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# AYUDAS RAMÓN Y CAJAL
# CONVOCATORIA 2014

## Turno de acceso general


**Nombre:** **SANCHEZ ARRIAGA, GONZALO**
**Referencia:** RYC-2014-15357
**Área Científica:** Ingeniería Mecánica, Naval y Aeronáutica
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**Título:**

Deorbiting of space debris by electrodynamic tethers

**Resumen de la Memoria:**


I graduated in Aerospace Engineering (5-years program ) by Universidad Politécnica de Madrid (UPM) in 2005 (end of course project with the highest marks). I got PhD in 2009 from UPM. The thesis, developed under a FPI grant and the supervision of the inventor of the bare tether J. Sanmartin, was dealing with the excitation of a wave-front by a tether in space plasmas. It received the highest marks, Mention Doctor Europeo and Premio Extraordinario de Doctorado. I was invited 122 days in Kyushu University (Japan, 2007) and 102 days at the Nice Observatory (France, 2008). In 2009 I got a 2-year postdoctoral contract at Commisariat a l'Energie Atomique (France) under a project on laser-plasma interactions. In 2010 I obtained the Physics Degree (5-years) by Universidad Complutense de Madrid. In 2011 and 2012 I got a postdoctoral research contract and a position as Profesor Ayudante Doctor in UPM, respectively.

My main research line aimed at the development of electrodynamics tethers applied to space debris removal, one of the most important topics in aerospace engineering today. The research trajectory gave me the opportunity to study this technology in a multidisciplinary way, including the tether interaction with the ambient plasma, the non-linear tether dynamics and mission design among others. I participated in several projects about tethers. The most important was BETs, an FP7/Space project with a budget about 2 million Euro coordinated by the Emeritus Prof. J. Sanmartin. I was responsible of the development of 2 software tools and tasks related with the coordination, management and dissemination activities. In the last months, we started the preparation of a proposal for the H2020 PROTECT-1 call, which fits with BETs Consortium capabilities. In parallel I drove a new research line about kites in the ETSIAE (UPM) and continue with the laser-plasma interaction research line.

These activities were carried out in collaboration with world-leading institutions. They led to 25 peer-reviewed articles in ISI journals (18 as first author), 1 book chapter, 17 presentations in international conferences, co-advisor of 2 PhD thesis and advisor of 1 master thesis and 2 final projects. Three additional articles and 2 codes are currently under peer-review and registration process, respectively. The CONICET (Argentina) will fund a PhD grant to extend one of the codes. Referee in 6 ISI journals.


**Resumen del Currículum Vitae:**

Current position
- Profesor Ayudante Doctor, ETSIAE (UPM) 2012-

Previous position
- Posdoctoral contract, ETSIA (UPM), 2011-2012.
- Posdoctoral contract, Comissariat a l'energie Atomique, 2009-2011.
- FPI Grant 2005-2009.

University Education
- Ingeniero Aeronáutico, UPM, 2004.
- Licenciado en Ciencias Físicas, UCM, 2010.
- Doctor Ingeniero Aeronáutico, UPM, 2009.

Awards Received
- The PhD thesis received Sobresaliente Cum Laude, Mención de Doctor Europeo and Premio Extraordinario de Doctorado UPM 2010.

Teaching activities
- Fisica II, ETSIA, 2007-2009.
- Mecánica Analítica, ETSIAE, 2013/2014.
- Física I, ETSIAE, 2012-2015.
- Física II, ETSIAE, 2012-2014.
- Co-advisor of 2 PhD thesis
- Advisor of 1 Master Thesis.
- Advisor of 2 end of course projects

Co-advisor of a PhD grant funded by CONICET (Argentina), start date 2015

Research Activities

Participation in 5 R&D&I projects, (funded by spanish and french institutions and the European Commission).

25 peer-reviewed articles published in ISI journals (18 as first author and 4 as single author) including 1 article in Physical Review Letter, 1 in New Journal of Physics, 4 in Physical Review E, 1 in Journal of Geophysical Research and 10 in Physics of Plasmas.

