



AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2019

Turno de acceso general

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Referencia: RYC2019-027683-I
Área Temática: Ciencias físicas
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Título:

Supernova forensics to constrain progenitors and improve cosmology

Resumen de la Memoria:

I am an observational astrophysicist with broad and multidisciplinary interests spanning supernova (SN) science, massive stars, galaxy evolution, and cosmology. The prime goal of my research is to deepen the understanding of the systematic uncertainties in the SN light-curve standardization for measuring cosmological distances by using the information retained in their environment. My research has significantly advanced our knowledge regarding the characteristics of the local environment of SN and their connection with the observed SN properties, as well as the characterization of their progenitor systems.

I obtained a PhD in Physics from U. Autònoma de Barcelona in 2011, under the supervision of Prof. Ramon Miquel. During my PhD I became a member of the SDSS-II SN survey, which compiled a sample of type Ia SNe (SN Ia) at intermediate redshifts ($0.1 < z < 0.45$). I was involved in several cosmological analyses with SN Ia, two of them were part of my PhD thesis: a spectroscopic characterization of the peculiar SN Ia 2007qd as a SN Iax (McClelland et al. 2010), and correlations between photometric parameters of SN Ia and the distance to the host galaxy center used as a proxy for local galactic properties (Galbany et al. 2012).

My first 2-year postdoctoral experience was at the Instituto Superior Técnico under the supervision of Dr. Vallery Stanishev and Prof. A. M. Mourao. I became a full member of the CALIFA survey, which obtained Integral Field Spectroscopy (IFS) of more than 600 nearby galaxies. The main goal of the postdoctoral project was to characterize the local environment of different SN types which resulted in two separated studies I led: the relation between different SN types and the strength of the local star formation (LG et al. 2014a), the effects of the local metallicity on determining the SN type (LG et al. 2016a), and the combination of resolved molecular gas observations (LG et al. 2017). I continued this effort with PISCO, a compilation of new observations of SN host galaxies with IFS (Galbany et al. 2018).

Next, I got a 3-year Fondecyt postdoctoral fellowship to work with Prof. Mario Hamuy at the Astronomy Department of Universidad de Chile. The aim of the fellowship was to develop a purely photometric technique to standardize SN II light curves and make them useful as standard candles for cosmological distance measurements (LGL 2014b). This effort involved the reduction and analysis of multiband historical unpublished data from the CATS survey that is now available to the community (LG et al. 2016b). Given my previous experience with IFS, we started in 2015 the AMUSING survey (PI: Galbany/Anderson) that has already collected IFS observations of more than 600 nearby galaxies using MUSE (LG et al. 2016c).

Then, I became a Research Associate at the Physics and Astronomy Department of University of Pittsburgh, and besides keep working on SN environments with IFS, I spent most of my time involved in the LSST and W-FIRST collaborations. Currently I hold a Marie Skłodowska-Curie Fellowship at the Department of Theoretical and Cosmological Physics of Universidad de Granada, focused on exploiting IFS data of SN host galaxies from AMUSING and PISCO to deepen the understanding of the systematic uncertainties in measuring cosmological distances from SNIa light-curves, by using the information retained in their environment.

Resumen del Currículum Vitae:

During my career in astrophysics I have been concerned with key observational aspects of supernova (SN) science that have a direct impact on other fields of astrophysics such as stellar evolution, galaxy enrichment, and cosmology. The prime goal of my research is to deepen the understanding of the systematic uncertainties in the SN light-curve standardization for measuring cosmological distances by using the information retained in their environment. My research has significantly advanced our knowledge regarding the characteristics of the local environment of SN and their connection with the observed SN properties, as well as the characterization of their progenitor systems. The topics I have been investigating can be listed as: (1) Improving the use of SNIa as distance indicators; (2) Characterizing SNIa subgroups; (3) Constraining SN progenitors via Integral Field spectroscopy of their environments; and (4) Exploring multiple alternative probes to measure extragalactic distances.

Although these topics cover different scientific goals, they share a common drive to develop innovative data mining techniques, and can be handled with the same kind of observations. In addition to these main lines of research I have also been contributing to i) understanding the nature of the extragalactic extinction towards SN observations, which is another important source of uncertainty in SN standardization; ii) a wide range of galaxy enrichment, formation, and evolution studies; and iii) observation and interpretation of gravitational wave counterparts. In the near future I would like to break new ground in these fields in various directions.



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So far, I have published 172 articles, 10 as a first and 7 as a second author (most led by students I mentored), with more than 9000 citations and an h-index of 43 (ADS, 2020 Jan 14). My work has been presented in international conferences giving in total 52 talks, including 25 invitations to deliver seminars at different institutions. I have been PI of 26 successful observational proposals in a competitive basis in the largest observatories around the world, and participated in other 28 observational campaigns. I have led analyses within major international collaborations (SDSS-II/SNe, CALIFA, PESSTO, DES, HSC-SSP, MaNGA, J-PLUS, LSST, WFIRST), including PISCO and AMUSING in which I am the PI. I had the chance to mentor 11 undergraduate and 12 graduate students, including two funded 3-months research visits, and directed 6 of them in their Master thesis. I have been in the LOC/SOC of three conferences, and led the organization of up to 9 workshops focused on SN different science topics (including a Special Session at EAS 2020).



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Nombre: ARAGONES GOMEZ, JUAN LUIS

Referencia: RYC2019-028189-I

Área Temática: Ciencias físicas

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Título:

Locomotion and collective behaviors of artificial systems in complex environments

Resumen de la Memoria:

My lab at Universidad Autónoma de Madrid (UAM) applies experimental and theoretical methods to study soft matter systems out-of-equilibrium. In these systems, the interactions are of the order of thermal fluctuations and thus, small perturbations can drastically modify the assembled structures and their dynamical behaviors. More specifically, we are focusing on the study and characterization of the emergent interactions between microscopic motile elements mediated by complex environments, as well as the resulting dynamics of the system due to the complex nature of the matrix. I really enjoy this type of problems, in which the coupled dynamics between the matrix and a motile element generates fascinating behaviors not possible in ideal systems. This type of coupled systems, where physics and chemistry meet, invites to develop different approaches to tune the system interactions and control the system behavior. Moreover, this research line is pushing us towards biological challenges, where complex substrates are ubiquitous, playing a pivotal role on an infinity of vital processes such as tissue remodeling, immune response or bacterial communication.

I studied Chemistry at Universidad Complutense de Madrid (UCM), where I also carried out my PhD under the advice of Prof. Vega, which focused on the phase behavior of water by means of molecular simulations. During the PhD, I visited the laboratories of Prof. Siemann (USA) and Prof. Gallo (Italy), and the research work carried out during both visits resulted in the publication of papers. In October 2012, I earned my PhD with the maximum qualification and received the Best Thesis Award by UCM. After my PhD, I joined the laboratory of Prof. Alexander-Katz at the Massachusetts Institute of Technology as a postdoc for 4 years. During that time, I had the opportunity of facing a great variety of scientific challenges and developing my own ideas. First, and inspired by the movement of cells, we designed an artificial microscopic walker able to walk on biologically relevant substrates exploiting friction. We also studied how the transport properties of these active systems are determined by the structure and mechanics of the environment.

In May 2017, I joined the Condensed Matter Physics Centre (IFIMAC) at UAM as a young group leader through a highly competitive contract. Then, in May 2018 I was awarded with the prestigious Junior Leader fellowship (JL) by "la Caixa", thus I declined the Juan de la Cierva Incorporation fellowship. My group is currently formed by 1 Postdoc, 3 PhDs (funding: 1 FPI, 1 through JL and 1 Chilean government) and 2 MSc students (1 MS fellowship from IFIMAC). Recently my group has received funding by MICIU through the Retos call. These three grants as PI sum up 390.5 k . In addition, I have participated in a total of 13 research projects.

I have attended to many international conferences and workshops and given several invited seminars and conferences. I hold multiple collaborations, both international (2 USA, 1 EU) and national (3). Finally, I am also committed with the academic side of the career. I have taught 253 hours in both theoretical and practical bachelor courses for 4 different student backgrounds: physicists, chemists, chemical engineers and biochemists. I have supervised several Bachelor and Master thesis and I am the main director of three ongoing PhD thesis.

Resumen del Currículum Vitae:

Publications:

- 28 publications (2 under review); 1339 total citations (Google Scholar, 1046 WoS); 48 citations/paper average and 80 citations/year average.
- 26 publications (93%) in Q1 (SJR) journals and 5 in D1 journals (18%; including 1 Nat. Comm., 2 PNAS, 2 PRL).
- 14 as first author, 2 as corresponding author and 13 without PhD supervisor.
- h-index = 18 (Google Scholar; 17 WoS); i10 = 21; AcclF = 103.3

Funding: 15 awards (grants/fellowships); 3 as PI with 390.5 k

- Research grant from MICIU Retos 2018 (RTI2018-101953-A-I00)
- Junior Leader la Caixa
- Doctor Banco Santander Maria de Maeztu
- Research grant from MICIU Redes de Investigacion 2018 (RED2018-102593-T)
- Juan de la Cierva Incorporacion 2017 (declined)
- NVIDIA GPU Grant
- Short-listed to interview ERC Starting Grant 2019 (Final panel score: B; Ranking range 69%-100%).

International experience:

- 01/2013 - 11/2016 Post-doctoral Researcher at MIT (USA).
- 06/2012 - 09/2012 PhD visit at at Universitat Roma Tre (Italy).



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- 04/2011 - 08/2011 PhD visit at at University of Minnesota (USA).
- 26 conferences/workshops as contributor; 6 invited lectures/seminars: 2 at international conferences.

Organization of R&D activities:

- Member of the local organizing committee CMD2020GEFES, 31/08/2020 - 04/08/2020, Madrid (Spain).
- Organizer of the Summer School Nicolas Cabrera, 05/08/2020 - 09/08/2020, Madrid (Spain).
- Organizer of the BioReAct - EBSA 2019 satellite meeting, 19/07/2019, Madrid (Spain).

Research Leadership and Supervision:

- Current group: 3 PhD students (main supervisor); 1 Postdoc; 2 MSc.
- Completed Supervisee: 4 BSc.
- 3 short projects (8 weeks) supervision at MIT.

