelona due to the potential of FAPEC for being transferred to terrestrial applications. The two-years incubation program at the UPC Campus of Castelldefels is providing the necessary resources to boost the R&D activities, including the IEEC-DAPCOM PICFAPEC project (Parallel and Imaging Capabilities for FAPEC). The first work package was nearly finished by the end of 2014, leading to a DWT-based pre-processing stage for lossless or lossy FAPEC image compression.

Ideas Service (SiUB)

After its creation in 2013, the service has slowly started to operate providing support for local research groups and external laboratories. The service has also signed collaboration agreements with a couple of companies.

To begin with, several ASIC designs have been produced for LHCb and CTA projects, using different technologies (IBM 130nm, TSMC 130nm or AMS 350nm SiGe BICMOS). See section *Electronic and Instrumentation Development* for more details.

PACTA family of ASICs has also shown good characteristics for a variety of applications related to PMT readout. This has allowed using PACTA in two other projects for ICFO and CNRS.

Finally, several collaboration agreements have been signed with Scientifica Internacional S.L. and Hamamatsu Photonics for the development of readout electronics for photo-detectors. In both cases, good results open the opportunity of longer term relationships.

PROJECTS AND FUNDS

4

EUROPEAN PROJECTS AND FUNDS

Advanced European Infrastructures for Detectors at Accelerators (AIDA)

Reference: 262025 (FP7-INFRASTRUCTURES)
PI: Laurent Serin (CERN) (ICCUB: Ángel Diéguez)
Agency: European Community (EC)
Period: 01/02/2011 - 31/01/2015

Cosmological physics with future large scale structure surveys (PHYSS.LSS)

Reference: 240117 (FP7-IDEAS-ERC)
PI: Licia Verde
Agency: European Research Council (ERC)
Period: 01/11/2009 - 30/11/2015

European Particle physics Latin American NETwork (EPLANET)

Reference: PIRSES-GA-2009-246806 (FP7-PEOPLE)
PI: Luciano Maiani (Università degli Studi di Roma, La Sapienza) (ICCUB: Domènec Espriu)
Agency: European Community (EC)
Period: 01/02/2011 - 31/01/2015

Gaia European Network for Improved User Services (GENIUS)

Reference: 606740 - GENIUS (FP7- SPACE)
PI: Xavier Luri
Agency: European Community (EC)
Period: 01/10/2013 - 31/03/2017

Gaia Research for European Astronomy Training (GREAT)

Reference: 08-RNP-118 ()
PI: Nick Walton (ICCUB: Carme Jordi)
Agency: European Science Foundation (ESF)
Period: 18/02/2010 - 17/02/2015

Gaia Research for European Astronomy Training (GREAT-ITN)

Reference: PITN-GA-2010-264895 (FP7-PEOPLE)
PI: Nick Walton (ICCUB: Francesca Figueras)
Agency: European Community (EC)
Period: 01/03/2011 - 28/02/2015

Holography for the LHC era (HoloLHC)

Reference: 306605 (FP7-IDEAS-ERC)
PI: David Mateos
Agency: European Community (EC)
Period: 01/10/2012 - 30/09/2017

INVISIBLES

Reference: PITN-GA-2011-289442 (FP7-PEOPLE)
PI: B. Gavela (UAM) (ICCUB: M^a Concepción González-García)
Agency: European Community (EC)
Period: 01/04/2012 - 31/03/2016

Probing strongly coupled deconfined matter at the LHC (DECOLHC)

Reference: PCIG12-GA-2012-333786 (FP7-PEOPLE)
PI: Joan Soto, Jorge Casalderrey-Solana
Agency: European Community (EC)
Period: 01/03/2013 - 31/10/2016

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: 01/03/2011 - 28/02/2014

Star Formation in the Turbulent Interstellar Medium (SFTISM)

Reference: PIRG07-GA-2010-261359 (FP7-PEOPLE)
PI: Paolo Padoan, Eduard Salvador-Solé
Agency: European Community (EC)
Period: 01/01/2011 - 31/12/2014

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: 01/01/2012 – 31/12/2014

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

Reference: PCIG11-GA-2012-321520 ()
 PI: Josep M^a Paredes, Valentí Bosch-Ramon
 Agency: European Community (EC)
 Period: 01/03/2013 – 28/02/2017

The Astrodynamics Network (ASTRONET-II)

Reference: PITN-GA-2011-289240 (FP7-PEOPLE)
 PI: Gerard Gómez
 Agency: European Community (EC)
 Period: 01/01/2012 – 31/12/2015

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

Reference: 262053 (FP7-INFRASTRUCTURES)
 PI: Werner Hofmann (MPIfK) (ICCUB: Josep M^a Paredes)
 Agency: European Community (EC)
 Period: 01/01/2010 – 31/08/2014

The String Theory Universe

Reference: MP1210 (Cost Action)
 PI: Silvia Penati (Universita' di Milano-Bicocca) (ICCUB: Roberto Emparan)
 Agency: COST Action (European Cooperation in Science and Technology)
 Period: 04/03/2013 – 03/03/2017

OTHER INTERNATIONAL PROJECTS

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

Reference: NNX11AO83G
 PI: David Lario (Johns Hopkins University/APL) (ICCUB: Neus Águeda)
 Agency: NASA
 Period: 01/08/2011 – 01/07/2015

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

Reference: FA8655-12-1-2060

PI: (ICCUB: Jaume Casademunt)
 Agency: Air Force Office of Scientific Research (USA)
 Period: 20/03/2012 – 19/03/2015

Contract for the initial portion of the final design of the MIRADAS Spectrograph for the Gran Telescopio de Canarias

Reference: MIRADAS II
 PI: Jordi Torra Roca
 Agency: U. Florida
 Period: 10/06/2014 – 31/07/2014

NATIONAL PLAN PROJECTS

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: 01/01/2011 – 30/06/2014

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

Reference: FPA2011-29678-C02-02
 PI: Licia Verde
 Agency: MINECO
 Period: 01/01/2012 – 31/12/2014

Contribución al desarrollo científico y tecnológico de la misión Gaia II

Reference: AYA2012-39551-C02-01
 PI: Jordi Torra Roca
 Agency: MINECO
 Period: 01/01/2013 – 30/09/2014

Contribución al desarrollo científico y tecnológico de la misión Gaia III

Reference: ESP2013-48318-C2-1-R
 PI: Jordi Torra Roca
 Agency: MINECO
 Period: 01/01/2014 – 30/09/2015

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

Reference: FPA2010-21549-C04-01
 PI: Ángel Diéguez
 Agency: MICINN
 Period: 01/01/2011 - 01/09/2014

Desarrollo de nuevos detectores y estudios de física para futuros colisionadores lineales

Reference: FPA2013-48387-C6-4-P
 PI: Ángel Diéguez
 Agency: MINECO
 Period: 01/01/2014 - 31/12/2015

Diseño detallado de SOLAR ORBITER/PHI

Reference: AYA2011-29833-C06-05
 PI: Josep M^a Gómez-Cama
 Agency: MICINN
 Period: 01/01/2012 - 31/12/2014

Diseño detallado, fabricación e integración de SO/PHI

Reference: AYA2012-39636-C06-02
 PI: Josep M^a Gómez-Cama
 Agency: MINECO
 Period: 01/01/2013 - 31/12/2014

Estructura a Gran Escala, Cuásares y las Primeras Estrellas con los Espectros de Absorción de Cuásares de BOSS

Reference: AYA2012-33938
 PI: Jordi Miralda-Escudé
 Agency: MICINN
 Period: 01/01/2013 - 31/12/2015

Estudio de la Violación de CP con el detector LHCb

Reference: FPA2011-30163-C02-01
 PI: Eugeni Graugés
 Agency: MICINN
 Period: 01/01/2012 - 31/12/2014

Eyecciones astrofísicas en procesos de alta energía no térmicos. Teoría y observaciones multi-longitud de onda

Reference: AYA2013-47447-C3-1-P
 PI: Josep M^a Paredes
 Agency: MINECO
 Period: 01/01/2014 - 31/12/2016

Fabricación e integración de SOIPHI (Polarimetric and Helioseismic Imager for Solar Orbiter)

Reference: ESP2013-47349-C6-3-R
 PI: Josep M^a Gómez-Cama
 Agency: MINECO
 Period: 01/01/2014 - 31/12/2015

Hacia una Píldora inteligente para la diagnosis y tratamiento de cáncer gastrointestinal

Reference: TEC2013-49954-EXP
 PI: Ángel Diéguez
 Agency: MINECO
 Period: 03/04/2014 - 31/12/2014

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

Reference: AYA2010-21782-C03-01
 PI: Josep M^a Paredes
 Agency: MICINN
 Period: 01/01/2011 - 30/06/2014

Información Cuántica: entrelazamiento, frustración, gases fríos y orden topológico

Reference: FIS2013-41757-P
 PI: José Ignacio Latorre
 Agency: MINECO
 Period: 01/01/2014 - 31/12/2015

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

Reference: FIS2010-16185
 PI: José Ignacio Latorre
 Agency: MICINN
 Period: 01/01/2011 - 30/06/2014

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

Reference: AYA2011-30228-C03-03
 PI: Robert Estalella
 Agency: MICINN
 Period: 01/01/2012 - 30/09/2015

Las Componentes del Universo

Reference: AYA2012-36353
 PI: M. Pilar Ruiz Lapuente
 Agency: MINECO
 Period: 01/01/2013 - 31/12/2015

Materia blanda forzada, activa y viva

Reference: FIS2013-41144-P
 PI: Jaume Casademunt
 Agency: MINECO
 Period: 01/01/2014 - 31/12/2016

Métodos constructivos en sistemas dinámicos y aplicaciones

Reference: MTM2012-32541
 PI: Ángel Jorba
 Agency: MINECO
 Period: 01/01/2013 - 31/12/2015

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

Reference: AYA2012-39168-C03-02

PI: Eduard Salvador-Solé

Agency: MINECO

Period: 01/01/2013 - 31/12/2015

Non-thermal high-energy processes in astrophysical outflows. Theory and multi-wavelength observations.