3 peer-reviewed articles sent to ISI journals

17 Works presented in international conferences (2 as invited speaker)

1 chapter of book

2 software are under registration process.

R&D&I management experience in the FP7/Space Project BETs.

2 predoctoral stays in Kyushu University (122 days) and in the Observatory of Nice (102 days).

2 short (few days) posdoctoral stays invited by The Mas-Planck Institute in Dresden and the Observatory of Nice.

Dissemination Activities

Organizer of 4 activities in Semana de la Ciencia de Madrid 2012-2014.

2 Interviews in media

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# AYUDAS RAMÓN Y CAJAL
# CONVOCATORIA 2014

## Turno de acceso general

**Nombre:** **FUTATANI , SHIMPEI**
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**Área Científica:** Ingeniería Mecánica, Naval y Aeronáutica
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**Título:**

Nonlinear MHD modelling of pellet injection for ELM control in ITER

**Resumen de la Memoria:**

My research activities have been dedicated to contribute the achievement of an international nuclear fusion R&D megaproject called ITER [www.iter.org].

The first part of my research is called "Turbulent impurity transport in plasmas".
The performance of magnetically confined fusion plasmas can be critically affected by impurities which are defined as anything other than the fuel ions, i.e. deuterium and tritium.
A related problem is the plasma instabilities which lead turbulent particle transport in the plasma. My research has been dedicated to answer the combined problems, "impurity" and "turbulence" which both are inevitable in fusion plasmas.

I have studied the turbulent impurity transport by non-linear fluid simulation codes which I have developed/contributed. In order to characterize the plasma turbulence and the impurity transport, I borrowed analysis techniques which are commonly used in fluid mechanics field. The multiscaling analysis revealed the responsibility of vortex filament structure for the impurity dynamics and the intermittency of the impurity dynamics. And I performed the analytical calculation and numerical simulations to derive the technique to control the impurity transport. I demonstrated that the impurities can be expelled from the core region by modifying the magnetic field configuration. This scenario is favorable for plasma operation to keep the plasma clean.

The second part of my research is called "Control of MHD dynamics in fusion plasma".
One of the critical undissolved problems is MHD (MagnetoHydrodynamics) instabilities at the plasma boundary called Edge Localized Modes (ELMs). Fusion reactors can be damaged by ELMs as they release large energy from plasmas to the reactor wall. One of the methods of ELM mitigation is injection of small pellet (small deuterium ice cube) to induce small ELMs before large ELM occurs. The technique is experimentally proved, but the theoretical understanding is not yet established.
In order to solve this physics problem, I contributed the development of the advanced non-linear 3D MHD simulation code, called JOREK. I performed the modelling of ELM triggering by pellet injection for existing experiment devices and prediction for ITER scenario. This is the first simulation of pellet triggered ELM in the world, and moreover, it has a good agreement with the experiment results. The JOREK modeling shows that the critical pressure gradient is the key physics parameter to trigger an ELM. Furthermore, I performed the dependence of the pellet injection geometry to contribute the optimization of pellet injector for ITER.

The third part of my research is called, "Self-organization of plasmas."
This work has been progressed with the collaboration of the groups of fluid mechanics field to exchange our knowledge with latitudinous aspects. The importance of the velocity field in fusion plasma is a central theme for both of plasma physics and fluid mechanics. A special configuration of magnetic field creates the plasma transition from quasi-stable to unstable through self-organization processes. In this work, I performed the non-linear MHD simulation and showed how a spatial inhomogeneity of the viscosity and resistivity coefficients influences this self-organization of the plasma.

**Resumen del Currículum Vitae:**

Starting in October 2014, I am Senior Researcher at Barcelona Supercomputing Center. My main responsibility is to provide ITER with computational analysis from 3D non-linear MHD simulations of pellets injected in ITER plasma operational scenarios with close collaboration with existing experimental fusion devices. The aim is to establish the requirements for the ITER pellet injector for the control of the undesirable MHD instabilities in fusion plasma.

