



AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2015

Turno de acceso general

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Título:

Processing and quantification methods for early diagnosis in neuroimaging

Resumen de la Memoria:

Medical imaging research has a significant social impact, as new advances in imaging software and instrumentation can lead to earlier diagnosis and better evaluation of response to treatments. It is commonly known that there are three channels to advance towards an increasingly early diagnosis: advances in scanners instrumentation, search for new imaging biomarkers and novel information and communications technologies (ICT) for acquisition, processing and medical image analysis. My career (2003-2015) has been focused on the latter, mainly concentrated on signal processing from scanners, tomographic reconstruction methods and image analysis. After my PhD (Universitat de Barcelona, 2008), my research career has taken place both in universities or research institutes and hospitals, in Spain, France and UK (2009-2015).

Today, after the funding received in last 5 years (>300.000 Euros in 4 projects as PI), I have consolidated my own research line on processing and quantification methods for early diagnosis in neuroimaging. In particular, my research line received a major boost after my work at CNRS-Strasbourg (2014-2015) and currently at LICMM-Leeds (2015-2016), establishing a stable collaboration between France, UK and my colleagues in Spain. From last year, I am the leader of the full project IQBRAIN-ARTFIBIO, a coordinated project aimed at developing web-based tools for neuroimaging processing and radiotherapy functional analysis under a SaaS model. In addition, I got increase significantly my budget through an international collaboration agreement with Actelion Ltd (Allschwil, Switzerland) for using my image processing tools for evaluating treatments in patients.

My scientific achievements can be summarized in 40 journal articles (ISI) in reference journals (Q1: 22/40 and Q1+Q2: 35/40), with high impact factor (mean IF= 2.6 and summed IF= 104.2), h-index=9 (scholar) and mostly as main author (70%). In terms of intellectual and industrial property, I registered 5 software packages, 1 patent application and I signed a transfer agreement. Furthermore, I founded Qubiotech S.L., a spin-off company considered by StartExplore within Top Ten companies representing the health future in Spain. My company is currently based on Barcelona after being selected by Bayer AG for the GrantsforApps® program.

Resumen del Currículum Vitae:

PUBLICATIONS AND CONFERENCES

- 40 journal articles (ISI-JCR), Q1: 22/40 and Q1+Q2: 35/40, with high IF (mean: 2.6 and summed: 104.2), h-index=9 (scholar) and mostly as main author (28/40).
- 18 conference papers (mainly IEEE) and 21 conference presentations (only international).
- 5 invited talks (3 in foreign countries).
- 1 complete book and 1 book chapter.

R&D PROJECTS

- Principal investigator: 4 projects with total budget of 319.087 Euros (2010-2015)
3 projects funded in competitive calls (2 national & 1 regional).
1 project funded through an international agreement with Actelion Ltd (Allschwil, Switzerland).
- Team member: 13 projects (2003-present)
11 projects funded in competitive calls
2 projects funded by contracts or agreements (CIEMAT & ERESA S.L.)

INTELLECTUAL & INDUSTRIAL PROPERTY

- 1 transfer agreement and 1 patent application (as main author), and 5 registered software (4 as main author).
- I founded a spin-off company (Qubiotech S.L.).

INTERNATIONAL ACTIVITY

- 1 project funded through an international collaboration agreement (as PI).
- 3 European projects (as team member).
- About 30% of my papers published with foreign researchers and a patent application
- > 2 years as postdoc in Strasbourg (France) and currently in Leeds (UK) for 1 year.



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LEADERSHIP ABILITIES

Leadership in papers & conferences

- 6 papers as senior author (5/6 in 1st-quartile journals)
- 5 invited talks (3 in international conferences)

Leadership in R&D projects

- 3 projects as PI (1 regional, 2 national) and 1 international collaboration agreement

Leadership in training & supervision

- 2 PhD students, 3 MSci students and supervisor of STSMs in European COST Action

OTHER MERITS

- Panel member at Instituto Salud Carlos III (Ministerio de Economía y Competitividad), 2015
- Panel member at Agència de Gestió d'Ajuts Universitaris i de Recerca (Generalitat Catalunya), 2015.
- Numerous fellowships along my career (pre-doc & post-doc): last grant ranked 1st as the most valued.
- Referee of Physics in Medicine and Biology, Medical Physics, IEEE Trans. Neural Eng

Note: Main author is first, second (equally contributed) or last author (senior or corresponding).

Note: Although I have been mostly main author in my works (70%), the average number of signing authors is about 7. It can be considered a number relatively low when considering my works involved not only the development of image processing methods but also the clinical validation on patient data (clinicians providing patient data are included as authors).



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Nombre: CUEVAS RUMÍN, ÁNGEL
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Título:

Understanding the socio-economic and technical fundaments of popular Internet Services through advanced Internet Measurements technologies

Resumen de la Memoria:

The PhD of Dr. Cuevas focused in the area of Data-Centric Storage for Wireless Sensor and Actor Networks. The PhD work led to 5 JCR publications (including 1 JCR-Q1) and 3 conference publications (including the Best Paper Award of ACM MSWiM 2010).

