MINISTERIO DE CIENCIA E INNOVACIÓN

CURRICULUM VITAE (maximum 4 pages)

AGENCIA ESTATAL DE INVESTIGACIÓN

CV date	10/01/2022

Part A. PERSONAL INFORMATION

First and Family name	Carlos Leon Yebra		
Social Security, Passport, ID number	11809668L	Age	53
Researcher codes	Open Researcher and Contributor ID (ORCID**)	0000-0002-3262-1843	
	SCOPUS Author ID (*)	56488447600	
	WoS Researcher ID (*)	A-5587-2008	

(*) Optional
(**) Mandatory

A.1. Current position

Name of University/Institution	Universidad Complutense de Madrid			
Department	Fisica de Materiales			
Address and Country	Avda Complutense sn. 28040 Madrid			
Phone number	+34 913945212	E-mail	carlos.leon@ucm.es	
Current position	Full Professor of Physics	From	03/04/2017	
Key words	Condensed Matter Physics, Materials Physics			

A.2. Education

PhD, Licensed, Graduate	University	Year
Licenciado en Física (5-years Diploma in Physics)	*Universidad Complutense*	1991
PhD in Physics	*Universidad Complutense*	1997

A.3. General indicators of quality of scientific production *(see instructions)*

Total number of peer reviewed publications (without extended abstracts): 201
Total number of registered publications (Source: Scopus): 208
Total number of invited talks: 15
Total number of citations (Scopus): 6607
Citations last 5 years>1900 (Scopus)
H-factor (Scopus): 46
H-factor (Google):51 https://scholar.google.es/citations?user=d7uSOeMAAAAJ&hl=es&oi=ao
Total number of papers in **first quartile (1Q) 2016-2019: >85%** (Source: SCOPUS)
Total number of papers in **first decile (1D) 2016-2019: >50%** (Source: SCOPUS)
I am author of more than 200 papers, many of them in high impact journals, with 2 Science, 1 Nature Physics, 1 Nature Nanotechnology, 1 Nature Materials, 4 Nature Communications, 5 Advanced Materials, 2 Scientific Reports, 11 Phys. Rev. Lett., 43 Phys Rev. B, 3 Chem. Mater, and 11 Appl. Phys. Lett., receiving a total of more than 6600 citations and with an h-index of 46 (SCOPUS). I have been invited to international conferences 15 times, and also to give more than 10 seminars and colloquia. I am coauthor of a book on "Ionics" (http://www.springer.com/us/book/9783319423890) published by Springer-Nature in 2017 .

Part B. CV SUMMARY *(max. 3500 characters, including spaces)*

Since 2017 I am Full Professor of Physics at the Department of Materials Physics of the University Complutense Madrid. I have a teaching experience of more than 28 years covering from Physics introductory courses for undergraduates to specialized subjects in Master degrees, particularly Electromagnetism, Physics of Semiconductors, and Spintronics. As a researcher, I have coauthored more than 200 papers, receiving more than 6600 citations, with an h-index of 46. I have been invited 15 times to present my research results at international conferences. My current areas of interest are correlated transition metal oxides, spintronics, ionic transport and nanoionics for energy applications, and resistive

switching and memristive devices for neuromorphic computing, with special emphasis on nanofabrication. I have also expertise in Broadband Dielectric Spectroscopy for the study of relaxation phenomena and charge dynamics in dielectrics, ionic conductors, glass formers, semiconductors and complex oxides. I have supervised 14 Master Degree Research Projects and 6 PhD students. Since 2013 I am serving as Spanish National Contact Point for Nanotechnology and Advanced Materials Calls of the European Research Program H2020. Since 2016 I am Editorial Board Member for Scientific Reports.

Main scientific achievements

▪**Enhanced ionic conductivity at oxide interfaces**. We have shown a huge enhancement of oxide ion conductivity at epitaxial interfaces between yttria stabilized zirconia and strontium titanate. The large in-plane strain caused by a 7% mismatch in thelattice parameters seems to play a relevant role in increasing the concentration of oxide mobile ions (or oxygen vacancies) and also their mobility due to a decrease of the activation energy for ion hopping (Science 321, 676 (2008), 493 times cited). Ten years later our work is still driving an important research activity in the new field ofnanoionics.

▪**Origin of constant loss in ionically conducting materials.** We have found experimental evidence of the relationship between the caged motion of ions and the nearly constant dielectric loss which is ubiquitous in ionically conducting materials at low temperatures and/or high frequencies (Phys. Rev. Lett. 89, 1279 (2001), 188 times cited). We have proposed a theoretical model to account for the various properties of this nearly constant loss such as its temperature dependence, dependence on the mass of mobile ions, and correlation of its magnitude to the activation energy of the dc ionic conductivity (Phys. Rev. B. 66, 064308 (2002))

▪**Relationship between the primary and secondary dielectric relaxation processes inglass formers.** We have measured broadband dielectric spectra of several glass formers and found that a clear correlation holds between the ratio of the characteristic relaxation times of the primary (alpha) and secondary (beta-Johari Goldstein) relaxations, and the shape of the primary relaxation, at the glass transition temperature (J. Chem. Phys. 110, 11585 (1999), 180 times cited; J. Chem. Phys. 115, 1405 (2001), 226 times cited).

