

Parte A. DATOS PERSONALES

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| Fecha del CVA | 8/9/2014 |
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|--------------------------------------|-----------------------------------|------|----|
| Nombre y apellidos | Jacobó Santamaría Sánchez-Barriga | | |
| DNI/NIE/pasaporte | 5373600H | Edad | 54 |
| Núm. identificación del investigador | Researcher ID | | |
| | Código Orcid | | |

A.1. Situación profesional actual

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|-----------------------|---|--------------------|--|
| Organismo | Universidad Complutense de Madrid | | |
| Dpto./Centro | Física Aplicada III | | |
| Dirección | Facultad de Física. Avda Complutense s/n . 28040 Madrid | | |
| Teléfono | +34913944435 | correo electrónico | jacsan@ucm.es |
| Categoría profesional | Catedrático de Universidad | Fecha inicio | Noviembre 2004 |
| Espec. cód. UNESCO | | | |
| Palabras clave | Materiales. Materia Condensada. Magnetismo. Superconductividad. Transporte iónico. Óxidos Complejos. Películas delgadas, Interfases | | |

A.2. Formación académica (título, institución, fecha)

| Licenciatura/Grado/Doctorado | Universidad | Año |
|------------------------------|----------------|------|
| Licenciatura | U. Complutense | 1983 |
| Doctorado | U. Complutense | 1990 |

A.3. Indicadores generales de calidad de la producción científica (véanse instrucciones) número de sexenios de investigación (**4**) y la fecha del último concedido (**2008**), número de tesis doctorales dirigidas en los últimos 10 años (**5**), citas totales (**3500**), promedio de citas/año durante los últimos 5 años (**330**), publicaciones totales en primer cuartil (**190**), índice h (**34**).

Total de **10 tesis dirigidas** y 3 en el último año. Más de **200 publicaciones**. 2 Science (1 reply to comment), 2 Nature Physics (1 News and Views), 2 Nature Communications, 6 Advanced Materials, 20 Phys. Rev. Lett., 50 Phys. Rev. B. More than **70 invited talks** at prestigious international conferences (including APS Meeting, MRS Meeting , MMM, etc.). More than **50 invited seminars and colloquia**.

Parte B. RESUMEN LIBRE DEL CURRÍCULUM

Head of the Complutense Research Group "Physics of Complex Materials- GFMC". (www.ucm.es/info/gfmc) The research group is devoted to the fabrication and study of thin films, nanostructures and heterostructures of correlated oxides with special emphasis on magnetism and superconductivity and ion diffusion in solids. In the last 10 years we have put a continued effort on the physics of complex oxides interfaces. Materials include (colossal magnetoresistance) manganites, (high T_c superconducting) cuprates, Mott and band insulators, and solid electrolytes. Structures and devices are superlattices, magnetic tunnel junctions, and planar nanostructures for lateral transport fabricated by optical and e-beam lithography. Currently there are 4 permanent scientists including myself, 3 5-years tenure track (Ramon y Cajal) scientists and 6 Ph D students.

Main scientific achievements

- **Long range ferromagnetic-superconducting proximity effect.** We found first evidences for long range penetration of the superconducting condensate into a (half metal) manganite from T_c modulation with ferromagnet layer thickness. ("Ferromagnetic/Superconducting proximity effect in La_{0.7}Ca_{0.3}MnO₃ /YBa₂Cu₃O_{7-x} superlattices" Phys. Rev. B **67**, 214511 (2003) (140 citations). "Coupling of superconductors through a half metallic ferromagnet: evidence for a long range proximity effect" Phys Rev. B. **69**, 224502 (2004) (93 citations). We have recently explained the microscopic mechanism of this effect in terms of triplet correlations penetrating the ferromagnet. *Equal-spin Andreev reflection and long-range coherent transport in high-temperature superconductor/halfmetallic ferromagnet junctions*. Nature Physics, **8**, 539 (2012). This trajectory evidences the impact and recognition of our contribution to this field.