After the PhD Dr. Cuevas research has focused on applying novel measurement techniques to different Internet services contributing a large number of reference works to better understanding socio-economic and technical fundaments of P2P networks, online social networks (OSNs) and, more recently, online advertising systems.

In the area of P2P networks Dr. Cuevas contributed to model, analyze and quantify the piracy phenomenon in BitTorrent, measure the efficiency of antipiracy countermeasures, and design novel solutions to reduce negative effects associated to this phenomenon. This line produced 5 JCR publications (including 3 JCR-Q1) and 2 conference publications in top conferences: ACM CoNEXT and IEEE P2P. The obtained results were referred in more than 200 international mass media like: TVE, Antena 3, ABC, EL País, Cadena Ser, Wireed UK, Arstechnica, 20 minutes, etc.

In the area of OSNs Dr. Cuevas contributed to develop large-scale data collection infrastructures for major OSNs. Using that information and sophisticated data analysis techniques we have advanced the state of the art to better understand the structure of OSNs, propose novel location and similarity prediction models and model the behaviour of end-users in OSNs. This line started during the postdoc of Dr. Cuevas in Institut Mines-Telecom SudParis and has produced so far 6 JCR publications (including 5 JCR-Q1) and 7 conference papers including 4 in top venues: WWW and IEEE/ACM ASONAM. The EU-FP7 eCOUSIN project and the Chaire Réseaux Sociaux in which Dr. Cuevas was PI have supported this research line. In addition, this line produced 2 PhD Thesis supervised by Dr. Cuevas.

Dr. Cuevas has become recently interested in developing theoretical frameworks and practical tools that allow end-users understanding the monetary value associated to their personal information in the on-line advertising market. The final goal of this research is to create privacy awareness among average Internet Users. Dr. Cuevas is actively participating in the development of large-scale measurements tools to retrieve the value that advertisers pay to show their banners to particular user profiles in popular services like Facebook or Google. In parallel, we are developing the Facebook Data Valuation Tool (FDVT), a web plug-in that allows Facebook users to know in real-time the money they are generating for Facebook (www.fdvt.org for more information). The FDVT was presented in The 2nd DTL Conference at MIT, and has received large media coverage: El País (ES), La Nación (AR), BBC (UK), etc. This research line is currently supported by the EU-H2020-TYPES project, a Data Transparency Lab grant and the national BigDataAM project. Dr. Cuevas is PI of these projects.

In a nutshell, Dr. Cuevas has demonstrated strong abilities to: (i) conduct research lines that lead to top quality publications, (ii) attract large amount of funding to support his research lines, (iii) implement applied research in order to disseminate the results to the society through mass media dissemination or development of practical tools (e.g., FDVT).

Resumen del Currículum Vitae:

Dr. Ángel Cuevas received his Telecommunication Engineering Degree (5 years), MSc in Telematics Engineering, and Ph.D. in Telematics Engineering from the Universidad Carlos III de Madrid in 2006, 2007, and 2011 respectively.

Dr Cuevas is currently Visiting Professor in the Department of Telematic Engineering at Universidad Carlos III de and Adjunct Professor at Institut Mines-Telecom SudParis.

Dr. Cuevas has published 25 JCR Indexed journal papers (10 of them in the first quartile JCR-Q1) like: IEEE/ACM Transactions on Networking, IEEE Network, IEEE Communications Magazine, IEEE Internet computing, ACM Transactions on Sensor Networks, etc. In addition, he has published 19 conference papers, some of them in top venues such as: WWW, ACM CoNEXT, ACM MSWiM, IEEE P2P and IEEE/ACM ASONAM. He is co-recipient of 2 Best Paper Awards prizes: ACM MSWiM 2010 and SECUREWARE 2009. The H-index of Dr. Cuevas is 11.



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Dr. Cuevas has served as TPC Chair of ACM MOBIWAC in the last three editions (13, 14 and 15). In addition, Dr. Cuevas serves as TPC member of relevant conferences in the area of networking and Internet technologies:

- AAAI ICWSM 2016
- IEEE CCNC 2016
- WWW poster/demo Track 2015, 2016
- IEEE Globecom 2014, 2015
- ACM MSWiM 2013, 2014, 2015
- IEEE LCN 2013, 2014, 2015, 2016
- IEEE VTC 2014

Dr. Cuevas has attracted 1 million € in research funding since 2012 as IP of 5 projects/grants. These projects are:

- EU-H2020 TYPES project (2015-2017).
- 1 research grant from the Data Transparency Lab for the project €FDVT: Data Valuation Tool for Facebook Users€ (2015-2016). The DTL provided only 6 grants among 62 applications from universities all over the world. The competition included universities like MIT, Harvard, CMU, Princeton, Columbia, etc.
- BigDatAAM project funded by the Spanish Ministry of Economy (2014-2016).
- EU-FP7 TYPES project (2012-2014).
- Private funding to support the €Chaire Réseaux Sociaux€ at Institut Mines-Telecom to perform research in On-line social Networks (2011- 2013).