I lead the project as the Principal Investigator of the ITER Expertise Call (50000 Euros-2015-2017). And I awarded Severo Ochoa Mobility Grant (1500 Euros) which allows me to carry out the project within strong collaboration with ITER Organization. In order to carry out the numerical simulation research, I was awarded the computation time in IFERC-CSC HELIOS Supercomputer (12/2014-11/2015) as the Principal Investigator. During 2013-2017, I am in the member of EUROfusion Project which is the largest European fusion research activities and the project is funded by the Euratom Association. I lead the project of the pellet triggered ELM simulation which is unique and no one

else can carry out.

From June 2013 to September 2014, I was Postdoctoral Researcher at the Ecole Centrale de Lyon in France which is considered as one of the most prestigious French Grandes Ecoles of engineering. I was in the group of the fluid mechanics laboratory to study the self-organization of fusion plasmas using MHD description, by complexifying a non-linear MHD simulation code.

From October 2010 to May 2013, I was Postdoctoral Researcher at the ITER Organization. I was awarded the Monaco Postdoctoral Fellowship (a highly competitive fellowship awarded to only 4 or 5 people from across the world once every two years). During my postdoctoral fellowship, I have contributed to the development of an advanced non-linear MHD simulation code (JOREK) by incorporating the physics process involved in the pellet ablation. Since 2010, I am in the Expert Member of the Pedestal and Edge Physics Topical Group of ITPA (International Tokamak Physics Activity).

Regarding my academic formation, I completed my PhD at Kyoto University, Japan on 24 Sept. 2008. The PhD was obtained within 2.5 years which is an exceptional graduation. I have another independent PhD from the University of Provence, France on 22 Oct. 2009. The PhD program has been supported by Bourse de Government du Francais which is a competitive stipend. During my PhD, I studied the turbulent impurity transport using the non-linear fluid simulation code which I developed/contributed in CEA Cadarache which is the French nuclear research center.

In my R&D activities carried out, I have 18 publications (12 as a first author, including 3 Phys. Rev. Lett.) and contributed more than 30 conference communications. I have closely worked (in some cases as a visiting researcher) with international groups of US, France, Greece and Japan.

Alongside of my R&D activities, I have been involved in organization activities, such as ITER International Summer School as a member of organizing committee and the editorial assistant of the book.

I have a total of 10 years of experience in the development of fusion research. Through my 2 independent PhDs and several postdoctoral and present Senior researcher positions, I have international experience and broad scientific expertise.

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# AYUDAS RAMÓN Y CAJAL
# CONVOCATORIA 2014

## Turno de acceso general

**Nombre:** **IGLESIAS SALTO, GUILLERMO RAMON**
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**Título:**

New Technologies based on nanoparticles systems. Fundamentals and implementation

**Resumen de la Memoria:**

As nanoparticle science progresses, new systems with extraordinary properties are made accessible to different areas of technology. These new systems permit an improvement of current techniques and introduce new procedures. This can only be made possible after an understanding of the physical properties and mechanisms that govern their behavior.From different perspectives, it can be said that all my research has dealt with the physico-chemical properties and applications of colloidal and nano-systems. A large group of activities had to do with magnetizable particles, typically in concentrated suspensions. This led to the physics of concentrated systems in general. Finally, a more recent objective, and a significant contribution in my recent research, has to do with the application of interfacial properties of microporous particles to the production of clean energy from salinity gradients (blue energy).This is a good description of the candidate's progress in research, always moving between fundamental knowledge and device and application building. Such a mixture was clear at the initial steps of his investigation, finally leading to his Ph.D. thesis. The topic (magnetorheological MR- fluids) involved particle preparation and characterization and MR behavior modeling, as much as designing methods and devices for evaluation of their stability and setting up methods for checking their MR performance.

The high concentration of solids typically used for these fluids, and their optical opacity prepared me for the investigation of highly concentrated systems, not necessarily magnetic eventually. This was demonstrated during my postdoctoral work in Austria, where I investigated highly concentrated systems, e.g., glasses or gels,having incomplete relaxation processes (for this reason they are called non-ergodic). This fundamental property combines with their wide technological interest.