- **Inverse superconducting spin switch effect** in which superconductivity is enhanced in ferromagnetically aligned ferromagnet-superconductor-ferromagnet structures as compared to the AF configuration yielding a giant magnetoresistance effect. (“*Giant magnetoresistance in ferromagnet / superconductor structures*” Phys. Rev. Lett. **94** 57002 (2005) (124 citations)). This paper has pioneered the concept of inverse spin switch. This effect is due to the modulation of the superconductivity by the exchange fields created by induced magnetic moments at interfacial Cu atoms. (*Effect of Interface-Induced Exchange Fields on Cuprate-Manganite Spin Switches* Phys. Rev. Lett. **108**, 207205 (2012)).
- **Enhanced ionic conductivity at oxide epitaxial interfaces.** We have succeeded in fabricating epitaxial interfaces between ionic conductors (YSZ) and perovskite oxides (STO) despite a 7% mismatch strain. *Colossal ionic conductivity at interfaces of epitaxial $ZrO_2:Y_2O_3$ / $SrTiO_3$ heterostructures.* Science **321**, 678 (2008) (209 citations). Strain engineering by selecting the spacer perovskite oxide allows tailoring granularity, which controls the conductivity enhancement. This work has opened a completely new direction of research showing that not only electronic but also ionic mobility can be enhanced at oxide interfaces.
- **Electric field control of magnetism in oxide magnetic tunnel junctions.** We have found evidence for Ti magnetism at epitaxial interfaces between a manganite and a titanate. “Spin and orbital Ti magnetism at $LaMnO_3$ / $SrTiO_3$ interfaces”, Nature Comm. **1**:82 doi: 10.1038/ncomms1080 (2010). This interface magnetism controls the magnetic response of LSMO/STO/LSMO structures with ultrathin STO barriers. Phys. Rev. Lett. **106**, 147205 (2011). Interface magnetism in tunnel barriers can be electrically controlled of and enables magnetization switching in magnetic tunnel junctions in the absence of a magnetic field . “*Reversible electric-field control of magnetization at oxide interfaces*”, Nature Comm. **5**, 4215 (2014).

Parte C. MÉRITOS MÁS RELEVANTES (ordenados por tipología)

C.1. Publicaciones (>200)

- 1) V. Peña, Z. Sefrioui, D. Arias, C. Leon, J. L. Martinez, S. G. E. te Velthuis, A. Hoffmann and J. Santamaria, “Giant magnetoresistance in ferromagnet superconductor superlattices” Phys. Rev. Lett. **94**, 57002 (2005)
- 2) J. Garcia-Barriocanal, A. Rivera-Calzada, M. Varela, Z. Sefrioui, E. Iborra, C. Leon, S. J. Pennycook, J. Santamaria *Colossal ionic conductivity at interfaces of epitaxial $ZrO_2:Y_2O_3$ / $SrTiO_3$ heterostructures.* Science **321**, 678 (2008).
- 3) J. Garcia-Barriocanal, F. Y. Bruno, A. Rivera-Calzada, M. Varela, Z. Sefrioui, C. Leon, N-Nemes, M. Garcia Hernandez, S. J. Pennycook, J. Santamaria *Charge leakage at $LaMnO_3$ / $SrTiO_3$ interfaces.* Adv. Mater. **22**, 627 (2010).
- 4) J. Garcia-Barriocanal, J.C. Cezar, F.Y. Bruno, P. Thakur, N.B. Brookes, C. Utfeld, A. Rivera-Calzada, S.R. Giblin, J.W. Taylor, J.A. Duffy, S.B. Dugdale, T. Nakamura, K. Kodama, C. Leon, S. Okamoto, J. Santamaria. “Spin and orbital Ti magnetism at $LaMnO_3$ / $SrTiO_3$ interfaces”, Nature Comm. **1**:82 doi: 10.1038/ncomms1080 (2010)
- 5) Z. Sefrioui, C. Visani, M. J. Calderón, K. March , C. Carrétéro , M. Walls , A. Rivera-Calzada , C. Leon, R. Lopez Anton , T. R. Charlton , F. A. Cuellar , E. Iborra , F. Ott , D. Imhoff , L. Brey, M. Bibes, J. Santamaria, A. Barthélémy. “*All-Manganite Tunnel Junctions with Interface-Induced Barrier Magnetism*”, Adv. Mat. **22**, 5029 (2010).
- 6) F. Y. Bruno, J. Garcia-Barriocanal, M. Varela, N. M. Nemes, P. Thakur, J. C. Cezar, N. B. Brookes, A. Rivera-Calzada, M. Garcia-Hernandez, C. Leon, S. Okamoto, S. J. Pennycook, and J. Santamaria *Electronic and Magnetic Reconstructions in $La_{0.7}Sr_{0.3}MnO_3/SrTiO_3$ Heterostructures: A Case of Enhanced Interlayer Coupling Controlled by the Interface* Phys. Rev. Lett. **106**, 147205 (2011)
- 7) C. Visani, Z. Sefrioui, J. Tornos, C. Leon, J. Briatico, M. Bibes, A. Barthélémy, J. Santamaria and Javier E. Villegas, *Equal-spin Andreev reflection and long-range coherent transport in high-temperature superconductor/halfmetallic ferromagnet junctions.* Nature Physics **8**, 539 (2012)
- 8) F. Y. Bruno, R. Schmidt, M. Varela, J. Garcia-Barriocanal, A. Rivera-Calzada , F. A. Cuellar , C. Leon, P. Thakur, J. C. Cezar, N. B. Brookes , M. Garcia-Hernandez, E. Dagotto, S. J. Pennycook and J. Santamaria. *Electron Doping by Charge Transfer at $LaFeO_3$ / Sm_2CuO_4 epitaxial Interfaces.* Adv. Mater. **25**, 1468 (2013)