Overall Dr. Cuevas has participated in 1 EU-H2020 project, 4 EU-FP7 projects, 1 EU-ITEA2 project, 3 National Projects, 1 Regional (Comunidad de Madrid) project and 6 research contract funded by private or public entities.

Currently Dr. Cuevas is serving as Technical Manager of the H2020 TYPES project leading and coordinating a team of +20 researchers and developers from 10 different institutions.

Dr. Cuevas has supervised 2 PhD Thesis, 2 MSc Thesis and 9 Bachelor Final Projects.

The postdoctoral international experience of Dr. Cuevas consists of 2 years (2011-2013) as postdoc researcher at Institut Mines-Telecom SudParis followed by two visits of 5 months to this institution in 2013 and 2014 to lead the participation of Institut Mines-Telecom SudParis in the FP7 eCOUSIN project. In addition, Dr. Cuevas was an invited researcher in the Paradise Lab at Ottawa University in the summer of 2014.

Dr. Cuevas has been invited to deliver talks in recognised universities and companies all over the world like: MIT, Xerox Research Center Europe, Orange Labs, Cassidian, McGill University, INRS Montreal, Boston University, University of Massachusetts Amherst, University of Ottawa, etc.

Dr. Cuevas obtained the €Acreditación nacional para el cuerpo de Profesores Titulares de Universidad€ from ANECA in July 2013 just 2 years and 5 months after his PhD defense.



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Título:

Desarrollo de técnicas de microscopia avanzada

Resumen de la Memoria:

During the last 14 years of my personal research career, as PhD student and post-doc, the main focus has been always the development of cutting edge technology on the field of fluorescence microscopy applied to different biomedical areas, including cancer research, neuroscience, developmental biology and ophthalmology. Between the microscopy techniques developed one can find most of the new techniques appeared in the last 25 years, which had changed completely the microscopy scene: confocal microscopy, two-photon excitation microscopy (TPEF), second and third-harmonic generation (SHG/THG), light-sheet fluorescence microscopy (LSFM), optical projection tomography (OPT), fluorescence correlation spectroscopy (FCS), fluorescence lifetime imaging microscopy (FLIM) and super-resolution techniques including stimulated emission depletion (STED) and stochastic optical reconstruction microscopy (STORM).

This research has been carried along the years in five different European research institutions, namely Universitat Politècnica de Catalunya (UPC), Institut de Ciències Fòniques (ICFO), Foundation for Research and Technology Hellas (FORTH) in Greece, Laboratorio de Óptica-Universidad de Murcia (LOUM) and Instituto Gulbenkian de Ciencia (IGC) in Portugal. In all those positions I had the pleasure to work with or collaborate with top level researchers (Prof. Lluís Torner, Prof. Juan Pérez-Torres, Dr. Pablo Loza-Alvarez, Prof. Kostas Fotakis, Prof. Pablo Artal and Prof. José Feijo) leaders on their respective research areas. As a result of this work during the last 11 years I have published 30 research and technical papers on high impact level journals on the areas of optics, biophysics and biomedicine, achieving an h factor of 12. (Source WoK Author Identifier: C-8935-2014).

All this experience and knowledge has provided me a set of skills that include not only understanding of the physical advantages and limitations regarding each technique, but also a broad knowledge of some of the underlying biological mechanisms, mainly on neurobiology, developmental biology and cancer research. Moreover the design and construction of ten different microscopes, each of them adapted to its specific needs, has allowed me to work with a broad spectrum of scientific equipment (i.e. lasers (cw and femtosecond), spectrometers, AOM/AOTF, detectors (PMT, APD, CCD, CMOS, etc.), programming languages (Matlab, LabView, Java, C/C#/C++, etc.), electronics and mechanics (piezo and stepper motors, galvo mirrors, deformable mirrors, 3D printers, custom made pieces, etc.)

One can distinguish two clear main research lines over those years: development of non-linear imaging techniques, namely (TPEF, SHG, THG and non-linear ablation) and development of light-sheet based microscopy. All those developments had been demonstrated on biomedical studies on different areas in close collaboration with medical doctors and biologists.