Reference: AYA2013-47447-C3-2-P

PI: Kazushi Iwasawa

Agency: MINECO

Period: 01/01/2014 - 31/12/2016

Participación española en el diseño y prototipado del Cherenkov Telescope Array: perspectivas de física, prototipado de ASICs y explotación de DIRAC

Reference: FPA2013-48381-C6-6-P

PI: Marc Ribó

Agency: MINECO

Period: 01/01/2014 - 31/12/2015

Red de infraestructuras de astronomía

Reference: AYA2014-53365-REDT

PI: Jordi Torra Roca

Agency: MINECO

Period: 01/12/2014 - 30/11/2016

Simulación Monte Carlo del transporte de radiación. Emisión de electrones secundarios

Reference: FPA2013-44549-P

PI: Francesc Salvat

Agency: MINECO

Period: 01/01/2014 - 31/12/2016

Simulaciones de interacciones y fusiones de galaxias durante la formación de grupos

Reference: AYA2013-40609-P

PI: Josep M^a Solanes

Agency: MINECO

Period: 01/01/2014 - 31/12/2016

Sistemas de Fermi fuertemente correlacionados: átomos, núcleos y hadrones

Reference: FIS2011-24154

PI: Xavier Viñas

Agency: MICINN

Period: 01/01/2012 - 31/12/2015

Spanish Participation in the LHCb experiment at CERN: Physics exploitation and Upgrade.

Reference: FPA2013-48020-C3-3-P

PI: Ricardo Graciani Díaz

Agency: MINECO

Period: 01/01/2014 - 31/12/2015

Sucesos solares de partículas energéticas: análisis y modelos. Aplicaciones para Solar Orbiter y herramientas para el tiempo espacial

Reference: AYA2013-42614-P

PI: Blai Sanahuja

Agency: MINECO

Period: 01/01/2014 - 31/12/2016

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

Reference: FPA2010-16963

PI: Joan Soto

Agency: MICINN

Period: 01/01/2011 - 30/06/2015

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: 01/01/2011 - 30/06/2014

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

Reference: FPA2013-46570-C2-1-P

PI: Domènec Espriu

Agency: MINECO

Period: 01/01/2014 - 31/12/2016

Teoría y fenomenología de las interacciones fundamentales: Gravitación y cosmología

Reference: FPA2010-20807-C02-02

PI: Roberto Emparan

Agency: MICINN

Period: 01/01/2011 - 31/12/2014

Teoría y fenomenología de las interacciones fundamentales: gravitación y cosmología

Reference: FPA2013-46570-C2-2-P

PI: Roberto Emparan

Agency: MINECO

Period: 01/01/2014 - 31/12/2016

CONSOLIDER INGENIO PROJECTS

Centro nacional de física de partículas, astropartículas y nuclear

Reference: CSD2007-00042

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

Agency: MEC

Period: 01/10/2007 - 09/06/2015

Canfranc Underground Physics

Reference: CSD2008-00037

PI: M^a Concepción González-García

Agency: MEC

Period: 15/12/2008 - 14/12/2015

OTHER NATIONAL GRANTS

GaiaApp

Reference: FCT-13-7148

PI: Jordi Torra

Agency: FECYT

Period: 01/09/2013 - 31/08/2014

Agency: MINECO

Period: 01/01/2014 - 31/12/2014

Hacia pruebas holográficas de la materia caliente en el LHC

Reference: FPA2013-40360-ERC

PI: Jorge Casalderrey-Solana

Agency: MINECO

Period: 01/12/2013 - 30/11/2014

PTA Mod. Impulso a la Participación Internacional

Reference: PTA2012-7891-A

PI: Jordi Torra, M. Dolores Balaguer-Núñez

Agency: MINECO

Period: 01/10/2013 - 30/09/2016

Participación Española en la Fase Preparatoria del Cherenkov Telescope Array (CTA)

Reference: AIC-A-2011-0660

PI: Marc Ribó

Agency: MICINN

Period: 10/08/2011 - 10/08/2014

PTA Mod. Infraestructuras científico-tecnicas: Gaia

Reference: PTA2010-3704-I

PI: Jordi Torra

Agency: MINECO

Period: 20/01/2011 - 19/01/2014

Preparation for 'DIRAC Virtual Research Environments'

Reference: EUIN2013-50926

PI: Ricardo Graciani Díaz

The Milky Way Unravalled by Gaia. The final conference of the GREAT (Gaia Research for European Astronomy Training) network

Reference: FCT-14-9208

PI: Francesca Figueras

Agency: FCYT

Period: 01/09/2014 - 31/12/2014

CONSOLIDATED GROUPS

Astronomia i Astrofísica

Reference: 2014SGR86

PI: Josep M^a Paredes

Agency: AGAUR

Period: 01/01/2014 - 31/12/2016

Física nuclear teòrica i de moltes partícules en interacció

Reference: 2014SGR401

PI: Àngels Ramos

Agency: AGAUR

Period: 01/01/2014 - 31/12/2016

Gravitation, Strings, and Cosmology

Reference: 2014SGR1474

PI: Jaume Garriga

Agency: AGAUR

Period: 01/01/2014 - 31/12/2016

Grup de Física experimental d'altres energies

Reference: 2014SGR769

PI: Lluís Garrido

Agency: AGAUR

Period: 01/01/2014 - 31/12/2016

Grup de Física Experimental d'Altes Energies

Reference: 2009SGR1268

PI: Lluís Garrido

Agency: AGAUR

Period: 26/11/2009 - 31/05/2014

Grup de Física Teòrica d'Altes Energies (FISALTEN)

Reference: 2014SGR104

PI: Jorge Russo

Agency: AGAUR

Period: 01/01/2014 - 31/12/2016

Grup de Sistemes Dinàmics

Reference: 2014SGR1145

PI: Àngel Jorba

Agency: AGAUR

Period: 01/01/2014 - 31/12/2016

Grup d'informació i simulació quàntiques (UB)

Reference: 2014SGR727

PI: José Ignacio Latorre

Agency: AGAUR

Period: 01/01/2014 - 31/12/2016

Maximizing the scientific return of future galaxy surveys

Reference: 2009SGR1280

PI: Licia Verde

Agency: AGAUR

Period: 03/07/2009 - 02/12/2014

Physical Cosmology, PhysCos

Reference: 2014SGR921

PI: Licia Verde

Agency: AGAUR

Period: 01/01/2014 - 31/12/2016

CONTRACTS WITH THE INDUSTRY

Advanced electronics for Hamamatsu detectors (I)

Reference: FBG 307548

PI: Ricardo Graciani Díaz

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

Period: 10/11/2013 - 18/01/2014

Advanced electronics for Hamamatsu detectors (II)

Reference: FBG 307550

PI: Ricardo Graciani Díaz

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

Period: 18/11/2013 - 04/05/2014

Advanced electronics for Hamamatsu detectors (III)

Reference: FBG 307696

PI: Ricardo Graciani Díaz

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

Period: 08/02/2014 - 30/09/2014

Advanced electronics for Hamamatsu detectors (IV)

Reference: FBG 307697

PI: Ricardo Graciani Díaz

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

Period: 08/02/2014 - 18/04/2014

Advanced electronics for Hamamatsu detectors (V)

Reference: FBG 307699

PI: Ricardo Graciani Díaz

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

Period: 15/02/2014 - 09/05/2014

Advanced electronics for Hamamatsu detectors (VIII)

Reference: FBG 307758

PI: Ricardo Graciani Díaz

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

Period: 05/05/2014 - 08/06/2014

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

Reference: FBG 306720

PI: Lluís Garrido

Agency: Scientifica Internacional

Period: 27/02/2012 - 26/02/2014

Joint research agreement. Work: Further development of the modification and/or customization of PENELOPE, which is under consulting service between the parties, for use with lower energy particles below 100 eV

Reference: FBG 307269

PI: Francesc Salvat

Agency: Hamamatsu Photonics K.K.

Period: 01/04/2013 - 31/03/2015

Miniaturization of the controller for an endoscopic diagnosis capsule

Reference: FBG 307319

PI: Ángel Diéguez

Agency: Ovesco Endoscopy AG

Period: 02/05/2013 - 01/05/2014

Optimització de recursos en entorns sostenibles

Reference: FBG 307429

PI: Lluís Garrido

Agency: WeeDooCare Business Solutions GmbH

Period: 16/09/2013 - 15/01/2014

Optimització de recursos en entorns sostenibles

Reference: FBG 307607

PI: Lluís Garrido

Agency: WeeDooCare Business Solutions GmbH

Period: 16/01/2014 - 30/06/2014

Production of FlexToFv1 demonstrator elements

Reference: FBG 307910

PI: Ricardo Graciani Díaz

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

Period: 28/07/2014 - 01/10/2014

Production of FlexToFv1 demonstrator elements

Reference: FBG 307911

PI: Ricardo Graciani Díaz

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

Period: 28/07/2014 - 01/09/2014

SCI PUBLICATIONS

Aaij, R; et al. (LHCb Collaboration; ICCUB: **Camboni, A.; Comerma-Montells, A.; Garrido, L.; Graciani Diaz, R.; Grauges, E.; Marin Benito, C.; Picatoste Olloqui, E.; Potterat, C.; Rives Molina, V.; Ruiz, H.**)

A study of CP violation in $B^{\pm} \rightarrow DK^{\pm}$ and $B^{\pm} \rightarrow D\pi^{\pm}$ decays with $D \rightarrow K_s^0 K^{\pm}\pi^{\mp}$ final states. Article.

Physics Letters B, Vol. 733, p. 36-45 (2014)

[10.1016/j.physletb.2014.03.051](https://doi.org/10.1016/j.physletb.2014.03.051)

Aaij, R; et al. (LHCb Collaboration; ICCUB: **Camboni, A.; Comerma-Montells, A.; Garrido, L.; Graciani Diaz, R.; Grauges, E.; Marin Benito, C.; Picatoste Olloqui, E.; Potterat, C.; Rives Molina, V.; Ruiz, H.**)

Evidence for the decay $X(3872) \rightarrow \psi(2S)\gamma$. Article.

