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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** DIEZ PARDOS, CARMEN  
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#### Título:

Top quark physics at the LHC: from precision to searches

#### Resumen de la Memoria:

I am an experimental physicist in the field of high energy physics (HEP). I was a member of the Compact Muon Solenoid (CMS) experiment at the Large Hadron Collider (LHC) between 2008-2012 and I am a member of the ATLAS Collaboration since 2019. As a PhD student (2008-2012) at CIEMAT (Madrid), I focused on electroweak physics, searches for a new heavy charged gauge boson (first searches for  $W'$  in CMS) and I was involved in the detector commissioning within the CMS Barrel Muon Spectrometer subsystem using cosmic muon data. Previously I was awarded with several research grants for undergraduate students and worked at the H1 experiment at HERA (Germany) in 2007.

As a postdoctoral researcher at DESY (Hamburg), I established myself as an expert in top quark physics. I have been deeply involved in many topics of that field, from the most precise measurements of the top quark pair ( $t\bar{t}$ ) production cross section and the top quark mass to searches for rare standard model processes, contributing significantly to the observation of  $t\bar{t}$  production in association with a Higgs boson in 2018. Besides those measurements, I led the first studies of QCD radiation in top quark events in CMS, comprising the cross sections as a function of jet multiplicity and properties of the additional jets from initial- and final-state radiation. I had several coordination responsibilities within the CMS in data analysis activities: coordinator of the  $t\bar{t}Hbb$  working group and the Top Quark Mass group. Since 2019, as staff scientist at the University of Siegen, I lead the analyses focusing on  $t\bar{t}+\text{photon}$  topologies.

I have a broad expertise in lepton and High Level Trigger performance studies and responsibility positions related to detector performance: both in CMS and ATLAS: From 2014 till 2016, I was the liaison person between the "Muon Performance" and the "Top Physics Analyses" groups within CMS, reviewing the muon usage in top quark physics analyses. I was responsible for the coordination of the trigger strategy and the development of the trigger menu for top quark related measurements (2016-2018). In September 2020, I was appointed as a coordinator of the "Muon trigger signature group".

#### Resumen del Currículum Vitae:

I completed my master in Fundamental Physics in 2008 at the UCM and my degree in Physics in 2006 at the UAM, with the university extraordinary academic award to the best academic record. I started my research career with two grants for undergraduate students (DESY Summer Student program and Introductory Research Fellowship from CSIC) and an internship at the H1 experiment (DESY Zeuthen, Germany) in 2007.

I joined the CMS experiment in 2008 for my PhD degree, funded by a FPI fellowship at CIEMAT, with four stays at CERN. I specialised in electroweak physics, searches for new heavy particles and muon performance. I participated in the project Participación en el experimento CMS (FPA2011-29237-C02-01).

After completing my PhD (European doctorate, Summa cum laude), I became a DESY fellow in 2012 and I joined the research project Ultimate precision measurements and searches for new physics using top quarks at the CMS experiment at the LHC in 2014. I focused on top quark and Higgs boson physics and in lepton and triggers studies. The most relevant milestones of my research at DESY are (I) the most precise inclusive top-quark pair ( $t\bar{t}$ ) production cross section and top quark mass measurements, (II) pioneering studies of  $t\bar{t}$  production in association with additional hard radiation, and (III) searches for produced in association with a Higgs boson, contributing to the first observation of the  $t\bar{t}H$  process. I received the performance bonus every year for my contributions to the CMS DESY group.

I joined the University of Siegen in 2019 as scientific staff. I took the lead of the top quark group, focusing on the study of the associated production of  $t\bar{t}$  with a photon, which probes the  $t$ -photon electroweak coupling. I am responsible of the organization of the advanced laboratory (master of physics) and the supervisor of three laboratory assistants, as well as independently teaching at master level (30-60h/semester).

My research has resulted in more than 20 novel publications in peer-reviewed journals with impact indices between 8.8 and 4.1 (Q1). I am also the author of 1 ATLAS and 8 CMS preliminary results, 11 published proceeding articles and I am the primary author of 20 internal CMS analysis notes.



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I was invited to 12 international conference presentations (ICHEP, LHCP, TOP Conference, LaThuile), 7 national presentations in Germany and Spain, seminars and numerous workshops within CMS and LHC working groups.

I am a reviewer for EPJC and member of the editorial board in CMS (until 2018) and ATLAS (from 2019). I was invited to three thesis committees, I organise seminars at the U. Siegen and I was a local organiser and chair of several annual workshops of the German CMS and LHC groups. I had several leading and coordination roles: coordinator of the Muon trigger signature group in ATLAS (since 2020) and subconvenor of the  $t\bar{t}Hbb$  working group (2018) and the Top quark mass subgroup (2016-2018), coordinator of the trigger strategy for top quark related measurements (2016-2018) and liaison between the Top Quark Physics Analyses and the Muon Physics Objects groups (2014-2016) in CMS.

I supervised and contributed to develop the research project of a PhD student and tutored other 4 PhD students and 6 undergraduate students within the DESY Summer School at DESY. Since 2019 I supervised on daily basis the work of five PhD and one master student.



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** AKRAMI CHEGHASIAHI, YASHAR

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**Área Temática:** Ciencias físicas

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#### Título:

Hunting for new physics from cosmic inflation to cosmic acceleration: Fundamental theories in light of Stage IV cosmological surveys and cutting-edge inference techniques

#### Resumen de la Memoria:

As the main line(s) of research, I have always been interested in signatures of physics beyond the standard models of particle physics and cosmology, and the unique interplay between fundamental theories and cosmological observations. I have been a link between theory and observation, holding a unique position to connect the two: as a theoretical physicist connected to an extensive network of theorists, I am deeply familiar with open theoretical questions, while being strongly connected (with leading roles) to the frontier of cosmological data analysis and observational challenges. I have worked on a wide range of topics, including theory and phenomenology of supersymmetric dark matter, new physics beyond standard models of particle physics and cosmology, theories of gravity beyond general relativity, observational tests of gravity (cosmological, astrophysical and laboratory tests), cosmic acceleration and dark energy, physics of the early Universe (inflation and cosmic initial conditions), extreme objects (primordial black holes and ultra-compact mini-halos of dark matter), cosmic anomalies and observational tensions, implications of high energy theories (supergravity and string theory) for cosmology, cosmic microwave background data analysis, cosmic large-scale structure, and statistical inference and high-performance computing techniques. I have contributed significantly to these lines of research by publishing a large number of high-impact papers and building an extensive network of international collaborations, both small- and large-scale. I have been a member of several large-scale cosmological collaborations (Fermi, Planck, Euclid, the Square Kilometer Array, LiteBIRD and CMB-HD) with leading roles.

As a leading theoretical physicist connected to a large network of collaborations, and with a long history of working with various types of data and modern concepts and techniques in statistics, inference and data science, I have the ambitious plan of developing a novel, synergistic machinery where theoretical models are combined with cutting-edge observational data and are analyzed through state-of-the-art statistical inference and high-performance computing (including artificial intelligence) techniques with the objectives of further understanding our standard frameworks in cosmology and high energy physics, and unravelling some of today's biggest mysteries through searches for new physics. I have worked on these directions for many years and played leading roles on various fronts, both theoretical and through large observational collaborations. I plan to maintain my unique position on the intersection between theory and observation in future. My career so far, all the experience, expertise and skills that I have gained, and the extensive network of collaborations that I have built have all paved the way and provided me with all the necessary ingredients for developing my ambitious and multidisciplinary program for future work (which I have recently begun) to build a powerful pathway to deepening our understanding of the standard model of cosmology and hunting for new physics beyond it.

#### Resumen del Currículum Vitae:

I hold a junior, pre-faculty, non-tenure-track position in Cosmology at the International Centre for Fundamental Physics (ICFP), École Normale Supérieure (ENS), Paris, as the 2018 laureate of the ENS-ICFP Junior Research Chair (JRC) program, a highly prestigious and competitive position with generous research funding provided by the French Ministry of Higher Education, Research and Innovation - this includes funding for hiring PhD students.

Previously, I was a senior postdoctoral research fellow at the Lorentz Institute for Theoretical Physics, Leiden University, the Netherlands, a postdoctoral research fellow at the Institute for Theoretical Physics, Heidelberg University, Germany, and a postdoctoral researcher at the Institute of Theoretical Astrophysics, University of Oslo, Norway. I did my PhD in Theoretical Physics at the Oskar Klein Centre, Stockholm University, Sweden.

I am a theoretical physicist, and specialize in cosmology, with a broad range of interests, expertise and experience. My research revolves around the interplay between fundamental physics, cosmological observations, statistical inference, high-performance computing and data science, and I have contributed significantly to these lines of research by writing many high-impact papers and through collaborations with a large number of theoretical and observational cosmologists. I have been strongly involved in a number of large-scale collaborations, including NASA Fermi Large Area Telescope, Planck Collaboration (as a Core Team II member), ESA Euclid Consortium (member of the Theory Working Group and leader of Work Package on early Universe and initial conditions), the Square Kilometre Array and CMB-HD. I have also recently joined the LiteBIRD Collaboration. I have refereed papers for 15 international journals, reviewed for 3 international



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funding bodies, been invited to visit >30 institutions worldwide, and attended >80 international schools/conferences/workshops/meetings. I have given 61 invited talks and seminars, including 16 plenaries at major international conferences. I have taught a large number of courses, and been strongly involved in supervision of students--I have been advisor/de facto supervisor of 6 PhD and 13 MSc students. In particular, I am currently the PhD advisor of one student at ENS through the funding provided as part of the support for my JRC position. I have also organized several meetings, schools and conferences.

I have 66 papers (56 peer reviewed, 4 white papers, 5 conference proceedings and 1 popular scientific article) and have >10 papers in preparation. My total number of citations, as of 19.01.2021, is 10778, with an h-index of 34, according to the High Energy Physics information system, INSPIRE (<https://inspirehep.net>), which is the commonly and widely used system for citation counts in Cosmology and HEP (for an updated list of my publications, see <http://inspirehep.net/author/profile/Y.Akrami.2>). The total number of citations based on the SAO/NASA Astrophysics Data System (<https://ui.adsabs.harvard.edu>) is 10408, which is another commonly used citation system in my fields of research. I have 4 papers with 500+, 1 paper with 250-500, 15 papers with 100-250, 9 papers with 50-100, and 21 papers with 10-50 citations each. I have 53 papers published in the first quartile (Q1) and 2 in Q2.



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### Turno de acceso general

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**Área Temática:** Ciencias físicas  
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#### Título:

Quantum Information and Technology

#### Resumen de la Memoria:

I am currently Ikerbasque researcher at the University of the Basque Country, where I lead the group Quantum Microwave Technologies and Architectures since 2018, which comprises two senior and one postdoctoral researchers, and four PhD, three Master and two Bachelor students. The two main research lines that we are developing are quantum computing in NISQ architectures and microwave quantum communication and sensing. I have close experimental collaborations in superconducting circuits with R. Gross and F. Deppe at the Walther-Meissner Institute (Garching, Germany), Y. Nakamura at the University of Tokyo (Japan), B. Huard at the ENSL (Lyon, France), and A. Wallraff and C. Eichler at ETH Zürich (Switzerland). I am also exploring a novel research line of hardware-engineered quantum neural networks employing dissipative nanoelectronic quantum devices called quantum memristors. There are ongoing experiments in superconducting platforms with M. Mariani at the IQC (Waterloo, Canada) and in photonics with J. Lukens at ORNL (Tennessee, USA).

I actively participate in several National, European and International projects. I took care of the European FP7-ICT project Quantum Propagating Microwaves in Strongly Coupled Environments (PROMISCE, 294,588) and I am currently PI of the Quantum Flagship projects Quantum Microwave Communication and Sensing (QMICS, 317,000) and An Open Superconducting Quantum Computer (OpenSuperQ, 420,000), and also of the US DoE project Heterogeneous Digital-Analog Quantum Dynamics Simulations (HDAQDS, \$280,000). Currently, I am also co-PI of a project with the quantum computing company IQM Germany entitled Hybrid quantum algorithms and optimization for quantum computers (120,000).

According to Google Scholar, my 64 articles, 55 already published (including 1 Nat. Commun., 6 PRL, 2 AQT, 2 PRApplied, 1 Neural Networks, 16 SciRep, 20 PRA/B/E/R, among others) and 3 accepted, have received over 1670 citations, more than 1500 of which happened in the last 5 years. Additionally, I am the first, last or corresponding author of 32 of them, submitting, on average, 9 papers per year since 2015. I have organized the international Workshops Ultra-Strong Light-Matter Interactions in 2016 and Quantum Machine Learning and Biomimetic Quantum Technologies in 2018. Recently, I have organized an IBM Quantum Hackathon in Bilbao. Additionally, I am Guest Editor of a special issue entitled Quantum Machine Learning and Biomimetic Quantum Technologies in the prestigious journal Advanced Quantum Technologies, referee of multiple peer reviewed journals, secretary-treasurer of the Basque division of the Spanish Royal Physics Society (RSEF), and evaluator of the Polish National Science Center since September 2018. Additionally, I have a European patent application called Quantum Computer-Implemented Method for Solving a Partial Differential Equation (Appl. Number EP20382822 of the 17.09.2020), and now applying for another one.

Furthermore, I enjoy being deeply involved in the education of young researchers. Proof of this is that, in the last few years, I have already supervised two PhD Theses on a daily basis and I am currently the official supervisor of 4 PhD students. Additionally, I have supervised 11 Bachelor and 7 Master theses, many of them published as papers. I also have teaching experience at undergraduate level at the TU Munich.

#### Resumen del Currículum Vitae:

I am Ikerbasque researcher at the University of the Basque Country, Bilbao, where I lead the group Microwave Quantum Technologies and Architectures since 2018, which comprises two senior and one postdoctoral researchers, and four PhD, three Master and two Bachelor students. The two main research lines that we are developing are quantum computing in NISQ architectures and microwave quantum communication and sensing. We have close experimental collaborations in superconducting circuits and quantum photonics with R. Gross and F. Deppe at the Walther-Meissner Institute (Garching, Germany), Y. Nakamura at the University of Tokyo (Japan), B. Huard at the École Normale Supérieure de Lyon (France), and A. Wallraff at ETH Zürich (Switzerland). We are also exploring a novel research line of in-hardware engineered quantum neural networks employing quantum memristors. We have the first experimental results in superconducting platforms in collaboration with M. Mariani at the IQC (Waterloo, Canada), and in quantum photonics with J. Lukens at the ORNL (Tennessee, USA).

I have actively participated in several National, European and International projects. I was PI of the European FP7-ICT project Quantum Propagating Microwaves in Strongly Coupled Environments (PROMISCE, 294,588) and I am currently PI of the Quantum Flagship projects



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### Turno de acceso general

Quantum Microwave Communication and Sensing (QMICS, 317,000) and An Open Superconducting Quantum Computer (OpenSuperQ, 420,000), and PI of the US DoE project Heterogeneous Digital-Analog Quantum Dynamics Simulations (HDAQDS, \$280,000). Currently, I also have, together with Dr. Jorge Casanova, a project with the quantum computing company IQM Germany entitled Hybrid quantum algorithms and optimization for quantum computers (120,000).