My current research line is focus on the development of new high throughput LSFM systems for fast sample screening to address issues from basic research to target validation of newly developed therapeutics and their toxicological effects on different types of biological models, such as complex 3D cell cultures, zebrafish embryos and larvae or *C. elegans* nematodes, very relevant for high content, high-throughput screening of the effects of different drugs

Resumen del Currículum Vitae:

During my PhD degree at the Universitat Politècnica de Catalunya (UPC) I have developed simulation tools for light propagation and dispersion compensation in optical fiber communications (international collaboration project UPC/Pirelli Submarine Telecom Systems, Italy). During the last two year of my PhD I collaborated with the Super-resolution Light microscopy and Nanoscopy lab (SLN) led by Dr. Loza-Alvarez at ICFO-The Institute of Photonics Sciences. I participated in the development of two new techniques (CFROG and MEFISTO) to fully characterise femtosecond pulses from a Ti:Sapphire laser at the sample plane in nonlinear microscopy (NLM).

Afterwards I have performed five postdoctoral stays. First, at Dr. Fotakis' lab at Foundation for Research and Technology Hellas (Greece) on the development of NLM techniques (multi-photon, second and third harmonic generation) applied to biological samples (*C. elegans*) and art conservation. This work showed for the first time the advantages of using THG signals for the observation of neurodegeneration in worms and the depth of varnish, information crucial for painting restoration.

Later on at Dr. Artal's group in Laboratorio de Óptica-Universidad de Murcia applying NLM and ultrashort pulse laser ablation on ocular tissues. This work included the use of adaptive optics and wavefront measurements and lead to the publication of 9 research papers, regarding characterization of the retinal structure in human, effect of deprivation on chicken retina, corneal collagen organization in different species and the effects of cross-linking surgery.



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During my third postdoc I was in charge of a commercial Stimulated Emission Depletion (STED) super-resolution microscope at the SLN lab at ICFO visualizing the distribution of DC-SIGN receptors in dendritic cells with 100 nm resolution.

Then I became the responsible of the Development Area of the Cellular Imaging Unit at IGC-Instituto Gulbenkian de Ciência (Portugal). In 2011 I was awarded with a Post-doctoral grant from the Fundação para a Ciência e Tecnologia (FCT) for the development of novel microscopy systems. I was the co-coordinator of a project aimed at design and constructing a super-resolution microscope based on direct Stochastic Optical Reconstruction Microscopy (dSTORM) and Fluorescence Correlation Spectroscopy (FCS). Furthermore, with two additionally awarded founding projects, I have designed and constructed two Light Sheet Fluorescence Microscopes (LSFM): one at IGC for 3D culture imaging and the other one at the Fundação Champalimaud (Portugal) dedicated to image brain activity in zebrafish.

Currently I am back to ICFO where I am developing high-throughput light-sheet based microscopes within the framework of a Jovenes Investigadores personal grant.

I have a strong background on several imaging techniques including confocal, TPEF, SHG, THG, STED, STORM, FCS, FLIM, OPT and LSFM for applications in *C. elegans*, ocular tissues, zebrafish, and 3D cell cultures. All this research experience provides me a broad skills spectrum in terms of optics and photonics, microscopy development and control, image and data processing and sample handling. My scientific records include 25 research papers, 40 participations in national and international congresses and meetings, 12 invited talks, organization of three EMBO practical courses at IGC and a diploma thesis coordination.



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Turno de acceso general

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Área Científica: Tecnología Electrónica y de las Comunicaciones
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Título:

Advanced Remote Sensing of Soil Moisture and Vegetation from Space

Resumen de la Memoria:

Soil Moisture (SM) is a key state variable of the Earth's water and energy cycles; global measurements of SM are needed to understand the effects of a changing climate on natural resources. My research is based on developing new retrieval capabilities for the two first space missions specifically launched to measure the Earth's SM: the ESA SMOS (2009-2017) and the NASA SMAP (2015-2018). Their spatial resolution of 40-50 km is suitable for climate applications, but is too coarse for regional studies, where spatial scales of 1-10 km are necessary. I proposed a novel downscaling algorithm to combine SMOS and Optical/Thermal data into high-resolution SM estimates (PhD). My downscaling method, successfully validated over Australia (postdoc, Melbourne University) and the Duero basin (postdoc, UPC), is implemented as an operational web-service at Barcelona Expert Center (BEC) facilities, providing for the first time daily 1-km SM maps of the Iberian Peninsula in near real-time. Since 2012, the Diputació de Barcelona uses these maps in its fire risk bulletin and prevention service. I have also fostered collaborations to evaluate the prospect use of fine-scale SM information in forest die-off prediction models and Global Primary Production estimation. After demonstrating that the downscaling methodology could be extended to airborne sensors, a technological startup was created to exploit its applicability using unmanned platforms. I also contributed to build the first integrated Soil Moisture & Sea Surface Salinity combined climatologies with 6 years of SMOS data, which have been central for studying fresh water variations in the global water system and its recent changes. Within the SMAP mission, I participated in the development of its active passive baseline downscaling approach (PhD, MIT, international award) and developed a multi-temporal inversion scheme to estimate Vegetation Optical Depth (VOD) and albedo, alongside SM (postdoc, MIT). I am one of the leading researchers in the field of microwave remote sensing of land geophysical parameters (invited contributions, chair of conference sessions); I am board-member of the IEEE-GRSS Spain Chapter and have been awarded with two prestigious MIT International Science and Technology projects and a highly competitive BBVA Foundation research project.

