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D. Espriu, Professor Honoris Causa of the State University of Saint Petersburg, 16/09/2014
Supernova Cosmology Project Team (incl. P. Ruiz-Lapuente), Breakthrough Prize in Fundamental Physics 2015, 15/11/2014

DEFENDED THESES

On the origin of masses at the LHC, J. González-Fraile, supervised by M.C. González-García, 05/09/2014
Applications of Supersymmetry: Exact Results, Gauge/Gravity Duality and Condensed Matter, A. Barranco, supervised by J. Russo, 03/10/2014
Stellar activity in exoplanet hosts, E. Herrero, supervised by C. Jordi, I. Ribas, 06/10/2014
Symmetry breaking and its restoration in QCD. Hadron physics in extreme conditions, X. Planells, supervised by D. Espriu, 06/11/2014
Milky Way-like galaxy simulations in the Gaia era: disk large scale structures and baryonic content, S. Roca, supervised by F. Figueras and O. Valenzuela, 26/11/2014
Physics of the Intergalactic Medium: A study of the Power Spectrum of the Lyman Alpha Forest and the Metal Content of Damped Lyman Alpha Systems, A. Ariño, supervised by J. Miralda-Escudé, 03/02/2015

DEFENDED THESES

First observation of two new baryonic beauty particles.
Please visit: http://icc.ub.edu/about/reports

OUTREACH ACTIVITIES

ICCUB REPORTS

Please visit: http://icc.ub.edu/about/reports
Real data is being used rather than theory to measure the cosmos

A research team from the ICCUB and the Imperial College London has used data from astronomical surveys rather than calculations related to general relativity to measure a standard distance that is central to our understanding of the expansion of the universe.

The standard ruler measured in the research is the baryon acoustic oscillation scale. The team calculated the length to be 143 Mpc (nearly 480 million light years) which is similar to accepted predictions for this distance from models based on general relativity [Phys.Rev.Lett. 113, 241302 (2014)].

**Black hole gamma-ray lightning**

The Magic telescopes at La Palma have recorded one of the fastest gamma-ray flares seen to date, produced in the vicinity of a super-massive black hole. The result, published in Science [Science, 346, 1080 (2015)], was explained by the Magic Collaboration, which includes ICCUB members, by a mechanism similar to that producing lightning in a storm.

**Magnetic moments of light nuclei from lattice quantum chromodynamics**

The ICCUB was involved in a recent work of the NPLQCD collaboration [Phys. Rev. Lett. 113, 252001 (2014)], published in December 2014, that demonstrates for the first time that Quantum Chromodynamics (QCD) can be used to calculate the structure of nuclei from first principles.

This study performed exploratory Lattice QCD calculations of the magnetic moments of light nuclear systems, at the SU(3) flavor symmetric point, corresponding to a pion mass of 800 MeV. When presented in terms of the natural nuclear magneton at the corresponding quark masses, the extracted magnetic moments were seen to be in close agreement with those of nature. Additionally, the magnetic moment of $^3$He was found to be close to that of the neutron, and that of the triton was close to that of the proton, in agreement with the expectations of the phenomenological shell-model, and therefore suggesting that this model structure is a robust feature of nuclei even away from the physical quark masses.

**CENSAT: A new Centre for Satellite Applications and Technologies in Barcelona**

CENSAT (Centre for Satellite Applications and Technologies) is a new centre of analysis, technological design and development of microsatellite scientific and commercial applications, promoted by the Barcelona City Council and supported by the UB, the UPC, the University of Florida and the ICGC.

ICCUB will be the centre most involved in the initiative. It will collaborate in issues such as the development of mathematical algorithms for microsatellite formation flying, the electronic design of sensors, big data processing, data analysis algorithms, etc.