Teaching:

- Taught 253 hours in both theoretical and practical bachelor courses.
- Tutor PAT (plan de accion tutorial) of 10 physics students since 09/2018 until they obtain their degrees.
- Professional tutor for an internship (Curricular practice).
- Attended to trainings about development of Leadership skills in research.

Outreach:

- Several interviews in popular Radio and Newspapers (SER, COPE, La Razon, El Mundo).
- Several events including public lectures, open days and hosting pre-university students.



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Nombre: DE LA CRUZ DOMBRIZ, ALVARO
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Título:

Constraining the Dark Energy and Dark Matter contents: Towards the era of precision Cosmology

Resumen de la Memoria:

My research to date has dealt with Cosmology and High Energy Physics and their multiple relations and overlapping results. More specifically, I have thoroughly worked on the possibility of dark matter and dark energy to be explained by the so-called extended (also dubbed modified) theories of gravity. Hence, throughout my career, I have studied their theoretical soundness and confronted their predictions with the latest astrophysical, cosmological and particle-physics data.

On the one hand, I have studied a variety of theoretical features for the aforementioned theories for which I have made seminal contributions in studying the cosmological expansion history, the growth of large-scale structures - both in the metric and in the 1+3 gauge-invariant formalisms -, the thermodynamics of black holes, the gravitational collapse of spherical configurations, the attractive character of gravity in late-time universe, the interplay between gravitational and particle physics in high-energy configurations such as neutron stars, the existence of topologically non-trivial solutions, the relevance of cosmological backreaction effects, the soundness of cosmographic reconstruction techniques and the effects of cosmological torsion. More recently, I am the PI of one project (EUR 100,000.00; 2020-2022, NRF South Africa) to study the features of gravitational waves in such theories and their observational implications.

On the other hand, I devoted a particular section of my research to comparing these results to experimental data from both available catalogues and prospects provided by satellites, particle accelerators or ground-based detectors, using data from Supernovae, Baryon acoustic oscillations, measurements of $H(z)$ and galaxies matter power spectra (through BOSS and different generations of SDSS as well as other surveys) and neutron stars gravitational redshift, among others.

My second field of expertise has been the study of one of the possible mechanisms to explain the dark matter cosmological component: the brane-world extra dimensions theories. These theories enable solving the hierarchy problem by lowering the fundamental gravity scale to the electroweak scale and may also explain the observed accelerated expansion of the Universe. I have studied the astrophysical and cosmological effects that those configurations may have in the CMB data and I have pursued a research line to determine the gamma-ray fluxes and radio signals from annihilating dark matter produced by the oscillations in brane-world theories. Thus I have tested the goodness of the predictions when compared to data coming gamma-ray fluxes from detectors such as MAGIC, EGRET, HESS and ACT. More recently, I have extended this line of research to radio signals using AMS02 data and SKA telescopes prospects, a collaboration in which I am also a member in two Working Groups.

All the aforementioned techniques, when applied in a systematic way to any theory or model claiming to be viable, assist enormously in breaking the degeneracy of predictions provided by these theories with respect to the standard cosmological Concordance Lambda-CDM model and well-known results from General Relativity. These techniques also help to constrain the parameters space of suggested models and eventually may provide some hints on the underlying theory of gravity and other fundamental issues in Physics.

Resumen del Currículum Vitae:

In Aug. 2015 I joined the Dept. of Mathematics and Applied Mathematics at the U. of Cape Town (UCT) as a Faculty Lecturer and a full-time member of the Astrophysics, Cosmology and Gravity Centre (ACGC) at UCT. Promoted to Senior Lecturer in January 2019. ACGC is a worldwide reference institution in both the Cosmology and Astrophysics disciplines. Also, I was appointed as an Associate Member in the SKA collaboration (Working Groups: Cosmology since 2017, Gravitational Waves since 2019).

Previously, I obtained my PhD at the Complutense U. of Madrid (UCM 2010, Summa cum Laude) on topics of extended theories of gravity. Then in the period 2010-2012 I was hired as a postdoctoral fellow in the Cosmology and Gravity group at UCT. Then in 2013, I received the prestigious Marie Curie postdoctoral fellowship at the ICE-IEEC at the UAB-CSIC Barcelona. In 2014, I was awarded a Profesor Ayudante Doctor (Assistant Lecturer) contract at the Theoretical Physics Dept. at the UCM Madrid, working in the Effective Field Theories group.

Since 2006 I have published more than 50 articles in high-impact peer-reviewed journals ($h=25$ impact factor, 2000 citations, Jan 2020) with seminal contributions in the areas of cosmological large-scale structures and dark matter signals. Among them, there are six very well-known papers (more than 100 citations), five well-known papers (more than 50 citations), one white paper for the SKA collaboration and one extensive EU-COST review. I am also a scientific referee for twenty-seven journals (including Nature) and several international



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scientific agencies. Also, I have developed an extensive teaching record at both undergraduate and graduate levels. I have also given postgraduate courses at the U. of Lisbon (2105), IFT UAM-CSIC Madrid (2016) and the U. of Oslo (2017-2019) as an invited lecturer and performed research visits at renowned institutions such as the Universities of Geneva, INFN Torino, California Irvine, Marseille, Heidelberg, Oslo, Lisbon and the Kavli Institute of Beijing. At the moment, I mentor 2 postdocs, 2 MSc theses and 2 PhD theses. So far, I have already graduated 2 PhD students, 7 MSc students and supervised 14 Honours theses. Notably, both ENQA DOCENTIA and the equivalent of this agency in South Africa have accredited my performance as a lecturer. Throughout the course of this time, I have regularly delivered talks at international meetings, delivered 10 conference proceedings contributions and organised seven scientific conferences, one of the last ones was the Texas2017 Symposium (260 participants, Dec. 2017).

I have also been a member of the scientific teams for seventeen research projects funded by either Spanish, European or fully international agencies. Since 2016, I have been a member of two running EU-COST actions and a member of the Management Committee for one of them. Throughout my career I have been the Principal Investigator (PI) of nine funded research projects in both Europe and South Africa, for which funds of EUR 450,000.00 have been set aside.

In terms of scientific outreach, I frequently deliver public talks for wide audiences and appear in public media. I have been member of several university committees, examiner in PhD committees and I chair the Mathematics Dept. UCT Internationalisation Committee. Since 2016, I have been the EU Erasmus+ facilitator in South Africa. In Nov. 2019 I was elected President of the Society of Spanish Researchers in South Africa (RAICEX).



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Nombre: DI CINTIO , ARIANNA
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Área Temática: Ciencias físicas
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Título:

Galaxy formation with simulations: the small-scale problems of cosmology

Resumen de la Memoria:

I am a theoretical astrophysicist specialized in running and analyzing numerical cosmological simulations of galaxies, to understand how they form and evolve, and to address open questions within the current cosmological model at small, galactic scales. I have been working actively in the field of cosmological numerical simulations, being directly involved into projects such as the Constrained Local Universe Simulations (CLUES, Gottloeber+10), the Making Galaxies In a Cosmological Context (MaGICC, Stinson+13), the Numerical investigation of a hundred astrophysical objects (NIHAO, Wang+15) and the Romulus (Tremmel+17) simulations. I am expert in using several simulation codes (Gadget and Gasoline), and analysis tools (AHF halo finder and pynbody). My main interest is understanding the different aspects of the formation of galaxies, by means of detailed comparisons between state-of-the-art simulations and observations: for this, I work in close collaboration not only with theoreticians, but also with observers. In the past years I have made major contributions to a variety of topics in the area of galaxy formation and evolution, in particular to the understanding of dwarf, ultra-diffuse and low surface brightness (LSB) galaxies, to the role of feedback in shaping dark matter density profiles, as well as to constraining dark matter models using numerical simulations. Some of the main lines of research that I have carried out during my career include the study of: i) The Local Group of galaxies, ii) The distribution of matter within galaxies and the density profiles of dark matter haloes, iii) The low surface brightness universe, iv) Alternative dark matter models.

Resumen del Currículum Vitae:

Arianna Di Cintio obtained her PhD in Astrophysics at the Universidad Autonoma de Madrid in July 2014, marks sobresaliente cum laude, with mención internacional, winning the Exceptional PhD prize from UAM in the same year. Since then, she has been awarded 3 prestigious independent fellowships to carry out her research: 3 yrs at the DARK cosmology center (Copenhagen), 5 yrs at the AIP-Leibniz institute for astrophysik (Potsdam), and more recently a Marie Curie Individual Fellowship at the IAC (Tenerife), where she currently works. Despite of her young career, as of January 2020 (5 and 1/2 yrs after her PhD) she has a total of 34 published papers, over 1380 citations, and h-index of 19. She has been main organizer (chair or co-chair) of 7 international meetings held around the world. She is scientific referee for at least 6 different international journals, including MNRAS, JCAP, ApJ, A&A, PRD, Science Bulletin. She has been referee in various international scientific committees, including OPC referee for ESO telescope time assignment P103 and next P107, USA NSF National Science Foundation 2019 panels, Spanish telescope allocation time committee CAT 2019/2020, 2 PhD thesis committees, 2 postdoctoral position reviewing committees, and 1 Grants committee for Argentinian government. She has been invited to more than 25 international conferences, either as plenary, review, or focused talks. In addition she delivered other 10 contributed talks in conferences. She has been invited to 19 colloquia in international institutes. She lectures in different PhD schools (2017 Cosmology School in the Canary Islands, Fuerteventura, and 2020 COST WG1 Milky Way Gaia School, Barcelona). She won several grants and awards, including 2 for her master and PhD thesis, and 2 million CPU hours on international nodes as PI. She supervised/ing 4 students at the bachelor, master and PhD level (3 currently at IAC) and led papers with other 2. She is part of international projects, i.e. NIHAO and CLUES collaboration. She has more than 240 hours of teaching experience at undergrad and master level. She regularly participates to outreach activities, both in schools and for the general public, including mentoring of women in physics.



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Área Temática: Ciencias físicas
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Título:

Quantum computation with superconducting circuits

Resumen de la Memoria:

My academic career focuses on quantum computation and quantum optics using superconducting circuits.