Resumen del Currículum Vitae:

María Piles was born in Valencia, Spain, in 1982. She received the M.S. and Ph.D. degrees in telecommunication engineering from the Universitat Politècnica de València (UPV), València, in 2005 and Universitat Politècnica de Catalunya (UPC), Barcelona, Spain, in 2010, respectively. Her research activity is centered in remote sensing for Earth observation, with special emphasis in microwave radiometers, radars and hyperspectral sensors, retrieval of soil moisture and vegetation geophysical parameters, development of downscaling algorithms and data fusion techniques. In 2008, she was a visiting Ph.D. student at the Department of Civil and Environmental Engineering, Massachusetts Institute of Technology, Boston, where she worked on a change detection algorithm to combine NASA's SMAP active and passive microwave measurements into high-resolution soil moisture estimates. This work set the basis for the development of the operational SMAP active-passive retrieval algorithm. In 2010, she joined the Department of Civil and Environmental Engineering, University of Melbourne, Melbourne, Australia, as a Research Fellow, where she worked on the downscaling and validation of ESA's SMOS soil moisture products. An evolution of this method is operationally distributing enhanced spatial resolution soil moisture maps over the Iberian Peninsula at the Barcelona Expert Center (BEC). From 2011 to 2015, she was a Research Scientist at UPC, actively participating in BEC activities. During these years, she was also a Research Affiliate at MIT through two projects of the MIT International Science and Technology Initiative program. In January 2016, she started a 1-year contract as a Research Scientist at CSIC. She has advised 6 Master Thesis and 2 Ph.D Thesis (underway). She received the Med-Storm Prize for Young Researchers in the European Geophysical Union Plinius conference (2011) and the UPC Special Doctoral award in Information Technology and Communication (2012). Since 2012, she is board member of the IEEE Geoscience and Remote Sensing Society (GRSS) Spanish Chapter. Since 2015, she is an external reviewer for the European Commission in the 7th framework program. She is also a reviewer of scientific journals IEEE TGARS, IEEE JSTARS, IEEE GRSL, Remote Sensing of Environment, Remote Sensing, Hydrol. Earth System Sciences, J. Hydrometeorology, Water Resources Research and AGU books. She has published 23 papers in international peer-reviewed journals and 2 book chapters, and has contributed to more than 65 international conference presentations.



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Título:

Nuevos conceptos y materiales para el desarrollo de células solares de alta eficiencia

Resumen de la Memoria:

The research of Dr. Antolín has focused on the development of new photovoltaic materials and devices with the potential to achieve a very high conversion efficiency. During her predoctoral time at the Technical University Madrid (UPM) she worked on the proof of concept of the intermediate band (IB) solar cell (SC). The high efficiency potential of the IBSC relies on its capability to absorb sub-bandgap photons and to use them to produce extra photocurrent while preserving a high voltage. At the moment when her research began, it had been proposed that the IB required to mediate the sub-bandgap transitions could be implemented with quantum dots (QD) or in a bulk material through the doping with deep-level impurities.

Dr. Antolín has made relevant contributions to the experimental demonstration of the operation principles of the IBSC: she has measured the first reported photocurrent produced by absorption of two sub-bandgap photons in an InAs/GaAs QD-IBSC, she has demonstrated voltage preservation at low temperature in QD-IBSC prototypes and has studied experimentally the limitations to voltage preservation at room temperature in current devices. She has envisaged and patented a new type of QD-IBSC based on lead-salt materials which can overcome the limitations of current QD-IBSC prototypes. In the area of bulk materials, the main hurdle to implement an IB is the non-radiative recombination (NRR) generally associated with deep-level impurities. Dr. Antolín collaborated in the development of the theory of NRR suppression in materials doped with deep-level impurities at densities over the Mott transition density. She performed the first experimental study in which a lifetime recovery was reported in such an IB material, namely heavily-doped Si:Ti.

After her PhD, as a visiting researcher at University of Michigan, she observed for the first time optical absorption due to two sub-bandgap transitions in a bulk IB material (ZnTeO). Back in Spain and working at the Instituto de Microelectrónica de Madrid \blacklozenge CSIC as a Juan de la Cierva, she resumed the work on QD devices, together with a PhD student under her supervision. They explored extending the IB concept to produce a new type of QD-based photodetector.

As a Marie Curie Research Fellow at the University of Nottingham, she has been trained in molecular beam epitaxy (MBE) and has studied the feasibility of synthesizing highly-radiative IB materials based on GaAs. She has produced GaAs doped with Fe at a density of 10^{20} cm^{-3} which exhibits IB electrical properties. Since her return to UPM she is responsible for the semiconductor device fabrication by MBE, while she keeps being involved in the characterization and analysis tasks. She is involved in different projects on the IBSC, novel multi-junction solar cell structures, ultra-thin SCs for space applications and plasmonic SCs.