According to Google Scholar my h-index is 22 and my i10-index is 41. My 64 articles have received over 1670 citations, more than 1500 of which happened in the last 5 years. I have submitted, on average, 9 papers per year since 2015. I have organized the international Workshops Ultra-Strong Light-Matter Interactions in 2016 and Quantum Machine Learning and Biomimetic Quantum Technologies in 2018. Recently, I have organized an IBM Quantum Hackathon in Bilbao in collaboration with IBM and Innolab Bilbao, in which I have also mentored several groups. Additionally, I am Guest Editor of a special issue entitled Quantum Machine Learning and Biomimetic Quantum Technologies in the prestigious journal Advanced Quantum Technologies, referee of multiple peer reviewed journals, secretary-treasurer of the Basque division of the Spanish Royal Physics Society (RSEF), and evaluator of the Polish National Science Center since September 2018.

Furthermore, I enjoy being deeply involved in the education of young researchers. Proof of this is that, in the last few years, I have supervised 11 Bachelor theses, some of them published as papers, 7 Master theses, and I am currently the official supervisor of 4 PhD students. I also have teaching experience at undergraduate level at the TU Munich.



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** SERRA MARI, JAVIER  
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#### Título:

Beyond the Standard Models: theory and phenomenology from colliders to the cosmos

#### Resumen de la Memoria:

My research covers a wide spectrum of areas in fundamental physics, motivated by the basic questions that both the Standard Models of particle physics and gravity leave unanswered. At the intersection between theory and experiment, my major goal is to understand the new principles/dynamics, at scales from cosmological to Planckian, that hide behind these questions.

Since the start of my Ph.D. at U. Autònoma de Barcelona, I have worked on building and testing strongly coupled theories for the electroweak scale, with salient contributions in all of its compelling variants. A key part of my research has been the study of the phenomenological implications at particle accelerators like the LHC, from the characterization of resonances to signals best described by the SM effective field theory. My leadership in this field has been recognized e.g. by the high impact of many of my works (6 articles with more than 100 cites), some of which have significantly influenced several ATLAS and CMS new-physics searches.

Moreover, recently I have organized a workshop on top-quark physics aimed at bridging the gap between theorists and experimentalists and, along with my Ph.D. students, I have proposed novel signals at future colliders, a matter of the utmost importance for the future of high-energy physics.

Since my postdoctoral experience at Cornell U., I have contributed as well to formal aspects of quantum field theory, specially in connection with gravitational interactions. To highlight, the construction, via the AdS/CFT correspondence, of the first natural theory of a strongly coupled light dilaton, and of a novel model of inflation based on such a mechanism.

Later, as a fellow at CERN, I have become one of the principal exponents of the S-matrix constraints on effective theories beyond the SM. Specifically, the bounds I derived have had far-reaching implications for galileon and massive gravity theories, higher-spin theories, as well as the weak gravity conjecture, and have opened the door to many (forthcoming) applications ranging across fields, from the dynamics of black holes in scalar-tensor theories, to tests of fundamental principles at high-energy colliders. My work on the WGC has been exceptionally influential, as shown by e.g. the large number of invited seminars (Oxford, Saclay, Scuola Normale, Max Planck I., Harvard, Cornell, Davis, etc.), and by its high citation rate (35 cites/year).

Since late 2017 I am at the Technische U. München, where I hold a 6-year research associate position. Particularly relevant works include the construction of the GRSMEFT, i.e. the most general effective parametrization of all new physics deformations of gravity coupled to the SM of particle physics, and several articles on the physics of light degrees of freedom in neutron stars. The latter are part of a joint effort with nuclear- and astro-physicists within the ORIGINS excellence cluster to explore the implications of BSM physics in astrophysics and cosmology, motivated by the excellent observational prospects in the near future. In this context, I am currently organizing two long-term programs (co-organizers include C. Csaki, C. Dvorkin, R. Sundrum, etc.) on the interplay between particle physics and cosmology in probing fundamental physics.

#### Resumen del Currículum Vitae:

Ph.D. in theoretical physics (UAB 2012, Summa cum laude), and extraordinary doctorate award. Supported by FPU grant, with research stays at NYU, CERN, and la Sapienza. My work on composite Higgs models (3 articles with 175+ cites) as well as numerous invited seminars and plenary talks placed me as leading figure in this field.

Postdoctoral positions at Cornell U. (3 years), U. di Padova (1 year) and CERN (2 years) established my prominent role in BSM physics for the electroweak scale, corroborated by e.g. a famous review article with original insights after the Higgs boson discovery (2014, 300+ cites), or a single-author publication on resonant collider signals (2015, 65+ cites). In several pioneering articles, I highlighted novel scattering processes with top quarks, later adopted by ATLAS and CMS as motivation and guide for several new-physics analyses at the LHC.

My scientific production goes well beyond particle phenomenology, covering as well formal aspects of fundamental physics, specially in connection with gravitational interactions. I have been the first to construct the theory of a naturally light dilaton (2013), and a novel model of inflation (2014) in excellent agreement with data (target of CMB-S4). Leading proponent of theoretical constraints on BSM scattering amplitudes, ruling out massive gravity as a viable theory of gravitation (2017) and providing a proof of the weak gravity conjecture (2019); the latter has received the mention of editor's suggestion by PRL and 65+ cites in only 2 years.





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My most notable works thus extend over the arXiv categories hep-ph, hep-th, and gr-qc. Moreover, my ample postdoctoral experience has resulted in a strong network of international collaborators.

Over 2,000 citations not counting community reports, average of 79 cites/publication and 217 cites/year during the postdoctoral period. Only 15% of my publications are with my thesis advisor. h-index = 19, g-index = 26, with 13(6) articles out of 26 with 50+(100+) citations. Less than 10% self-citations (inSPIRE data).

Since late 2017, I am a senior postdoctoral associate at TUM, with the role of a junior faculty position: project management, teaching at the M.Sc. level (Quantum Field Theory, General Relativity), and selection and supervision of M.Sc. and Ph.D. students. Already supervised 2 M.Sc. theses and currently advising 2 Ph.D. and 2 M.Sc. students. Recent work includes first-ever systematic construction of the EFT of particle physics and gravity, and proposal of novel collider signals of composite Higgs models (target of HL-LHC). Currently developing as well the research field of BSM physics in systems at finite density, e.g. neutron stars. Awarded the TUM Performance Award (2019) in recognition of my research and teaching accomplishments.

World-class status as effective field theorist and its many BSM applications recognized by 36 invited seminars and 21 international plenary talks. Reviewer for 6 journals in Q1. Lecturer at 3 international schools on theoretical physics. Organizer of 2 long programs at IFT, Madrid, and GGI, Florence (funded after competitive calls). Organized an outreach course (TUM) for high-school girls to have a living experience in a scientific environment, and written a storybook on the LHC, finalist in outreach contest.





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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** ZURLO ZURLO, ALICE  
**Referencia:** RYC2020-029944-I  
**Área Temática:** Ciencias físicas  
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#### Título:

A closer look to young exoplanets

#### Resumen de la Memoria:

My field of research focuses on extrasolar planets and protoplanetary disks. I am an expert in both high-contrast and high-resolution image processing, analysis, and characterization of detected sub-stellar companions. My past research took full advantage of groundbreaking facilities for direct imaging (DI) and interferometry; the synergy between these two techniques is helping us in understanding how planets form and evolve. I focused my PhD on the detection and characterization of exoplanets via the DI technique. The advanced reduction methods that I developed were applied to push the high contrast imaging technique to its limit and measure a microlensing event caused by Proxima Centauri. I led a dedicated survey to combine RV and DI results to fine tune the mass extrapolated from evolutionary models, one of the major limitation of our field. Lately, I widened my expertise to sub-millimeter data to study very young systems and protostars. My research project focuses on 3 avenues related to planet formation: I/ the study of the close surroundings of directly imaged companions, II/ the detection and characterization of accreting protoplanets, and III/ the effect of multiplicity on protoplanetary disks. So far, there is no conclusive detection of satellites nor disks around exoplanets. Nevertheless, almost all the planets in our solar system host natural satellites, all the gas giants have rings. It is natural to think that these objects exist around exoplanets, and I will search for them using 3 different techniques: direct imaging (DI), spectroastrometry, and interferometry. The probability of finding liquid water and essential conditions for life are high in telluric exomoons. The second part of my project aims to detect and characterize protoplanets. As of today, the only firm detection of accreting protoplanets is around the star PDS 70. Two planets are emitting in H&#945;, an indicator of accretion. This kind of search is even more sensitive than near-infrared observations in the case of accreting protoplanets. Finding more protoplanets will give crucial insights on planet formation. The third part is related to the study of the environment where planets form: the protoplanetary disk. In particular, the effect that a (sub)stellar companion may have on the disk around the primary is still not understood. The presence of a companion can affect the disk properties, and therefore, the planets that will form there. Alongside these three lines of research, as presented in the summary of past research, all the projects that I developed in the past are still continuing with follow-ups. The systems around HR8799 and Proxima Centauri were regularly observed with SPHERE for orbital monitoring (former) and to refine the mass measurement from the microlensing event (latter). As responsible of both targets, I am in charge of the observations, data reduction, analysis, and of the publication of the results. On a longer timescale, the project of the direct observation of radial velocity companions will continue with future telescopes as the James Webb Space Telescope and the ELT.

#### Resumen del Currículum Vitae:

I am an astrophysicist working in the field of exoplanetary sciences, an expert in high-contrast and high-resolution image processing, and in analysis and characterization of detected companions. My past research took full advantage of groundbreaking facilities to help understand how planets form and evolve, using both direct imaging and interferometric techniques. I am currently an assistant professor at Universidad Diego Portales (UDP) in Chile. I obtained my master degree in Astrophysics (110/110 summa cum laude) in 2011 at Università di Padova (Italy), then I started a double PhD in astrophysics in between the universities of Aix-Marseille (France) and Padova, obtained on June 1st 2015, with mention of honor. Right after the PhD I started a one-year postdoctoral contract at Universidad de Chile and UDP. In 2017, I was awarded with the prestigious "Fondecyt Postdoctoral" fellowship, a 3yr grant with 90.9 keuros of funding at UDP. In March 2018, I was granted the "PAI, Iniciación a la Academia" funding (187.2 keuros), and I was hired at UDP as an Assistant Professor. In 2019 I obtained the very prestigious "Fondecyt Iniciación" fellowship, for additional 95.8 keuros. Lately, I obtained the ESO Comité mixto fellowship, with 50 keuro grant. All these grants have been successful thanks to the originality and exclusivity of the work I have proposed, and due to the leadership that I have developed since my PhD degree. Since 2018, I am the supervisor of the PhD thesis of Cecilia Lazzoni (Università di Padova). Since 2020 I am the supervisor of Pedro Nogueira, PhD candidate of the Universidad Diego Portales. I am co-investigator of 5 observing large programs: NACO-LP, SHINE, DISK, SPHERE Other Science, and DESTINYS. Since 2011, I am co-instrument scientist of the SPHERE instrument at VLT, for which I performed many weeks of visitor observations. My record of publications is outstanding: since 2012 I have participated in 119 refereed publications with more than 3000 citations. For first-authored 9 of them and my h-index is 31. I have been invited to 8 international conferences and I gave contributed talks to 18 international meetings. In 2019, I received the mention of honor of the Lorenzoni price.



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

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#### Título:

Gravitational physics and quantum entanglement

#### Resumen de la Memoria:

My research interests lie at the intersection of high-energy physics and gravity. I am pursuing problems in a wide range of areas, including: the interplay between quantum information and quantum field theory (QFT); general aspects of gravity (including its holographic nature, phase-space dynamics, lower-D and large-D approaches, etc.); higher-curvature gravities; black hole physics; various aspects of AdS/CFT and, more recently, algebraic QFT. I have published 37 papers in Q1 journals which accumulate around 1180 citations. My h-index is 21 [sources: INSPIRE-HEP, Google Scholar]. The main two lines of my research concern: 1) understanding the entanglement properties of quantum fields and gravity; 2) exploring the physics of the gravitational interaction, with special emphasis on black holes. Regarding the first line, one of the highlights of my research so far has been a very detailed understanding of the information encoded in the entanglement entropy of QFTs as a function of the geometric shape of the entangling regions. This started with my most cited paper [PRL 115 (2015) 021602; 113 citations], which triggered a lot of research in the community, and set the basis for many subsequent developments. Recently, I have also produced seminal works regarding the construction of finite notions of entropy in QFT [JHEP 05 (2020) 103, JHEP 11 (2020) 148]. My interests in this line have been progressively drifting towards more structural questions, with the long-term goal of performing axiomatic approaches to QFT based on quantum information principles. Regarding the second, an important highlight was the discovery of Einsteinian cubic gravity alongside my PhD student Pablo A. Cano [PRD 94 (2016) 104005; 86 citations]. This was the first of an interesting new family of modifications of Einstein gravity which have been since then subject of intense study by dozens groups. Currently I am an It from Qubit Postdoctoral Fellow at Centro Atómico Bariloche (Argentina). The It from Qubit: Simons Collaboration on Quantum Fields, Gravity and Information is one of the most prestigious international collaborations in the field. Previously I have worked at IFT UAM/CSIC (PhD student; 4 years), Perimeter Institute (Visiting graduate fellow; 6 months), Amsterdam University (Delta ITP visitor; 2 months) and KU Leuven (FWO Postdoctoral Fellow; 3 years). Recently I have been selected for a three-year Senior Postdoctoral Fellowship at CERN. Additional future plans for research include: the connection between quantum dynamics and classical actions, quantum information-inspired axiomatizations of QFT and aspects of black hole dynamics and holography.

#### Resumen del Currículum Vitae:

I completed my undergraduate studies in physics at Universidad de Oviedo (3.591/4; Premio fin de carrera) in 2011. During that period I was selected and took part in the DESY (Hamburg, Germany) and CERN (Geneva, Switzerland) Summer Student programs 2010 and 2011 respectively. In 2013 I completed my MSc degree in theoretical physics at the Universidad Autónoma de Madrid (UAM). At the same time, my research career was starting at the Instituto de Física Teórica UAM/CSIC, where I earned my PhD in theoretical physics under the supervision of Prof. Tomás Ortín in May 2015 (I was awarded a JAE-Predoc grant to do that). During that period, I enjoyed a Perimeter Institute (PI) "Visiting Graduate Fellowship" to do research at PI (Waterloo, Canada) during half a year. After my PhD, I was awarded a "FWO Postdoctoral Fellowship" by the Research Foundation-Flanders which I enjoyed at the ITF, KU Leuven (Belgium), where I worked from 2015 to 2018. I was also awarded a "Delta ITP visitor's program" grant to visit the University of Amsterdam String Theory group for two months in 2016. Since 10/2018, I am an official "It from Qubit Postdoctoral Fellow" funded by the Simons Foundation at the Instituto Balseiro of the Centro Atómico Bariloche (Argentina) in the group of Prof. Horacio Casini (New Horizons in Physics Prize 2015). The It from Qubit: Simons Collaboration on Quantum Fields, Gravity and Information is one of the most prestigious international collaborations in the area of high-energy physics (hep). Recently, I have been selected for a Senior Postdoctoral Fellowship at CERN. This is perhaps the most prestigious position at the Postdoctoral level available in Europe. I have co-authored 41 scientific papers. 37 have already been published in Q1 journals (2 more under review), including some of the most prestigious hep ones. My h-index is 21, and my papers total around 1180 citations (300/year during the last two years). I have one 100+ and seven 50+ (citations) papers. I have been awarded two "Honorable Mentions" at the international "Gravity Essay Foundation Awards" 2017 and 2019. I have given more than 40 international talks, including invited seminars, talks at conferences and lectures at schools. I accumulate more than 100 hours of teaching experience at UAM, KU Leuven and PI at the bachelor and MSc levels. I have also (officially) co-supervised one PhD thesis, earned by Pablo A. Cano at UAM, one MSc thesis and one trabajo fin de grado. All my works have been within the areas of high-energy physics and gravity. More precisely, I have developed a strong expertise in a variety of areas which include aspects of: quantum information, (algebraic) quantum field theory, general aspects of gravity and black holes, Supergravity theories and AdS/CFT. On a different front, I also perform an intense outreach labor. I am the main scientific advisor for world's most followed YouTube science-oriented channel in Spanish: "Quantum Fracture". I have contributed and co-authored several outreach videos which combined accumulate several million views. I also won the "V concurso de divulgación del CPAN" with a video about the thermodynamic properties of black holes and co-authored the June 2019



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

**Turno de acceso general**

cover story of Investigación y ciencia .