The main results I obtained were achieved in two very ambitious and challenging projects of high difficulty developed over the course of my PhD in TU Delft and my postdoctoral position at IQC, which I led from their inception. Both projects have resulted in publications of very high impact in the field of quantum optics and superconducting circuits in Q1 journals, triggering follow-up works by research laboratories around the world (WMI in Germany, NICT in Japan) and theory teams (Prof. Blais in Canada, Prof. Nori in Japan, Prof. Grifoni in Germany) using the outcomes of my work. The results of my research have led to unprecedented levels of light-matter interaction, which did not seem attainable at a time before the start of my scientific career and have positioned me as a renowned world-leader in ultrastrong light-matter couplings.

Most publications in my curriculum had a real impact, with original and difficult topics involved, addressing open questions not previously explored. I was the researcher in charge of the two most important experiments I have been involved with and presented the results at important international conferences (APS March Meeting) and workshops (Benasque2015, CEWQ2018, WQED2018).

In all institutions where I worked, I have taken every opportunity to effectively play the role of leading investigator. I have at the same time co-supervised Master and PhD theses and administered the laboratories where I worked. I developed fruitful collaborations not involving my direct supervisors, which are still active and have positively influenced the success in my career. I taught several courses to undergraduates, and while at IQC I developed a 5-lecture module for a graduate course.

Since the start of my position at BSC, and currently as tenure-track researcher at IFAE, I have launched a new line of research on experimental quantum computation with superconducting circuits. I have already been granted national and European projects to fund my research. I directly supervise two PhD and two master students. I have been invited as committee member of several PhD theses. I started a summer school series in 2018 on 'Experimental Quantum computation' to be repeated in 2020. I chaired sessions at international conferences and workshops. I also regularly participate at public events to disseminate my research to all audiences.

A short summary of my research results:

- H index: 13/11 (Google Scholar/Scopus).
- Total number of citations: 1479/1009 (Google Scholar/Scopus).
- 15 publications, all in Q1 journals. First author in 6 publications.
- 15 participation at international conferences, 4 as invited speaker.
- 28 invitations to workshops, schools, seminars and symposiums.
- Publication <https://doi.org/10.1103/PhysRevLett.105.237001> cited 572 times (Google Scholar).
- Organizer of 1 international summer school and co-organizer of 2 international conferences.

Resumen del Currículum Vitae:

During my PhD at TU Delft, I performed challenging experiments with superconducting circuits for quantum information applications. The project I led was developed during the whole PhD, and concluded in a high-impact publication in PRL (2010) with over 500 citations which is extremely high in its field. In my first postdoctoral position at Caltech, I participated in experiments in the field of quantum optics with cold atoms. The experience of participating in a challenging project not mature enough strengthened my capacities with problem-solving and the detection and implementation of risk-control measures. In my following postdoctoral position at the Institute for Quantum Computing (IQC), I embarked in new directions in the area of propagating microwave fields in superconducting circuits, which culminated in publications in Nature Physics, Nature Communications and Physical Review Applied. The results of my research have significantly influenced the field of quantum optics with two highly-cited



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publications, opening a new field of research on ultrastrong couplings, positioning me as a renowned world leader. During my PhD and postdocs, I developed solid collaborations with the Spanish-based groups of Prof. Solano and Dr. García-Ripoll, as well as international renowned groups, such as Prof. Oliver at MIT, USA, Prof. Weides at University of Glasgow, and Dr. Roch at Grenoble. These collaborations have resulted in high-impact publications and continue to be very active.

Since 2017, I led a new line at the Barcelona Supercomputing Center (BSC) on quantum computing, using my expertise in superconducting circuits. I acquired transverse skills to complement my profile as group leader, such as project and research group management. I have been principal investigator in several funded proposals, including 'Proyectos I+D de Excelencia', and MISTI (USA).

Since May 2019, I established a new group at the High Energy Physics Institute (IFAE) located in Bellaterra (Barcelona), as tenure-track researcher. In this new position, I am establishing a new laboratory of quantum computing using my previous expertise. Currently, two PhD candidates, a master student and two undergraduate students are under my direct supervision.

I have already published an article under my lead as a principal investigator, along with a first-author Review of Modern Physics article. I have received competitive funds from the La Caixa foundation Junior leader fellowship, and the Quantero-based consortium that I created involving several of the strongest European laboratories. I also led another consortium in the FET Open call to build a superconducting quantum processor, to be established at IFAE, that is under review.

In all institutions where I worked, I led the scientific development and presented the results at important conferences. I have at the same time co-supervised Master theses during my PhD and during my postdoc at IQC, where I also co-supervised PhD theses. I am frequent reviewer of several of the most high-impact journals in physics and actively participate in outreach activities.

I am co-founder of startup Qilimanjaro, based on quantum computing technology. I am also well tied to the industry through my involvement in the Barcelona-based consultancy Entanglement Partners.



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Nombre: MORENO LLACER, MARIA

Referencia: RYC2019-028510-I

Área Temática: Ciencias físicas

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Título:

Física experimental de partículas (CERN/LHC): física del quark top y bosón de Higgs

Resumen de la Memoria:

Publications: 878 (most of them Q1); citations 98751; hHEP-index: 149; h-index 87

Research lines

- Data analysis (top quark and Higgs boson physics)
- Monte-Carlo event generators for simulation of QCD processes at hadron colliders
- Detector development and R&D: characterization of silicon modules

Scientific awards:

- Premio Real Sociedad Española de Física - Fundación BBVA: Investigador Novel en Física Experimental 2018
- Leona Woods Distinguished Postdoctoral Lectureship Award 2018, by Brookhaven National Laboratory, NY, USA
- Principal Investigator of LaCaixa-JuniorLeader research grant 2019-2022
- CIDEGENT 2019 research grant (2020-2024, PI)
- Seal of Excellence certificate (European Commission), for my H2020-MSCA-IF-2018 proposal

Commissions of trust

- Member of Editorial Boards (CERN internal rigorous review), since 2016
- Referee of three thesis committees (evaluator and/or jury in thesis defense), 2017-18
- Management of scientific activities: four positions as convener within the ATLAS collaboration and LHC working groups, co-organizer of ATLAS physics workshop and HASCO summer schools

One of the key questions in particle physics today is the understanding of the Electro-Weak Symmetry Breaking mechanism and origin of the mass of fundamental particles. The properties of the recently discovered Higgs boson still need to be accurately measured. The ongoing LHC (Large Hadron Collider) program is a unique opportunity to address this and many other open/unresolved questions in the Standard Model of Particle Physics, by making precise measurements involving heavy quarks where new physics effects are expected to be more pronounced. As an experimental particle physicist, working since 2007 in the ATLAS experiment of the LHC at CERN laboratory, now as principal investigator (PI) of LaCaixa-

JuniorLeader grant and previously as a CERN Research Fellow, my research focuses on the precise measurement of the top quark couplings, which is the heaviest elementary particle and with the strongest coupling to the Higgs boson.

The main topic of my Ph.D. thesis was the measurement of a novel observable sensitive to CP (charge-parity) violation in the tWb vertex using polarised top quark events. I was awarded with PhD state grants (JAEPreDoc and FPU) and I joined the ATLAS group at IFIC (CSIC-U.Valencia), participating actively in the Run-1 commissioning phase at CERN. My first postdoc was at the University of Goettingen in Germany (also teaching and supervising students) and later I joined CERN with a Research Fellow (also preselected for CERN LD staff in Nov. 2018). My research focused on the Higgs boson produced in association with a top quark pair reaching a major milestone in 2018, the observation of $tt+H$ process, for which I was awarded with two prizes.

Based on my expertise in top quark physics, I was coordinator of the ATLAS Top Quark Properties group (2016-2018). Being also involved in theoretical modelling studies, I was appointed convener of two ATLAS Physics Modelling groups, MC validation (2015-2016) and Top processes (since 2018), and the LHC Higgs $tt+H/t+H$ group (since 2017). I am also working in detector development and technology, towards future upgrades of the LHC. I have been invited to >40 international conferences and workshops. I am very active in outreach activities and qualified as CERN official guide.

Resumen del Currículum Vitae:

My career focuses on one of the key questions in particle physics today: the understanding of the Electro-Weak Symmetry Breaking mechanism and the origin of the mass of fundamental particles. The properties of the recently discovered Higgs boson still need to be accurately measured. The ongoing LHC (Large Hadron Collider) program is a unique opportunity to address this and many other open/unresolved questions in the Standard Model of particle physics, by making precise measurements involving heavy quarks where new



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physics effects are expected to be more pronounced. As an experimental particle physicist, working in the ATLAS experiment at CERN s LHC, now as PI of a Junior Leader grant and previously as a CERN Research Fellow, my research lines focus on the precise measurement of the couplings of the top quark, the heaviest elementary particle and with the strongest Yukawa coupling to the Higgs boson. My outstanding contributions have been awarded and recognized with positions of responsibility and invitations to conferences.

My career in science started already before the end of my physics degree, since I participated in competitive research programs for students: European Space Agency success contest, grants from CSIC (Becas JAE de Introducción a la Investigación) and Education & Science Ministry (Beca de Colaboración), GSI and CERN summer student.

Thanks to my academic records, I obtained two state grants to do the PhD and I joined the ATLAS IFIC's. I did performance studies of combined muon and jet reconstruction relevant for first ATLAS cross-section measurements, and the main topic of my PhD was the measurement of a novel observable sensitive to CP violation using polarised top quarks.

After graduating, I joined Uni. Goettingen (Germany) with a postdoctoral position in the ATLAS group. My teaching experience was boosted having the opportunity to give lectures and supervise students. My main research topic was the search for the Higgs boson produced in association with a top quark pair, one of the LHC flagship measurements. I was also leading other analyses of top quark properties, I became an expert on top quark physics and I was appointed as coordinator of the ATLAS Top Quark Properties group (2016-2018). Since the precision of some of these LHC results is limited by theoretical uncertainties, I was actively involved on modelling studies and working in close collaboration with Monte Carlo generators' authors to implement their latest developments. For this, I was appointed as convener of two ATLAS Physics Modelling groups and LHC Higgs tt+H group. Within the CERN team (as Research Fellow), I worked on silicon detector development and advanced statistical data analysis. I have been invited to >40 international conferences, as well as colloquiums/seminars in prestigious laboratories (SLAC, BNL, IHEP, MPI and Bonn).