Nuclear Physics B, Vol. 886, p. 665-680 (2014)

[10.1016/j.nuclphysb.2014.06.011](https://doi.org/10.1016/j.nuclphysb.2014.06.011)

Aaij, R; et al. (LHCb Collaboration; ICCUB: **Camboni, A.; Comerma-Montells, A.; Garrido, L.; Graciani Diaz, R.; Grauges, E.; Marin Benito, C.; Picatoste Olloqui, E.; Potterat, C.; Rives Molina, V.; Ruiz, H.**)

Observation of Photon Polarization in the $b \rightarrow sy$ Transition. Article.

Physical Review Letters, Vol. 112, Iss. 16, Num. 161801 (2014)

[10.1103/PhysRevLett.112.161801](https://doi.org/10.1103/PhysRevLett.112.161801)

Aaij, R; et al. (LHCb Collaboration; ICCUB: **Camboni, A.; Comerma-Montells, A.; Garrido, L.; Graciani Diaz, R.; Grauges, E.; Marin Benito, C.; Picatoste Olloqui, E.; Potterat, C.; Rives Molina, V.; Ruiz, H.**)

Observation of Z production in proton-lead collisions at LHCb. Article.

Journal of High Energy Physics, Vol. 2014, Iss. 09, Num. 30 (2014)

[10.1007/JHEP09\(2014\)030](https://doi.org/10.1007/JHEP09(2014)030)

Aaij, R; et al. (LHCb Collaboration; ICCUB: **Camboni, A.; Comerma-Montells, A.; Garrido, L.; Graciani Diaz, R.; Grauges, E.; Marin Benito, C.; Picatoste Olloqui, E.; Potterat, C.; Rives Molina, V.; Ruiz, H.**)

Precision measurement of the ratio of the Λ_b^0 to \bar{B}^0 lifetimes. Article.

Physics Letters B, Vol. 734, p. 122-130 (2014)

[10.1016/j.physletb.2014.05.021](https://doi.org/10.1016/j.physletb.2014.05.021)

Aaij, R; et al. (LHCb Collaboration; ICCUB: **Camboni, A.; Comerma-Montells, A.; Garrido, L.; Graciani Diaz, R.; Grauges, E.; Marin Benito, C.; Picatoste Olloqui, E.; Potterat, C.; Rives Molina, V.; Ruiz, H.**)

Study of the kinematic dependences of Λ_b^0 production in pp collisions and a measurement of the $\Lambda_b^0 \rightarrow \Lambda_c^+ \pi^-$ branching fraction. Article.

Journal of High Energy Physics, Vol. 2014, Iss. 08, Num. 143 (2014)

[10.1007/JHEP08\(2014\)143](https://doi.org/10.1007/JHEP08(2014)143)

Aaij, R; et al. (LHCb Collaboration; ICCUB: **Camboni, A.; Comerma-Montells, A.; Garrido, L.; Graciani Diaz, R.; Grauges, E.; Marin Benito, C.; Picatoste Olloqui, E.; Rives Molina, V.; Ruiz, H.**)

Measurement of polarization amplitudes and CP asymmetries in $B^0 \rightarrow \omega K^(892)^0$.* Article.

Journal of High Energy Physics, Vol. 2014, Iss. 05, Num. 69 (2014)

[10.1007/JHEP05\(2014\)069](https://doi.org/10.1007/JHEP05(2014)069)

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Measurement of charged particle multiplicities and densities in pp collisions at $\sqrt{s} = 7$ TeV in the forward region. Article.

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Measurement of the forward W boson cross-section in pp collisions at pp collisions at $\sqrt{s} = 7$ TeV. Article.

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Measurements of indirect CP asymmetries in $D^0 \rightarrow K^- K^+$ and $D^0 \rightarrow \pi^- \pi^+$ decays Article.

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PHD THESES

Finished Theses

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

Author: Alejandro Barranco López

Director/s: Jorge Russo

Date: 03/10/2014

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

Author: Albert Comerma

Director/s: David Gascón (tutor: Atilà Herms)

Date: 09/01/2014

Effective theories and Monte-Carlo simulations: SUSY phenomenology at the Large Hadron Collider

Author: Arian Abrahantes

Director/s: Jaume Guasch, Siannah Peñaranda (U. Zaragoza)

Date: 21/07/2014

Gamma ray emission from young stellar massive stars

Author: Pere Munar

Director/s: Josep M^a Paredes Poy

Date: 28/03/2014

Milky Way-like galaxy simulations in the Gaia era: disk large scale structures and baryonic content

Author: Santi Roca

Director/s: Francesca Figueras, Octavio Valenzuela Tijerino (IA-UNAM)

Date: 26/11/2014

Non-mesonic weak decay of hypernuclei in effective field theory

Author: Axel Pérez-Obiol

Director/s: Assumpta Parreño, Bruno Julià

Date: 11/02/2014

On the origin of masses at the LHC

Author: Juan González Fraile

Director/s: M^a Concepción González-García

Date: 05/09/2014

Self-consistent Green's functions with three-body forces

Author: Arianna Carbone

Director/s: Artur Polls, Arnau Ríos (U. Surrey)

Date: 11/04/2014

Stellar activity in exoplanet hosts

Author: Enrique Herrero Casas

Director/s: Carme Jordi, Ignasi Ribas (ICE-CSIC)

Date: 06/10/2014

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

Author: Xumeu Planells

Director/s: Domènec Espriu, Alexander Andrianov

Date: 06/11/2014

Ongoing theses

100.000 espectros de cuásars y perturbaciones primordiales

Author: Andreu Ariño

Director/s: Jordi Miralda-Escudé

Tentative Date: February 2015

Agujeros negros y modelos de gravitación emergente

Author: Luciano Gabbanelli

Director/s: Domènec Espriu

Tentative Date: March 2019

Astrostatistics for luminosity calibration in the Gaia era

Author: Max Palmer

Director/s: Xavier Luri, Eduard Masana, Frédéric Arenou (Observatoire de Paris)

Tentative Date: January 2015

Black holes in higher dimensions

Author: Marina Martínez

Director/s: Roberto Emparan

Tentative Date: June 2016

Contaminació lumínica

Author: Salvador Ribas
 Director/s: Francesca Figueras, Jordi Torra
 Tentative Date: 2015

Contribution to GNSS inter-satellite link technique: Usage of low earth orbital and sub-orbital measurements

Author: David Roma
 Director/s: J. Maria Gómez Cama, M. Hernandez-Pajares
 Tentative Date: January 2017

COTS Analog Prototype for LHCb's Calorimeter Upgrade

Author: Carlos Abellán
 Director/s: David Gascón, Atilà Herms
 Tentative Date: January 2015

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

Author: Víctor Moreno de la Cita
 Director/s: Valentí Bosch-Ramon
 Tentative Date: October 2016

Dinámica efectiva de agujeros negros y branas negras

Author: Adriana Di Dato
 Director/s: Roberto Emparan
 Tentative Date: September 2015

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

Author: Pablo Oriol Bitaubé
 Director/s: J. Maria Gómez Cama, J. Torra
 Tentative Date: December 2015

Electronics control and signal processing for the LHCb fast calorimeter detectors

Author: Eduardo Picatoste
 Director/s: David Gascón, Atilà Herms
 Tentative Date: 2015

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

Author: Carla Marín
 Director/s: Ricardo Graciani, Lluís Garrido (tutor: Domènec Espriu)
 Tentative Date: September 2017

Estudi de Sistemes Fortament Acoblats mitjançant Holografia

Author: Genís Torrents
 Director/s: Tomeu Fiol
 Tentative Date: 2016

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

Author: Laia Casamiquela
 Director/s: Carme Jordi, Dolores Balaguer, Ricardo Carrera (IAC)
 Tentative Date: 2017

Far-from-equilibrium holography and heavy ion collisions

Author: Miquel Triana
 Director/s: David Mateos
 Tentative Date: 2017

Física del sabor e incertidumbres hadrónicas

Author: Albert Renau
 Director/s: Federico Mescia
 Tentative Date: October 2015

High performance computing of massive Astrometry and Photometry data from Gaia

Author: Javier Castañeda
 Director/s: Claus V. Fabricius, Jordi Torra
 Tentative Date: 2015

Jets as Probes of Strongly Coupled Quark Gluon Plasma

Author: Daniel Pablos
 Director/s: Jorge Casalderrey
 Tentative Date: April 2016

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

Author: Satya Gontcho A Gontcho
 Director/s: Jordi Miralda Escudé
 Tentative Date: Fall 2017

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

Author: Daniel Pérez
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 Tentative Date: 2015

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

Author: Albert Feijoo Aliau
 Director/s: Volodymyr Magas, Angels Ramos
 Tentative Date: July 2016

Nonlinear procedures applied to formation flight strategies for spacecrafts

Author: Fabrizio Paita
 Director/s: Gerard Gómez, Josep J. Masdemont (UPC)
 Tentative Date: 2015

Non-thermal emission from high-energy binaries through interferometric radio observations

Author: Benito Marcote
 Director/s: Marc Ribó, Josep M^a Paredes
 Tentative Date: October 2015

Observational and theoretical study of the interaction of relativistic winds from young pulsars with inhomogeneous stellar winds

Author: Xavier Paredes
 Director/s: Marc Ribó, Valentí Bosch-Ramon
 Tentative Date: September 2016

On the characterisation of the galactic warp in the Gaia era

Author: Hoda Abedi
 Director/s: Francesca Figueras, Luís A. Aguilar (UNAM)
 Tentative Date: February 2015

Physical mechanisms in high-energy pulsars and their environments

Author: Daniel Galindo
 Director/s: Roberta Zanin, Josep M. Paredes
 Tentative Date: May 2019

Probing Gauge Theories: Exact Results and Holographic Computations

Author: Blai Garolera Huguet
 Director/s: Bartomeu Fiol (tutor: Enric Verdaguer)
 Tentative Date: February 2015

Properties of WDM Halos

Author: Enric Juan Rovira
 Director/s: Eduard Salvador Solé
 Tentative Date: Spring 2015