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** MAESTRO MARTIN, ARMANDO  
**Referencia:** RYC2020-029797-I  
**Área Temática:** Ciencias físicas  
**Correo Electrónico:** armanmaestro@gmail.com

#### Título:

Self-assembly of membrane-binding colloidal bio- and/or nano-objects

#### Resumen de la Memoria:

I have been always interested in the physics of soft and biological matter. I have focused on my PhD and post-doc positions precisely on the intermolecular forces governing the dynamics and morphology of soft condensed materials confined to thin films at fluid interfaces. I have experience in the self-assembly of polymers (including proteins and DNA/RNA), nanoparticles and amphiphilic molecules, and have worked both on measuring mechanical properties and on neutron (and X-ray) scattering and imaging techniques (including optical tweezers and AFM). I am also familiar with the methods in use nowadays for working on in vitro model systems of biological membranes and also in the lab-of-a-chip and microfluidic fabrication of organic/inorganic nanomaterials.

The two more significant contributions from my PhD were (a) different physical mechanism for the dynamics of neutral polymers depending on the interaction with the interface were determined: From a reptation-like motion, in analogy with the bulk polymer motion defined by de Gennes, to a soft-glass dynamics described by a 2D percolation theory. (ii) Two experimental techniques were developed within this framework: a method based on the electrical excitation of capillary waves and a passive interfacial microrheology technique by particle tracking analysis, including the theoretical model formulation to calculate the shear elasticity.

The most remarkable contribution in my post-doc at the Solid State Physics Laboratory (University Paris-Saclay), in the group of Prof. Dominique Langevin, was to describe the static and dynamical properties of soft grain dispersions, such as foams or emulsions, widely used in industrial applications and as precursors of novel materials. I become also interested in the physics behind wetting of solid surfaces with relevance in the oil-recovery industry as a research assistant working at the University of Twente sponsored by the oil company BP.

As a Newton Research fellow at the University of Cambridge, I extended my work to gain a quantitative understanding of the physics of biological flows by using colloidal models and in developing a novel in vitro model of a biologically relevant process such as endocytosis joining physical and biological efforts and deploying myself between the Physics Department (Cavendish Lab) and the Cambridge Institute for Medical Research. During this period, I also studied the influence of the surfactant concentration on the 2D solid-like structure with amorphous order of nanoparticle-laden interfaces and the fabrication of microcapsules by compression induced interfacial buckling of polymer films.

Since 2017, I am a staff scientist in the Institut Laue Langevin (France). I am also co-responsible of the Fluid Interfaces Grazing Angles Reflectometer (FIGARO). To date, I am heading a group of 3 PhDs and an MPhil student. My interest is in the physics of soft and biological interfaces. In particular, by using a battery of rheological, imaging and scattering techniques, including primarily neutron (and X-ray) reflectometry, my current research focuses on (A) exploring the self-organization of supramolecular assemblies of multifunctional nanoscale objects and (B) understanding and modelling the interactions and self-assembly of membrane-binding colloidal bio- and/or nano-objects.

#### Resumen del Currículum Vitae:

I am currently employed as a scientist in the Large Scale Structures group at the Institut Laue Langevin (Grenoble, France) and I am interested in the physics of soft and biological interfaces. In particular, by using a battery of rheological, imaging and scattering techniques, including primarily neutron (and X-ray) reflectometry, my research group, composed by 3 PhD and 1 MPhil student, explores the self-organization of supramolecular assemblies of multifunctional nanoscale objects including colloidal nanoparticles, (bio)polymers and amphiphiles and understanding and modelling the interactions and self-assembly of membrane-binding colloidal bio- and/or nano-objects. I received my BSc and MSc in Chemistry followed by a PhD at the University Complutense of Madrid in 2010. I hold a CNRS postdoctoral fellowship at the Solid States Physics Laboratory (University of Paris-Saclay, France; 2010/12) and during a postdoctoral research stay at the University of Twente (The Netherlands; 2012/13), sponsored by the oil company BP, I extended my work to interfaces with interest in industrial applications. Before I moved to Grenoble in 2017, I joined the Cavendish Laboratory (University of Cambridge, UK) in 2013 thanks to a Newton Fellowship awarded by the Royal Society. In 2015, I started as a University of Cambridge/Wellcome Trust Junior Interdisciplinary Fellow deploying myself across the Cavendish Laboratory and the Cambridge Institute for Medical Research CIMR joining Physical and Biological efforts. Besides, I was a Junior Research Fellow of Wolfson College, where I carried out additional teaching/mentoring and dissemination activities.



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As of 2021, I have published 45 scientific articles (with more than 1000 citations; 21 as first author and 15 as the corresponding author), including 3 standard review articles in the area of colloids and interfaces, and 5 book chapters. My h-index is 18. I have attended more than 90 conferences, and have been invited to several seminars and two keynote talks. Finally, I have won several competitive awards that include research funding and thereby I have already developed and independent profile keeping a productive collaborative independent network in Europe (mainly UK, France, Germany, Netherlands, Italy and Spain) and also in Japan, USA, Argentina, Brazil and Mexico.



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** BECEIRO NOVO, SAUL  
**Referencia:** RYC2020-030669-I  
**Área Temática:** Ciencias físicas  
**Correo Electrónico:** saulbeceiro@gmail.com

#### Título:

Nuclear physics with active targets

#### Resumen de la Memoria:

I started my research working in nuclear astrophysics in GSI (Germany). During that time I was privileged to run the first experiment with the pre-R3B setup, that gave me a lot of background in how to start a new program from scratch. We had new detectors and no analysis programs or simulations ready to be used. Because of that I participated in the development of the package R3BROOT in GEANT4 and the tracking algorithm program land02 still used to date in the collaboration. Because of that experience I got hired as a postdoc in MSU to participate in the development of a new active target (AT-TPC) that was being designed. I was a key member of the team that prepared a simulation package and started the analysis code nowadays called ATTPCROOT, which is extensively used by many users around the world using active targets. The nature of both projects made me work mostly in the mechanical design and simulation of detectors in my first years. This experience certainly made me grow as a researcher since it helped me understand deeper the nature of the detection systems and its challenges. Once the final detector was built and tested, many upgrades were also implemented until we started a very successful scientific program. The amount of topics we covered in the first years of the ATTPC are very broad since we wanted to benchmark all the possibilities. We focus in the study of low energy low Z projectile reactions. As such we were able to study pseudo-molecular structures in nuclei such as  $^{12}\text{C}$  (Hoyle state),  $^{14}\text{C}$  or  $^{11}\text{B}$ , fission fusion mechanisms in Ar and Pb, astrophysical reactions like  $^{22}\text{Mg}(\alpha, p)$  and general nuclear structure via scattering of multiple nuclei. Together with my group we became world experts, leading the active target community. As such we were invited to write 3 review articles on the topic.

After my successful postdoc in MSU, I got a Faculty position in the same university but with a strong teaching and mentoring component. In that realm I have co-directed the PhD thesis of Dr. Adam Fritsch and Mr. Nathan Watwood (thesis to be presented in February 2021). I have also successfully mentored over 20 undergraduate students in research projects, most of them are now in prestigious graduate schools of physics or engineering. Because of that, the chair of my department asked me to lead an effort to redevelop the introductory physics courses in our department that teach all the physics and engineering majors, as well as non science majors. This was assigned as 80% of my work load since 2015. I have successfully rewritten 3 courses and 3 lab programs and I am now in the process of finalizing a text book as well. I have received 3 teaching awards from the College of Natural Science of MSU. At the same time I kept a strong research component of my work, working with at least 3 students at a time in research projects and one doctoral candidate. I have also been spokesperson of 2 successful experiments in MSU, 2 at the university of Notre Dame and one in TRIUMF.

#### Resumen del Currículum Vitae:

Phys. Rev. Lett. 125(20), 202701 (2020)      Physics Letters B. 809, 135748 (2020)  
Physics Letters B, 807, 135565 (2020)      Nucl. Instr. Meth. A 954, 161341 (2020)  
Phys. Rev. Lett. 123, 082501 (2019)      Prog.Part.Nucl.Phys, 114, 103790 (2020)  
Nucl. Inst. Meth. A. 948, 162830 (2019)      Physics Letters B, 795, pp. 682-688 (2019)  
Eur. Phys. J. A (2018) 54: 181 Phys. Rev. C. 94, 034304 (2016)  
Phys. Rev. C. 98, 3, 024603 (2018)      Phys. Rev. C. 93, 054601 (2016)  
Nucl. Inst. Meth. A. 887, 81 (2018)      Physics Letters B, 759, 200 (2016)  
Phys. Rev. C. 97, 3, 034612 (2018)      Phys. Rev. C. 93, 045811 (2016)  
Phys. Rev. Lett. 120, 15, 152504 (2018)      Nucl. Instr. Meth. B. 376, 321 (2016)  
Physics Letters B. 780, 227 (2018)      Phys. Rev. C. 93, 014321 (2016)  
Phys. Rev. C. 97, 2, 024311 (2018)      J. of Instr. Vol 10, N 9, P09020 (2015)  
Phys. Rev. Lett. 120, 5, 052501 (2018)      Prog.Part.Nucl.Phys. 84 (2015) 124-165  
Physics Letters B. 778, 155 (2018)      Nucl. Instr. Meth. A 784, 494 (2015)  
Nucl. Inst. Meth. A. 880, 166 (2018)      Acta Phys.Pol. B46,473 (2015).  
Phys. Rev. C. 96, 3, 034303 (2017)      Eur.Phys.J. A 51, 9 (2015).  
Nucl. Inst. Meth. A. 875, 65 (2017)      Phys. Rev. C. 87, 054301 (2013)  
Phys. Rev. C. 96, 3, 034301 (2017)      Phys. Rev. Lett. 112, 211101 (2014)  
Phys. Rev. C. 96, 5, 054305 (2017)      Phys. Rev.Lett. 112, 132502 (2014)  
J. of Physics G. 44, 4, 045101 (2017)      Phys. Rev. C 89, 035806 (2014)  
Phys. Rev. C. 95, 014613 (2017)      Acta Phys. Pol. B 45, 2, 229 (2014)



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

Nucl. Inst. Meth. A. 830, 82 (2016)    Phys. Rev. C. 88, 034313 (2013)





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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** RIVILLA RODRIGUEZ, VICTOR MANUEL  
**Referencia:** RYC2020-029387-I  
**Área Temática:** Ciencias físicas  
**Correo Electrónico:** vmrivilla@gmail.com

#### Título:

Cosmic Origins of Life

#### Resumen de la Memoria:

My research career started on 2010, after finishing the 2-yr Master in Astrophysics (Universidad Complutense de Madrid/Universidad Autónoma de Madrid). I did my PhD thesis in the Center of Astrobiology in Madrid, under the supervision of Jesús Martín Pintado, about the role of low-mass star clusters in the formation of massive stars. Although this work was mainly based on photometry at different wavelengths (radio, sub-millimeter, X-rays, infrared and optical), the molecular observations of massive star-forming regions that I performed during my thesis showed, thanks to the improved sensitivity of the instruments, a rich variety of molecules that started to attract my attention. For this reason, when I moved to the world-leading group in massive star formation of the Arcetri Astrophysical Observatory (INAF, Italy) for my first postdoc, I started to study the molecular complexity in massive star-forming regions, and I extended my research to low-mass star-forming regions (Solar-like protostars). Within the plethora of molecules detected in this kind of regions, I was more interested in those relevant for prebiotic chemistry and the chemical processes that led to the origin of life. I dedicated several studies to understand the formation of complex organic molecules (i.e. interstellar species with more than 5 atoms) in star-forming regions. Moreover, in this period I started a branch of my research dedicated to the largely unknown chemistry of phosphorus - a fundamental element for life - in the interstellar medium (ISM), combining pioneering observations and chemical models. In 2017, my project BIOSFERA (Birth Of Stars and liFe: Edge Research at inAf) was awarded with a Marie Skłodowska Curie grant. This project was devoted to the study of interstellar precursors of nucleotides, the building blocks of DNA and RNA. This fellowship contributes significantly to enlarge my network of international collaborations, and allowed me to expand my research to other related fields, like the molecular content of Solar System objects like the comet 67P/Churyumov-Gerasimenko. Gradually, my work naturally approaches interdisciplinary fields like prebiotic chemistry and astrobiology, all of them related to the origin of life, that have influenced my work and oriented my lines of research. In 2019, my project COOL (Cosmic Origins Of Life) was awarded an Atracción de Talento Investigador para doctores con experiencia grant funded by the Comunidad de Madrid. The main scientific aim of this project is to search in the ISM for key molecular precursors proposed to play a role in prebiotic experiments within the context of the "RNA world" scenario for the origin of life.

#### Resumen del Currículum Vitae:

I received my 5-year Physics degree (Univ. Autónoma de Madrid) in 2008, and my Master Degree (Univ. Autónoma de Madrid/ Univ. Complutense) in 2010, with excellent grades (30 Sobresaliente and 15 special mentions of Matricula de honor), which were recognised by several Grants of Excellence awarded by the Comunidad de Madrid (2004/2004, 2004/2005 and 2005/2006), and allowed me to obtain the Junta de Ampliación de Estudios (JAE/CSIC) grant for the completion of a doctoral thesis. From 2010 to 2014 I worked on my PhD thesis in the Center of Astrobiology of Madrid (INTA-CSIC). My thesis, entitled "The role of low-mass star clusters in the formation of massive stars", presented on July 24 2014 with the maximum grade of Sobresaliente cum laude and the special mention of Doctor Internacional, was selected as finalist for the Best PhD thesis award of the Astronomical Spanish Society. During my PhD I spent more than 8 months abroad visiting several research institutions such as the National Radioastronomy Observatory, the Arcetri Astrophysical Observatory and the Harvard-Smithsonian Center for Astrophysics. After my PhD I moved to the Arcetri Astrophysical Observatory (Italy) for a first postdoc (2015-2017). In 2017 I obtained a Marie Skłodowska Curie grant with my project BIOSFERA (Birth Of Stars and liFe: Edge Research at inAf), and to be developed in the Arcetri Astrophysical Observatory. This project also received the Seal of excellence, quality label awarded by the European Commission. From August 2020, I am back in the Center of Astrobiology (Madrid) thanks to an Atracción de Talento para doctores con experiencia grant, funded by the Comunidad de Madrid. My scientific research aims to elucidate to what extent the chemistry that takes place in the molecular clouds of the interstellar medium is able to synthesize molecules that are important for understanding the prebiotic chemistry allowed the emergence of Life on Earth. To achieve this ambitious goal, I have adopted a multidisciplinary approach that combines high sensitivity astronomical observations and development of new chemical models. My work has reported the first detections in the interstellar medium and in comets of several key prebiotic species relevant for the RNA world hypothesis for the origin of life. I have lead more than 30 observational projects that have been accepted after highly-competitive proposals calls in the most important world-wide astronomical facilities. I have experience working with state-of-the-art chemical models, in particular with the codes MONACO and UCL-CHEM. I am also involved in the development of the software of MADCUBA to analyse molecular data. I regularly serve as reviewer for several astronomical journals, and I am also part of scientific committees for the revision of scientific proposals and projects. I have co-supervised four students of astrophysics from the University of Florence, and I am now supervising the work of the master's student and a postdoc. My research has not only impacted the scientific community, but it has also



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

got important attention of the general media (TV, newspapers, radio, websites and social media). I am also actively involved in outreach events to explain the benefits of astronomy and in a more general context science for society.