▪**Atomic origin of barriers for ionic transport through interfaces.** We have been able tomeasure and characterize ionic transport through a single bicrystal boundary in yttriastabilized zirconia, an emblematic oxide ion conductor used as electrolyte in Solid OxideFuel Cell devices. We found that experimental data cannot be explained in terms of thesimple Mott-Schottky model that has been proposed in the past, and we suggest a different model based on DFT calculations and relative concentration profiles of the different atomic species obtained from STEM-EELS measurements with subangstron resolution (Scientific Reports 5: 17229 (2015)).

Finally I would like to remark my contribution as co-author, together with Dr. Junko Habasaki and Dr. Kia Ngai, in the book entitled “Dynamics of Glassy, Crystalline and Liquid Ionic Conductors: Experiments, Theories, Simulations” published by Springer-Nature in 2016 (http://www.springer.com/us/book/9783319423890). The book, which reviews the most relevant experimental and theoretical work in the field, is intended to make possible for newcomers to grasp the past history, current status and frontiers of the field. The book can also be used as material for teaching graduate or undergraduate course in academic institutions since it covers the fundamentals of ionic conductors and their applications to various fields.

Part C. RELEVANT MERITS *(sorted by typology)*

C.1. Publications *(see instructions)*

1) D. Sanchez-Manzano, S. Mesoraca, F.A. Cuellar, et al. “Extremely long-range, high-temperature Josephson coupling across a half-metallic ferromagnet”. Nat. Mater. (2021). https://doi.org/10.1038/s41563-021-01162-5

2) D. Hernandez-Martin, F. Gallego J. Tornos, V. Rouco, J. I. Beltran, C. Munuera, M. Cabero, F. Cuellar, D. Arias , G. Sanchez-Santolino, F. J. Mompean, M. Garcia-Hernandez, A. Rivera-Calzada, S. J. Pennycook, M. Varela, M. C. Muñoz, Z. Sefrioui, C. Leon, and J. Santamaria" Controlled sign reversal of electroresistance in oxide tunnel junctions by electrochemical-ferroelectric coupling", Phys. Rev. Lett. 125(26), 266802 (2020).

3) J. Tornos, F. Gallego, S. Valencia, Y. H. Liu, V. Rouco, V. Lauter, R. Abrudan, C. Luo, H. Ryll, Q. Wang, D. Hernandez-Martin, G. Orfila, M. Cabero, F. Cuellar, D. Arias, F. J. Mompean, M. Garcia-Hernandez, F. Radu, T. R. Charlton, A. Rivera-Calzada, Z. Sefrioui, S. G. E. te Velthuis, C. Leon, and J. Santamaria. "Ferroelectric Control of Interface Spin Filtering in Multiferroic Tunnel Junctions", Phys. Rev. Lett. 122, 037601 (2019).

4) Gabriel Sanchez-Santolino, Javier Tornos, David Hernandez-Martin, Juan I. Beltran, Carmen Munuera, Mariona Cabero, Ana Perez-Muñoz, Jesus Ricote, Federico Mompean, Mar Garcia-Hernandez, Zouhair Sefrioui, Carlos Leon, Steve J. Pennycook, Maria Carmen Muñoz, Maria Varela & Jacobo Santamaria "Resonant electron tunnelling assisted by charged domain walls in multiferroic tunnel junctions" Nature Nanotechnology volume 12, pages655–662(2017)

5) M. A. Frechero, M. Rocci, G Sánchez-Santolino, A. Kumar, J. Salafranca, R. Schmidt, M.R. Díaz-Guillén,O.J. Durá, A. Rivera-Calzada, R. Mishra, S. Jesse, S.T. Pantelides, S.V. Kalinin, M. Varela, S.J. Pennycook, J. Santamaria, C. Leon "Paving the way to nanoionics: Atomic origin of barriers for ionic transport through interfaces" Scientific Reports 5: 17229 (2015). DOI: 10.1038/srep17229

6) Mirko Rocci, Javier Tornos, Alberto Rivera-Calzada, Zouhair Sefrioui, Marta Clement, Enrique Iborra, CarlosLeon, Jacobo Santamaria, "Resistive switching in manganite/graphene hybrid planar nanostructures", Appl. Phys. Lett. 104, 102408 (2014).

7) Carlos Leon, Jacobo Santamaria, Bernard A. Boukamp, "Oxide interfaces with enhanced ion conductivity",MRS Bulletin 38 1056 (2013).

8) F. A. Cuellar, G. Sanchez-Santolino, M. Varela, M. Clement, E. Iborra, Z. Sefrioui, J. Santamaria C. Leon,"Thermally assisted tunnelling transport in La0.7Ca0.3MnO3 / SrTiO3:Nb Schottky-like heterojunctions", Phys. Rev. B 85 245122 (2012).