Radiative B decays at LHCb

Author: Vicente Rives Molina
 Director/s: Albert Puig (tutor: Lluís Garrido)
 Tentative Date: November 2015

Rotation, magnetic fields and fragmentation in the earliest stages of star formation: High angular resolution observations in the ALMA and JVL A era

Author: Carmen Juárez Rodríguez
 Director/s: Robert Estalella
 Tentative Date: September 2016

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

Author: Mauricio Mariño
 Director/s: Sofyan Iblisdir (Co-advisor: José Ignacio Latorre)
 Tentative Date: 2015

Super-resolución de imágenes astronómicas y teledetección

Author: M^a Teresa Merino Espasa
 Director/s: Jorge C. Núñez
 Tentative Date: -

The Milky Way stellar population in the Gaia era: Archive validation tasks and First Science

Author: Roger Mor
 Director/s: Francesca Figueras, Annie Robin (Observatoire de Besançon) (tutor: Alberto Manrique)
 Tentative Date: 2018

Vacuum energy in Quantum Field Theory and Cosmology

Author: Adrià Gómez Valent
 Director/s: Joan Solà (tutor: Domènec Espriu)
 Tentative Date: Spring 2018

Wideband pulse amplifier for the integrated camera of the Cherenkov Telescope Array

Author: Andreu Sanuy
 Director/s: David Gascón (tutor: Pere Miribel, U. Barcelona)
 Tentative Date: 2015

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Author: Aldo Dector
 Director/s: Jorge Russo

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Author: Daniel Alsina
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Author: Ignasi Pérez-Ràfols
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Author: Lluís Mas
 Director/s: Jordi Miralda Escudé

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Author: Zubin Philip Olikara
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MASTER THESES

AdS₅ Gravitational wave on a Domain-wall

Author: Nikola Gusterov
 Director/s: David Mateos
 Date: 07/02/2014

Automatic reduction of GEO survey data

Author: Lluís Canals
 Director/s: Jorge Núñez
 Date: 05/09/2014

Causal Perturbation Theory and its Mathematical Ramifications on a mathematically rigorous approach to the PCT-Theorem.

Author: Jordi Gaset
 Director/s: Josep M. Pons (tutor: K. Ebrahimi-Fard, U. Bohn)
 Date: 05/02/2014

Cold bosons in optical lattices: an exact diagonalization study

Author: David Raventós
 Director/s: Bruno Juliá, Tobias Grass (ICFO)
 Date: /07/2014

Constraining the high-mass end of the stellar IMF using galactic Cepheids

Author: Roger Mor
 Director/s: Francesca Figueras
 Date: 05/09/2014

Dynamical vacuum energy, inflation and cosmic evolution

Author: Laura Cervantes
 Director/s: Joan Solà
 Date: 07/02/2014

Efficiency and background studies of the $K_s \rightarrow e\pi\pi$ stripping line at LHCb

Author: Mar Barrio
 Director/s: Lluís Garrido
 Date: 08/09/2014

Hyperons in strongly magnetized neutron stars

Author: Jorge Lerendegui Marco
 Director/s: Àngels Ramos, Laura Tolós (ICE-CSIC)
 Date: 16/10/2014

Image data compression with a Hierarchical Pixel Averaging algorithm and FAPEC

Author: Riccardo Iudica

Director/s: Enrique Garcia-Berro; Jordi Portell
 Date: 06/07/1905

Improvement of DWTFAPC: applications and tests

Author: Hamed Ahmadloo
 Director/s: Enrique Garcia-Berro; Jordi Portell
 Date: 06/07/1905

Nuclei of greatest impact on the composition of neutron-star outer crusts

Author: Irene Dedes
 Director/s: Mario Centelles
 Date: 22/09/2014

Observing the shadowing of the Cosmic Ray electron flux by the Moon with the MAGIC telescopes: a feasibility study

Author: Daniel Guberman
 Director/s: Valentí Bosch-Ramon (tutor: Abelardo Moralejo, IFAE)
 Date: 05/09/2014

Open clusters as seen by Gaia

Author: Javier Río
 Director/s: Carme Jordi
 Date: 05/09/2014

Quantum Forces in Solids with Two-State Systems at finite temperature

Author: Nahuel Statuto
 Director/s: J. Tejada (U. Barcelona) (tutor: Joan Soto)
 Date: 08/09/2014

Starobinski inflation vs. Starobinski inflation

Author: Luís Guardado
 Director/s: Enric Verdaguer
 Date: 08/09/2014

Strong baryon-baryon interaction in the strangeness -3 sector

Author: Martí Florit Gual
 Director/s: Assumpta Parreño, Àngels Ramos
 Date: 16/10/2014

The Crab Pulsar at high- and very high-energies with the Fermi/LAT and MAGIC telescopes

Author: Daniel Galindo
 Director/s: Roberta Zanin (tutor: Marc Ribó)
 Date: 05/02/2014

The mean metal line spectrum of Damped Lyman- σ Systems (DLAs) in BOSS

Author: Lluís Mas

Director/s: Jordi Miralda

Date: 02/07/2014

Tonks-Girardeau gases in different trapping potentials

Author: Abel Vicenç Yuste

Director/s: Miguel A. Garcia-March, Artur Polls

Date: 23/07/2014

Top Mass Determination by Montecarlo Generator

Author: Daniel Moreno

Director/s: Federico Mescia

Date: 07/02/2014

Variability analysis of Gaia calibration candidate SPSS034 from Joan Oró Telescope data

Author: José Luis Chica

Director/s: Carme Jordi (tutor: Josep M.Carrasco)

Date: 02/07/2014

ACTIVITIES

ICCUB COLLOQUIA

The ICCUB Colloquium Series consist on 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 grade students.

Colloquia Comission

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

2014 ICCUB Colloquia

Michele Trenti (Univ. Cambridge)
Stars and Galaxies in the First Billion Years after the Big Bang
10/02/2014

Nora Brambilla (TUM)
Quarkonium with Effective field theories
03/03/2014

Giovanni Cantatore (Univ. Trieste and e INFN - Trieste)
Hunting for Axions and WISPs with cutting-edge sensors
20/05/2014

Denis Barkats (ALMA Science Center, Chile)
Detection of B-mode polarization at degree angular scales using BICEP2
30/05/2014

Mark Alford (Dept. Physics, Univ. Washington)
Superconducting Quarks: Condensed Matter in the Heavens
30/06/2014

David d'Enterria (CERN)
Impact of LHC results on particle astrophysics (ultra-high-energy cosmic rays & dark matter)
ICC Colloquium
10/11/2014

Mario Livio (Space Telescope Science Institute)
Brilliant Blunders
27/11/2014

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),
- Department of Astronomy and Meteorology (DAM).

2014 Seminars

Ricardo Carmona, Ángel Rodríguez (CNM-IMSE)
CMOS Smart Image and Vision Sensors
ICC Seminar
10/01/2014

Julian Sitarek (IFAE)
What gamma-ray observations can tell us about intergalactic magnetic fields?
ICC Seminar
17/02/2014

Stéphane Corbel (Univ. Paris Diderot & CEA Saclay)
*A panchromatic overview of accreting binary systems
 and their associated relativistic jets*
 ICC Seminar
 28/04/2014

Héctor Gil-Marin (Institute of Cosmology &
 Gravitation, Univ. Portsmouth)
*Measuring the galaxy bias, gravity and σ_8 using
 the bispectrum technique*
 ICC Seminar
 31/07/2014

Camille Avestruz (Yale Univ. & Yale Center for
 Astronomy and Astrophysics)
Cosmological Simulations of Galaxy Cluster Outskirts
 ICC Seminar
 10/11/2014

Mireia Montes (IAC)
*Age and metallicity gradients support hierarchical
 formation for M87*
 DAM Colloquium
 31/01/2014

Vibor Jelic (Kapteyn Astronomical Institute, Univ.
 Groningen & Netherlands Institute for Radio Astronomy)
*The LOFAR-Epoch of Reionization experiment:
 towards the first stars in the Universe*
 DAM Seminar
 13/03/2014

Martín López-Corredoira (Inst. de Astrofísica de Canarias)
The Twilight of the Scientific Age
 DAM Seminar
 24/04/2014

Natalia Lewandowska (Wuerzburg Univ.)
Giant Pulse Radio Emission From The Crab Pulsar
 DAM Seminar
 06/05/2014

Jerome Bouvier (IPAG, Grenoble)
*Angular momentum evolution of low-mass stars and
 brown dwarfs: observations and models*
 DAM Seminar
 03/06/2014

Franco Giovannelli (Istituto di Astrofisica e
 Planetologia Spaziale, Roma)
*The Prototype of Transient X-ray Sources A0535+26/
 HDE245770: Time Delay between Optical and X-ray flares*

DAM Colloquium
 20/06/2014

David W. J. Thompson (Dept. Atmospheric Science,
 Colorado State Univ.)
Climate change and midlatitude Weather
 DAM Colloquium
 09/07/2014

Eric Gotthelf (Columbia Astrophysics Laboratory,
 Columbia Univ.)
*What is powering HESS J1640-465, the Most Luminous
 Galactic TeV Source?*
 DAM Colloquium
 14/07/2014

David W. J. Thompson (Dept. Atmospheric Science
 Colorado State Univ.)
Periodicity in the midlatitude atmospheric circulation
 DAM Seminar
 16/07/2014

Giacomo Monari (Kapteyn Astronomical Institute,
 Groningen)
*The dynamical effects of the bar on the Galactic thin
 and thick Disks*
 DAM Seminar
 08/10/2014

David Valls-Gabaud (CNRS, Observatoire de Paris)
The MESSIER satellite: unveiling galaxy formation
 DAM Seminar
 14/11/2014

Laurent Loinard (Centro de Radioastronomía y
 Astrofísica, UNAM, México)
*Tomography of star-forming regions with VLBI radio
 interferometers*
 DAM Seminar
 28/11/2014

Fabio Anulli (INFN Rome)
*Measurement of exclusive hadronic cross sections via
 Initial State Radiation*
 HEP Seminar
 04/02/2014