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** TORRONTGUI MUÑOZ, ERIK  
**Referencia:** RYC2020-030060-I  
**Área Temática:** Ciencias físicas  
**Correo Electrónico:** eriktorrontegui@gmail.com

#### Título:

Quantum control

#### Resumen de la Memoria:

- \* More than 10 years of research experience focused on the development of quantum technologies. Strong expertise on quantum control and its application to speed up the manipulation of quantum systems, i.e. shortcuts to adiabaticity.
- \* Relevant contributions in quantum control and quantum thermodynamics:  
43 papers in prestigious journal: Book chapters, RMP, PRL, NJP,
- \* Highly motivated researcher with proven capacity of achieving planned research goals:  
First author in 20 papers.
- \* Experience in leading research projects:  
Main Researcher 3 projects ~235k , participation in other 12.  
Master thesis supervision: 8  
5 papers with a single co-author or as last author designing the whole project.  
1 thesis committee.  
Teaching experience at university
- \* Technological relevant research:  
Technological transfer of 12 theoretical proposal.  
Participation in 3 experimental collaborations.  
Free-software development: quantum propagators, machine learning, quantum computing
- \* Internationally recognized research:  
Citations > 2500  
h-index: 23  
Invited Speaker: 20 conferences/workshops and seminars.  
Outreach and popularization: 1 EPL highlights (2019), CSIC highlights (2019), WOS 1% top (2016), Whitehouse distinction (2016), APS Kaleidoscope (2012).
- \* Wide research network:  
Collaborations with 41 researchers of world-leading groups.  
Numerous short scientific (~1 week) and long scientific stays in the corresponding institutions.  
Co-organization of various international congresses as STA or SOLID both > 50 participants.  
Co-organization of several seminars imparted by Nobel prize C. Cohen-Tannoudji or Sir M. Berry.
- \* Increasing experience in national/international assessment:  
Evaluator of the Spanish Evaluation Agency ANEP since 2014  
Presenting research deliverables in scientific review meeting of LPS/ARO project W911NF-15-1-0250  
Member of COST Action MP-1209 Thermodynamics in the quantum regime & Trapped ions .  
Design bachelor(b)/master(m) courses: Engineering physics(b) & Quantum engineering(m) (UC3M), Quantum technologies(m) (CSIC).
- \* Main Research lines: devoted to the development of new quantum technology.

Quantum control: development of the experimentally tested control techniques shortcuts to adiabaticity. These controls provide the same result as slow adiabatic passages in an arbitrary shorter time, thus increasing the number of operations compatible within the system coherence time. Design of efficient control protocols leading to new technology including two-qubit fast gates, quantum simulators, atomic diode, quantum sensors, or artificial neural networks for quantum machine learning.

Quantum thermodynamics: studying decoherence and fundamental questions such the third principle. Using quantum



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

thermodynamics I have analyzed the efficiency and quantum speed limits of time dependent processes, and reach them with optimal control, e.g. designing protocols robust against decoherence. Development of theoretical and numerical tools for the simulation of large open quantum systems, e.g. surrogate Hamiltonian and semiglobal propagators. Design of quantum engines.

Quantum foundations: specializing and providing physical insight on quantum transients, elusive and exotic temporary features displayed by matter waves before they reach a stationary regime, e.g. tunneling, diffraction in time, post-exponential decay, or backflow.

### Resumen del Currículum Vitae:

I am a visiting professor working at the Universidad Carlos III (UC3M) and affiliate doctor at the Spanish Research Council (CSIC) Madrid, with more than 10 years of experience working in the burgeoning field of quantum technologies. I have 43 publications, and submitted several others (see my Google Scholar or arXiv for the full list and further updates). These publications include 2 book chapters, 1 Review of Modern Physics, and 3 Physical Review Letters among others. All my work has been highly cited with > 2500 citations, 6 articles have > 100 citations, and sets my h-index in 23 (19) according to Google Scholar (Scopus). My research work has received a strong experimental interest influencing a variety of implementations, up to 12, in different quantum platforms. Nowadays, I am directly participating in 3 new experiments. I have imparted 9 talks at international conferences and 11 invited seminars at different institutions. I also have experience in the organization of dissemination activities, as for example, with the organization of several international workshops. This provides me with a broad research network including both theoretician and experimental collaborators allowing me to stay at their respective research institutions for a whole period longer than 10 months. Another aspect to remark in my scientific profile is my capacity to attract scientific funding from national (ref: POS\_2013\_1\_138 ) and international (ref: W911NF-15-1-0250) agencies becoming Main Researcher of 3 projects with a funding ~235k and being awarded with several research grants and prizes. I also have contributed to the formation of a number of PhD students in cooperation with each host group leader at The Hebrew University of Jerusalem and at the University of the Basque Country. The HUJI recognized this merit granted me with a postdoctoral grant. I also carried out teaching activities, first with undergraduate students and then with graduate students in master courses. Nowadays, I am leading the area of quantum technologies at the UC3M and the subgroup of quantum control at the Fundamental Physics Institute of CSIC. At these institutions I continue mentoring new young researchers guiding their master final projects. My main research line on quantum control consists of designing efficient protocols for the development of new technology, such fast and robust gates leading to scalable quantum computing, artificial neural networks, or efficient sensors among others.



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** VAQUERO AVILES-CASCO, ALEJANDRO

**Referencia:** RYC2020-030244-I

**Área Temática:** Ciencias físicas

**Correo Electrónico:** serianam@gmail.com

#### Título:

Precision testing of the Standard Model from Lattice QCD

#### Resumen de la Memoria:

My research focuses on the high precision testing of the Standard Model (SM), mainly using Lattice QCD (LQCD) as a tool to perform non-perturbative QCD calculations. I have developed recognized expertise in the calculation of hadronic form factors and disconnected diagrams, as many of my publications confirm, with several papers with ~100 citations on the field, one of them a PRL where I pioneer the calculation of disconnected diagrams at light quark masses.

I am also looking for new physics in the weak sector of the SM. Very recently I have presented results on the  $B \rightarrow K^* \ell^+ \ell^-$  semileptonic decay at non-zero recoil in several conferences and seminars. My work has settled the problem of the parametrizations, ruling out CLN and potentially solving the inclusive-exclusive discrepancy in the determination of  $B \rightarrow K^* \ell^+ \ell^-$ . My program extends much further, including other CKM matrix elements and decay constants.

Other important topic I am working on is the calculations of the hadronic contributions to the anomalous magnetic moment of the muon using LQCD. I have been credited with the introduction of state-of-the-art techniques in my current collaboration, resulting in several high-profile articles.

In the cosmological frontier I am exploring the axion as a dark matter candidate performing large numerical simulations of the axion field in the post-inflationary scenario. My expertise in computing enabled our group to perform the largest simulations ever done on the field, whose results have been published in the JCAP. The connection axion-QCD is another of my research topics, with several papers describing methods to simulate a gauge theory with a theta-vacuum term in a computer.

Finally, I am a recognized HPC expert currently involved in several projects (USQCD, QUDA) to develop a software stack for lattice applications optimized for exascale architectures, including Intel vector processors, MICs and GPUs.

#### Resumen del Currículum Vitae:

I am a Spanish researcher specialized on theoretical physics that conducts high precision tests of the Standard Model and looks for new physics, mainly within the framework of non-perturbative QCD using lattice methods. I obtained my PhD at the University of Zaragoza in January 2011, under the supervision of Vicente Azcoiti Pérez, with top marks (Cum Laude). During this period I developed an expertise in field theories, as well as in computational methods and High Performance computing. As a result, I was awarded a three year postdoctoral contract supported with European funds at the Cyprus Institute. In 2014 I moved to the INFN Sezione Milano-Bicocca with a 2-year INFN postdoctoral fellowship for theoretical physicists. This is a 80000 euro grant to support an independent scientist for two years, plus 5000 euro for trips and 2500 euro for material. At the end of 2016 I moved to the University of Utah as a postdoctoral fellow where I am currently employed.

My main research field is the validation of the Standard Model by performing high precision calculations and contrasting the results with experiments, in order to rule out (or not) the existence of new physics. To this end I am mainly focusing on non-perturbative QCD calculations using lattice methods to reduce the hadronic uncertainties that plague the SM predictions for a wide range of observables. This requires a constant contact with the experimental particle physics community in order to assess what are the most urgent needs and how to orient future experiments. I am also pursuing a related research line on the axion, both as a dark matter candidate and as a potential solution to the strong-CP problem.

Computing plays an important role in my research, and I'm deeply involved with the leading supercomputing industry (Intel, AMD, nVidia and Cray). I have signed several NDAs and periodically receive confidential information on forthcoming machines. In this field, early development of computer code is key to keep a competitive research.

My teaching experience consists of two courses at the University of Zaragoza during my PhD as an assistant, as well as mentoring in a GPU hackathon and in a TAE (Taller de Altas Energías). I have also imparted a graduated course on Lattice QCD for PhD students, and I co-supervised two PhD students: Shuhei Yamamoto at the University of Utah and Julia Stadler at Durham University. I have been awarded



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

ANECA certifications for the roles of "Profesor Contratado Doctor", "Profesor Ayudante Doctor" and "Profesor De Universidad Privada", as well as the 13 certificate given by the "Ministerio de Ciencia, Innovación y Universidades", given to scientists with an outstanding research trajectory.



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** LARA LOPEZ, MARITZA ARLENE  
**Referencia:** RYC2020-029354-I  
**Área Temática:** Ciencias físicas  
**Correo Electrónico:** maritza.lara.lopez@gmail.com

#### Título:

Identifying the main drivers in the evolution of galaxies

#### Resumen de la Memoria:

With over a decade of research in galaxy abundances and evolution, I have become an adaptable and independent researcher. I have pioneered, led and developed a diversity of topics in extragalactic astronomy, having authored 76 refereed articles with more than 2700 citations. I have worked and lived in Mexico, Spain, Australia, Denmark and the UK. Each country has enriched me with different ways of thinking and working, enhancing my creativity and problem solving skills. Additionally, these experiences have improved my leadership, diplomacy, and proficiency in managing large groups.

During my PhD (obtained from the University of la Laguna (ULL) in Tenerife), I focused on the scaling relations and evolution of the star formation rate (SFR), stellar mass and metallicity using thousands of spectra from the Sloan Digital Sky survey (SDSS). The most important result during my PhD was the discovery of a fundamental plane in the 3-Dimensional plane formed by the SFR, stellar mass and metallicity of galaxies (Lara-López et al., 2010, A&A, 521, L53, cited ~260 times to date). Additionally, I detected, for the first time, small decrements of metallicity as redshift increased, with prima facie evidence of a 0.1 dex decrement at redshifts  $0.3 < z < 0.4$ . The results of this study were published in Lara-López et al. (2009a, A&A, 493, L5), and Lara-López et al. (2009b, A&A, 505, 529). During my PhD I published 5 first author papers, and a total of 10. My PhD won a nation prize in Mexico, and an Institutional prize from the ULL for the best PhD thesis.

At the end of 2010 I moved to Australia and became part of the Galaxy And Mass Assembly (GAMA) survey, funded first with a research fellowship, followed by a 3-year Super Science Fellowship, hosted at the Australian Astronomical Observatory (AAO) in Sydney. As part of this survey, I participated in telescope observations, data reduction and generation of catalogues available for the whole collaboration. During this period, I published 4 first author papers on galaxy evolution as part of the GAMA survey, and co-authored dozens more papers. Also, during my time in Australia I won the Discovery of Early Career Researchers Award (DECRA).

In 2014 I moved to UNAM, in Mexico city for 2.5 years, followed by a 3-year DARK fellowship at the DARK Cosmology Center, Niels Bohr Institute, University of Copenhagen.

For my next big project, I designed, and I am leading the Metal-THINGS survey, together with a group of 20 researchers from different institutions. Metal-THINGS is observing with Integral Field Unit (IFU) spectroscopy a unique sample of nearby galaxies with complementary information at different wavelengths. With this project I became the winner of the L'Oreal-UNESCO prize for women in science in 2016, becoming the first astronomer to win this prize in Mexico. Also, with this project I was shortlisted to an European Research Council (ERC) starting grant. To date, I have observed more than 120 nights of telescope time using IFU instruments (VIRUS-P, McDonald Observatory, Texas; and MUSE/ESO, Chile) for the Metal-THINGS survey.

Currently, I am an STFC research fellow at Armagh Observatory and Planetarium, in the UK. I participate in several large galaxy surveys, including Metal-THINGS (PI), FORNAX-3D, LOFAR, OTELO, GAMA, and Lockman SpReSO.

#### Resumen del Currículum Vitae:

I obtained my PhD in Sept. 2010 from the Universidad de la Laguna (ULL) and Instituto de Astrofísica de Canarias (IAC) in Tenerife, Spain. In 11/2010, I moved to a research fellowship at the Australian Astronomical Observatory (AAO) in Sydney, Australia, followed by a 3-year Super Science Fellowship at AAO. Afterwards, I moved for 2.5 years to Mexico for a tenure-track position at the Institute of Astronomy at UNAM.

From 07/2017- 06/2020 I was a DARK-Carlsberg foundation fellow at the DARK Cosmology Centre, Niels Bohr Institute, University of Copenhagen, Denmark. From 08/2020 I am a STFC research fellow at Armagh Observatory, UK. My PhD thesis won a national prize in Mexico and an institutional prize at IAC/ULL, Spain for the best thesis. In 2016 I won the L'Oreal-UNESCO prize for women in science of Mexico, becoming the first astronomer to win this prize.

In 2018 I was shortlisted for an European Research Council (ERC) starting grant.

I have 76 refereed publications in international journals (first author of 11), with more than 2700 citations. My most cited paper as first author has ~260 citations (Lara-López et al. 2010). I have supervised 10 students from undergrad to PhD levels. I have attended 56 international meetings/schools, and given 22 seminars in different institutions in Mexico, Spain, UK, Germany, Netherlands, Australia, and Denmark, and participate actively in Institutional activities as well as outreach and teaching. I have participated in major commissions, such as the Hubble Space Telescope TAC, and the L'Oreal prize for women in Science. Currently I am leading my own survey of nearby galaxies, Metal-THINGS, as Principal Investigator. I am member of the following international survey teams: Metal-THINGS (PI), FORNAX-3D, GAMA,





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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

SAMI, Lockman SpReSO, OTELO and LOFAR. I am a frequent referee for MNRAS and ApJ. I speak fluently Spanish, English, and have a good level of French.



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** MARIÑAS PARDO, CARLOS  
**Referencia:** RYC2020-029875-I  
**Área Temática:** Ciencias físicas  
**Correo Electrónico:** carlosmarinas@gmail.com

#### Título:

Ultralight pixel detectors for New Physics searches in the flavor sector at the Belle II experiment

#### Resumen de la Memoria:

I am a GenT Distinguished Researcher with more than 10 years of experience in instrumentation for particle physics. I am the head of the Belle II group at IFIC (CSIC-UVEG) and currently the deputy Technical Coordinator of the Belle II experiment (1052 authors, 123 institutions) at the Japanese super flavor factory SuperKEKB (KEK, Japan).