My main goal for the next years is to fully exploit the LHC potential performing measurements of novel observables sensitive to the Higgs self-coupling and CP-structure of top quark Yukawa coupling. I am also interested in global interpretations (combining several LHC results) to set constraints on new physics following a model independent approach.



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Título:

Star and planet formation across different astronomical scales

Resumen de la Memoria:

My career is devoted to the study of star and planet formation from a broad perspective. This research line is divided in three sub-topics depending on the spatial scale considered, all guided through a common path: the study of accretion. The mass accretion rate is a fundamental parameter that constraints the growth of the object under analysis, measuring the amount of material that falls onto its surface per unit time.

On small scales I play a leader role studying the formation of planets. I have led statistical studies aiming to identify young stars with protoplanetary disks -the sites where planets form- with more probabilities to host planets, as inferred from their general observational properties. Currently, I aim to break the sharp contrast between the large number of detections of planets around evolved stars and the few candidate planets in disks around young stars. To this end I make use of high-resolution techniques focused on particular sources, publishing several high-impact works based on state-of-the-art instrumentation like SPHERE/VLT. I recently led a couple of papers showing that an alternative, relatively classic technique (spectro-astrometry in H α) can be used to test the presence of forming -accreting- planets and understand the way they grow. Currently I lead the largest survey in the northern hemisphere aiming to find planets in formation using this technique. Once the exoplanet population around mature stars can be compared with a significant number of planets in disks around young stars we could have a clear picture about the formation of planetary systems similar to our own.

On intermediate scales, I have significantly contributed to show that two types of young stars that have been studied separately for decades -low mass T Tauris and intermediate mass Herbig Ae/Be (HAeBe)- actually accrete in the same manner. My results have also showed that a transition between accretion modes must occur at some point within the high-mass end of the HAeBe regime, for which these early type stars are my main focus now. I lead an ambitious project based on data from the new interferometer GRAVITY/VLTI, XMM-Newton and the coming World Space Observatory with ~ 300 hours of observations awarded for the coming years that will face the problem in more detail than ever. The final goal is to have a broad picture about how stars form considering the full mass range.

On large scales I recently led a high-impact paper showing that there is a unique, global correlation connecting the rate at which gas transforms into stars and the amount of dense gas mass available for star formation that spans 16 orders of magnitude, probably representing one of the widest ranges of any empirical correlation known. The possible implications of our finding are many. In short, our study could represent a crucial step towards a unified view of star formation across a vast range of astronomical scales. We have proposed a bottom-up hypothesis to explain the global correlation in terms of the basic constituents of star formation: the stellar accreting population hosted by molecular clouds and galaxies. My immediate goal is to test our hypothesis from a well defined observational programme, which is based on infrared data taken with the Spitzer and (the future) James Webb space telescope.

Resumen del Currículum Vitae:

I was reincorporated to Centro de Astrobiología (CAB-CSIC/INTA, Madrid) on 2017 thanks to an Ayuda de Atracción de Talento Investigador, a highly competitive grant to attract research talent working abroad. I have previous post-doctoral experience at the University of Leeds (UK), Clemson University (USA) and Universidad Autónoma de Madrid, where I obtained my PhD on January 2012. My doctoral research was conducted at LAEFF (then a seminal part of the CAB), at the facilities of the European Space Agency in Spain (ESA/ESAC-Madrid), where I also did my master-degree project and spent almost a year as an ESA trainee. I gained additional pre- and post-doctoral international experience through long and short stays (e.g. at the Space Telescope Science Institute, USA), and my international activity continues nowadays participating in teams and consortia like the European Astrobiology Institute.

Since 2010 I have published 38 refereed papers in international journals with the highest impact in the field, 13 as first author. With more than 1100 citations, my work has obtained sustained recognition by other means too: my thesis, based on three first-author articles, was classified the 2nd best Spanish thesis in Astrophysics by the Spanish Astronomical Society (SEA) and then nominated by SEA for the best European thesis. Some years later one of my 2015 first-author papers was a scientific highlight of the year according to the European Southern Observatory -ESO; the world's most important scientific organisation devoted to astrophysics-, and deserved an independent research note by the prestigious journal Nature. Recently, my last two refereed papers have been highlighted by the Astronomy & Astrophysics journal. The impact of my work also reaches the general public outside academia, based on several press releases, and CSIC has recognised my professional trajectory by including me as one of the few scientist in the Protagonistas de la Ciencia list.

During my career I have led and participated in several competitive calls obtaining almost 1 million euro in funds for research, my actual Talento contract including 200000 euro for project expenses. I also lead and participate in dozens of accepted observational proposals judged by international committees to use state-of-the-art ground- and space- based observatories, currently being Principal Investigator of three large surveys with around 300 hours of observations awarded for the coming years. Remarkably, I have experience with a broad



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range of observational techniques.

In addition, I serve as referee and panellist for major astrophysical journals and institutions, and also as member of Master Thesis tribunals. I have organised international workshops in Spain and abroad, disseminating scientific results in conferences and seminars through invited or plenary talks, and publishing proceedings and related book chapters. Teaching and Outreach are also part of the transfer of knowledge activities that I carry out. I have been the Master thesis supervisor of three post-graduate students and co-advisor of a pre-graduate student, collaborating in the supervision of several PhD theses. Currently, I lead a team with PhD student under my supervision and a post-doc also contracted through my Talento project.



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Turno de acceso general

Nombre: CUMMINGS , ARON
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Título:

Energy transport and conversion in nanoscale systems

Resumen de la Memoria:

I am a Senior Researcher at the Catalan Institute of Nanoscience and Nanotechnology (ICN2) in Barcelona. I specialize in numerical simulation of the transport of charge, spin, and heat in nanoscale systems such as carbon nanotubes (CNTs), nanowires, graphene, and other 2D materials, and how the properties of these systems may be exploited for next-generation applications in electronics, spintronics, and sensing.

I completed a Master's degree at Washington State University, where I studied thermal transport in CNTs, and a PhD at Arizona State University, where I studied spin transport in semiconductor nanowires. During a postdoc at Sandia National Laboratories, I studied charge transport in CNT transistors and photodetectors. During my time at ICN2 I have investigated how defects and disorder impact the transport of charge, spin, and heat in graphene, graphene van der Waals heterostructures, and other 2D materials.

I am the PI of two projects (one FLAG-ERA, one European) on gas sensing, the co-PI of a FLAG-ERA project on 2D material modeling, and the co-PI of a completed national project on spin transport in Dirac systems. I am the co-supervisor of two PhD students and the supervisor of one postdoc.

I am currently collaborating with an experimental group in the US to develop graphene-based gyroscopes for navigation applications, and am establishing collaborations with experimental groups at ICN2 to investigate optical sensing applications with graphene. I am also hiring one postdoc, to join in mid-2020, to implement a computational framework to study the interplay and interconversion between light, electricity, heat, and spin in graphene and other nanoscale materials.

I have published 44 journal articles (31 in Q1 journals) and 3 book chapters, with 758 (1100) citations and an h-index of 18 (20) in Web of Science (Google Scholar). I have presented at 26 international conferences, including 8 invited talks, and have given 7 invited seminars. I have mentored 4 summer students, I am the co-supervisor of 2 PhD students, and the supervisor of one postdoc (+1 more to arrive in mid-2020). I am a referee for >15 journals, averaging >10 reviews per year, a reviewer for US Office of Science grant proposals, and I am on the screening committee of the US Department of Energy's Computational Science Graduate Fellowship.

Resumen del Currículum Vitae:

I am a Senior Researcher at the Catalan Institute of Nanoscience and Nanotechnology (ICN2) in Barcelona. I specialize in numerical simulation of the transport of charge, spin, and heat in nanoscale systems such as carbon nanotubes (CNTs), nanowires, graphene, and other 2D materials. Over the course of my career, I have focused on how transport in these systems may be exploited for next-generation applications in electronics, spintronics, and sensing.

I obtained a Master's degree at Washington State University, where I studied thermal transport in CNTs, and a PhD at Arizona State University, where I studied spin transport in semiconductor nanowires. As a postdoc at Sandia National Laboratories, I studied charge transport in CNT transistors and photodetectors. During my time at ICN2 I have investigated how defects and disorder impact the transport of charge, spin, and heat in graphene, van der Waals heterostructures, and other 2D materials.

I am the PI of two projects (one FLAG-ERA, one EU) on gas sensing, the co-PI of a FLAG-ERA project on 2D material modeling, and the co-PI of a completed national project on spin transport in Dirac systems. I am the co-supervisor of two PhD students and the supervisor of one postdoc. I am collaborating with an experimental group in the US to develop graphene-based gyroscopes for navigation applications, and I am establishing collaborations with experimental groups at ICN2 to investigate optical sensing applications.

At each step in my career I have developed a different set of numerical tools to study the problems at hand: molecular dynamics for thermal transport in CNTs, scattering matrices for spin transport in nanowires, nonequilibrium Green's functions for charge transport in CNT electronic and optoelectronic devices. At ICN2 I have developed efficient real-space simulations based on the Kubo formula to study graphene systems containing tens of millions of atoms.

My medium and long-term research goals involve the implementation of a computational framework to study the interplay and conversion



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between light, electricity, heat, and spin in graphene and other nanoscale materials. This project will unify my long experience with the numerical simulation of heat, spin, and electron transport, and will enable deeper exploration of how these phenomena may be utilized for applications in electronics, spintronics, sensing, and energy harvesting. I will hire one postdoc in mid-2020 to begin work on this project.

I have published 44 journal articles and 3 book chapters, 31 of which are in Q1 journals such as Physical Review Letters, Nano Letters, ACS Nano, 2D Materials, Advanced Materials, Chemical Society Reviews, and Nature Communications. I have 758 (1100) citations and an h-index of 18 (20) in Web of Science (Google Scholar). More than 80% of my citations have appeared in the past 5 years, highlighting my growth as a researcher. I have presented at 26 international conferences, including 8 invited talks, and I have given 7 invited seminars. I have mentored 4 summer students, I am the co-advisor of 2 PhD students, and the supervisor of one postdoc (+1 to arrive in mid-2020). I am a referee for >15 journals, averaging >10 reviews per year, a reviewer for US Office of Science grant proposals, and I am on the screening committee of the US Department of Energy's Computational Science Graduate Fellowship.