Pau Figueras (DAMTP Cambridge)
*Localised plasmaballs and confinement/deconfinement
 in AdS/CFT*
 HEP Seminar
 06/02/2014

Daniel Arean (MPI Munich)
Dirty Holographic Superconductors
 HEP Seminar
 13/02/2014

Domènec Espriu (ICCUB)
What can unitarity teach us about the Higgs?
 HEP Seminar
 14/02/2014

Daniel G. Figueroa (Geneva Univ.)
Imprints of the Standard Model in the Sky
 HEP Seminar
 20/02/2014

Arnab Kundu (ICCUB)
Aspects of Thermalization and the AdS/CFT Correspondence
 HEP Seminar
 21/02/2014

Guillermo Silva (La Plata)
Wilson loops in ABJM
 HEP Seminar
 27/02/2014

Maximilian Attems (ICCUB)
State of the art realtime dynamics of non-equilibrium anisotropic systems
 HEP Seminar
 28/02/2014

Antonio Vairo (TUM)
Non-relativistic particles in a thermal bath
 HEP Seminar
 04/03/2014

Vittorio Lubicz (Univ. Roma 3)
Light quark physics and lattice QCD
 HEP Seminar
 06/03/2014

Thomas Epelbaum (IPhT, Saclay)
Non-renormalizability of the classical-statistical approximation
 HEP Seminar
 11/03/2014

Paul Kuijser (NIKHEF & ALICE collaboration)
Recent results on Pb-Pb and p-Pb collisions from ALICE
 HEP Seminar
 13/03/2014

Albert Renau (ICCUB)

Photon propagation in a cold axion background and strong magnetic fields
 HEP Seminar
 14/03/2014

Pere Talavera (UPC & ICCUB)
The lowest scalar in QCD from low-energy data
 HEP Seminar
 21/03/2014

Alexander Rothkopf (U. Bern, AEC)
Heavy Quarkonium: A thermometer for the quark-gluon plasma
 HEP Seminar
 25/03/2014

Marina Martínez (ICCUB)
Black String Flow
 HEP Seminar
 28/03/2014

Norihiro Tanahashi (Tokyo U., IPMU & Cambridge U., DAMTP)
Dynamical Meson Melting in Holography
 HEP Seminar
 03/04/2014

David Mateos (ICCUB)
Far-from-equilibrium Holography and Heavy Ion Collisions
 HEP Seminar
 04/04/2014

Miguel Tierz (Univ. Complutense de Madrid)
Chern-Simons matrix models and 1/2-BPS Wilson loops in N=4 SYM theory
 HEP Seminar
 10/04/2014

Anton Faedo (ICCUB)
On the IR of holographic gauge theories at finite density
 HEP Seminar
 11/04/2014

Yuko Urakawa (IAR, Nagoya Univ. and UB)
dS/CFT and prospects on cosmology
 HEP Seminar
 24/04/2014

Xumeu Planells (ICCUB)
Parity breaking in heavy ion collisions
 HEP Seminar
 25/04/2014

Cristiano Germani (LMU Munich)

Cosmological consequences of non-standard gravitational interactions

HEP Seminar

25/04/2014

Jorge Zanelli (CECS Valdivia)

2+1 black hole with SU(2) hair

HEP Seminar

08/05/2014

Joaquim Gomis (ICCUB)

Conformal symmetry for relativistic point particles

HEP Seminar

09/05/2014

Glenn Barnich (Univ. Libre de Bruxelles)

BMS3 representations, Virasoro coadjoint orbits and holographic positive energy theorems in 3d gravity

HEP Seminar

15/05/2014

Jorge Russo (ICCUB)

Localization and Quantum phase transitions in N=2 supersymmetric theories

HEP Seminar

16/05/2014

Tommi Markkanen (Helsinki Univ.)

Applications of Curved Space Field Theory to Scalar Field Models of Inflation

HEP Seminar

22/05/2014

Joan Soto (ICCUB)

Nucleon-nucleon effective field theory with dibaryon fields

HEP Seminar

23/05/2014

Claudio Pica (CP3-Origins)

Composite Higgs Dynamics on the Lattice: Spectrum of SU(2) Gauge Theory with two Fundamental Fermions

HEP Seminar

29/05/2014

Tolga Altinoluk (Univ. Santiago de Compostela)

CGC beyond eikonal accuracy and its applications in pA collisions

HEP Seminar

04/06/2014

Antonino Flachi (IST, Lisbon)

Chiral Symmetry Breaking and Geometry

HEP Seminar

05/06/2014

Wolfgang Hollik (MPI Munich)

Higgs bosons and precision physics

HEP Seminar

12/06/2014

Andrea Puhm (UC Santa Barbara)

Metastability in Bubbling Geometries

HEP Seminar

13/06/2014

Philippe Mota (Frankfurt Univ.)

Event-by-event fluctuations and the correlation between early and late emitted particles

HEP Seminar

18/06/2014

Alfredo Urbano (SISSA)

Fingerprints of Dark Matter in the gamma-ray sky

HEP Seminar

19/06/2014

Ben Shlaer (Tufts Universit)

Unimodular gravity and the problem of time

HEP Seminar

20/06/2014

Keiju Murata (Keio Univ.)

Electric Field Quench in AdS/CFT

HEP Seminar

09/09/2014

Diego Hofman (Univ. Amsterdam)

Warped Conformal Field Theory and Non-AdS holography

HEP Seminar

18/09/2014

Konstantinos Sfetsos (Univ. Athens)

Spacetimes for lambda-deformations

HEP Seminar

02/10/2014

Benson Way (DAMTP, Cambridge Univ.)

The Characteristics of Lovelock Theories

HEP Seminar

16/10/2014

Roberto Emparan (ICCUB)

The large- D limit of General Relativity

HEP Seminar

24/10/2014

Guy F. de Teramond (Univ. Costa Rica)

Baryon spectrum from superconformal quantum mechanics and its light-front holographic embedding

HEP Seminar

30/10/2014

José Ignacio Latorre (ICCUB)

Primes go Quantum

HEP Seminar

31/10/2014

Monica Guica (Uppsala Univ.)

Two Virasoro symmetries in stringy warped AdS3

HEP Seminar

06/11/2014

Kenji Fukushima (Tokyo Univ.)

Quarks in Glasma -- Particle Production with Magnetic Field

HEP Seminar

07/11/2014

Davide Meloni (Univ. Roma III)

A non-susy $SO(10)$ model for the physics below MGUT

HEP Seminar

13/11/2014

Marjorie Schillo (Leuven Univ.)

Unwinding Inflation and Brane Dynamics

HEP Seminar

20/11/2014

Christiana Pantelidou (ICCUB)

Four-dimensional conformal field theories with a helical twist

HEP Seminar

21/11/2014

Stefano di Vita (MPI Munich)

Standard Model vacuum stability with a 125 GeV Higgs

HEP Seminar

04/12/2014

Guillermo Ballesteros (ICCUB)

The effective theory of fluids and dark energy

HEP Seminar

05/12/2014

César Gómez (IFT UAM & CSIC)

Towards a corpuscular approach to gravity and cosmology

HEP Seminar

10/12/2014

Spiros Basilakos (Academy of Athens)

Geometrodynamics in Cosmology

HEP Seminar

11/12/2014

Alessio Notari (ICCUB)

Hemispherical Power Asymmetry and Dipolar modulations in Planck CMB Data

HEP Seminar

12/12/2014

Antonio Cuesta & Licia Verde (ICCUB)

Climbing the cosmic distance ladder

HEP Journal club

16/12/2014

Jose Ademir Sales Lima (São Paulo Univ., Brazil)

Accelerating Universe, Dark Energy and Alternative Cosmologies: The Case for a Dynamical Λ -Term

HEP Seminar

18/12/2014

Alessandro Pastore (U. L. Bruxelles)

Nuclear matter response function with a central plus tensor Landau interaction

FAN Seminar

24/04/2014

Luís Santos (Univ. Hannover)

Ultra-cold lattice gases with density-dependent hopping

FAN Seminar

15/05/2014

Fernando Sols (U. Complutense de Madrid)

Hawking radiation from sonic black holes in flowing atom condensates

FAN Seminar

03/07/2014

Albert Feijoo (ICCUB)

Cascade production in antikaon reactions with protons

FAN Seminar

10/07/2014

K.A. Gridnev (Univ. Saint Petersburg)

Properties of the nuclei in the neighborhood of the neutron and proton drip lines

FAN Seminar
15/07/2014

Laszlo Csernai (Univ.e Bergen)
New collective processes in high energy heavy ion collisions
FAN Seminar
17/07/2014

A. Gridnev (Univ. Frankfurt)
Threshold Phenomena: Halos and Efimov states
FAN Seminar
22/07/2014

Steve Campbell (Queens Univ., Belfast)
Shortcuts to optimal control: the LMG model

FAN Seminar
25/09/2014

Angela Mecca (U. Roma La Sapienza)
Effective interaction approach to the Fermi hard-sphere system
FAN Seminar
02/10/2014

Jordi Mur-Petit (IEM & CSIC)
Quantum technologies with cold polar molecules and molecular ions
FAN Seminar
13/11/2014

EVENT ORGANIZATION

At ICCUB

Graciani-Díaz, R.
Organization
DIRAC 4 EGI. Follow up mini-workshop
Facultat de Física, UB
13/03/2014

Graciani-Díaz, R.
Organization
DIRAC 4 ESRFs H2020 INFRADEV-4 Initiative
Facultat de Física, UB
14/03/2014

Solanes, J.M.
Organization
Physis 2014
Facultat de Física, UB
16/06/14-20/06/14

Zanin, R.
Organization
Galactic MAGIC Meeting
Facultat de Física, UB
15/09/14-16/09/14

Arnab, K.; Faedo, A.
Organizing committee
Workshop: Holography and Strongly Coupled Plasma in the Veneziano Limit
10/11/14-14/11/14

Figueras, F. (Chair); **Jordi, C.**; **Torra, J.**; **Luri, X.**;
Balaguer-Núñez, L.; **Romero-Gomez, M.**; **Masana, E.**;
Carrasco, J.M.; **Bascon, S.**; Bertolín, A.; Montes, P.;
Mor, R.; **Casamiquela, L.**; **Roca-Fabrega, S.**; **Olarte, S.**;
Portell, J.; **Fabricius, C.**; **Abedi, H.**; **Palmer, M.**
Local Organizing Committee
The Milky Way Unravalled by Gaia
Facultat de Física, UB
01/12/14-05/12/14

Aran, A.; **Bosch-Ramon, V.**; **Mescia, F.**; **Miralda-Escudé, J.**; **Notari, A.**; **Parreño, A.**
Organizing committee
ICCUB Christmas Meeting
Facultat de Física, UB
17/12/14-19/12/14

At other institutions

Paredes, J.M.
Participation in organizer committee
Cosmic Ray Origin - beyond the standard models
Conference Centre of San Vito di Cadore
16/05/14-22/05/14

E. Epelbaum; Phillips, D.; **Parreño, A.**; **Soto, J.**
Organizing committee
Bound states and resonances in Effective Field Theories and Lattice QCD calculations
Centro de Ciencias de Benasque Pedro Pascual
20/07/14-01/08/14

PUBLIC OUTREACH

Courses and Workshops

Masterclass on Particle Physics 2014

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.