During my Master Thesis (2005-2006), at the University of Santiago de Compostela, I was in charge of the construction, installation and commissioning of the time-of-flight detector of the DIRAC (PS212) experiment at CERN (Geneva, Switzerland).

It was during my PhD Thesis at the University of Valencia (2007-2011) when I started working in the development of modern semiconductor detectors, in particular DEPFET pixels for the future International Linear Collider and the cooling system of the Belle II vertex detector.

In 2011, I joined the Silicon Laboratory (SiLab) of the University of Bonn, first as PostDoc and then as Junior Research Leader (2014-2019) in charge of the Belle II PXD detector group. I have participated in the development and construction of the Belle II pixel detector. I was in charge of its installation in the final experiment in 2018 and then head of the Belle II commissioning group when SuperKEKB started operation.

Afterwards, I was Belle II deputy Run Coordinator in charge of detector performance optimization, data acquisition and study of beam background levels. During this period, I joined the Belle II Technical and Executive Boards.

In 2019, I was awarded with a grant as GenT distinguished researcher at IFIC, forming my own research group and initiating a new research line in monolithic detectors. I created in Valencia the pixel laboratory (PixLab) for the development of monolithic CMOS pixel sensors for the Belle II upgrade as well as for generic research collaborations like RD50 at CERN, collaboration I am also member of.

In the incoming years, my research activities will continue to focus on the development of monolithic technologies for current detector upgrades and future collider experiments.

#### Resumen del Currículum Vitae:

I am a GenT Distinguished Researcher with a long-standing experience in experimental particle physics. I am the head of the Belle II group at IFIC (CSIC-UVEG) and currently the Belle II Deputy Technical Coordinator (1052 authors, 123 institutions) at the Japanese super flavor factory SuperKEKB (KEK, Japan).

During my Master Thesis (2005-2006), at the University of Santiago de Compostela, I was in charge of the construction, installation and commissioning of the time-of-flight detector of the DIRAC (PS212) experiment at CERN (Geneva, Switzerland).

I made my PhD Thesis at the University of Valencia (2007-2011) in the development of DEPFET pixels for the future International Linear Collider and the cooling system of the Belle II vertex detector.

In the period from 2011-2019, I joined the University of Bonn, first as PostDoc (German category E13) and then got promoted as Junior Research Leader (group E14). Since then, I do independent research and supervise all the Master and PhD students working in my group. I have participated in the development and construction of the Belle II pixel detector. I was also in charge of the installation of the Belle II vertex detector in 2018 and head of the Belle II commissioning group.

After the successful detector installation, I was in charge of the data acquisition of the entire experiment as Belle II deputy run manager. As a result of this work, the first paper of the Belle II collaboration was produced. During this period, I joined the Belle II Technical and Executive Boards.



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

In 2019, I obtained a grant as GenT distinguished researcher and moved back to IFIC, forming my own research group and initiating a new research line in Spain in monolithic detectors. I am leading the Belle II group at IFIC and managing the Spanish institutional membership in the experiment. I created in Valencia the pixel laboratory (PixLab) for the development of monolithic CMOS pixel sensors, for applications as LHCb (LHC) and Belle II (SuperKEKB) upgrades as well as for generic research collaborations like RD50 at CERN.

In the last 10 years I have participated in R&D projects funded by the Spanish Ministry as well as by the German BMBF. Additionally, I took part in the European projects AIDA2020 and AIDAInnova for detector development (Advanced European Infrastructures for Detectors and Accelerators) and JENNIFER Consortium (Japan and Europe Network for Neutrino and Intensity Frontier Experimental Research).

I am external project evaluator in Peru and article reviewer in the main journal in the field (NIMA).

I have given regular instrumentation lectures in the Master program of the University of Bonn ( Physics of particle detectors ). I am member of the Belle II outreach team and have given public audience lectures ( La Física de Partículas tras el boson de Higgs , Ateneo de Santander, 2018) and interviews in newspapers (front cover printed version La Opinión de A Coruña 16/07/2017, Faro de Vigo 20/12/2017, Sociedad de Bioquímica y Biología Molecular de Chile 8/6/2018).

In the incoming years, my research activities will continue to focus on the development of monolithic technologies for current detector upgrades and future collider experiments.



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** VALIENTE CIFUENTES, MANUEL  
**Referencia:** RYC2020-029961-I  
**Área Temática:** Ciencias físicas  
**Correo Electrónico:** mvaliente10@hotmail.es

#### Título:

Strongly interacting ultracold atomic systems

#### Resumen de la Memoria:

I am an expert in the few-body problem and a pioneer in the application of highly non-perturbative few-body physics in the many-body problem in ultracold gases, condensed matter physics and optics. My work is motivated by the recent advances in experiments with ultracold atoms, while relevant and sometimes exclusive to condensed matter systems or optical settings. As such, I work closely with experimentalists and produced a number of seminal works by putting forward proposals for experimental realisation of exotic phenomena using optical settings (photonic lattices and nonlinear media). I led the theory teams that supported the first observation of anomalous Floquet edge modes [Nature Comms. 8,13918] and droplets of light with non-zero angular momentum [PRL 121, 133903; PRA 98, 053835]. I am an author of and major contributor to the arguably most influential theoretical work on strongly-interacting low-dimensional quantum gases of this decade [Nature Comms. 5,5300], which an important problem that had been open for over 50 years. Our results were experimentally confirmed shortly thereafter [PRL 115, 215301].

Very recently, I showed that interacting bosons and fermions in one spatial dimension and at low energies are fully equivalent, or dual, to each other. Duality is valid for arbitrary spin, internal structure, external fields, or kinetic dispersion including relativistic systems [PRA 102, 053304 & arXiv:2009.00614]. My novel methods are trivially extended to higher dimensions, and lattices, and research in this direction is ongoing.

The role of emergent three-body interactions, whose theory I have developed in recent work [PRA 100, 013614], in the physics and stability of quantum droplets in one spatial dimension will be pursued. Extension to two spatial dimensions, which is more complicated than the one- and three-dimensional counterparts, will also be studied in detail. These are topics of great current interest in the ultracold atomic community, with recent experiments that have shown remarkable success in the creation and observation of quantum droplets and liquids of ultracold atoms (see, e.g. [Science 359, 301]).

#### Resumen del Currículum Vitae:

- Current position:  
Investigador Doctor, Universidad de Murcia (competitive fellowship: Contrato de renovación generacional para el fomento de la investigación de la Universidad de Murcia)

- Previous positions:

- 1.- Faculty positions:  
Associate Member (equivalent to Assistant Professor), Institute for Advanced Study, Tsinghua University (ranked 20th worldwide, 1st in Asia)
- 2.- Postdoctoral positions:  
Aarhus University (2010-2012), Heriot-Watt University (2012-2018)
- 3.- PhD positions:  
Marie-Curie ESR at IESL-FoRTH (2007-2010)

- Publications:  
48 articles and 1 book chapter, with over 1350 citations (Scholar) / 1000 (Scopus). h-index 19/17. 200+ cites/year in the last 5 years (Scholar).

- Research supervision:  
4 PhD, 2 MSc and 1 BSc theses to completion.

- Invitations to scientific events:  
10+ invited talks, seminars and colloquia, and an international school, as well as a KITP program.

- Funding:



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

Attracted over EUR 500k in external funding. Approximately EUR 75,000 as sole PI in the past year in 2 projects.

- Grant review:

Reviewer for Polish National Science Center, SONATINA scheme

- Peer review:

Reviewer for 16 journals in general, AMO, condensed matter and nuclear physics, including Nature Comms., PRL, PRX, PRA, PRB and Nucl. Phys. A and B.



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** GARCIA CELY, CAMILO ALFREDO  
**Referencia:** RYC2020-029248-I  
**Área Temática:** Ciencias físicas  
**Correo Electrónico:** camilo.garcia.cely@desy.de

#### Título:

Dark matter in the age of neutrino and gravitational wave astronomy

#### Resumen de la Memoria:

I have a broad range of interests within the field of dark matter and gravitational waves. Concretely, my research is focused on the following interrelated topics:

(i) I am interested in the indirect detection of dark matter, which consists of searching for the annihilation or decay products of dark matter particles. In particular, the next few years will be an important time for carrying out investigations on indirect searches of dark matter candidates in the multi-TeV range or above. On the one hand, this is due to certain non-perturbative effects that typically enhance the annihilation signals leading to large fluxes on Earth. The study of such effects was an important part of my doctoral dissertation, which gave me the opportunity to obtain postdoc positions, first in Brussels, and later in DESY-Hamburg. On the other hand, indirect searches are also promising because experiments looking for gamma rays and neutrinos will improve their sensitivity to TeV-scale particles within the next few years. Furthermore, powerful telescopes such as the Cherenkov Telescope Array (CTA) and the Square Kilometer Array (SKA) will become available in this decade. Given this experimental situation, my numerous contributions to this field and the papers that I have written, I believe that I am in a privileged position to carry out research on this topic.

(ii) In addition, I am interested in exploring possible connections between gravitational waves and dark matter. One possible avenue is the investigation of first-order phase transitions triggered by dark matter. These cosmological processes proceed via the formation of bubbles, that eventually collide releasing a huge amount of gravitational radiation. Searching for this type of signals is very promising in the light of future gravitational observatories such as LISA and the Einstein Telescope.

An alternative avenue is the Gertsenshtein effect, which arguably provides a deeper connection between dark matter and gravitational waves. This is the conversion of the latter into electromagnetic waves in the presence of a magnetic field.

As the same process occurs for axion dark matter, I would like to exploit the Gertsenshtein effect on astrophysical and cosmological environments, with the aim of detecting gravitational waves by adopting techniques from axion dark matter.

DESY-Hamburg is a world-leading institution in the investigation of both axions and cosmological phase transitions. Having worked there places me in an advantageous position, specially because of the papers I have written on this subject.

(iii) Finally, I am interested on the potential implications of dark matter self-scattering on the distribution of dark matter in astrophysical objects. This has attracted a lot attention because numerous studies over the last decades claim that such scatterings can alleviate an alleged discrepancy between observations and the predictions of Lambda-CDM model. The latter is the accepted description of dark matter at large scales. I have written numerous papers on the subject. Moreover, my investigations have led to a clearer understanding of dark matter scattering in dark matter halos from the particle-physics point of view.

I hope I can attain the goal of carrying out my investigations on dark matter or gravitational waves as a Ramón y Cajal researcher.

#### Resumen del Currículum Vitae:

I am an Alexander von Humboldt fellow in the theory group of DESY-Hamburg. I carry out research on dark matter and gravitational waves. My accomplishments have been recognized by the Alexander von Humboldt Foundation, which awarded me its prestigious fellowship for pursuing my own research since 2019. Before this, I held postdoctoral positions in DESY-Hamburg, from October 2017 to September 2019; and in the Université Libre de Bruxelles, from October 2014 to September 2017. My graduate studies were carried out at the Technical University of Munich in Germany and in the University of Wisconsin, USA. Needless to say, international mobility has been at the core of my career.

I have published several scientific papers in well-recognized peer-reviewed international journals. These include three Physical Review Letters, with a significant impact in the fields of dark matter and gravitational waves. Moreover, since the culmination of my PhD, in more than 20 occasions, I have been invited to present my work in university seminars, workshops and international conferences in Europe, America and Asia. Furthermore, having been discussed by popular science media in several languages, the impact of my research goes beyond academic circles.



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

I have a broad range of interests. These include indirect detection signals of dark matter, specially in gamma-ray, neutrino and radio telescopes. I am considered a leading specialist on the non-perturbative effects that are required to understand heavy dark matter annihilation as well as dark matter self-interactions in galaxies. I am interested in the Gertsenshtein effect, by which gravitational waves convert into electromagnetic radiation in the presence of magnetic fields, in complete analogy to axion dark matter. I have recently shown that exploiting this effect leads to a novel way to detect gravitational waves using radio telescopes, establishing a previously unknown connection among seemingly different fields.

I have collaborated with world-leading theorists in astroparticle physics. These include Alejandro Ibarra, who was also my PhD advisor; Tao Han, who served as my master advisor; Hitoshi Murayama from University of California in Bekerley; Thomas Hambye from Brussels in Belgium and Kai Schmidt-Hoberg from Hamburg in Germany. I have also worked with young people. For instance, I supervised Andrés Rivera Romero during the last year of his PhD Project, and currently I supervise two master students in Kai Schmidt-Hoberg's group: Isak Stomberg and Esaú Cervantes.

This adds to my teaching experience of several years, specially from 2008 to 2011 where I held a half-time teaching assistantship at the University of Wisconsin. Furthermore, my teaching experience comprises courses on physics beyond the Standard Model, cosmology, quantum mechanics, general relativity, quantum field theory, electromagnetism and thermodynamics. Due to this record and the aforementioned skills, I am perfectly capable of assuming a faculty position with teaching responsibilities.

Finally, I am highly committed to academic life, which in my view consists of not only research but also teaching, mentoring students and participating in the administrative life of academic institutions. I have extensively done that, as supported by the attached documents, and I hope I can continue doing so as a Ramón y Cajal researcher.





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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** FELIPE GARCIA, TOBIAS  
**Referencia:** RYC2020-030307-I  
**Área Temática:** Ciencias físicas  
**Correo Electrónico:** tobias@iac.es

#### Título:

Waves in solar active regions: numerical simulations, spectropolarimetry, and local helioseismology

#### Resumen de la Memoria:

I obtained my bachelor's degree in Physics in 2006 and my master's degree in Astrophysics in 2007 from University of La Laguna (ULL), both of them with the recognition of Extraordinary Award. During this period I had my first contact with scientific research through two fellowships: the Summer Research program from the Instituto de Astrofísica de Canarias (IAC), and the collaboration fellowship from the Spanish Ministry of Education and Science to work in the Department of Astrophysics (ULL). I was selected in the first position for the Resident Astrophysicist program from the IAC to perform my doctoral thesis. I obtained my Ph.D. degree in 2010. My thesis was distinguished with the Extraordinary Award. Right after finishing my Ph.D., I moved to Boulder (USA) for a postdoctoral position at NorthWest Research Associates (NWRA). I expended four years abroad until I joined ULL in 2014 thanks to a Juan de la Cierva Fellowship (success rate <7,5%). Since 2016 I have held two successive postdoctoral positions (PNAYA, Severo Ochoa) at the IAC and a highly competitive IAC Fellowship (success rate <6%).

I am the PI of the Solar and Stellar Magnetism group of the IAC (5 senior researchers, 5 postdocs, 2 Ph.D. students) and I have been awarded three projects in competitive calls as PI. These grants (together with my IAC fellowship) provide me scientific independence and allowed me to hire a postdoc to work under my direction. The following lines summarize my contributions to several fields of solar physics:

#### -Wave propagation in the solar atmosphere

The study of atmospheric waves has been one of my main research lines during my whole scientific career. Eighteen of my papers (16 as first author, 3 of them as sole author, one Nature Astronomy, one selected as A&A Highlight) focus on this topic. During my PhD I have developed a three dimensional numerical code which solves the MHD equations in solar-like conditions. I have employed this code to investigate the theoretical aspects of wave propagation in the atmosphere of solar magnetic structures, to compute observationally driven numerical simulations, and to construct numerical models that allow a direct comparison with observations. This code has been the basis of two ERC projects developed at the IAC. I have also carried out purely observational works of wave propagation in sunspots between the photosphere and chromosphere.