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Título:

Physics beyond the Standard Model

Resumen de la Memoria:

I did the PhD in the University of Granada, combined with long stays at CERN and ETH, on the field of model building and collider phenomenology. I was subsequently postdoc at DESY, where I became also interested in dark matter, effective field theories and cosmology. In particular, together with local postdocs, I compared the potential of different collider and direct detection facilities in simplified models of dark matter. This work has shaped several ATLAS and CMS searches, and it has received more than 100 citations in just four years. Also, together with my Master student at the time, I worked out a viable solution to the dark matter and baryogenesis problems, and made one of the first detailed estimates of the reach of gravitational wave observatories to the stochastic background generated in first order phase transitions at the electroweak scale. This work has been cited more than 70 times, and it allowed me to join the CosmoWG of the LISA Collaboration.

After a one-year interlude at the IFIC for family reasons, I moved to the IPPP Durham as research fellow of the Royal Society in the context of the Newton International Fellowships, which allowed me to lead my own international project on composite dark matter. There I became also interested in flavour physics, and in particular in new rare top and B meson decays predicted in non-minimal composite Higgs models, as well as in CP violation.

In 2019, I was the first selected candidate in the Juan de la Cierva-Incorporación program and I joined the University of Granada. In the near future I aim to focus my research more on the quantum structure of effective field theories, as well as on gravitational wave physics (I am member of LISA) and experimental aspects of colliders (I became recently member of the ATLAS Collaboration).

Resumen del Currículum Vitae:

I finished my PhD in less than 3 years with the greatest honors, having been awarded the prize to the best PhD thesis in Science at the University of Granada (out of 93). During that period I published 12 articles on the collider phenomenology of beyond the Standard Model physics. In particular, I developed as single author one of the few non-minimal composite Higgs models to the date (more than 70 citations). After completing my PhD, I moved to the ETH Zurich for two months. I started working on the interplay between collider, dark matter and other cosmological signatures of new particles. During that time, I was also awarded the first prize in the V Outreach Contest organized by the Spanish CPAN in the category "Outreach Articles".

I moved then to DESY as research fellow. I published 10 articles in two years, two of them receiving over 100 citations. During that time I also supervised one PhD student and one Master student. I was awarded the individual performance bonus by DESY, "in recognition of the exceptionally good work done in 2015". I also got very involved in teaching activities, coordinating a whole master course on the Standard Model of particle physics. At the end of this time, I also started to write an outreach book on Quantum Mechanics, which was later published under the title of "Física cuántica para Alicia". Due to the sudden illness of a relative, I resigned after two years and I moved to the IFIC in the context of the Severo Ochoa excellence program. I published several articles (another one as single author) and I continued doing outreach, being selected as one of the finalists of the XVIII edition of the international contest "Science in action".

During 2017 I was awarded the Newton International Fellowship (success rate ~ 7 %) which supports early stage post-doctoral researchers to carry out their research projects at UK institutions. I was therefore based at Durham University as research fellow of the Royal Society for two years. I managed to collaborate with 9 members of the IPPP, publishing several papers with two to four authors. I also continued doing outreach very extensively, including a two-week tour to the remote Orkney islands to explain particle physics to hundreds of primary and secondary school pupils.

In 2019 I joined the University of Granada as fellow Juan de la Cierva-Incorporación (first among the selected candidates). Currently I am



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supervising the doctoral thesis of two PhD students, and I have continued doing outreach activities. In total, I have coauthored 43 peer-reviewed articles. I have written more than 65 % of my papers without my thesis advisors (most with only other postdocs/students, including my five most cited), two by myself. In total, my work has received over 2000 citations, h-index = 26. I have given talks at more than 60 international conferences and seminars all around Europe as well as United States and Asia, more than 40 as invited speaker. Moreover, I have co-organized 4 conferences. I have also made research stays at CERN, Zurich, Fermilab, Bern and Prague, among others. I am involved in the ATLAS Collaboration and in the LISA CosmoWG. I have also obtained experience in applying and managing national and international funding, being PI of several international projects. Finally, I have acted as referee for peer-reviewed journal as well as for funding agencies.



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Título:

Exploring the Extreme Universe through Relativistic Jets

Resumen de la Memoria:

My investigation is focused on the study of relativistic jets at high energies, including the study of gamma-ray blazars, gamma-ray bursts (GRBs) and the search of gravitational waves (GWs) counterparts.

The exploration in very high energy (VHE, $E > 100$ GeV) gamma rays became possible only recently thanks to the development of the Cherenkov telescopes. The VHE sky is still vastly unexplored, being the extragalactic sky only composed of 75 sources (68 of them blazars). My main research line is the study of VHE gamma-ray blazars, where I have contributed to the study of around 35% of the currently known extragalactic VHE emitters. These studies are also important to constrain the cosmological backgrounds: the Extragalactic Background Light (EBL) and the Intergalactic Magnetic Field (IGMF).

The origin of the gamma-ray emission from blazars (relativistic jets) is still highly debated. This can only be addressed in a multi-wavelength framework to test the predictions from different theoretical models. I am the leader of different multi-wavelength projects which allowed us to test and constrain the origin of gamma-rays. I have also studied the structure of blazar jets and found evidences for a more complex jet structure than the one typically considered in the current generation of jet models.

I have also contributed to the study of GRBs and GWs. The highlight of my studies on this topic is the detection of the first X-ray counterpart of a gravitational wave (GW170817) together with the follow-up in optical-IR. This work allowed us to find the first observational evidences that link the origin of short GRBs to neutron star mergers as well as identify the production of heavy elements within the associated kilonova explosion. Recently, I have participated on the detection of the second kilonova detected at IR associated to GRB 160821B.

All this work lies the foundation to the operation and scientific exploitation with the future Cherenkov Array Telescope (CTA) whose northern observatory is currently under construction in La Palma (Spain).

Resumen del Currículum Vitae:

After completing my PhD thesis at Instituto de Astrofísica de Canarias in 2011, I have worked as a postdoctoral researcher at different international institutions. More than three years as Research Associate at NASA Goddard Space Flight Center. I have different responsibilities within the gamma-ray community, currently I am extragalactic physics coordinator and AGN flare working group leader for the Cherenkov Telescope Array (CTA) collaboration and target-of-opportunity coordinator for the MAGIC collaboration. I am also the responsible for the scientific exploitation at IAC of the Cherenkov ASTRI mini-array to be installed in Tenerife. In the past, I have been Active Galactic Nuclei (AGN) coordinator, observation scheduler, PI for the Gamma-ray Burst (GRB) observations and member of the publication board for the MAGIC collaboration. These responsibilities demonstrate my expertise in the field.

My main research line is focused on the study of relativistic jets, mainly in AGN. Since 2015 I also started to contribute to the search of gravitational waves (GWs) counterparts, participating in the first detection of a X-ray counterpart of a gravitational wave GW170817. My experience in hardware/technical work is based on my participation on the construction and commissioning of the MAGIC II telescope, the commissioning of the HAWC observatory, the testing phase and commissioning of the CTA LST-1 camera and the assembly of the mirror interface plates for LST-1. I have also strong experience in observations and data analysis, having enjoyed more than 150 nights of observations. While my main expertise is focused on gamma rays, I have also wide experience in optical and X-rays. In particular, I have been granted in highly competitive proposal calls for e.g. NuSTAR and Swift X-ray, as well as GTC optical observations being myself the PI. Indeed, I was awarded a Swift grant of 37 k which I managed as PI in addition to the yearly 8 k awarded by NASA from 2013 to 2016. I have been invited to 6 different NASA review panels (4 of them as panel chair). I am currently member of the Research Division Committee at IAC as well as a member of the master and PhD commission at ULL. I have acted as referee for high impact journals. Currently, I am co-director of one PhD, and I was the director of three master theses. I have also experience mentoring PhD students during my stay at NASA Goddard Space Flight Center. Moreover, I have teaching experience in optical spectroscopy and high energy astrophysics. Regarding the organization of scientific events, I have been the organizer of the NASA Journal Club at NASA Goddard Space Flight Center, part of the seminar committee at IAC, local organizer of the 6th Fermi Symposium and the CTA collaboration meeting at La Palma, as well as part of



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the scientific organizer committee for the inauguration of the Large Size Telescope-1 (LST-1) part of CTA. My contribution to outreach encompasses a wide range of activities as astronomy talks, participation at NASA Science Jamboree, press conferences and releases, media interviews among other activities. Being one of the most active members within the MAGIC collaboration, I was awarded with the Florian Goebel prize by the MAGIC collaboration in 2016. I have been invited to 13 talks at international and national conferences and seminars at world-wide top institutions, as Yale University and NASA Goddard Space Flight Center.



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Turno de acceso general

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Título:

Growing black holes: from the first seeds to active galactic nuclei

Resumen de la Memoria:

My research aims at investigating how supermassive black holes form and grow and which role they play in galaxy formation and evolution. This includes the study of intermediate-mass black holes (IMBHs) and active galactic nuclei (AGN), which is my main line of research, as well as of ultraluminous X-ray sources, dwarf galaxies, radio jets, and galaxy mergers.

I carried out my PhD at the Max-Planck-Institut für Radioastronomie (Germany) in just three years. The focus of my thesis was the study of observational evidence for binary black holes in the context of galaxy evolution, which resulted in six first-author refereed publications. One of the most relevant results was the discovery of two strong candidates for IMBHs, which are thought to be the seeds from which supermassive black holes in the early Universe grow.

Given the potential role IMBHs play in black hole and galaxy growth, I actively pursued my research on this field during my postdocs at the Instituto de Astrofísica de Canarias (Spain), the Harvard-Smithsonian Center for Astrophysics (USA), the University of Montréal (Canada), and now at the Institute of Space Sciences (Spain). I carry out my research following a multiwavelength approach (optical, infrared, radio, and X-ray observations), contrasting the observational results with theoretical models, and building a network of international collaborations. Some of the most notable results I have obtained during my postdoctoral career have been the discovery of an IMBH with a powerful radio jet in the arm of a spiral galaxy, the finding that the most massive black holes grow more rapidly than the galaxies they inhabit, and the discovery of the youngest dwarf galaxies to host AGN. These results have been the focus of several press releases, and have provided very significant advances in our current view of how supermassive black holes grow.