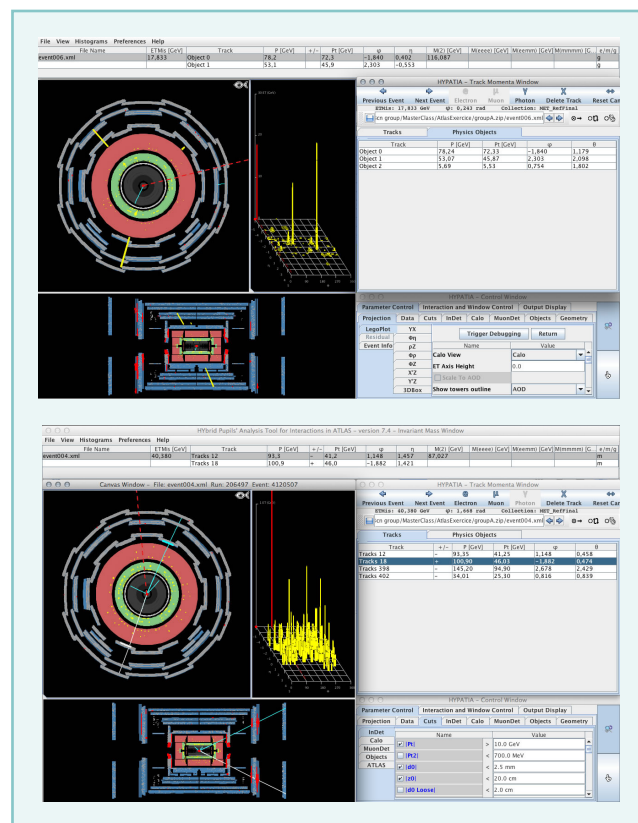
This year 2014, two sessions for high school students have been held, on the 27th of March and on the 2nd of April, and 164 students from 94 catalan high schools have attended. Additionally, a session for high school teachers has also been held on the 21th of March. This session was organized in collaboration with the *Institut de Ciències de l'Educació* of the UB and it included a workshop about teaching with inquiry techniques gaved by professors of the Psychology department of the UB.

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 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 2014 the ICCUB received 5 students within the framework of the two projects *Introduction to Theoretical Physics: Quarks, Black holes, Cosmology and Strings* (from the 18th of June to the 2nd of July) and *Discovering Particle Physics* (from the 23th of June to the 2nd July).



SOFTWARE USED IN THE MASTERCLASS ON PARTICLE PHYSICS

During the 2014 edition of the Masterclass on Particle Physics at ICCUB, students analysed real data from the LHC using the Hypatia software. This software uses real data from the ATLAS detector to produce the so-called "event displays", i.e. dynamic images which show how the particles travelled through the detector. Each screenshot corresponds to a different event display.

Exhibitions

The ICCUB is responsible of four exhibitions which are printed by the institute and annually exposed at different external centres like, high schools, libraries or civic centres. Two of these exhibitions were fully produced by the ICCUB.

A thousand million eyes for a thousand million stars

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

This is an itinerant exhibition about the Gaia mission consisting of 14 information boards which were edited and printed both in Catalan and Spanish in 2013.

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

Itinerary 2014 of the Catalan version:

- University of Barcelona (Historic building)
1 to 5 December 2014
In occasion of the International Congress *The Milky Way Unravalled by Gaia*.
- Sant Cugat Council
2 May to 12 June 2014
- Escola Mestral (Igualada)
1 to 13 May 2014
- University of Alacant
3 March to 29 April 2014
- Engineering schools of UPC (Terrassa campus)
17 February to 3 March 2014
Relativity divulgation session.
- Escola Nostra Llar (Sabadell)
11 to 28 February 2014

Itinerary 2014 of the Spanish version:

- Universidad Complutense de Madrid
All along 2014
- School Compañía de María (A Coruña, Galicia)
10 to 30 November 2014,
- IES de Manuela Rial Mouzo Cee (A Coruña, Galicia)
14 to 21 May 2014
- IES Fernando Blanco de Cee (A Coruña, Galicia)
30 April to 13 May 2014
- IES de Beade (Vigo, Galicia)
7 to 11 April 2014
- Colexio Martín Códax (Vigo, Galicia)
31 March to 4 April 2014
- Colexio Rosalía Castro (Vigo, Galicia)

24 to 27 March

- Colexio Amor de Dios (Vigo, Galicia)
17 to 21 March 2014
- Science Faculty of the Vigo University (Vigo, Galicia)
7 to 14 March 2014

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 2014:

- IES Menéndez y Pelayo (Barcelona)
19 November to 19 December 2014
- Centre penitenciari Ponent (Lleida)
11 February to 31 March 2014
- Associació Astronòmica de Sant Cugat-Valldoreix
December 2013 to January 2014
- Escola Joan Maragall (Sant Cugat)
27 to 30 January of 2014

The cosmic distances

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

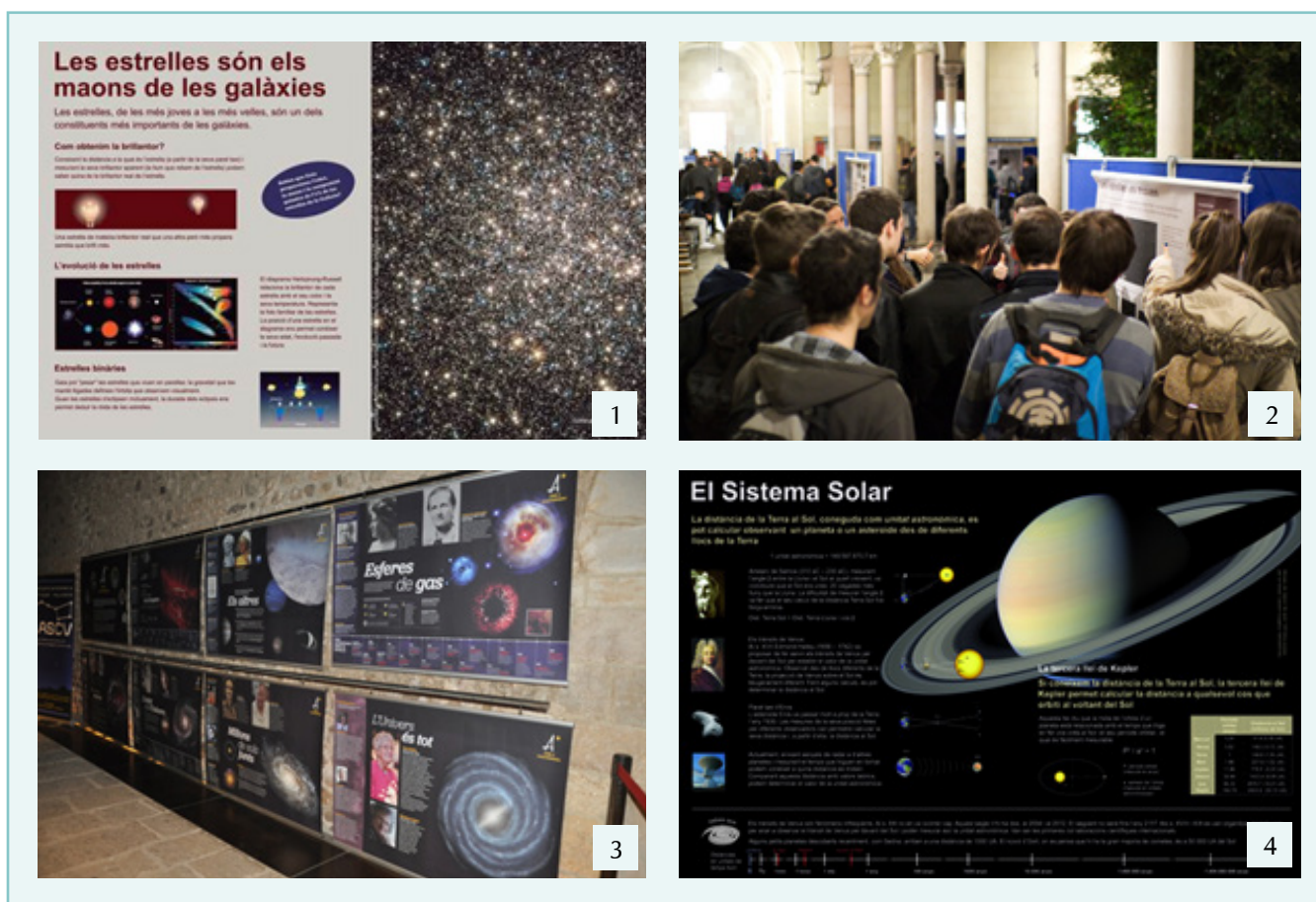
This exhibition, which was fully created by ICCUB members in 2012, shows the methods scientists use to calculate the distances to celestial objects, and how this methods have progressively evolved through the years depending on how far were the objects which were needed to be observed.