Resumen del Currículum Vitae:

Dr. Antolín received in 2010 the PhD in Physics and was awarded the Doctoral Extraordinary Prize by the Technical University Madrid (UPM). During her pre-doctoral years she worked at the Solar Energy Institute (IES-UPM) under the supervision of Prof. A. Martí. She specialized in the characterization of photovoltaic solar cells and materials, and in particular, new high-efficiency photovoltaic concepts. Her most relevant works were related to the demonstration of the operation principles of a new type of solar cell called the intermediate band (IB) solar cell (SC) implemented with quantum dot (QD) materials. For example, she measured for the first time the photocurrent produced by absorption of two sub-bandgap photons in a QD IBSC.

In 2011 Dr. Antolín was a visiting researcher at the University of Michigan, where she worked on the characterization of ZnTeO as IB material. After that stay, she returned to Spain. This time she worked at the Instituto de Microelectrónica de Madrid - Consejo Superior de Investigaciones Científicas (IMM \blacklozenge CSIC) as a Juan de la Cierva fellow with the group of Prof. F. Briones. She stayed only for eight months in that position because she was awarded a Marie Curie Intra-European Fellowship by the European Commission and was incorporated at the University of Nottingham, UK, in October 2012. Her work there focused on studying the feasibility of using impurity-doped semiconductors as IB materials. With that aim she was trained in semiconductor synthesis by molecular beam epitaxy (MBE) and developed out-of-equilibrium growth techniques. She was able to demonstrate IB electrical properties in GaAs samples doped with ultra-high densities of Fe. In September 2014 she finalized that task and returned to IES-UPM. In 2015 she had one maternity leave period.

Dr. Antolín has supervised one PhD Thesis and two MSc Thesis. She has taught different subjects related electronics and photovoltaics at UPM and the Universidad Europea Madrid (UEM). With respect to technological activities, she has participated in the establishment of IBLab at IES-UPM. IBLab is the first international infrastructure devoted to the characterization of prototypes of novel photovoltaic devices. Since 2009, it belongs to the Laboratory Network Madri+D and is certified with the Quality Mention ISO9001 (AENOR). In IBLab she has performed characterization services for companies and research institutions. Since her re-incorporation in 2014, IBLab also offers the growth of MBE samples as a commercial service. Also, since 2015 she is involved in the production of high efficiency solar cells for the aeronautic industry. In particular she is currently collaborating with the company DHV Technologies in the R&D of solar cells for micro-satellites.



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Presently, Dr. Antolín aims to combine her knowledge on semiconductor growth with her previous expertise in solar cell modelling and characterization to generate novel solar cell technologies. Her project for developing plasmonic designs to increase the absorption of very thin QD solar cells been awarded one of the five L'Oréal-UNESCO Spanish Fellowships for Women in Science. Dr. Antolín has participated in 15 research projects, has authored 4 book chapters and 47 papers in ISI journals, is co-inventor in 4 patents, has given 9 invited talks in international events and is co-author of 46 contributions to international conferences. Her current h-number is 19, with 1394 WOS citations.



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Título:

Acoustic wave-based electronic and optoelectronic devices on semiconductors and graphene

Resumen de la Memoria:

During his research career, the applicant has contributed significantly to the Electronic and Communications Technology (COM) area in the field of surface and bulk acoustic wave (SAW and BAW) devices on semiconductor materials and graphene, where he has taken advantage of his expertise combining Physics and Electronic Engineering.

Acoustic devices on piezoelectric semiconductor materials (instead of standard piezoelectric insulators) permit, for example, to integrate signal processing and frequency control capabilities for electronics and communications, and to develop novel optoelectronic applications. These advantages have been investigated extensively by the applicant during his PhD period at the Universidad Politécnica de Madrid (UPM), where he has demonstrated a variety of different SAW devices engineered on nitride-based heterostructures with enhanced performance (e.g. filters and resonators with frequency beyond 10 GHz in AlN), novel degrees of freedom allowing tunable operation (e.g. phase shifters and oscillators using the field-effect modulation of a 2D electron gas in AlGaIn/GaN), or additional functionalities (e.g. remote GaN photodetectors using SAW-quenched electron-hole recombination). Furthermore, acoustic waves in low-dimensional semiconductor systems are versatile tools for the control of carrier transport and of elementary excitations at cryogenic temperatures. Acoustically-modulated quantum phenomena have been explored by the applicant during his postdoctoral period at the University of Cambridge, working on SAW-driven single-electron devices and its application as single-photon emitters in ZnO/GaAs-based systems. In parallel, he has also developed ZnO/Si-based BAW resonators for biosensing applications, where a dual-mode scheme has been demonstrated to avoid false responses related to temperature shifts without additional reference devices or complex electronics.