Resumen del Currículum Vitae:

My work has provided me with an international recognition that is reflected by the nearly 30 invited talks in international conferences and prestigious institutions and the invitation to write a review on IMBHs and a comment for Nature Astronomy. I have also exceptional skills in leadership (as demonstrated by the numerous projects I have led and by being awarded observing time as PI in world-renown facilities), and in acquiring research funding (~332 k €, of which ~173 k € associated to Spanish projects) in the form of fellowships (Beatriu de Pinós, Juan de la Cierva, IMPRS, IAC summer fellowship) and research grants (NASA observing time budget, COSPAR, DFG, COST, RadioNet). I am referee of several high-impact scientific journals in astronomy (Nature Astronomy, MNRAS, Proceedings of Science), proposal reviewer of very competitive observatories (Canarian telescopes, Gemini, ALMA, Chandra, NuSTAR), and member of numerous international collaborations (SKA, DESI, VLASS, eXTP, PAU). I have supervised >10 Master/undergrad students, and taught Astrophysics to undergrad and Master students (9 credits). I have been member of the scientific and local organizing committee of several scientific workshops, and been involved in numerous outreach events (workshops, public talks, interviews in newspapers, radio, TV). I have published 65 scientific papers (24 as first or second author in refereed journals), which have been cited >800 times. My h-index is 18 (source: ADS).



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Título:

New generation of electronic devices based on low-dimensional materials

Resumen de la Memoria:

During 14 years of research experience, including a PhD in Physical Chemistry (UCM, Spain) and 3 Postdoctoral positions (1 year in Brazil, 2.5 years in Czech Republic and 3.5+ years in Spain), I have acquired a broad range of scientific and personal skills which enable me tackling interdisciplinary problems. Throughout the different periods and research institutions, my work comprehends from the synthesis of 2D materials to the analysis of their response under different environments. My interest in 2D materials, such as graphene and transition metal dichalcogenides (TMDs), relies on their extraordinary mechanical and opto-electronic properties and the coupling between them, whose understanding is essential for later technology purposes. My scientific achievements are twofold. First, I have developed innovative approaches to study the mechanical and optoelectronic properties of 2D materials. Second, in my current research position, I provide fundamental input to researchers in a more applied field; showing the impact that the morphology, quality and strain level may have in the performance of 2D materials-based electronic devices. I recognize the needs in the technologies developed in my group for neural interfacing and understand how my expertise could help in the advance of such technologies; after that I start developing my own research line, to improve the performance of electronic devices based on graphene through the optimization of the 2D materials and the understanding of their interaction with the environment.

In my current position in ICN2 with Prof. Garrido I shared responsibilities for team management including the supervision of ungraduated (3), Master (1) and PhD (3) students. I am involved, among others, in 4 European Projects; actively leading the actions of two of them: Nanosmart (fabrication of TMDs electronics for environmental applications) and WASP (design and fabrication of wearable devices for biosensing). Additionally, I am Co-PI of a National Project I+D+i Retos, entitled 2DtecBIO, with the aim of exploring new routes of 2D materials and devices fabrication with high impact in biomedical applications.

During most of my research career, I have held competitive fellowships: I performed the bachelor thesis under a Beca de Colaboración from the Ministerio de Educación, the PhD under a FPU grant, my first postdoc with a CNPq National competitive grant in Brazil, and finally I started my present position in the ICN2 with a highly competitive Juan de la Cierva Incorporación fellow. Since the beginning of my PhD, I have contributed to a total of 37 scientific publications (24 Q1), 7 of them with IF higher than 10. I am the first author of 21 and corresponding author of 20 of these works. I have a steadily growing h-index of 11, with a total of 696 citations (web of science).

Therefore, it would be very important to be awarded with the RyC contract, to consolidate myself as an independent researcher, continue developing my own research lines, recently started, on the understanding of the intrinsic and extrinsic properties of 2D materials and their impact on the performance of new flexible devices with applications in biomedicine. The RyC contract will allow me to lead a research team, interact with top scientists in the community and expand my scientific expertise and interests through collaborative networks.

Resumen del Currículum Vitae:

My track record includes 7 high quality publications, IF>10, (Nat Mater x1, Acc Chem Res x1, Nano Lett x3, ACS Nano x1 and Adv Fun Mat x1) being first and corresponding author in 4 of them, with >690 citations (h-index 11). I've participated in national and international conferences, given 2 invited talks, and contributed with 22 oral presentations and 28 posters.

I got the Degree in Chemistry in 2005 in the UCM, with a qualification of 2.45 and holding a Collaboration grant for carrying out the Bachelor research project in the Physical Chemistry department of the UCM. During my PhD in the same institution I was awarded with a FPU Fellowship and 2 mobility grants: (i) Prof. San Miguel's group at Université Lyon I (France 2007, 3.5 months) for high pressure experiments in graphene, (ii) Prof. Baughman's Nanotech laboratory, UT Dallas (USA 2010, 3 months) to perform straintronics in carbon nanotubes. I got the Doctorate in 2011 with the maximum qualification and was granted with the PhD Extraordinary Award in 2012. As post-doc I first hold a competitive CNPq grant in Prof. Pimenta's group in UFMG (Brazil 2012, 13 months) for resonant Raman studies in new 2D materials; then I move with a contract to Prof. Kalbac's group in Heyrovsky Inst. (Prague 2014, 28.5 months) for high pressure combined with Raman studies on 2D materials. I have long international mobility, in total 5 years abroad. In 2017 to the present I joined the Advanced Electronic Materials and Devices group in the Catalan Institute of Nanoscience and Nanotechnology (ICN2), under the supervision of Prof. Jose Garrido, holding a Juan de la Cierva Incorporación Grant. Along my research career I demonstrated creativity and excellent capacity to carry out original research, supervising research teams. I've developed my career in worldwide laboratories with world-class scientists and succeeded in getting funds (>200k) through FPU-PhD and highly competitive postdoctoral fellowships (CNPq Brazil and Juan de la Cierva).

I've participated in >20 research projects in different areas; presently, I participate in 4 active research projects funded by the EU (H2020 FETFLAGSHIP CORE2, H2020 FETPROACT-2016, H2020- ICT-02-2018, H2020-ICT-07-2018), and I am currently coPI in a national competitive



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research project (FIS2017-85787-R). Within these projects I lead the actions concerning the growth and characterization of novel materials, the development of the micro fabrication processes and the biosensing capabilities of wearable devices.

Concerning my teaching experience, I have been involved in 8 subjects of the Degrees of Chemistry, Geology and Physics of the UCM and I'm qualified by ANECA to teach at Spanish public and private Universities. I am co-directing 3 PhD students (expected in 2020, 2022 and 2023), supervised 1 Master and 3 undergraduate students and have been jury for 1 PhD viva. I have a multidisciplinary research profile including activities such as seminars impartation, scientific programs elaboration, chairperson in international conferences, certified publications referee (ACS, Wiley, Springer-Nature, Elsevier) and I frequently participate in dissemination and outreach activities and in the organization of international meetings (Joint 25th AIRAPT-53rd EHPRG 2015 and Cursos de Verano de El Escorial 2011).



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Turno de acceso general

Nombre: RUIZ DE ELVIRA CARRASCAL, JACOBO

Referencia: RYC2019-027605-I

Área Temática: Ciencias físicas

Correo Electrónico: jacoboruiz@gmail.com

Título:

Dispersive techniques for low-energy Hadron and Nuclear Physics

Resumen de la Memoria:

My previous research and main interests are in different theoretical and phenomenological aspects of Hadron, Nuclear and High Energy Physics. Throughout my research career, I have focused on providing rigorous and systematic theoretical descriptions of some open questions in Hadron and Nuclear Physics, by means of non-perturbative techniques rigorously derived from QCD and first principles. Specifically, my work has been based on the Effective Field Theory formalism, including dispersion relations, statistical methods, Chiral Perturbation Theory at zero and finite temperature, Lattice QCD and other techniques such as the $1/N_c$ expansion and semi-local duality.

I obtained my PhD in Physics in February 2013 with a thesis entitled "Study of the properties and nature of the lightest scalar mesons and their relation to spontaneous chiral symmetry breaking", under the supervision of Prof. J. R. Peláez. The thesis was granted the highest qualification (Sobresaliente CUM LAUDE), an special "European Doctor" mention and it was awarded the 2013 Extraordinary Doctorate Prize of the Complutense university.

My thesis was devoted to the study of the properties and nature of the lightest scalar mesons, as well as their relation to the Spontaneous Chiral Symmetry Breaking.

After the completion of my PhD studies, I obtained a postdoctoral contract at the Instituto de Física Corpuscular at the CSIC in Valencia, where I worked with Prof. J. M. Nieves and A. Pich. In March 2013, I started a position as a postdoctoral researcher at the University of Bonn, where I collaborated with Prof. U.-G. Meißner and Prof. B. Kubis. The work I conducted in the university of Bonn was awarded the 2015 Erkelenz prize, which recognizes a outstanding contribution in the field of Nuclear and Hadron Physics from a young scientist in Germany and it is endowed with 5000 €.

In October 2016, I started a new postdoctoral position at the prestigious Institute for Theoretical Physics at Bern University, where I am currently pursuing my research activities working with Prof. G. Colangelo and the emeritus Prof. H. Leutwyler, one of the founders of QCD. In November 2017 I was awarded an Ambizione grant from the Swiss National Science Foundation to conduct, manage and lead my own research project with a budget over 500000 CHF (587032 CHF). In this way, I became part of the scientific staff of the Institute for Theoretical Physics at the University of Bern.

In addition to these institutions, I have done short-term visits to the University of Durham, the Lisbon Institute of Technology, the Yukawa Institute for Theoretical Physics in Kyoto, the Institute for Nuclear Theory in Seattle, the IFIC in Valencia, the University of Granada, the University of Vienna, the GSI in Darmstadt, the college of William and Mary and the JLab in Virginia and the Universidad Autónoma de México.