**DAPCOM joins ESA**

DAPCOM Data Services, a spin-off company of the ICCUB and UPC, was selected in October 2014 to joint the ESA Business Incubation Centre of Barcelona due to the potential of its space technology FAPEC to be transferred from space sector to terrestrial applications. This will allow DAPCOM to enhance and boost its R&D activities on data compression techniques, which will reinforce the company as a reference in data compression technologies and techniques.

**Report on Night Sky Quality in Barcelona and Tarragona**

ICCB researchers have presented the final report, performed under contract with Gencat, in the area of Barcelona and Tarragona. The areas around Port de Beseit have been identified as a potential starlight place.
The Gaia mission: One year after the launch

Gaia will revolutionize our knowledge of the origin and evolution of our Galaxy and impact all fields of astrophysics in the next decades. After its successful launch on 19 December 2013 and the completion of the commissioning phase, Gaia has completed its first full-sky scan coverage yielding 10 billion observations with 90 billion individual images, 20 billion low-resolution spectra and 2.5 billion high-resolution spectra. More than ever collected from ground or space. The inspection of raw and pre-processed data confirms that the Initial Data Treatment (IDT) module, one of the critical items developed by ICCUB researchers, performs over the expectations. IDT is responsible for the ingestion and pre-processing of the 50 GB of daily data. The models for the photometric data reduction developed by ICCUB researchers have also demonstrated to be well performing.

Gaia's on-board detection algorithms registered more than 84,000 detections in the Cat’s Eye Nebula

Left: HST image of the Cat’s Eye 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.

LHC 2015 restart schedule

The Large Hadron Collider is scheduled to restart for physics early in 2015 after two years of maintenance and upgrading. The collision energy at restart will be 13 TeV, a significant increase over the initial LHC run.

The LHCb experiment, in which ICCUB participates, will be able to collect data of higher energy proton-proton collisions. This will increase by 4 times the detected number of particles containing b quarks, thus allowing us to get more insight into the asymmetry between matter and antimatter.

First observation of two new particles in the LHCb

Two new particles, known as the $\Xi_c$ and $\Xi_c^*$, are baryons made of one beauty (b), one strange (s), and one down (d) quark. The new baryons had been long predicted to exist, but their specific characteristics, such as their mass, were unknown.

The LHCb Upgrade

The LHCb detector has shown a very successful operation during the first period of LHC running. After restart, the LHC will be capable of delivering higher energy collisions. An LHCb upgrade is planned for 2018 which will allow the detector to exploit higher luminosity running starting in 2020.

The ICCUB has contributed to the LHCb upgrade with the design, production and test of a complete analog signal processing channel for the calorimeter, both in commercial on the shelf and ASIC (ICECAL-V2) versions. A first prototype for the input stage of the PACIFIC ASIC has also been designed for SiPM readout in the new Scintillating Fiber Tracker.
New edition of the ICCUB Colloquia starting in February 2015

The first speaker of the new ICCUB Colloquia series will be the distinguished Spanish physicist Ignacio Cirac, awarded Príncipe de Asturias 2006. The ICCUB Colloquia 2015 will consist on 6 exciting and accessible talks given by world renowned speakers about cutting-edge topics in cosmology, astrophysics and particle physics and will be directed to a diverse audience, including not only ICCUB members but also external researchers and graduate and master students. They will take place on Thursdays at 12:00 at the Aula Magna of the School of Physics, headquarters of the ICCUB, and will be preceded by an informal welcome with coffee and biscuits in which assistants will have the possibility to talk with the speaker.

The School of Physics hosts the exhibition Physics in our lives

The School of Physics of the UB hosts the exhibition “Physics in our lives”. The exhibition, created by National Center for Particle, Astroparticle and Nuclear Physics (CPAN), has been and brought to Barcelona by ICCUB and can be visited until 11 March 2015.

160 high school students will attend the Masterclass on Particle Physics

The Masterclass, organized by IPPOG at the international level and by ICCUB in Catalonia, will be held the 2 and 9 March at the School of Physics. During each session, participants will be able to analyse data registered by the Large Hadron Collider (LHC) at CERN.