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/DistanciasCosmiques>

Itinerary in 2014:

- Escola Virolai (Barcelona)
12 to 24 November 2014.



EXHIBITIONS

1: “Mil milions d’ulls per mil milions d’estrelles” exhibition panel; 2: “Mil milions d’ulls per mil milions d’estrelles”, exposed at University of Barcelona; 3: “Amb A d’Astronoma”, exhibited at the “Associació Astronòmica de Sant Cugat-Valldoreix”; 4: “Les distàncies Còsmiques”, exhibition panel at the Virolai School, Barcelona.

Web Sites and social networks

ServiAstro. <http://serviastro.am.ub.edu/>

This is a web site maintained by the Astronomy and Meteorology Department of the UB. It offers information about past and future astronomical ephemerides, particularly those which are visible from Catalonia, and a compilation of tools for astronomical calculations, news, answers to frequently asked questions and links to lots of other websites about astronomy, organized in sections.

Descobrint la Física de Partícules amb l'LHCb,
<http://www.lhc.cat/>

This a web site maintained by the Experimental Particle Physics Grup and int contains didactic material produced by the group and information about their outreach activities.

Cataquark: piulades de recerca i divulgació,
<https://twitter.com/cataquark>

Twitter account maintained by ICCUB member J. Guasch devoted to particle physics news.

Gaia-UB in the social networks:

- <https://www.facebook.com/gaiaub>,
- <https://twitter.com/GaiaUB>
- <https://www.youtube.com/channel/UCAdmF8h-oCIZZjMFxWpM5A>

Facebook, Twitter and Youtube channel devoted to the divulgation of the Gaia Mission, particularly those activities in which ICCUB members participate.

Didactic Material

Gaia cell phone App

Android version for the Iphone app *Gaia Mission App* which was created in 2013. 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.

Pamphlet about ICCUB itinerant exhibitions.

It was designed and produced an informative pamphlet about the itinerant exhibitions organized by the ICCUB.

GREAT Science from the Gaia Data Releases Banner

It was designed a banner, to be hung at the Central building of University of Barcelona, during the meeting GREAT Science from the Gaia Data Releases.

Publications

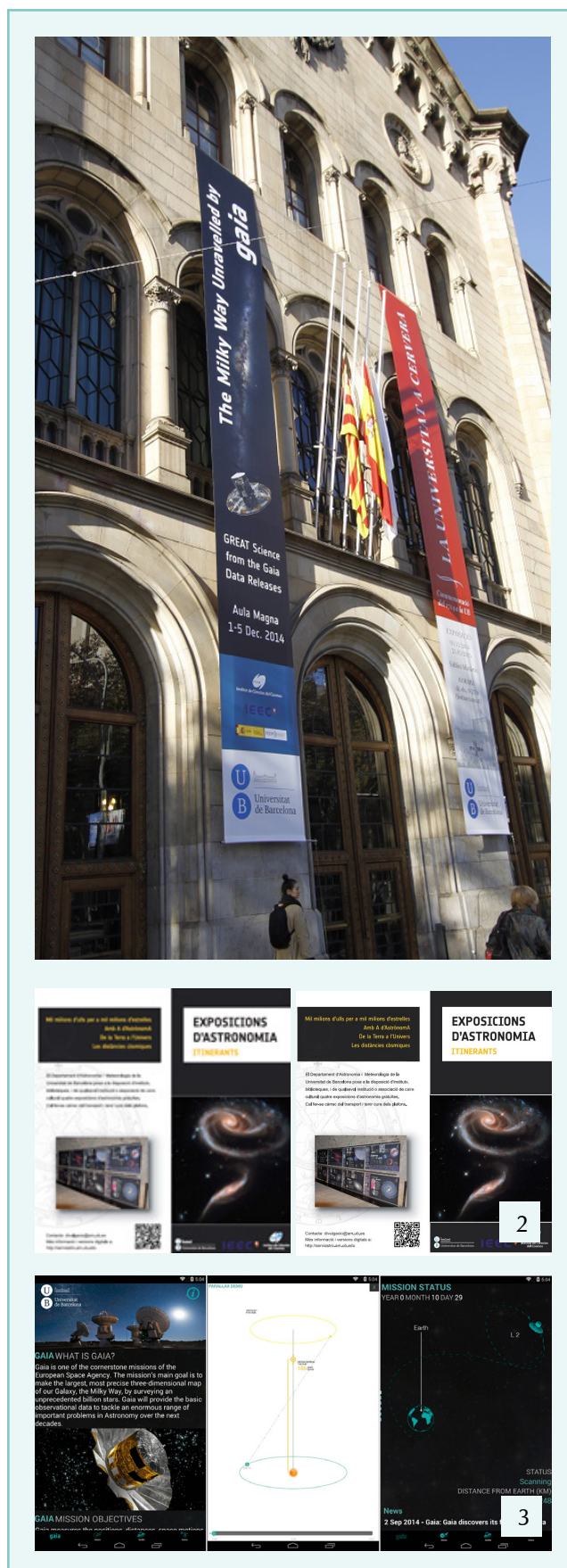
X. Luri, *Si tu me dices Gen lo deixo todo*, 2014. Writing of two chapters.

X. Luri, *El 'big data' també amaga respostes sobre l'Univers*, Diari ARA, 2014, http://www.ara.cat/suplements/diurne/tambe-amaga-respostes-sobre-lUnivers_0_1249675029.html

X. Luri, *Observar la pols del cometa pot ajudar la ciència*, Diari ARA, 2014, http://www.ara.cat/suplements/diurne/Observar-pols-cometa-ajudar-ciencia_0_1190880901.html

X. Luri, *Els experts treballen per reflotar el Galileo*, Diari ARA, 2014, http://www.ara.cat/suplements/diurne/experts-treballen-reflotar-galileo_0_1211878807.html

C. Jordi, **E. Massana**, **D. Galadí**, Physics dictionary (Spain): *Termcat*, 2014. Colaboration in the thematic area of Astronomy and Astrophysics.



DIDACTIC MATERIAL

1: Banner hung at the Historic building of UB during the GREAT Science - from the Gaia Data Releases meeting: 2: Pamphlet about the ICCUB exhibitions: 4: Screen shot of the Gaia Mission App for Android.

Press releases

The most precise measure of the Universe

9 January 2014

ICCUB Members: A. Cuesta, L. Verde

http://www.ub.edu/web/ub/en/menu_eines/noticies/2014/01/010.html

Spanish researchers discover the first black hole orbiting a 'spinning' star

16 January 2014

ICCUB Members: M. Ribó, J.M. Paredes

http://www.ub.edu/web/ub/en/menu_eines/noticies/2014/01/015.html

Gaia UB Group wins a 2013 Barcelona City Award

4 February 2014

ICCUB Members: Gaia Team

http://www.ub.edu/web/ub/en/menu_eines/noticies/2014/02/006.html

Special edition of the Particle Physics Workshop aimed at secondary education teachers

21 March 2014

ICCUB Members: A. Frutos, A. Moreno, H. Ruiz

http://www.ub.edu/web/ub/en/menu_eines/noticies/2014/03/037.html

The European Grid Infrastructure selects a software developed by ICCUB to give researchers access to computing resources

24 March 2014

ICCUB Members: R. Graciani

http://www.ub.edu/web/ub/en/menu_eines/noticies/2014/03/048.html

Dark energy hides behind phantom fields

25 March 2014

ICCUB Members: J. Solà

<http://www.agenciasinc.es/en/News/>

Joan Solà sull'energia oscura

28 March 2014

ICCUB Members: J. Solà

<http://gallery.media.inaf.it/main.php/v/voci/interviste/20140327-joan-sola.mp3.html>

Miraggi nel deserto quantistico

27 March 2014

ICCUB Members: J. Solà

<http://www.media.inaf.it/2014/03/27/quantum-vacuum-energy/>

The study of quasars reveals the most precise measurement of the expanding Universe

11 April 2014

ICCUB Members: J. Miralda

http://www.ub.edu/web/ub/en/menu_eines/noticies/2014/04/016.html

La UB se suma a la Big Data Week a Barcelona

6 May 2014

ICCUB Members: X. Luri, J. Portell, J. Torra

http://www.ub.edu/web/ub/es/menu_eines/noticies/2014/05/008.html

UB participates in the new Centre for Satellite Applications and Technologies created in Barcelona

18 June 2014

ICCUB Members: E. Salvador

http://www.ub.edu/web/ub/en/menu_eines/noticies/2014/06/037.html

Massive neutrinos and new standard cosmological model: No concordance yet

21 July 2014

ICCUB Members: L. Verde

http://www.ub.edu/web/ub/en/menu_eines/noticies/2014/07/052.html

La UB participa en el nou Centre d'Aplicacions Civils de Microsatèl·lits creat a Barcelona

1 September 2014

ICCUB Members: R. Guzmán, E. Salvador

http://www.ub.edu/web/ub/ca/menu_eines/noticies/2014/06/037.html

Gaia in your pocket: UB designs an app to track the progress of Gaia mission

10 September 2014

ICCUB Members: C. Jordi, M. Clotet

http://www.ub.edu/web/ub/en/menu_eines/noticies/2014/09/014.html

Gaia mission discovers its first supernova

12 September 2014

ICCUB Members: Gaia Team

http://www.ub.edu/web/ub/en/menu_eines/noticies/2014/09/016.html

Black hole gamma-ray lightning

10 November 2014

ICCUB Members: R. Zanin, J.M. Paredes, M. Ribó

http://www.ub.edu/web/ub/en/menu_eines/noticies/2014/11/015.html

The discovery that the expansion of the universe is accelerating receives another international award