Resumen del Currículum Vitae:

Throughout my research career, I have published 29 articles in several top journals of Particle physics, plus another pre-print already submitted for publication. In particular, I have published four articles in the prestigious journal Physics Review Letters and one in Physics Reports. I have also published 30 proceedings of international conferences or workshops.

All my publications account for more than 1400 citations (based on the HEP inspires data base, <http://inspirehep.net/author/profile/J.Ruiz.de.Elvira.1?ln=es>) and my h-index is 19. In addition, one of my papers is acknowledged as a "Famous Paper" with more than 300 citations and three of them as "Very Well Known Papers", with 186, 137 and 100 citations, respectively.

Moreover, four of my articles have been included in the Review of Particle Physics of the Particle Data Group (PDG), the main reference concerning the status of the field, and they have triggered the substantial revision of the $f_0(500)$, $f_0(980)$ and $K_0(700)$ scalar meson properties carried out in the 2012 and 2018 PDG editions, respectively.

The work performed during my thesis was awarded the Extraordinary Doctorate Prize of the Complutense University of Madrid. In addition, the work I conducted in the university of Bonn in the field of pion-nucleon scattering was awarded the 2015 Erkelenz, which recognizes outstanding contributions in the field of Nuclear and Hadron Physics from a young postdoc in Germany. In October 2017 I was awarded an Ambizione grant founded by the Swiss National Science Foundation to conduct, lead and manage my own research project



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with a budget of more than 500000 (587032 CHF), and hence I became part of the scientific staff of the University of Bern.

Moreover, I have been invited to give 13 specialized seminars in different universities and research institutes. I have attended 23 Conferences and workshops, 19 of them as invited speaker and 10 as a plenary speaker. I have also helped on the organization of four conferences or workshops, I have organized the 2017 fall semester internal seminars of the Institute of Theoretical Physics at the University of Bern and I have been convener of the "Goldstone Boson working group" of the Chiral Dynamics 2018 conference and the "Hadron decays, production and interactions session" of the Hadron 2019 conference.

In addition, I have served as Guest Editor of the Special issue "Effective Field Theories - Chiral Perturbation Theory and Non-relativistic QFT" of the Symmetry journal and I have been member of the editorial Board of the journal Tribuna Complutense.

Furthermore, throughout my research career I have also been interested in teaching. I have been assistant in several Math and Physics courses during my PhD and during my postdoc in the University of Bonn. In addition, as a member of the staff of the Institute for Theoretical Physics at the University of Bern I have also lectured a graduate course entitle "Introduction to the S-matrix theory and dispersive techniques". Furthermore, I have collaborated in the supervision of a Bachelor thesis in the University of Bonn and I am currently supervising two PhD students in the University of Bern; one of them is expected to defend his thesis in June 2020. In 2016, I got the Assistant professor accreditation of the ANECA.



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Nombre: LAPORTE , CHERVIN
Referencia: RYC2019-028091-I
Área Temática: Ciencias físicas
Correo Electrónico: chervin.laporte@gmail.com

Título:

galaxy formation on the scale of dwarf galaxies, the Milky Way and galaxy clusters

Resumen de la Memoria:

I am a computational astrophysicist interested in galaxy formation, dark matter, near-field cosmology. I run numerical experiments (idealised and in a cosmological context) to answer questions related to the dynamics and formation/evolution of galaxies as well as to interpret observations of our Galaxy and its dwarf galaxies. I have expertise in both extra-galactic and Galactic astronomy and have worked both on numerical simulations and observations.

For my doctoral thesis, I studied the formation and evolution of Brightest Cluster Galaxies and the distribution of dark matter at the center of galaxy clusters through cosmological N-body simulations. I have also worked on dark matter on small scales in dwarf galaxies developing the first triaxial models of dwarf spheroidals with multiple stellar populations and studying the phenomenology of cusp regrowth in the LCDM paradigm in cored dwarf galaxies affected by stellar feedback. Recently, my research has focused on the study of the Milky Way and its interactions with known dwarf galaxies. My latest models pre-Gaia DR2 models of the interaction of the Sagittarius dwarf galaxy with the Milky Way disc helped establish the central role of this galaxy on the structure and dynamics of the disc reproducing for the first time in a qualitative and quantitative sense many characteristics of the disc (before and after Gaia DR2) on both small scales and large scales. In particular this model was able to propose a unified model for the existence of large scale corrugations seen in the disc (such as the Monoceros Ring, Triangulum-Andromeda overdensities), the current velocity field seen in the Gaia DR2 data (Gaia Collaboration 2018) as well as the formation of the Gaia phase-spiral of Antoja et al. (2018).

The upcoming Gaia data releases and spectroscopic surveys on the ground (e.g. WEAVE, SDSS, 4MOST) are poised to allow many more discoveries to be made on the Milky Way in its various components (disc, bulge/bar, stellar halo) and test our predictions of galaxy formation in current cosmological LCDM. My research line is to further study the effect of the various ancient and ongoing accretions on the Milky Way to constrain the distribution of dark matter in the Galaxy as well as its accretion history and formation.

Resumen del Currículum Vitae:

I did my undergraduate at the University of Cambridge (2006-2010) in the UK and my PhD at the Max Planck Institute for Astrophysics in Garching (2010-2014) where I was an Early Stage Marie Curie CosmoComp fellow on the "evolution of clusters and large-scale structure of galaxies" (advisor: Simon D. M. White).

I have held postdoctoral fellowships in the US (Simons Fellow at Columbia University 2014-2017), Canada (as a CITA National Fellow at University of Victoria 2017-2019) and Japan (Kavli IPMU Fellow 2020).

Research Grants:

PI of the ERC Starting Grant "VIA LACTEA" (starting date September 2020)
PI of the ComputeCanada Computing the Milky Way (3 million CPU hours) 2018
PI of the XSEDE NSF grant on Stampede (1 million CPU hours) 2015

Scientific productivity:

I have published 25 papers in peer reviewed journals (11 as a first author). I have been to 21 conferences (9 as invited speaker). I have/am co-supervised/co-supervising 1 master thesis and 2 PhD thesis. I am a member of the science team on the Prime Focus Spectrograph (PFS) survey on Subaru. I am a member of the science working group for the Maunakea Spectroscopic Explorer on CFHT.

Services: I am a referee for Science, Nature Astronomy, MNRAS, ApJ, A&A, JCAP. I have also been asked to act as expert referee on large grants (ERC advanced grants 2020). I have organised a symposium and acted as an LOC member in an international conference in Garching (Germany).

For more information please consult my CV.



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Nombre: SABIN LESTAYO, CARLOS
Referencia: RYC2019-028014-I
Área Temática: Ciencias físicas
Correo Electrónico: c.sabin.les@gmail.com

Título:

New schemes of quantum technologies

Resumen de la Memoria:

I have published 51 papers in leading international peer-reviewed journals, including Physical Review Letters and Physical Review X. 1 more paper have already been submitted for publication. Among them, in 6 papers I am the single author, in another 18 I am the first author (including 5 where I appear as last author only because the order is alphabetical), and in another 11 I am the last author, as the full designer and supervisor of the project. The average number of coauthors is less than 3.

I have been working as a fully-independent researcher during the last five years: first as an assistant professor in the University of Nottingham, second as a ComFuturo Research Fellow, after my original research project was awarded with this highly competitive Fellowship (5% success rate, among all areas of Science) and now as a Junior Leader Fellow, with another original research project awarded in a call with 5% success rate.

Due to the length of my contracts and fellowships, I have never been allowed to supervise PhD students until the end of 2018. I am now supervising the PhD of my student Andrés Agustí, hired with my fellowship. However, I have supervised the Master Thesis of 8 students (2 more in progress). I also have experience in teaching, both in Nottingham and UAM (Madrid). I have received positive evaluation by the Spanish agency ANECA to be hired as Profesor Ayudante Doctor and Profesor Contratado Doctor.

I regularly realize outreach activities: I run a blog in the SciLogs platform, I have written articles for The Conversation and Investigación y Ciencia and I have given popular-science talks. My work has been covered in the media several times, both in prestigious popular science media such as Phys.org and New Scientist and in general Spanish newspapers.

My work lies within the area of quantum technologies. In particular: Quantum Information, both in quantum mechanical and quantum field theory setups, Quantum Computation with discrete and continuous variables, analog and digital Quantum Simulators as tools to explore the frontiers of physics, and Quantum sensing and Metrology.

In all the cases, my approach combines the interest in theoretical and foundational questions of quantum mechanics and quantum field theory with a constant effort in proposing realistic experiments and technological applications in modern quantum setups such as superconducting circuits, Bose-Einstein condensates or trapped ions.

Indeed, several experiments based on my theoretical results have been realized or are currently in progress. I have written many papers (both theoretical and experimental) with experimentalists and I am currently collaborating with several experimental groups around the world.

Resumen del Currículum Vitae:

Researcher in the field of quantum technologies. Doctor of Physics (UCM). 8 years of postdoctoral experience, more than 3 of them at the University of Nottingham where I was a Postdoctoral Researcher and finally Assistant Professor. After that, I directed my own lines of research at the Institute of Fundamental Physics (CSIC) thanks to a ComFuturo project funded by the Fundación General CSIC. At present, I keep working as an independent researcher and leading my own lines thanks to a Junior Leader project of the La Caixa Foundation.



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Nombre: AYYAD LIMONGE, FRANCESC YASSID

Referencia: RYC2019-028438-I

Área Temática: Ciencias físicas

Correo Electrónico: yassid.ayyad@gmail.com

Título:

Físico experto en nuclear experimental y detectores

Resumen de la Memoria:

I am a detector and experimental nuclear physicist working in the field of nuclear structure and nuclear reactions, and associated development of nuclear instrumentation. My experimental work, which is realized in state-of-the-art facilities capable of delivering exotic or radioactive nuclei, aims at providing a better understanding of how subatomic matter organizes itself and what are the underlying phenomena that emerge when the numbers of protons and neutrons in the nucleus are highly imbalanced. In particular, I have conducted an extensive research in the fission process at high excitation energies through spallation reactions, in the role of the interplay between isoscalar and isovector modes of neutron-proton pairing and in the clustering phenomena in exotic nuclei. More recently, I have started a new line of research to explore the connection between dark matter and nuclear physics. In particular, I am studying the possibility of emission of dark sector particles from loosely bound nuclei. My research lead to the first direct observation of the elusive beta- -delayed proton emission from a neutron rich nuclei.