9) O. J. Durá, M. A. López de la Torre, L. Vázquez, J. Chaboy, R. Boada, A. Rivera-Calzada, J. Santamaria y C.Leon, "Ionic conductivity of nanocrystalline yttria stabilized zirconia: grain boundary and size effects". Phys. Rev. B 81, 184301 (2010).

10) M. Paluch, S. Haracz, A. Grzybowski, M. Mierzwa, J. Pionteck, A. Rivera-Calzada, C. Leon, "A Relationshipbetween Intermolecular Potential, Thermodynamics, and Dynamic Scaling for a Supercooled Ionic Liquid". J. Phys. Chem. Lett. 1, 987 (2010).

C.2. Research projects

- "Broadband Dielectric Spectroscopy" Principal Investigator: Carlos Leon. Program on Scientific Infrastructure (2006). Ministry for Science and Innovation-EU structural funds. 180.000 EUR.
- "Electronics based on nanoscale oxides: interface engineering for magnetoelectronic devices." Spanish Minitry for Science and Innovation MAT2008- 6517. P I: Carlos Leon. 210.000 Eu..
- "Materials Science Down To The Sub Angström Scale" CSD2009-00013 Ministry for Science and Innovation MICINN. Programme Consolider-Ingenio 2010- 2015. PI: Jacobo Santamaria. 410.000 EUR.

- "Advanced Hybrid Materials for Photonic Applications (Ref. S2009/Mat-1756. Acronym: PHAMA) Regional Goverment of Madrid. Programmes of Research and Development in Technologies 2009- 2013. 900.000 Euros (PI: Cefe López).
- "Complex oxide interfaces in spintronics". MAT 2011 27474 C02. Ministry for Science and Innovation 2011- 2013. PI: Jacobo Santamaria. 508.000 EUR.
- "Advanced Hybrid Materials for Photonic Applications (Ref. S2013/MAT. Acronym: PHAMA2.0) Regional Goverment of Madrid. Programmes of Research and Development in Technologies 2014- 2018. 700.000 Euros (PI: Cefe López).
- "Optimimización de propiedades electrónicas de dispositivos de interfase: spin-orbitrónica y spin-memristores" MCI MAT 2014-52405-C2-R. PI: Jacobo Santamaría Sánchez-Barriga and Carlos León (300.000).
- "Hacia materiales cuánticos emergentes en interfases de óxidos complejos" MINECO MAT 2017-87134-C2-1-R. PI: Carlos León Yebra y Jacobo Santamaría Sánchez-Barriga (220.000).
- "QUANTOX: QUANtum Technologies with 2D-Oxides" ERA-NET Cofund in Quantum Technologies (QUANTERA). Call 2017. PI: Marco Saluzzo (CNR). IP nodo español: Jacobo Santamaría Sánchez-Barriga (UCM). PCI2018-093094 (105.000)
- "Nuevas funcionalidades para una electrónica de óxidos 2D: materia cuántica inducida por efectos de proximidad" MINECO PID2020-118078RB-I00 PI: Carlos León Yebra y Jacobo Santamaría Sánchez-Barriga (378.000).
- "To2Dox: Oxidos bidimensionales correlacionados transferibles" ERA-NET FLAGERA. Call 2019. PI: Jacobo Santamaría Sánchez-Barriga (UCM). PCI2020-112093 (115.000)

C.5 Other/Professional service

Supervision of students/postdocs:
PhD students: 6; Master Theses supervised: 16
Postdoctoral researchers supervised: 4
Reviewer for (selected journals):
Nature Communications, Physical Review Letters; Applied Physics Letters; Physical Review B; Journal of Applied Physics; Journal of Magnetism and Magnetic Materials; Journal of Non Crystalline Solids;
Professional Service (selected):
- National Contact Point for Nanotechnology, Advanced Materials and Processing (NMP) in the European Program Horizon 2020, since 2013.
- Reviewer for the Spanish Ministry of Economy & Competitivity (MINECO), Research Grants – Materials Program Calls (2012, 2016, 2018).
- Member of the Editorial Board for Scientific Reports, since 2016.
- Secretary of the Executive Committee of Condensed Matter Division (Real Sociedad Española de Fisica) 2014 -2018, and Vicepresident of Condensed Matter Division (Real Sociedad Española de Fisica) since 2018
- Conference organizer: International Meeting on Relaxation of Complex Systems (2009, 2013) , Internatrional Conference on Broadband Dielectric Spectroscopy (2010) International Worshop of Complex Oxides (2012)

C.6 Long term collaborators, selected:
Kia Ngai (National Research Laboratory), Junko Habasaki (Tokio Institute of Technology), Antonio Fuentes (CINVESTAV, Mexico), Steve Pennycook (ORNL), Sokrates Pantelides (Vanderbilt Univ.), Manuel Bibes, Javier Villegas (CNRS Thales, France), Jacobo Santamaria, Maria Varela (Univ. Complutense).