- 9) Yaohua Liu, F. A. Cuellar, Z. Sefrioui, J. W. Freeland, M. R. Fitzsimmons, C. Leon, J. Santamaria, and S. G. E. te Velthuis *Emergent spin filter at the interface between ferromagnetic and insulating layered oxides*. Phys. Rev. Lett. **111**, 247203 (2013)
- 10) F. A. Cuellar, Y. H. Liu, J. Salafranca, N. Nemes, E. Iborra, G. Sanchez-Santolino, M. Varela, M. Garcia Hernandez, J. W. Freeland, M. Zhernenkov, M. R. Fitzsimmons, S. Okamoto, S. J. Pennycook, M. Bibes, A. Barthélémy, S. G. E. te Velthuis, Z. Sefrioui, C. Leon, J. Santamaria. *Reversible electric-field control of magnetization at oxide interfaces*. Nature Communications **5**, 4215 (2014).

C.2. Proyectos (>30)

- 1) “E-beam lithography” Program on Scientific Infrastructure (2007). Ministry for Science and Innovation-EU structural funds. 542.000 Eu.
- 2) “New materials and processing for spin dependent transport”. Ministry for Science and Innovation MAT 2005-06024 C02-01. Co-investigator with budgetary control of 200.000 Eu. (2007)
- 3) “Interface phenomena in superconductor heterostructures” Joint US- Spain NSF- MICINN Materials World Network Proposal in collaboration with A. Goldman and C. Sa de Melo (2007) PI of the Spanish Part
- 4) “Electronics based on nanoscale oxides: interface engineering for magnetoelectronic devices.” Spanish Ministry for Science and Innovation MAT2008- 6517. 440.000 Eu. (2009) (Jacobo Santamaría Co- PI and responsible for one of the teams with budgetary control of 200.000 Euro).
- 5) “Advanced Hybrid Materials for Photonic Applications (Ref. S2009/Mat-1756. Acronym: PHAMA) Regional Government of Madrid. Programmes of Research and Development in Technologies 2009- 2013. 879.060 Euros (Co- PI and team coordinator with budgetary control of 180.000 Euro).
- 6) “Materials Science Down To The Sub Angström Scale” CSD2009-00013 Ministry for Science and Innovation MICINN. Programme Consolider-Ingenio 2010- 2015 IP: J. M. González- Calbet. 3.600.000 Euro. (Co- PI and team coordinator with budgetary control of 410.000 Euro)
- 7) “Complex oxide interfaces in spintronics”. MAT 2011 27474 C02. Ministry for Science and Innovation 2011- 2013. PI and Coordinator 508.000 Euro

C.5. Conferencias Invitadas en Congresos Internacionales de especial relevancia (>70)

- 1) “Interplay between magnetism and superconductivity at YBCO/LCMO interfaces” International Max Planck Research School IMPRS for Advanced Materials. Interfaces of Oxides. Stuttgart July 4- 8th 2005
- 2) “Ferromagnet / superconductor oxide superlattices” March Meeting of the American Physical Society. Baltimore. March 2006.
- 3) “Interplay between magnetism and superconductivity in cuprate / manganite structures” International Conference on Mesoscopic Superconductivity and Magnetism. Chicago. Il. 28 /8 – 2 /9/2006
- 4) “Effect of Epitaxial Strain on Selective Phase Nucleation at Complex Oxide Interfaces” Materials Research Society Spring Meeting. San Francisco Ca. March 2008
- 5) “Colossal ionic conductivity at YSZ/STO Complex Oxide Interfaces” Materials Research society Spring Meeting. San Francisco Ca. April 2009
- 6) “Superconductivity at Oxide Interfaces” Royal Society Satellite Meeting on Superconductivity at oxide interfaces on 14-15 September 2011 at the new Kavli International Centre London (<http://royalsociety.org/Kavli/>)
- 7) “Novel phenomena at oxide interfaces” CNRS International School of Oxide Electronics October 3rd to 15th, 2011, also September 3th- 14th (2013) Cargèse (Corsica)
- 8) “Novel functionalities of complex oxide interfaces” Materials Research Society MRS Spring Meeting. San Francisco Ca. April 2011
- 9) “Induced Magnetism at Complex Oxide Interfaces: Novel functionalities” 2012 Meeting of the Japanese Society of Applied Physics (International Symposium). Tokyo 15- 18 March 2012
- 10) “Low dimensional Magnetism at complex oxide interfaces” Materials Research Society MRS Spring Meeting. April 9 - 13, 2012 San Francisco, California