My research is also supported and enhanced with the synergic development of novel heavy-ion tracking and neutron imaging detectors for future radioactive beams facilities and, homeland security and safeguard applications. In fact, I am currently part of the Detector Lab of the Operations Department of the National Superconducting Cyclotron Laboratory (NSCL, USA). My role is to ensure the proper operation of every detector system of the cyclotron and to improve their performance in the advent of the upcoming Facility for Rare Isotope Beams (FRIB, USA).

I have actively promoted many activities leading to interdisciplinary collaborations with other institutions through different projects with financial support from government agencies. I have participated in more than 40 successful experiments in several facilities where I assumed key roles. I have published more than 70 peer-review publications about fundamental nuclear physics and instrumentation. Moreover, I am the primary spokesperson of several experiments approved by panels of experts in the subject. I am an active member of several collaborations within the nuclear physics domain in the United States and Europe.

Resumen del Currículum Vitae:

Present position: Detector systems physicist, Facility for Rare Isotope Beams, Michigan State University, 640 South Shaw Lane, East Lansing, MI 48824, USA

Previous positions:

Senior Scientific Engineering Associate at the Applied Nuclear Physics program of the Nuclear Science Division of the Lawrence Berkeley National Laboratory (LBNL, 2017-2018).

Research Associate at National Superconducting Cyclotron Laboratory (NSCL, 2015).

Specially Appointed Researcher at the Research Center for Nuclear Physics (RCNP, 2012-2015)

Ph.D. Student at GENP (Grupo Experimental de Nucleos y Partículas) at University of Santiago de Compostela (2008-2012).

Experiment proposals:

- Search for cluster and molecular states of neutron-rich C isotopes with transfer reactions (RCNP). Status: Completed. Spokespersons: Y. Ayyad, I. Tanihata and H.J. Ong (2012).

- Direct reactions with MAIKo active target (RCNP). Status: Completed. Spokespersons: Y. Ayyad and I. Tanihata (2013).

- Direct measurement of a key reaction for the rp-process with the AT-TPC (NSCL). Status: Completed (2018). Spokespersons: Y. Ayyad (2015).

- Search for the linear-chain cluster structure in ^{16}C through resonant alpha scattering (TRIUMF). Status: Approved. Spokespersons: Y. Ayyad and W. Mittig (2017).

- LOI at the Research Center for Nuclear Physics (RCNP), Osaka, Japan: Direct and resonant reactions with the Active Target Time Projection Chamber (RCNP). Status: Approved.

Spokespersons: Y. Ayyad and W. Mittig (2017).



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- Spectroscopy of ^{18}C : Single-Neutron Transfer $^{17}\text{C}(d, p)$ with the Active Target Time Projection Chamber (AT-TPC) (RCNP). Status: Approved. Spokespersons: B. Fernandez-Dominguez, D. Suzuki and Y. Ayyad
- Studying np pairing in $N = Z$ nuclei: The $^{52}\text{Fe}(^3\text{He}, p)$ reaction at ReA3 with the AT-TPC (NSCL). Status: Approved. Spokespersons: Y. Ayyad and A.O. Macchiavelli (2017).
- Electric dipole response of proton-rich nuclei. Status: Approved. Spokespersons: Y. Ayyad and A. Tamii (RCNP - Osaka) (2018).
- Study of exotic decay modes with the pATTPC. Status: Completed (2018). Spokespersons: Y. Ayyad and B. Olaizola (TRIUMF) (2018).
- Search for near-threshold narrow resonances. Status: Submitted (2020). Spokespersons: Y. Ayyad and W. Mittig (2019).
- Possible halo nature of ^{12}mBe and test of Brink-Axel hypothesis. Status: In preparation (2019). Spokespersons: Y. Ayyad , W. Mittig and G. Potel (2019).

h-index: 16

Peer-reviewed publications: 72

Proceedings and others: 64



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Turno de acceso general

Nombre: VALENZUELA AGUI, IRENE
Referencia: RYC2019-028512-I
Área Temática: Ciencias físicas
Correo Electrónico: irenevale.bu@gmail.com

Título:

Quantum Gravity Constraints on High Energy Physics

Resumen de la Memoria:

My research career is focused on the intersection between String Theory, Particle Physics and Cosmology. I am a leading figure on the Swampland program, which aims to identify the universal criteria that any effective quantum field theory must satisfy to be consistent with a Quantum description of Gravity. These Quantum Gravity constraints can have important phenomenological implications in Cosmology and Particle Physics. They also characterize the structure of possible compactifications or string geometries and are intimately related to cutting-edge mathematics.

During my PhD in Madrid, I covered a broad range of topics from phenomenological aspects of the Higgs sector and supersymmetry, to inflationary models in Cosmology and formal aspects of String Theory. A key piece of my PhD, my idea, was an inflationary model dubbed Higgs-otic inflation (70 citations) that started a very fruitful research line followed by other groups. I also initiated two collaborations with other researchers (without my advisor) that strongly shaped my scientific path. One of them about Calabi-Yau compactifications after a 3month stay in Munich, while the other is one of the founding publications about the implications of the Weak Gravity Conjecture (WGC) on inflation with 146 citations. The latter had a big impact and pioneered a new research field known as the Swampland program: the most active research topic in String Phenomenology nowadays.

During my postdoctoral experience, I decided to focus on different aspects of the Swampland Conjectures, bringing this novel research field to each of my institutions. I have had a prominent role on the development of the Swampland program, from which I can remark four key contributions:

- Leadership, alongside a PhD student, of a timely analysis of the implications of the WGC for the cosmological relaxation of the EW scale, a novel proposal in Particle Physics. (113 cit.)
- Single authored paper about backreaction issues in axion monodromy inflation (57 cit.), which triggered a new research line in Munich and posterior collaboration to study its interplay with the Swampland Distance Conjecture (SDC). These works placed me as a recognised expert on axion monodromy in String Cosmology, reflected by multiple seminar invitations including a review talk (2018) and leader of discussion sessions (2017)
- Stunning analysis of the implications of the WGC for Particle Physics, getting an upper bound on neutrino masses in terms of the cosmological constant and constraints on BSM light degrees of freedom. It brings a new perspective into the EW hierarchy problem and naturalness issues of our universe.
- Initiator of a project yielding new strong evidence for the SDC by using pure mathematical theorems of limiting Hodge Theory (91 cit.). This opens up a new approach to systematically test the Swampland conjectures in string theory, and brings these mathematical techniques to the string community with potential for multiple applications. Postdoctoral positions of increasing prestige: Max Planck Institute, Munich + Utrecht University, Cornell University and Harvard University (current position). Awarded the highly competitive Veni grant funded by NWO in the Netherlands.

My leadership in the field has been internationally recognised by 22 invited plenary talks at major conferences (including Strings 2018) + 29 invited seminars.

Resumen del Currículum Vitae:

Awarded 4 times with Scholarship for students of Academic Excellence during Bachelor and collaboration grant from the Spanish Ministry of Science. Finished ranked number one of my class (2011) and awarded the Extraordinary Award by UAM.

Master in Theoretical Physics at UAM, supported by a Teaching assistant contract. PhD in String Theory Phenomenology (Sobresaliente Cum Laude, UAM, 2015), supported by FPU grant from Spanish Ministry of Science, under supervision of Prof. Luis Ibañez. Awarded the Extraordinary Award for the PhD by UAM. Finished Master + PHD in barely four years with 12 publications. One of them (without my advisor) with 146 citations pioneered a new research field known as the Swampland program.

Extensive international postdoctoral experience at Max Planck Institute in Munich (2015-2017), Utrecht University (2017-2018), Cornell University (2018-2019) and Harvard University (2019-present), which has allowed me to build an extensive network of collaborators worldwide. Single authored paper on axion monodromy inflation + following works opened new research line and placed me as expert in Swampland Distance Conjecture.

h-index = 19 (Google Scholar), 1112 citations from 25 scientific articles (23 published in Q1 journals), average of 44.6 citations/paper (2 papers TopCite100+ and 8 papers TopCite50+). My leading role on the Swampland program and String Phenomenology are internationally recognized and has gained me 29 invited seminars (such as Harvard University, MIT and IAS at Princeton), and 22 plenary talks at international major conferences (StringPheno conference 2017-2019 and Planck 2018). The invited plenary talk at the Strings 2018



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conference (Japan) holds a special place since it is the most important conference in my field, being one of the youngest researchers in the field to have such privilege. Also: review talk on Swampland at Iberian Strings 2020 and lectures on Swampland at Winter School in Korea on Jan 2020.

Ability to get funding on my own by writing successful grant proposals: I was awarded Veni grant in the Netherlands (highly competitive national grant funded by NWO with 250.000 for three years). Member of the Simons collaboration for Cosmology since 2018.

Member of the scientific program committee of the prestigious Strings conference 2019 (Brussels) and panel member reviewer for InterTalentum Postdoctoral Projects 2018 funded by the European Commission. Reviewer of five scientific journals of high impact.

Organizer of multiple scientific events: seminars at Utrecht, Cornell and Harvard University, Swampland workshop at UMass University (Oct 2019, Amherst, USA) and three more long programs to be held at KITP, Santa Barbara, USA (Feb 2019); MITP, Mainz (Aug 2020) and ESI, Vienna (May 2021). I am also one of the main managers of a Swampland program at Harvard funded by Simons foundation.

Teaching assistant during PhD in Madrid and main lecturer of a course in the Master of Theoretical Physics at Utrecht University (I completely designed the course from scratch). Co-supervisor of two master thesis and one bachelor thesis at Utrecht and Madrid. I proposed the projects and follow their progress in a daily basis. My long term goal is to test and put in a solid mathematical ground all the Swampland conjectures, and continue my research on their phenomenological implications for Particle Physics and Cosmology.