#### -Local helioseismology

During my four years postdoc at NWRA (USA) I started my other main line of research. Internal layers of stars are opaque to radiation and, therefore, inaccessible by optical imaging. Seismology offers a unique approach to analyze their interiors. I have studied numerically how waves interact with magnetized structures, such as sunspots and flux tubes. I have also contributed to farside local helioseismology by developing a deep learning approach to improve the detection of far-side active regions in seismic maps. I have published seven papers on this topic as lead author.

#### -Spectropolarimetry

In addition to the research lines about waves in solar active regions described above, I have devoted part of my work to several independent but complementary topics. In these works, I have focused on spectropolarimetry. My works include the study of the magnetic structure and dynamics of sunspots and the modeling of the polarized signals from stellar prominences

#### Resumen del Currículum Vitae:

##### Positions

2018-present: IAC Fellowship, IAC, Spain  
2017-2018: Severo Ochoa Postdoctoral Researcher, IAC, Spain  
2016-2017: PNAYA Postdoctoral Researcher, IAC, Spain  
2014-2016: Juan de la Cierva Fellowship, ULL, Spain  
2010-2014: Postdoctoral Researcher, NWRA, USA  
2006-2010: Predoctoral Student (Astrofísico Residente, selected in the first position), IAC, Spain

##### Education

2006-2010: Ph.D. in Astrophysics, ULL. Excellent Cum Laude with Ph.D. Extraordinary Award.



## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

2006-2007: Masters in Astrophysics, ULL, with Extraordinary Award.  
2002-2006: Physics Degree, ULL, with Extraordinary Award.

#### Scientific productivity

- First author of 25 refereed publications (three as sole author).
- High-impact first-author publications (1 Nature Astronomy as sole author, 1 A&A Highlight, 1 ApJL, 2 A&A Letters)
- Most of my papers have received a number of citations higher than the average of the field.
- Publications with a reduced number of authors (median of 3 authors).
- Six invited talks at prestigious international conferences and colloquiums (about one per year since 2015).
- 37 contributions to conferences (20 oral presentations).
- Three press releases.

#### Projects and grants

- PI of three projects awarded in competitive calls (I+D Generación de Conocimiento 2018, Acciones de Dinamización Europa Investigación 2020, Proyectos I+D GOBCAN-ACISI 2020).
- PI of the Solar and Stellar Magnetism group of the IAC (2017- present). The group is composed of 5 senior researchers, 5 postdocs, and 2 Ph.D. students.
- Funding for my positions through competitive calls:
  - IAC Fellowship (success rate <6%).
  - Juan de la Cierva Fellowship (success rate <7.5%)
  - Several postdoc positions (Severo Ochoa, PNAYA, contracts under NASA and NSF projects).
- Total research funding as PI: 371,400 (including grants and fellowships)
- Participation in 8 international projects (ERC StG and CoG, NASA, NSF) and 7 national projects (total funding >8M ).
- Responsible researcher of a work package from a NASA project.
- Seal of Excellence from the European Commission (score of 90.6% in MSCA 2016 call).

#### Review activities

- Member of peer review panel (NASA ROSES 2015, Washington D.C., USA)
- Review of PRACE applications
- Member of the Agencia Estatal de Investigación peer review panel.
- Usual referee of the most prestigious journals of the field (Nature Astronomy, ApJ, ApJL, A&A, MNRAS).
- Member of Ph.D. and master s theses committees.

#### International activities

- Four years of postdoctoral experience in the United States (NWRA).
- Participation in 8 international projects funded by NASA and NSF (total funding >4M\$) and ERC (3M ).
- Member of peer review panel (NASA ROSES 2015, Washington D.C., USA)
- Review of PRACE applications
- Organization of three international conferences.
- Consolidated collaborations with researchers from numerous prestigious institutions: NWRA, Stanford University, NSO (USA), MPS, AIP, KIS (Germany), UiO:RoCS (Norway), ISF (Sweden), HUJI (Israel), IIA (India).

#### Teaching and mentoring

- Four years of teaching at Physics Degree (Astrophysics Fluids Dynamics), ULL
- Supervision of a Ph.D. thesis and a postdoc, masters and degree theses, contribution to the supervision of other 2 Ph.D. students.

#### Other merits

- Awards at all stages during my education (Degree, Master, and Ph.D. Extraordinary awards).
- Very active in outreach activities.



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** BORGE HOLTHOEFER, JAVIER  
**Referencia:** RYC2020-030609-I  
**Área Temática:** Ciencias físicas  
**Correo Electrónico:** borge.holthoefer@gmail.com

#### Título:

Human Systems Ecology: reframing complex social and urban systems

#### Resumen de la Memoria:

Javier Borge-Holthoefer, currently leading the Complex Systems group at the Internet Interdisciplinary Institute (IN3, Universitat Oberta de Catalunya), received a Ph.D. in Computer Science from the Universitat Rovira i Virgili (URV) in Tarragona (Spain) in 2011, preceded by a M.D. in Artificial Intelligence at the same university. Among other appointments, he taught at the Department of Computer Science and Mathematics and at the Department of Psychology (both in URV) in the period 2005-2010. Before joining the IN3, he was a member of the COSNET Lab and held a position as a post-doctoral fellow at the Institute for Biocomputation and Physics of Complex Systems (BIFI), University of Zaragoza in Spain (2011-2013). He then moved to Qatar to work as a Scientist, at the Qatar Computing Research Institute (QCRI), Hamad bin Khalifa University (2014-2016). In the process, he has taken part in 6 research projects (3 as main researcher, 2 in Spanish projects, and 1 in a European FET-Open project).

Founded on Interdisciplinary Physics, his research has successfully explored a variety of topics, ranging from social networks, to urban systems, to mutualistic assemblages in Ecology. Far from blurring his trajectory, Dr. Borge-Holthoefer's dedication to different fields has converged to the current synthesis efforts, e.g., mapping the ecological framework onto the context of online communication systems. The strength of this interdisciplinary endeavor relies on a solid theoretical and methodological foundation, a long training period in Computer Science with a focus on numerical methods and data analytics, and an heterogeneous education in Humanities and Philosophy previous to the scientific career (B.D. in Philosophy, 2003; M.D. in Cognitive Science, 2007).

With more than 50 peer-reviewed works, his research has been published (among others) in Science Advances, Nature Communications, Social Networks, Scientific Reports, Royal Society Interface, EPJ Data Science, Physical Review E, and Europhysics Letters. Dr. Borge-Holthoefer has also contributed two books and several chapters to the area of Computational Social Science, especially around the topics of coordination, collective action and information spreading on complex networks. Furthermore, his work has been disseminated both in Spain and abroad, with more than 40 oral talks and research seminars in national and international conferences (United States, Great Britain, Italy, Mexico, Finland, Singapore, etc.) and in first-class centers (including the Oxford Internet Institute, University of Cambridge, or the UNICEF headquarters in New York, among others).

#### Resumen del Currículum Vitae:

Javier Borge-Holthoefer, currently leading the Complex Systems group at the Internet Interdisciplinary Institute (IN3, Universitat Oberta de Catalunya), received a Ph.D. in Computer Science from the Universitat Rovira i Virgili (URV) in Tarragona (Spain) in 2011, preceded by a M.D. in Artificial Intelligence at the same university. Among other appointments, he taught at the Department of Computer Science and Mathematics and at the Department of Psychology (both in URV) in the period 2005-2010. Before joining the IN3, he was a member of the COSNET Lab and held a position as a post-doctoral fellow at the Institute for Biocomputation and Physics of Complex Systems (BIFI), University of Zaragoza in Spain (2011-2013). He then moved to Qatar to work as a Scientist, at the Qatar Computing Research Institute (QCRI), Hamad bin Khalifa University (2014-2016). In the process, he has taken part in 6 research projects (3 as main researcher, 2 in Spanish projects, and 1 in a European FET-Open project).

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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** LOPEZ COTO, RUBEN  
**Referencia:** RYC2020-028639-I  
**Área Temática:** Ciencias físicas  
**Correo Electrónico:** rlopezcoto@gmail.com

#### Título:

Understanding galactic cosmic ray acceleration through very-high-energy gamma-ray observations

#### Resumen de la Memoria:

I have been involved in the Astroparticle Physics field for more than 10 years in which I worked for the major collaborations of Very-High-Energy (VHE) gamma rays: MAGIC, H.E.S.S., HAWC, SWGO and CTA. I have played different roles within them, from which I would like to call attention to my leadership on Galactic Science (convener of MAGIC and SWGO), and Software (Analysis coordinator of the Large-Sized Telescope (LST) of the Cherenkov Telescope Array (CTA) and Deep Learning Coordinator, Analysis and Quality reviewer and member of the Software Board of MAGIC).

My scientific production is focused on the study of Cosmic Ray acceleration through the measurement of the non-thermal emission of galactic astrophysical sources, in particular those powered by pulsars, and their contribution to the cosmic ray flux measured at the Earth. My most significant contribution is the measurement of extended VHE gamma-ray emission centered in two nearby pulsars (Geminga and PSR B0656+14) produced by electrons and positrons via inverse Compton scattering of the ambient photon fields and its implication to the local cosmic ray electron and positron flux, published in Science. I have published several articles within the MAGIC and HAWC collaborations studying particle acceleration inside the well-known pulsars/pulsar wind nebulae/halos Geminga, Crab or 3C 58. I have also published several short author-list papers as first author investigating the phenomenology of gamma-ray halos and cosmic ray propagation within the Galaxy, in journals like Physical Review Letters. I have co-supervised two PhD students working on this topic and I am currently writing a review for Nature Astronomy as first author.

At the moment, I am coordinating the analysis of the LST-1 of CTA, the first telescope of the array and the only one built so far. I am also leading the software development in MAGIC with several coordinating roles. The improvement of the currently existing systems has also been the focus of my studies and I have also published several articles on software developments and simulations: proposing new types of Imaging Atmospheric Cherenkov Telescopes (IACTs), new types of trigger systems for IACTs, or deriving the fundamental drivers for the construction of VHE gamma-ray particle detectors. I have also contributed to hardware development of VHE gamma-ray systems by leading the design of the LST trigger system and the Data Acquisition of the HAWC upgrade.

My current Marie Skłodowska Curie research project aims at exploring the implementation of modern analysis techniques to the LST-1 data analysis and its application for the analysis of transient phenomena, for which I have already supervised three master thesis on the topic. I now aim at building my own research group with the support of a long-term Ramón y Cajal fellowship. I would add to the Spanish community a recognized expertise in the studies of galactic cosmic rays through VHE gamma-ray observations, coupled to strong technical experience in the commissioning, running, and data analysis of IACTs. These skills are invaluable at the advent of the CTA era, in particular with the exploitation of its LSTs for whose commissioning I am currently one of the key players. They are optimal instruments in the tens of GeV energy range, the unexplored region of a great number of the science cases on which I am an expert.

#### Resumen del Currículum Vitae:

During the last 10 years, I have been an active member of the major very-high-energy gamma-ray collaborations: MAGIC (2010-2015; 2017 - Present), H.E.S.S. (2015-2017), HAWC (2015 - Present), SWGO (2019 - Present) and CTA (2011-Present). I obtained my PhD in 2015 at the Institut de Física d'Altes Energies (IFAE) under the supervision of Juan Cortina and Oscar Blanch. I worked as a Postdoctoral Researcher for two years at the Max Planck Institute for Nuclear Physics (MPIK) in Heidelberg. In 2017 I was ranked first in the national INFN Postdoctoral Program and moved to INFN-Padova. Since 2019 I am a fixed-term Researcher Level III (Ricercatore Livello III a tempo determinato) categorized at the same level as permanent researchers thanks to a Marie Skłodowska Curie fellowship.

My CV contains articles from many different aspects of Astroparticle Physics, numerous invited talks and many coordination roles. My publication record (151 papers in refereed journals, 5127 citations, H-index=32, out of which 19 papers as one of the main authors (all in Q1), 11 as convener and one book) shows the impact of my research on the astroparticle community. My most influential paper [Science 358, 911-914 (2017)] received more than 150 citations (inspire-hep) in 3 years and started a new line of research on newly discovered gamma-ray halos. Further work on these sources and cosmic ray propagation, within the HAWC and MAGIC collaborations and in independent papers show my most influential contribution to the community. I led several research projects inside big collaborations, but also manifested independent thinking by developing new systems to improve the current ones with original ideas, as well as publishing several short-author list papers as a first author. The papers I led have been published in recognized international journals and very high



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

impact journals. I am currently the Galactic Working Group Coordinator of the MAGIC Collaboration, coordinating approximately 100 members. I am also the Analysis Software Co-coordinator of the Large-Sized Telescope (LST) of CTA (120 members) and member of the Executive Board of the LST (200 members). I am also the Galactic coordinator of SWGO and that of the Deep Learning group of MAGIC, showing leadership skills coordinating groups of more than 100 people in Software and Physics. I have been invited to give 23 talks at seminars, conferences and schools and presented my work in 12 additional talks on major conferences and more than 50 posters as one of the co-authors. I supervised three master and two PhD students and I am currently supervising one master, one PhD student and one postdoc. I have organized 8 international conferences with hundreds of participants. I am referee of Nature Astronomy, Nature Communications, Astrophysical Journal, Astroparticle Physics, Physical Review D and EPJP, and served as an external reviewer for the Polish Academy of Science and in other review committees. I received prizes and recognitions at national and international level.

My work has gotten world-wide media attention several times with several press releases. I am participating every year in the European Researchers Night, the International Cosmic Ray Day, and have participated in high school programs and other outreach events as member of the CTA outreach Working Group. Additionally, I have performed several research sojourns in different institutes abroad and fluently speak Spanish, English, Italian, Catalan and German.



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** COMERON LIMBOURG, SEBASTIEN

**Referencia:** RYC2020-030480-I

**Área Temática:** Ciencias físicas

**Correo Electrónico:** sebastien.comeron@iac.es

#### Título:

Archaeology of Thick discs (ArcThick)

#### Resumen de la Memoria:

I have developed my career in three countries and in two continents.

I obtained my PhD at the Instituto de Astrofísica de Canarias (IAC) and the Universidad de La Laguna (ULL) in 2006 - 2010. I obtained the prize for outstanding PhD thesis in sciences in the ULL.

I was awarded a postdoctoral fellowship at the Korean Astronomy and Space Science Institute (KASI) in 2010 - 2012. There, I obtained the prize for the most productive postdoc of the year in 2011 (~25 postdocs were working there).

In 2012 - 2020 I worked at the University of Oulu (Finland) under various positions, including a Finnish Centre of Astronomy (FINCA) with ESO fellowship. In 2013 I started teaching and currently I have a teaching experience of more than 100 ECTS credits.

I am now a Viera y Clavijo fellow at the ULL.

I have made fundamental contributions to the study of galaxy evolution, especially in the following three key areas:

A) The origin of thick discs. Thick discs contain most of the oldest stars in galaxies. The formation mechanisms of thick discs are disputed. Are they the remains of the early violent galaxy formation processes or the effect of a slow evolution over a cosmic time? Are their stars accreted in galaxy mergers or have they formed within their host galaxy? Understanding how thick discs formed is crucial to understand the early evolution of galaxies. I lead the Archaeology of Thick discs (ArcThick) project to unveil the secrets of thick discs. A few highlights of this project are:

- Thick discs are ubiquitous.
- They are much more massive than previously thought.
- Thick discs are a likely reservoir of missing baryons.
- I made the first integral field spectroscopy studies of thick discs.
- I am conducting an integral field spectroscopy survey of tens of thick discs in nearby galaxies with MUSE at the VLT. I have already published the results on the first subsample of eight galaxies.
- My studies have severely constrained when and how thick discs formed. The evidence gathered so far point at the thick discs being the primordial galaxy discs. The medium in these discs was very turbulent due to the intense star formation, which caused the gas to be distributed in a thick layer. As a result, the newly formed stars are born in a thickened disc. A thin disc formed afterwards within the thin disc from left-over gas and material accreted through minor mergers and cold flows.