Back at UPM, he has continued working on acoustic devices extending the scope to graphene, first example of the new paradigm of 2D materials, that with its rich physics offers a strong potential for novel applications. In particular, he has demonstrated theoretically the far-field excitation of plasmons in graphene via the dynamic grating generated by a SAW, paving the way for the fabrication of plasmonic devices on unpatterned graphene layers. Thus, the applicant is now the Principal Investigator (PI) of 2 projects, one within the Marie Curie Innovative Training Network **SAWTrain** (H2020, EU) focused on the dynamic control of graphene by acoustic fields for plasmonics and electronics, and the other one on mid-IR graphene optoelectronics (UPM). He is also the PI of a proposal under review for developing SAW-assisted graphene plasmonic biosensors (MINECO). In addition, he has co-founded the spin-off company 'GrapheneLight', focused on graphene technologies. Moreover, the applicant has also worked during this last period at UPM on the growth of graphene by chemical vapor deposition (CVD) and its transfer to arbitrary substrates (including piezoelectrics), demonstrating an automatic transfer method for CVD graphene (PCT patent). Additionally, he has also developed 3D graphene-foam-based electrodes for high-performance supercapacitors (EU patent with PCT extension) for portable electronics and electric vehicles under a contract with Repsol.

Resumen del Currículum Vitae:

The applicant obtained the PhD from the Department of Electronic Engineering at Universidad Politécnica de Madrid in 2007. During his PhD, devoted to surface acoustic wave (SAW) devices in nitride semiconductors, he did 3 stays, two at the Paul Drude Institute for Solid State Electronics and one at the Ferdinand Braun Institute for High Frequency Techniques (Germany). After that, he worked as a postdoctoral researcher on RF MEMS under contracts with Indra Sistemas.

In January 2009, he joined the Semiconductor Physics Group at the Cavendish Laboratory, University of Cambridge (UK), a pioneering group in mesoscopic physics and nanoelectronics. He moved there first as a visiting researcher, after receiving a Researcher Exchange Award (British Council) to investigate on SAW-driven single-electron devices. After this, he stayed there as a postdoctoral fellow for 3 years, after being awarded consecutively with Mobility (MCINN) and Marie Curie Intra-European (EU) Postdoctoral Fellowships, working towards SAW-driven quantum devices with optical readout of the spin, as well as on bulk acoustic wave (BAW) resonators for biosensing.

In March 2012, he returned to the UPM, after being awarded by the International Programme for Attracting Talent of the Moncloa Campus of Excellence, to work on graphene at the Institute for Optoelectronic Systems and Microtechnology. He is currently the Principal Investigator (PI) of 2 projects, one within the Marie Curie Innovative Training Network **SAWTrain** (H2020, EU) focused on the dynamic control of graphene by acoustic fields for plasmonics and electronics, and the other one on mid-IR graphene optoelectronics (UPM). He is also the PI of a proposal under review for developing SAW-assisted graphene plasmonic biosensors (MINECO). He has also participated in a 3-year research contract with Repsol for developing graphene-based energy-storage devices for portable electronics and electric vehicles. He has supervised a PhD student within the Erasmus Mundus Programme and is now supervising 2 PhD students within the ITN SAWTrain. He is accredited as 'Profesor Contratado Doctor' by ANECA and his teaching duties include various nanotechnology-related bachelor and master subjects as well as the supervision of BSc and MSc theses.

In total, the applicant has been involved in 15 research projects (2 as PI) and 4 research contracts with companies. He has more than 30



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publications in international journals (first author in 11, second in 12, third in 6) with over 180 citations (WOS) [200 (SCOPUS), 260 (Google Scholar)] and H-index of 9 (WOS) [10 (Google Scholar)]. Several of these papers have been highlighted in synopsis articles published in Physics World (Institute of Physics, UK), Physics (American Physical Society, USA), Chemistry World (Royal Society of Chemistry, UK), and Le Monde (France). In addition, he has 59 contributions to international conferences and workshops (8 invited talks, 34 oral communications) and 2 conference awards. He also has 2 patents and is co-founder of the spin-off company 'GrapheneLight', focused on graphene technologies. He has participated in the organization of the European Workshop on Heterostructure Technology 2012 and is a regular referee of international journals such Applied Physics Lett., IEEE Electron Device Lett., Nanoscale Research Lett., or Advanced Optical Materials.