- 11) International Workshop "MAMA-Hybrids: Multifunctional hybrids and organics" (<http://mama-hybrids.spin.cnr.it> Ischia (Naples, Italy) on October 22-24 (2012).
- 12) Modified layer structure at strained YSZ interfaces. 2012 MRS Fall Meeting. November 25 - 30, 2012 Hynes Convention Center - Boston, Massachusetts
- 13) "*Electric field control of magnetization at oxide interfaces*" 12th Joint MMM/Intermag Conference - January 14-18, 2013, Chicago Illinois
- 14) *Electric field control of magnetization at correlated oxide interfaces*. 2013 Japanese Society of Applied Physics JSAP-MRS Joint Symposia September 16th – 19th 2013 (Kyoto). Japan
- 15) *Novel functionalities at oxide interfaces: Magnetism and its electric field control. Fusion Conferences: Oxide Thin Films for Advanced Energy and Information Applications Conference*. Plenary Speaker. September 13th – 16th July 2014 (Chicago Illinois). USA.

C.6. Organización de eventos (selección)

- 2009 March Meeting of the American Physical Society (March 16- 20 Pittsburgh Focus Session L34. Hybrid Magnetic-Superconducting Systems. Co-organized with Jose Martin (Spain) and Charles Reichhardt (Los Alamos National Laboratory (US).
- XX International Materials Research Congress 2011. 14 - 19 August, Cancún, Mexico (Symposium 14) Fundamentals and Applications of Functional Oxide Materials in Energy, Information and Sensing. Co-organized with Petr Maksymovitch (Oak Ridge Ntl. Lab.), Hiromichi Ohta (Nagoya University) and Juan Muñoz Saldaña (Cinvestav Queretaro, Mexico).
- II International Workshop on Complex Oxides. 2- 5 October 2012. Mallorca. Co-organized with Sok Pantelides (Oak Ridge Ntl. Lab.), S. Maekawa (Tohoku University), E. Dagotto (Oak Ridge), D. Argyriou (ESSS), G. Pavassilou (Demokritos)
- 2015 March Meeting of the American Physical Society Focus Topic 10.1.3 "Magnetic Oxide Thin Films and Heterostructures" Co-organized with J. D. Burton (U. Nebraska Lincoln) and S. J. May (Drexel University)

C.7 Honores y distinciones

- Appointed (one of the 3 final candidates) by the International Search Committee for Director of the Iberian Nanoscience Laboratory (INL). June (2014).
- Awarded the Canada Excellence Chair in Quantum Materials and Devices (University of British Columbia. Canada). December 2013. Declined for personal reasons.
- Fellow of the American Physical Society (18 November 2008). "For seminal contributions to the understanding of the interplay between magnetism and superconductivity in oxide films and superlattices"

C.6 Servicio Profesional

- Program Manager (gestor) for Materials Sciences Initiative of the Spanish Secretary of State for Science and Innovation 2010- (with competences technical evaluation of grants
- Member (Treasurer) of the Executive Committee of the Topical Group on Solid State Physics of the Spanish Royal Physical Society, 2008-2013.
- Reviewer for the following Agencies: United States National Science Foundation (Condensed Matter), United States Dept. of Energy, Office of Basic Energy Sciences, Army Research Office (ARO. United States). European Research Council. Section Condensed Matter. (ERC Starting and Advanced grants). Agence Nationale de Recherche (ANR. France), Swiss Science Foundation (ERC), Other International Agencies (COLCIENCIAS (Colombia), CONICET (Argentina))
- Referee for the journals: Nature, Science, Physical Review Letters, Advanced Materials, ACS Nano, Applied Physics Letters, EPL, Physical Review B, Journal Applied Physics, Physics Letters, Chemistry of Materials, Solid State Ionics, Surface Science, European Physical Journal, Journal of Magnetism and Magnetic Materials, Journal of Non Crystalline Solids, Journal of Low Temperature Physics.