In my main research line during the last years of my work in UGR, we deal again with interfaces in highly concentrated systems, but with a focus on energy production. In this new area, I direct my research again to a double aspect. First, I collaborate in the generation of models allowing us to predict the optimum working conditions for the technique, always based on the changes in the electrical capacitance of the solid/liquid interface when the salinity of the solution is changed. Secondly, I have been able to plan experiments and design equipment aimed at such objective, that is, at maximizing energy production.

The applications of ferromagnetic and superparamagnetic particles in technology and biomedicine are also a significant part of my present and future research. In the former case (MR fluids) I have been involved in collaborations with architecture and civil engineering groups: magnetic fluids can be used in the seismic protection of buildings (UNAM, Mexico), or in the self-healing of asphalt pavements (UGR). Furthermore, magnetic nanoparticles are of application in the diagnosis and treatment of several diseases. I am involved in the investigation of the elimination of cancer cells by means of magnetic heating (hyperthermia with ferrofluids) and drug delivery. In summary, I have tried to find the balance between the understanding of physical properties and the design of devices and finding of new applications for the materials investigated.

**Resumen del Currículum Vitae:**

I received my Engineering degree from University of Tucuman, in Argentina in 1994. The first steps of my research career were taken in the Biomechanical Group of that University. I worked on the design and applications of vibration sensors. In 1997 I left the university to join technological private companies (Telefónica, Ericsson), where I held different positions of responsibility. After 5 years in the private sector, in 2001, I moved to Spain where I joined the Interfacial and Colloidal Systems group with a grant associated to a research contract with the financial support of Repsol Technology Center. During this period I published 9 patents and four papers in international journals dealing with magneto-rheological (MR) fluids and their applications. Two of these patents are actually licenced to Repsol, Spain. These applied studies granted the applicant the 2007 award of the University of Granada for his scientific popularization activities. In December 2008 I defended my PhD thesis.

In April 2009 I obtained a postdoc position at the University of Graz, Austria, as a senior researcher in the Physical Chemistry Dep. I had the opportunity to work with a renowned scientist in the area of the physico-chemical properties of interfaces, prof. O. Glatter. My task in the group involved the design of a light scattering instrument aimed at the characterization of different colloidal systems, including solid-gel transition, liquid crystals and arrested systems. This collaboration still continues and in 2013 I performed again a short stay in Graz. I was the co-author of six publications involving dynamic and static light scattering, and the small angle X-Ray scattering (SAXS) techniques.

Since August 2011 to present, I joined the group of Prof. A. Delgado working as postdoc research in an FPVII EU Project, called Capmix. This project was carried out in collaboration with private Companies of UK and the Netherlands, and two EU Universities, (Poland and Italy). The main topic of the research dealt with the challenge of obtaining energy from salinity differences. I collaborated mainly in the design of experimental cells and the setting up of the whole process. I was co-author of six papers and one European Patent. I am the co-advisor of a

PhD student and we expect to defend by the end of 2015.
Simultaneously, I have maintained a long-lasting collaboration with Prof. López-Durán of the University of Granada, in the Project. I worked in the design of a low cost friction damper to be installed in a new high quality washing machine. The final achievement was placed in two patents dealing with the design of the damper and with the formulation of the MR Fluid in collaboration with Fagor Company and Mondragón Goi Eskola Politeknikoa.
Recently, I started a collaboration with the Univ. Nac. Autónoma de Mexico (UNAM) through the co-direction of a master thesis related to the design of a new seismic damper for small buildings.
I would like to mention finally my current collaboration with a group of the School of Civil Engineering of our University, in the design of a smart novel magnetic binder for asphalt pavement. We just obtained an European Patent and prepared a common publication. I am also a co-director of three graduate theses degree in collaboration with the Electronics Department of our University (two papers are presently in preparation), and of one at the university of Jaen with common research in hyperthermia treatment against cancer tumor