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Título:

Optonomechanical Systems: New Paradigms In Ultrasensitive Biological And Physical Sensors

Resumen de la Memoria:

Daniel Ramos worked in the Bionanomechanics Laboratory (CSIC, Spain) pursuing his PhD starting in October 2004. Along this period, the researcher stated the basis of the biosensing using the dynamical characterization of nanoresonators. His work in the mass-sensing field consisted in both experimental and theoretical treatment of the response of the resonators. In this sense, working in pathogen detection the researcher was realized that there are some aspects different from the mass of the added particles that could have important effects on the resonant frequency, which are the mechanical properties of the adsorbed layer and the surface stress generated by the attachment of this layer on the resonant cantilever. These studies have gained high attention of the field (as a proof, articles with D. Ramos as main author have been cited in Research Highlights, Nature Nanotechnology, December 2006 and News and Views, Nature Nanotechnology, VOL 2, 18, 2007). Along with his PhD project, the researcher was also involved in the training of master students and collaborated in the management of the different running projects of the group.

In October 2009 the candidate joined the Yale Nanodevices Group (Yale University, USA) under the supervision of prof. Hong Tang. Along this period, the researcher was involved in theoretical studies related with bi-stability in dynamical systems actuated by optical forces, and the experimental realization of bio-functionalization of silicon nitride surfaces, microfluidics fabrication, and the design and fabrication of new optomechanical devices made in polymers by harnessing optical gradient forces under the DARPA grant **Light Forces in Silicon Optomechanics**. The researcher was responsible for the supervision of a master student, Andrew Wu, resulting in his master final work at Yale University (June 2010).

In 2010, he was awarded with a Marie Curie International Outgoing Fellowship to carry out the project **Optonomech** in the School of Engineering and Applied Sciences at Harvard University (USA) starting from January 2011 under the supervision of distinguished professor Federico Capasso (Robert L. Wallace Professor of Applied Physics and Vinton Hayes Senior Research Fellow in Electrical Engineering) and prof. Marko Loncar. The main objective of the project was the pumping of the confined optical energy inside engineered nano-photonics-cavities into the mechanical modes of NEMS. The ultimate goal was the enhancement of the mechanical quality factor of a mechanical resonator to improve the sensing performance via the nonlinear potential imposed by an optical cavity. At this time, the researcher also conducted experiments involving new promising optically active materials like NV centers (nitrogen vacant) in single crystal diamond, and quantum electrodynamic forces in Casimir experiments.

Daniel Ramos is currently completing his third postdoctoral position at IMM (CSIC, Spain) as Juan de la Cierva fellow. The results of the work that he has carried out these years have been published in 2 book chapters, 27 ISI-indexed articles (almost 1000 citations with h-index of 16) and 43 participations in conferences. He has participated in 13 international research projects, being the principal investigator of one European Marie Curie project. The candidate is co-inventor of 3 patents, one of them licensed to the industry

Resumen del Currículum Vitae:

Daniel Ramos worked in the Bionanomechanics Laboratory (CSIC, Spain) pursuing his PhD starting in October 2004. In October 2009 the candidate joined the Yale Nanodevices Group (Yale University, USA) under the supervision of prof. Hong Tang as postdoctoral associate working under the DARPA grant **Light Forces in Silicon Optomechanics**. In 2010, he was awarded with a Marie Curie International Outgoing Fellowship to carry out the project **Optonomech** in the School of Engineering and Applied Sciences at Harvard University (USA).

Daniel Ramos is currently completing his third postdoctoral position at Instituto de Microelectrónica de Madrid (CSIC, Spain) as Juan de la Cierva fellow. The results of the work that the candidate has carried out these years have been published in 2 book chapters, one of them as coordinator, and 27 ISI-indexed articles (3 Nature Nanotechnology, 1 Scientific Reports, 2 Nanoletters, 1 ACS Nano, 1 Analytical Chemistry, 1 Physical Review B, 7 Applied Physics Letters, 1 Nanotechnology, 3 Journal of Applied Physics, 3 Sensors, 1 New Journal of Physics, 1 Langmuir, 1 Solid-State Sensors, Actuators and Microsystems, and 1 International Journal of Thermal Sciences) plus 2 full journal articles currently under review and 2 in preparation. These results have also been communicated in national and international conferences (43 participations), and the candidate was part of the steering committee of the 11th International Workshop on Nanomechanical Sensing (Madrid, 2014). The researcher has participated in 13 national and international research projects, being the principal investigator of one European Marie Curie project. The candidate is co-inventor of 3 patents, one of them licensed to the industry (MecWins S.A.). As teaching activity, the candidate supervised the master final project of Andrew Wu at Yale University (USA) and co-advises the doctoral thesis of Oscar Malvar at Instituto de Microelectrónica de Madrid. The scientific work of the researcher has received almost 1000 citations, with an h-index of 16 (Google Scholar). The candidate is a usual reviewer of ISI journals such as Journal of Applied Physics, Optics Express, and Microelectronic Engineering.



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In recognition of achievements throughout his career, Daniel Ramos was invited to 2012 Lindau Nobel Laureate Physics Meeting by the European Commission, he was invited to coordinate a book chapter about optical methods for nanomechanical sensing, and he is currently nominated by Spanish Research Council for the BBVA-Real Sociedad Española de Física prize in the category of Investigador Novel en Física Experimental.