12 November 2014

ICCUB Members: P. Ruiz-Lapuente

http://www.ub.edu/web/ub/en/menu_eines/noticies/2014/11/024.html

Gaia mission researchers meet at the UB

5 December 2014

ICCUB Members: Gaia Team

http://www.ub.edu/web/ub/en/menu_eines/noticies/2014/fotonoticies/12/003.html

Researchers use real data rather than theory to measure the cosmos

15 December 2014

ICCUB Members: R. Jimenez, L. Verde

http://www.ub.edu/web/ub/en/menu_eines/noticies/2014/12/041.html

The Gaia mission: one year after the launch

18 December 2014

ICCUB Members: Gaia Team

http://www.ub.edu/web/ub/en/menu_eines/noticies/2014/12/011.html

Talks

J. Miralda, *La Lluna i els seus misteris en la història de l'astronomia: de l'antiguitat fins a l'actualitat*, Agrupació Astronòmica de Terrassa, Terrassa, 14/02/14

M. Romero, *Descobrint la Galaxia amb Gaia*, IES Joan Oró, Lleida, 19/02/14

C. Jordi, *La missió espacial Gaia*, "La nostra llar" School, Sabadell, 21/02/14

X. Luri, *La matèria fosca i les seves alternatives*, 4th Relativity divulgation days, Terrassa, 22/02/2014.

E. Masana, *Què fan els astrònoms?*, 1st and 3rd course primary students (two talks), Puiggraciòs School, La Garriga, 13/03/14

E. Graugés, *L'antimatèria*, Outreach course *De què està fet l'Univers?* CosmoCaixa, Tarragona, 18/03/14

J. González, J. Portell, *Gestió de dades del projecte Gaia de l'Agència Espacial Europea*, XXII Fòrum CIS (CosmoCaixa - BCN), 24/03/14

J. Portell, *Cartografiando la Galaxia: el procesado de datos de la misión Gaia*, 8th Meeting of the SIG Lliure de Girona (statewide), 27/03/14

N. Garralda, *Avances tecnológicos en materia aereo-espacial llevados a cabo para construir este satélite: Misión Gaia*, Inauguration talk for the exhibition *Mil milions d'ulls per a mil milions d'estrelles*, Universitat d'Alacant, Alacant, 03/04/14

M. Romero, *Descobrint la Galaxia amb Gaia*, Primary School "Pia Tàrrrega", 25/04/14

M. Romero, *L'Univers, estrelles i planetes*, Primary School Escola Pia Tàrrrega, 25/04/14

C. Jordi, *Mil milions d'ulls per a mil milions d'estrelles*, Inauguration talk, Ajuntament St. Cugat, 08/05/14

J.M. Carrasco, *Gaia*, Agrupació astronòmica de Barcelona (ASTER), 08/05/14

X. Luri, *El mètode científic a la vida quotidiana*, Centre Cívic Golferichs, Barcelona, 15/05/2014

J.M. Paredes, *Agujeros negros en el Universo*, Inauguration talk for the *XIII Jornadas de Divulgación de la Astronomía*, Alacant University, Alacant, 16/05/14

X. Luri, *Relatividad y cuántica para escépticos*, EEEP, Barcelona, 17/05/2014

E. Masana, *Què podem veure al cel?*, 1st course students of the primary school Joan Coromines, Mataró, 22/05/14

J. Portell, *Resultats inicials del satèl·lit Gaia: milions de mesures des d'un milió de quilòmetres*, Agrupació Astronòmica d'Osona (Vic), 24/05/14

J.M., Carrasco, talk for the *I curs de formació de monitors d'astronomia Starlight*, Centre d'Observació de l'Univers (Àger), 26-27-05/2014

C. Jordi, *Gaia mira mil milions d'estrelles amb mil milions d'ulls*, Aules de la Gent Gran, Calella, 28/05/14

C. Jordi, *Cometes: fascinació o misteri*, Aules de la Gent Gran, UB, May 2014

C. Jordi, *Cometes: fascinació o misteri*, Aules de la Gent Gran, Sabadell, May 2014

C. Jordi, J. Portell, X. Luri, *Big Data en astronomia: de l'antiga Grècia als nostres dies*, Exhibition *Big Bang Daf Big Data en astronomia ta*, Centre de Cultura Contemporània, Barcelona, 10/06/14

J.M. Carrasco, *Gaia*, Espai cultural Galileu (Barcelona), 13/06/14

L. Garrido, *L'accelerador de partícules LHC: un viatge cap al Big Bang*, Physics School, University of Barcelona, 17/06/14

J.M. Carrasco, *Gaia*, 1st Meeting of the Astronomy Associations in Catalonia, (Igualada), 14/06/14

M. Ribó, *L'espectre electromagnètic (l'Univers invisible)*, Starlight formation course, Centre d'observació de l'Univers (Àger), 17/06/14

N. Garralda, M. Palmer, *Gaia*, Col·legi Sacala Dei, 19/06/14

M. Ribó, *Els forats negres... i altres objectes compactes*, Physis- Summer workshop, Physics School, University of Barcelona, 19/06/14

J.M. Solanes, talk for the *I curs de formació de monitors d'astronomia Starlight*, Centre d'Observació de l'Univers (Àger), 16/06/14.

J.M. Solanes, talk for the *Physis 2014*, Facultat de Física, 16-26/06/2014

J. Portell, *L'exploració de l'Espai: la revisitació d'una aventura clàssica*, course *El Festival de Sitges i el cinema fantàstic i de ciència ficció del segle XXI*, at *Els Juliol a la UB*, 16/07/14

R. Emparan, *Agujeros negros: espacio-tiempo al límite*, Centre de Formació Interdisciplinària Superior, UPC, Barcelona, 01/10/2014

X. Luri, *What does an astronomer do?*, ESADE, Sant Cugat, 01/10/2014

J. Portell, *Gestión de datos del proyecto Gaia de la Agencia Espacial Europea*, Hotel NH Constanza, Barcelona, 08/10/14

M. Ribó, *Els forats negres... i altres objectes*, 1st Astronomy Festival at the Montsec, Centre d'Observació de l'Univers (Àger), 18/10/14

R. Emparan, *Energía* (two talks), "Setmana de la Ciència 2014", Primary School CEIP Collserola, Sant Cugat del Vallès, 04/11/14

M. Weiler, H. Voss, *Conferència i retransmissió amb motiu de l'aterratge de la sonda Philae al cometa Churyumov-Gerasimenko*, Physics School, University of Barcelona, 12/11/14

X. Luri, *El mètode científic a la vida quotidiana*, Biblioteca de Blanes, 18/11/2014

R. Emparan, *Hasta el infinito, y más allá! De los agujeros negros a los confines del cosmos*, "La Ciència en primera persona - Dia de la Ciència a les Escoles, Setmana de la Ciència", CRP Vallès Occidental III. Rubí. 19/Nov/2014

E. Masana, *Private Views IV*, Tàpies Foundation, 22/11/14

J.M. Paredes, *Forats negres*, 3rd Astronomy Conference, Centre d'Estudis Casa de Cultura d'Ulldecona, Ulldecona, 22/11/14

C. Jordi, J. Portell, J. Torra, *Gaia, l'Odissea Galàctica*, congress *The Milky Way Unravelled by Gaia*, Historical Bulding, UB, 02/12/14

J. Portell, *El camí dels bits cap a la Ciència: Milions de mesures des d'un milió de quilòmetres*, Historical Bulding, UB, 02/12/14

E. Antiche, J.M. Carrasco, L. Casamiquela, C. Jordi, M. Monguió, M. Palmer, M. Romero, S. Roca, guided visits *Mil milions d'ulls per a mil milions d'estrelles*, International congress *The Milky Way Unravelled by Gaia*, Historical Building, UB, 02/12/14

Covering of astronomical events

Monitoring of the landing of the international mission Rosetta, 23/10/2014

It was prepared a website about the landing and it was covered the the retransmission of the landing process, which took place at the School of Physics, University of Barcelona.

Participation in TV and radio shows

J.M. Carrasco, Interview about the mission Mars One at *8 al dia* with Josep Cuní (8TV), 21/01/14, <http://www.8tv.cat/8aldia/videos/2-catalans-preseleccionats-per-viatjar-al-planeta-mart/>

J.M. Carrasco, Interview *Gaia: el pirmer mapa 3D de la Galàxia* at *El problema de Gettier* (Xarxa de Televisions Locals), 05/03/14 <http://www.balaguer.tv/el-problema-de-gettier-gaia-el-primer-mapa-3d-de-la-galaxia/>

J.M. Carrasco, Interview *La Lluna i l'home*, at *Les notícies de les 10* (Barcelona TV), 15/04/14 <http://www.btv.cat/alcarta/les-noticies-de-les/30579/>

X. Luri, Interview about Gaia at *El cafè de la República*, Catalunya Ràdio, June of 2014.

X. Luri, Interview about the arrival of the man to the moon at the section *Viaje por la historia*, La Vanguardia, 2014.

X. Luri, Interview about exoplanets at *L'Illa Robinson*, El punt TV, September of 2014.

X. Luri, Interview about exoplanets at *L'Illa Robinson*, El punt TV, September of 2014.

Miscellaneous

C. Jordi, member of the jury of *Adopta una estrella, investiga*

D. Balaguer; **J.M. Carrasco;** **L. Casamiquela;** **C. Figueras;** **C. Jordi;** **E. Masana;** **R. Mor;** **S. Olarte;** **S. Roca;** **J. Torra**, *Fira de la recerca en directe*, Capella room, Historic building UB, 08-10/04/2014. Talk about the Gaia mission addressed to the students of several high schools.

J.M. Carrasco, *Espai ciència*, Fira de Barcelona, 12/03/2014. Participation at the Gaia mission stand of *La UB Divulga*.

Equip Gaia, participation in the *Fira de la Recerca en Directe*, Parc Científic de Barcelona, 08-10/04/2014

J.M. Carrasco, Interview about the hidden side of the moon, *La Vanguardia Digital*, 01/10/14

J.M., Carrasco, participation in *Taller de coets*, Escola Font d'en Fargas, 21/10/14

X. Luri, Collaboration in 4 articles, *Diari ARA*, 2014



FIRA DE LA RECERCA EN DIRECTE

Joan Manel Carrasco, from the Gaia Team, at “Fira de la Recerca en Directe”, 2014.



Institute of Cosmos Sciences
C. Martí i Franquès, 1
08028 Barcelona

www.icc.ub.edu