B) Galactic rings. Rings are fundamental to understand galactic dynamics. I wrote AINUR, a study of Nuclear Rings in HST images, and ARRAKIS, an analysis of the rings in the Spitzer Survey of Stellar Structure in Galaxies (S4G). These works are standard references on the topic.

C) Spectroscopy of the circumnuclear medium of active galaxies with high angular resolution. I am a member of the first team that has obtained data of the nuclear regions of an active galaxy with the Integral Field Spectrograph MUSE with full adaptive optics. The combination of great data and a careful analysis unveiled the great complexity in the inner parts of AGN outflows.

I am an expert on both imaging and Integral Field Spectroscopy techniques. My expertise covers much of the electromagnetic spectrum: UV (GALEX), optical (SDSS, HST), near-infrared (2MASS), and mid-infrared (Spitzer Space Telescope). I am a world expert in Integral Field Spectroscopy.

#### Resumen del Currículum Vitae:

I have made fundamental contributions to the study of galaxy evolution, especially in the following three key areas:





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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

- A) The origin of thick discs.
- B) Galactic rings.
- C) Spectroscopy of the circumnuclear medium of active galaxies with high angular resolution.

I have been leading the Archaeology of Thick Discs (ArcThick) project, an international collaboration aimed at understanding the origin of thick discs.

I am the author of 54 refereed articles (17 as first author). They have been cited 2300+ times (500+ times for first author articles). I have H=24 (12 for first author articles). 53 out of my 54 articles (all of the first author articles), have been published in first quartile journals.

I have been successful and finding funding to advance in my career:

- Competitive R grant to fund my PhD studies at the Instituto de Astrofísica de Canarias (2006 - 2010).
- Competitive postdoctoral fellowship at the Korean Astronomy and Space Science Institute (2010 - 2012). Included the salary and travel funding.
- Competitive Finnish Centre of Astronomy with ESO fellowship (2013 - 2015). Included my salary.
- Competitive Atracción de Talento fellowship of the region of Madrid (to be started in 2020; declined). Included funding for half of my salary and up to 200 000 for research-related expenses and to start building a research group.
- Competitive Viera y Clavijo fellowship (2020 - 2025). Includes my salary and 10 000 for research-related expenses.

I have been awarded telescope time 35 times, including twelve times as a PI. I have been the PI of accepted proposals in the GTC and the VLT. As a PI, I have been awarded time to the very over-subscribed MUSE instrument at the VLT twice. As a co-I I have been awarded time at the Spitzer Space Telescope.

My scientific and technical expertise has been recognised by my peers. I have been invited five times to talk at international conferences. I have been a member of the ESO OPC panels to evaluate telescope time proposals. I have participated in panels to select FINCA postdoctoral fellows. I have been a referee for A&A, MNRAS, ApJ, and ApJ Letters. I have also received several prizes, including the prize for outstanding PhD thesis in sciences in the Universidad de La Laguna and the prize for the best postdoc of the year at the Korean Astronomy and Space Science Institute (KASI).

At the University of Oulu I have taught at least twice each of the following subjects: Galaxies, Cosmology, Stellar Structure and Evolution, and Interstellar Medium. At the ULL I have taught Stellar Structure and Evolution. I have supervised the Bachelor theses of six students (plus one in progress) and I have supervised two MSc theses (plus one in progress). I have obtained the Profesor Titular de Universidad accreditation by ANECA.

I am active at communicating my results. I have attended 26 conferences, 14 specialised workshops, and given 33 talks at scientific institutions. I have also been active in public outreach and I have participated in many events such as the European Researchers' Night and multidisciplinary events combining music and outreach in astronomy.

In the 2018 Ramón y Cajal fellowship call I was ranked 25th (8th substitute). This encouraging performance was a requisite to be entitled to apply to my current Viera y Clavijo position.



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** RUBIO PEÑA, JAVIER  
**Referencia:** RYC2020-028870-I  
**Área Temática:** Ciencias físicas  
**Correo Electrónico:** javier.rubio.pena@gmail.com

#### Título:

Scale invariance in particle physics and cosmology

#### Resumen de la Memoria:

My research interests regard the interplay between cosmology and particle physics phenomenology, with special emphasis on the generic implications of scale invariance in the early and late Universe.

Scale invariance is a universal feature of objects or laws that remains intact when the scales of length, energy, or any dimensionful variable are multiplied by a common factor. Theories exhibiting this symmetry appear ubiquitously in many branches of science, ranging from biology to physics. In the case of particle physics, a scale-invariant theory is one in which the strength of particle interactions does not depend on the energy of the particles involved.

During my scientific career, I have developed two main lines of research:

##### 1. Spontaneously-broken scale symmetry

I seek for minimalistic extensions of the Standard Model of particle physics based on exact scale symmetry and volume-preserving diffeomorphisms. These theories are restricted by a variety of observations, ranging from astrophysics and cosmology to accelerator experiments. Under certain conditions, they give rise to universal predictions for the inflationary and dark energy observables that may become intertwined in some particular cases, leading to intriguing consistency relations among the early and the late Universe with a strong impact on the analysis of cosmological data sets.

##### 2. Emergent scale symmetry

I consider variable gravity scenarios where scale invariance emerges as an exact symmetry due to the presence of ultraviolet and infrared fixed points in the renormalization group flow of the Standard Model non-minimally coupled to gravity. The approximate dilatation symmetry around these fixed points leads to the generation of an approximately scale-invariant spectrum of primordial density fluctuations and to the appearance of a dynamical dark-energy component. The crossover to the infrared fixed point happens generically through a kinetic-dominated regime and comes associated with the appearance of long-range interactions. These two ingredients can have far-reaching consequences. On the one hand, the existence of attractive forces stronger than gravity may lead to the formation of primordial black holes or similar screened objects that could play the role of dark matter. On the other hand, the presence of a kinetic dominated era leads to the spontaneous breaking of the internal symmetries of spectator fields non-minimally coupled to gravity and its eventual restoration at the onset of radiation domination, generating a rich and interesting phenomenology.

#### Resumen del Currículum Vitae:

I obtained my Ph.D. degree with honours by the Universidad Autónoma de Madrid in 2011, under the supervision of Professor Juan Garcia-Bellido.

During my scientific career, I have done significant contributions to clarify i) the role of the Standard Model Higgs field in the early Universe ii) the implications of scale symmetry in particle physics and cosmology and iii) the inflation-dark energy connection.

I carried out this research at the Ecole Polytechnique Federale de Lausanne (Switzerland), the University of Heidelberg (Germany), the University of Helsinki (Finland) and the Instituto Superior Tecnico (Portugal), maintaining a high scientific production of +28 peer-reviewed articles with +1390 citations and including 1 Topcite 250+ paper, 3 TopCite 100+ papers and 4 TopCite 50+ paper (inspire-hep).

My research activity is further strengthened by more than +30 participations in key international events in particle physics and cosmology, including invited plenary talks in long-standing physics series such as PLANCK or PASCOS, smaller workshops and topical conferences and invited seminars in research centers worldwide.





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### Turno de acceso general

I have been involved as a team member in 7 research projects (national, European and non-European) and organized several international events such as 2 Euclid consortium group meetings in 2017, 5 editions of the Tonale Winter School on Cosmology and the CERN-TH institute on Scale invariance in particle physics and cosmology in 2019.

I am a scientific reviewer for the PRELUDIUM funding schemes of the Polish National Science Centre, the Chilean FONDECYT Regular Competition and 9 specialized journals on particle physics and cosmology with more than 50 contributions from 2011 (PRD, PRL, JCAP, JHEP, PDU, IJMP D, PLB, CQG, MNRS).

My research is complemented by an extensive lecturing and mentoring activity accounting for 17 courses at undergraduate and graduate levels, more than 680 hours of certified teaching experience, contributed lecture notes and the supervision of 6 MSc thesis and 2 ongoing PhD thesis.



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** LOPEZ SANTOS, MARIA CARMEN  
**Referencia:** RYC2020-030591-I  
**Área Temática:** Ciencias físicas  
**Correo Electrónico:** mcarmen.ls@gmail.com

#### Título:

Development of Multifunctional Surfaces by Plasma Technology for Advanced Applications

#### Resumen de la Memoria:

My scientific career, from the Degree in Physics (University of Seville (US), 2004) to my PhD thesis (US, 2009) and 11 years of postdoctoral experience, is focused on the study of multifunctional surfaces at micro/nanoscales, implying treatments and coatings, characterization of physical, chemical and structural properties and design and modelling for understanding and controlling the surface behavior for advanced applications in fields from environmental, protection, energy, optics to biomedicine, this last a novel topic for the Nanotechnology on Surfaces and Plasma group (Institute of Materials Science of Seville (ICMS)) which I introduced during my PhD work. I am responsible for the research task in smart surfaces for wetting, omniphobicity and antifreezing properties. I am specialized in the use of vacuum and atmospheric plasma assisted techniques and advanced user of surface characterization techniques (wetting, XPS, AFM, ESEM, GISAXS) and synchrotron facilities (ESRF, DESY, ALBA).

During my PhD thesis I studied the nitrogen plasma physics (Lisbon IST) and its application on surface functionalization of polymers and DLC coatings with biomedical applications (U. Zaragoza, Jiménez-Díaz Hospital Foundation and ICTP in Madrid). It was awarded with the Extraordinary US PhD Prize 2009/2010.

During my postdoctoral stage at the University of Namur (Belgium), I worked in applied physics in contact to industrial partners to develop wear resistant and low friction protective coatings for cylindrical parts of high competition engines as well as to biologists and pharmacists to demonstrate their good hemo- and biocompatibilities for biomedical pieces (NARILIS).

After my return to the ICMS in a Sponsoring Agreement framework project (Abengoa Research) and the PHOBIC2ICE H2020 european project, I have worked on the fabrication, surface functionalization and characterization of oriented and controlled porous oxide thin films and nanostructures, polymeric and fluorinated coatings with special wettability, antifreezing, optical and electrical properties for self-cleaning surfaces, aircraft parts, sensors or photoanodes in solar cells. I am developing active de-icing and passive anti-icing surface strategies in the context of the SOUNDofICE H2020 FETOPEN project for the application of acoustic waves on surface de-icing and the DURASOL national project based on the performance of waterproof perovskite solar cells, being WP2 co-Leader as US representative of the first one and co-PI of the last one. I am responsible for an awarded regional grant for the acquisition of R+D+I material to incorporate an equipment for surface wetting characterization under controlled environments. I am also involved in plasma technology applications for agriculture (INRA, IQAC), anisotropic surface properties (IO) and in industrial research activities (Airbus Group Innovations, Pratt and Whitney Canada, Arquimea, Cosentino, BSH, EPCOS).

#### Resumen del Currículum Vitae:

The researcher has a degree in Physics from the University of Seville (US) in 2004 and began her research career at the Institute of Materials Science of Seville (US - CSIC) through an internship funded by the Junta de Andalucía to develop her doctoral thesis "Nitrogen plasmas and surface functionalization of polymeric materials and diamond-like coatings for biomedical applications" supervised by Profs. A.R. González-Elípe (CSIC) and J. Cotrino Bautista (US) in the Nanotechnology in Surfaces and Plasma group (Doctorate Award of the University of Seville 2009/2010). She also obtained a degree in Materials Engineering in 2010. She started her postdoctoral period in the Department of Physics at the University of Namur (Belgium), working at the Center for Physics of Matter and Radiation (PMR) and the Namur Research Institute for Life Sciences (NARILIS) for two years. She rejoined the Nanotechnology in Surfaces and Plasma group (ICMS) through a framework agreement financed by Abengoa Research SL, dedicated to development, research and innovation. Then she continued working with a contract linked to the European project PHOBIC2ICE for the design and manufacture of icephobic and impact resistant surfaces to protect aircraft parts. Currently is a researcher of the Department of Atomic, Molecular and Nuclear Physics of the US with a contract for access to the Spanish Science, Technology and Innovation System for development of the own R + D + i program of the US. She has developed a solid profile of applied research with a strong vocation for technology transfer defined as "control of surface properties of functional materials and nanostructured thin films by plasma techniques" with contributions in fields such as protective coatings, biomedicine, optics and energy. She has specialized in the use of vacuum and plasma techniques for the manufacture of thin films and surface treatments, surface functionalization of materials and plasma physics, as well as advanced techniques for characterizing materials and their properties, obtaining access to large synchrotron radiation installations. The scientific production is summarized in 56



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

articles published in ISI (91% in Q1, 35.5% in D1, 50% open access), of which she is the first author of 15, second of 15 and corresponding author of 14, with 4 covers in "Plasma, Processes and Polymers", 1 in "Advanced Materials Interfaces" and 1 in "Advanced Energy Materials". 550 total cites and a H index = 15 and i10 index = 22 since 2006 (ref. Scopus). She has more than 40 contributions to conferences (3 invited, 20 oral) and participations in 28 public and private funding research projects being co-PI of a plan national project and PI of a regional infrastructure project. She has an active work of technology transfer with national and international companies (Arquimea, Airbus, Pratt&Whitney, Abengoa, Cosentino, INDO, BSH) through technical research reports and two licensed patents. She is permanently involved in training and teaching in Physics, Materials Engineering and Mathematics Degrees (US) and in the Laser, Plasma and Surface Technology Master (UCO-PM) as well as the supervision of 4 final degree projects and 2 master's degree projects at the US. I will supervise the PhD Thesis of Laura Montes on anti-icing and multifunctional coatings compatible with de-icing by surface acoustic waves (WP2 SOUNofICE).



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** MOLINA BUENO, LAURA  
**Referencia:** RYC2020-030551-I  
**Área Temática:** Ciencias físicas  
**Correo Electrónico:** laumobue@alumni.uv.es

#### Título:

Neutrino and dark sector physics

#### Resumen de la Memoria:

My scientific career covers a broad list of topics, as ultra high energy cosmic rays, neutrino physics and dark matter searches. Participation in leading experiments in their corresponding fields as the Pierre Auger Observatory, T2K, DUNE and NA64 has allowed me to develop the necessary hardware, software and data analysis skills to guarantee the proper development of my future research. This has been a great opportunity to mature as a scientist, diversify my researcher profile, adapt to different working environments and international collaborations, develop a broad network of contacts and have a general view of the high energy physics landscape. Moreover, the numerous responsibilities I had in those experiments as well as my current independent funding demonstrate my autonomy and maturity, as well as my capabilities for leadership.

I did my PhD studies in the University of Granada in Ultra High Energy Cosmic Rays within the Pierre Auger Collaboration, ending up in the erratum publication of Phys. Rev. D 92 019903 (2015) and nine internal notes. This was a great opportunity to develop strong analysis and software capabilities.

As a postdoctoral researcher at ETH (Zürich) and CERN (Geneva), I was heavily involved in the construction and operation of the 3x1x1 m<sup>3</sup> dual phase liquid argon time projection chamber (TPC), the first large scale prototype of its kind, which resulted in two technical papers. I have been responsible for the high voltage (HV) system and the operation of the prototype, and I co-lead the analysis of its data. I am currently a member of the ProtoDUNE and DUNE collaborations, where my work in the 3x1x1 m<sup>3</sup> for the HV system is being reused.

In 2018, I joined T2K, one of the world-leading neutrino running experiments, and NA64, a fixed target experiment at the CERN SPS, looking for Dark Sector searches, where I have done numerous analysis and hardware developments, leading to several publications, and I have several responsibilities such as leading the NA64&#956; experiment feasibility studies.

In June 2019 I won a JdC Incorporación which I rejected in favour of an Ambizione SNSF project of 825.184 CHF to develop a new Data Acquisition system based on Silicon Photomultipliers readout for NA64. In December 2020, I joined IFIC (Valencia) with a GenT grant from Generalitat Valenciana, to work in neutrino physics at the T2K and DUNE experiments, and to continue developments in LAr TPCs.

#### Resumen del Currículum Vitae:

- PhD: September 2015 (University of Granada).
- Postdoc: 2016-2019 (ETH Zürich (based at CERN)).
- Senior Scientist: 2019- (ETH Zürich (Zürich))
- Researcher with international experience CDEIGENT (IFIC (Valencia)): 1/12/2020-
- Peer-reviewed articles

73 published papers (from WoS), Total number of citations: 2534;  
h-index: 26. Average citations per year (2014-2019): 247.71  
16 talks in conferences and 3 invited seminars (some examples ICHEP2018, Swiss Institute of particle physics strategic workshop, LHCP2020, Kashiwa Dark Matter Symposium, SPSC open session)  
9 internal notes for the Pierre Auger Collaboration, 4 internal notes for NA64 Collaboration.

- Student supervision

PhD students (co-supervision): H. Sieber (ETH Zürich 2020-08/2023) (funded by SNSF Ambizione 186158)  
-co-supervision of the ETH Zürich neutrino group PhD students: C.Alt (2020), K.Fusshoeller(2021) and C. Schloesser(2021)  
Master students (co-supervision): P. Chiu (2017), K. Fusshoeller(2017), P. Degen(2020), P. Odagiu (01/2021).  
Semester work students(co-supervision): M. Schlomberg (2018), Y. Korn(2019), B. Bento(2020) and L. Pedrelli (2021)

- Research projects

->Principal investigator (PI) of the SNSF Ambizione 186158 Development of Data Acquisition Systems based on Silicon Photomultipliers readouts to search for dark sectors in NA64 at CERN" granted with 825.184 CHF at ETH Zürich.



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### Turno de acceso general

->PI of the DEIGENT2019/016 Neutrino physics in the NEXT, T2K and DUNE experiments granted with 100000 euros.

#### - Fellowships and awards

->2019: Investigadora con experiencia internacional (Plan GenT), Generalitat Valenciana

->2019: Ambizione grant, Swiss National Science Foundation.

->2019: Juan de la Cierva incorporación (rejected)

->10/2010 - 10/2014, FPI PhD Fellowship from the Spanish government, University of Granada.

->2011: Prize to the best master student. Master in Advanced Physics (University of Valencia).

->09/2009 - 06/2010, Collaboration grant from the Spanish government for undergraduate students, University of Valencia, Spain.

->07/2009 - 09/2009, JAE introduction Fellowship for undergraduate students, Instituto de Física Corpuscular (Consejo superior de investigaciones científicas), Valencia, Spain.

#### - R&D management and science meetings organization:

->NA64 Experimental Safety Officer (CERN), 09/2020

->Co-leader of the simulation/reconstruction task of the 3x1x1 m3 detector 05/2018-06/2019 (WA105 collaboration).

->Co-leader of the operation and commissioning of the 3x1x1 m3 detector 06/2017-12/2017: (WA105 collaboration).

->Co-leader of the development of the high-voltage system for the DUNE prototypes 08/2017-3/2018 (CERN Neutrino Platform) (WA105 collaboration/ProtoDUNE-DP).

- Research stays: Pierre Auger Observatory, LPNHE, JPARC, and CERN.

- Teaching experience: Teaching assistant since 2012 up to 2020 for undergraduate and master students at the University of Granada and ETH Zürich.

- Outreach: 8 talks in events like "International Masterclass: Hands on Particle Physics", "Semana de la Ciencia", 1 seminar for high-school students and CERN Neutrino Platform guide. NA64 CERN Open Days 2019 coordinator, September 2019, CERN (Switzerland).



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** SANTORO DOMINGO, GONZALO  
**Referencia:** RYC2020-029810-I  
**Área Temática:** Ciencias físicas  
**Correo Electrónico:** g.santoro.domingo@gmail.com

#### Título:

SYNCHROTRON RADIATION FOR INVESTIGATING PHYSICAL PHENOMENA AND LABORATORY ASTROPHYSICS

#### Resumen de la Memoria:

I performed my PhD Thesis at the Instituto de Ciencia y Tecnología de Polímeros (CSIC) on IR and Raman spectroscopy of polymer nanocomposites with carbon nanotubes. Afterwards, I got a contract at the P03 beamline of the PETRA III Synchrotron Radiation Facility (DESY, Germany) for in-situ and in-operando X-ray scattering. I am currently contracted at the Instituto de Ciencia de Materiales de Madrid (CSIC) within the ERC Synergy Grant NANOCOSMOS for simulating in the laboratory the formation of cosmic dust in Red Giants as well as its interaction with molecular ices in the interstellar medium. The quality of my scientific production has been recognized with the I3 Certification.

During my scientific career I have developed two main research lines. The first one is devoted to the use of Large Scale Facilities for Synchrotron Radiation to investigate physical phenomena in a wide range of materials and processes. Within this research line, I have pioneered in investigating organic solar cells under working conditions, in addressing the morphological changes of metal-ion batteries during the charge/discharge cycles as well as in investigating the growth kinetics of metallic, organic and macromolecular thin films for optoelectronics and photovoltaic applications. I have also made a strong impact in the development of synchrotron radiation techniques, pioneering in the use of the intrinsic polarization properties of the synchrotron radiation in the IR spectral range as well as developing microfocusing schemes for hard X-rays. These developments are nowadays widely used in synchrotron radiation facilities worldwide. Within this research line, I have participated in the proposal for the construction of an IR beamline (MIRAS) at the Spanish Synchrotron (ALBA) and I have provided scientific and technical advice on the implementation of X-ray scattering techniques at the NCD beamline of ALBA. Currently, I am co-proposer for the MiNaXS-IV beamline for the future PETRA IV facility, facility that will be synchrotron source with the highest brilliance in the world.

The second research line is related to Laboratory Astrophysics. At present, I am the scientific responsible of the Laboratory Astrophysics research line of the ESISNA group, planning and coordinating the scientific research of 2 postdocs, 1 PhD student and 2 Master thesis students. Within this line, I have participated in the design and implementation of the STARDUST machine, a worldwide unique experimental station for simulating in the laboratory the formation of cosmic dust in Red Giants. I have also succeeded in integrating the Stardust machine into the European project Nanoscience Foundries and Fine Analysis - Europe|PILOT, that has been recently approved with a budget of 15 M from which 1.2 M have been assigned to CSIC. I am the ICMM coordinator of the project, with a budget of 108 k for ICMM.

Along my scientific career, I have maintained a large number of international collaborations, I have carried out technology transfer activities by patenting devices and I have performed counselling and scientific advisory activities both at national and European levels. I have imparted invited seminars in Master courses, I have trained students and I am currently supervising a Master and a PhD thesis. I have participated in the organization of conferences and in dissemination activities.

#### Resumen del Currículum Vitae:

I performed my PhD Thesis at the Instituto de Ciencia y Tecnología de Polímeros (CSIC) on IR and Raman spectroscopy of polymer nanocomposites with carbon nanotubes. Afterwards, I got a contract at the P03 beamline of the PETRA III Synchrotron Radiation Facility (DESY, Germany) for in-situ and in-operando X-ray scattering. I am currently contracted at the Instituto de Ciencia de Materiales de Madrid (CSIC) within the ERC Synergy Grant NANOCOSMOS for simulating in the laboratory the formation of cosmic dust in Red Giants as well as its interaction with molecular ices in the interstellar medium. The quality of my scientific production has been recognized with the I3 Certification.

During my scientific career I have developed two main research lines. The first one is devoted to the use of Large Scale Facilities for Synchrotron Radiation to investigate physical phenomena in a wide range of materials and processes. Within this research line, I have pioneered in investigating organic solar cells under working conditions, in addressing the morphological changes of metal-ion batteries during the charge/discharge cycles as well as in investigating the growth kinetics of metallic, organic and macromolecular thin films for optoelectronics and photovoltaic applications. I have also made a strong impact in the development of synchrotron radiation techniques, pioneering in the use of the intrinsic polarization properties of the synchrotron radiation in the IR spectral range as well as developing microfocusing schemes for hard X-rays. These developments are nowadays widely used in synchrotron radiation facilities worldwide. Within this research line, I have participated in the proposal for the construction of an IR beamline (MIRAS) at the Spanish Synchrotron (ALBA) and I have provided scientific and technical advice on the implementation of X-ray scattering techniques at the NCD beamline of ALBA. Currently, I am co-proposer for the MiNaXS-IV beamline for the future PETRA IV facility, facility that will be synchrotron source with



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Along my scientific career, I have maintained a large number of international collaborations, I have carried out technology transfer activities by patenting devices and I have performed counselling and scientific advisory activities both at national and European levels. I have imparted invited seminars in Master courses, I have trained students and I am currently supervising a Master and a PhD thesis. I have participated in the organization of conferences and in dissemination activities.



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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

### Turno de acceso general

**Nombre:** GAGGERO , DANIELE  
**Referencia:** RYC2020-029184-I  
**Área Temática:** Ciencias físicas  
**Correo Electrónico:** daniele.gaggero@gmail.com

#### Título:

New Avenues in Dark Matter searches and Cosmic-Ray physics

#### Resumen de la Memoria:

My research is focused on several key aspects of theoretical astroparticle physics: cosmic-ray propagation, gamma-ray/neutrino astrophysics, dark matter searches.

I have published 45 papers on refereed journals. My h-index is 24. More than 3500 citations (Web Of Science).

I am currently PI of a La Caixa junior leader fellowship (298.500 €) since 24/09/2018. I am leading a group including 2 PhD students (F. Scarcella "Multi-wavelength searches for exotic physics"; O. Fornieri "Cosmic-ray transport in the Galaxy and related phenomenology"), and 2 master students (C. Fernandez, "Black hole merger rate in the Dark Ages", and M. Rocamora "CR positrons in the Galaxy"). The group has previously included a post-doc (Mathieu Boudaud, Oct 2019 - Jan 2020, deceased) and a master student (T. Franco Muñoz, thesis entitled "Estimación de la tasa de fusión de una población de agujeros negros primordiales en función del redshift y perspectivas de detección con LIGO y Einstein Telescope" defended in July 2019).

I was coordinator of the cosmic-ray science working group within the Cherenkov Telescope Array consortium in 2020. Previously, I was deputy coordinator of the same working group (2019). I collaborate with the ANTARES and HAWC collaboration as well.

I am co-author of the public DRAGON and HERMES codes, designed to simulate cosmic-ray propagation in the Galaxy and the related non-thermal emission over 20 orders of magnitude in energy. The code was first presented in 2008 (the paper published on JCAP collected ~200 citations). More than 30 papers (besides those signed by me) report the use of this code.

Prior to this position, I was a "GRAPPA fellow" in Amsterdam (2015-2018). I collaborated with Prof. G. Bertone, Prof. C. Weniger, and Prof. S. Markoff and co-supervised two M.Sc. theses entitled "Gamma Rays as Probes of Cosmic-Ray Diffusion Throughout the Galaxy" and "Black hole dark matter". The results presented in these theses have been published or submitted to peer-review journals.

Before moving to Amsterdam, I worked as a post-doc at SISSA, Trieste (2012-2015), under the supervision of Prof. P. Ullio. During this period, I informally supervised Ph.D. student M. Valli on three projects about cosmic-ray, gamma-ray and neutrino astrophysics and indirect dark matter detection.

I got the PhD at the University of Pisa, as member of the Fermi-LAT collaboration, under the supervision of Prof. V. Cavasinni and Dr. D. Grasso; my PhD thesis was published by Springer in 2012.

#### Resumen del Currículum Vitae:

I am currently PI of a "Junior leader Caixa fellowship" since 24/09/2018 at IFT Madrid.

I am leading a group including 2 PhD students (Francesca Scarcella, thesis projects: "Multi-wavelength searches for exotic physics"; Ottavio Fornieri, thesis project: "Cosmic-ray transport in the Milky Way") and 1 M.Sc. student (Cristina Fernández).

The group has included a post-doc (Mathieu Boudaud, Oct 2019 - Jan 2020. Passed away on 9/01/2020) and 1 master student (Tania Franco Muñoz, thesis project "Estimación de la tasa de fusión de una población de agujeros negros primordiales en función del redshift y perspectivas de detección con LIGO y Einstein Telescope").

I previously co-supervised 2 M.Sc. theses at the University of Amsterdam.

#### Main topics:

Theoretical Astroparticle Physics: Dark Matter (indirect) searches, Primordial Black Hole phenomenology, Cosmic-ray physics with particular reference to Galactic Cosmic Ray Transport, Modeling of non-thermal emission from the Galaxy.

My research is oriented towards identifying and analyzing multi-messenger signatures of new physics in different contexts: Primordial Black Hole searches, indirect Dark Matter searches in general. I pay particular attention to the modelling of the astrophysical backgrounds,





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## AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2020

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in connection with fundamental problems in high-energy astronomy and astrophysics.

#### Scientific Highlights:

- 45 papers published on refereed journals; 5 papers currently under review;
- 7 papers published on Physical Review Letters (3 as a member of the Fermi-LAT collaboration);
- More than 3500 citations (source: WoS; December 2020);
- h-index: 24 (source: WoS; December 2020);
- 1 review paper published in "Advanced in High-Energy physics"; 1 review paper published in "Int. J. Mod. Phys.

#### Other Activities:

- Coordinator of the Cosmic Ray Science Working group within the CTA consortium (2020). Deputy coordinator of the same group in 2019.
- Founding member and co-coordinator of the DRAGON and HERMES team. Co-Author of the public code DRAGON that simulates Cosmic-Ray propagation in the Galaxy: [github.com/cosmicrays](https://github.com/cosmicrays)
- I was often invited to give a plenary or highlight talk or review at conferences at workshops: CR workshop at APC (online, December 2020), MultiDark-IPPP workshop (October 2019), PAHEN workshop (September 2019), TeVPa 2018 (Berlin, Germany, August 2018), BAROLO Astroparticle workshop (Barolo, Italy, September 2018); Rencontres du Vietnam: Very high energy phenomena in the universe (August 2018, declined); CRATER workshop (Gran Sasso Science Institute, L'Aquila, Italy, May 2018); MIAPP workshop (Munich, Germany, March 2018); Amsterdam-Paris-Stockholm meeting (Woerden, The Netherlands, October 2017); TeVPa 2017 (Columbus, Ohio, August 2017); 11th International Workshop on Astroparticle Physics at Ooty (Ooty, India, December 2016); ICRC 2015 (The Hague, Netherlands, July 2015); CASPAR 2014 (Cosmic-Ray Acceleration, Sources and Propagation: A Rendez-vous, Hamburg, September 2014); TeVPa 2012 (TATA Institute, Mumbai, India, December 2012); 13th ICATPP Conference on Astroparticle, Particle, Space Physics and Detectors for Physics Applications (Como, Italy, October 2011).