DATE	09/12/18

Part A. Personal Information

Surname(s)	Suderow	
Forename	Hermann	
Social Security, Passport, ID number	NIF54979665M	
Sex	Male	
Age	48	
Researcher codes	WoS Researcher ID *(*)*	L-6612-2013
	SCOPUS Author ID*(*)*	7003666360
	Open Researcher and Contributor ID (ORCID)	0000-0002-5902-1880

A.1. Current position

Post/ Professional Category	Profesor Titular de Universidad (Assistant Professor)	
UNESCO Code	2211.27; 2213.06	
Key Words	Quantum materials, millikelvin cryogenics, high magnetic fields, visualization of quantum effects in new materials, superconductivity, vortex physics, quantum phase transitions.	
Name of the University/Institution	Universidad Autónoma de Madrid	
	Department/Centre	Física de la Materia Condensada
	Full Address	c/Fco Tomas y Valiente, 7
	Email Address	hermann.suderow@uam.es hsuderow@gmail.com
	Phone Number	+34 91 497 61 97 +34 646 23 59 99
Start date	May 2006	

A.2. Education *(title, institution, date)*

Year	*University*	*Degree*	*Title*
1994	Karlsruhe	Physics	Diplom-Physik
1997	Grenoble	PhD	Doctor in Physics

A.3. Indicators of Quality in Scientific Production *(See the instructions)*

4 sexenios until 2017 (included).
6 co-directed PhD thesis (one in 2017 and in 16, two in 13, one in 09 and in 06). 2 ongoing PhD thesis.
1743 total citations, 1269 without self-cites (from wos, 2308 from scholar).
154 average cites/year during last 5 years (from wos, 195 from scholar).
2 Nat Phys, 1 Nat Com, 9 PRL, 1 Comm Phys, 28 PRB, 4 NJP, 3 Superc Sci Tec. 1 perspective Science.
H index of 24 (from wos, 29 from scholar).

Part B. Free Summary of CV *(Max. of 3.500 characters, including spaces)*

I made my PhD in Grenoble (1997), with J. Flouquet and J.P. Brison. I performed the first thermal conductivity measurements at very low temperatures (15 mK) in the heavy fermion superconductor UPt_3. I discovered an increase in the electronic density of states when applying a magnetic field that is characteristic of nodal superconductors. This has been widely used since then to understand cuprates, pnictides or topological superconductors. In 1998 I obtained a Marie Curie fellowship and came to Madrid, to work in the low temperature laboratory with S. Vieira. I then obtained a Ramón y Cajal fellowship (2001) and won the national habilitation contest in 2004. I am "professor titular" since 2006. I brought to Madrid the technology of helium3-helium4 dilution refrigeration and pioneered Scanning Tunneling Microscopy (STM) experiments at millikelvin temperatures. Millikelvin STM provides neat images without thermal broadening with which we directly visualize electronic correlations and atomic scale topography. Using this technique, I have studied numerous superconducting materials, often for the first time; I helped establishing two-band superconductivity, contributed significantly to understand how magnetism and charge order coexist with superconductivity in nickel borocarbides and in dichalchogenides or obtained the first STM tunnelling conductance results in a heavy fermion superconductor.

My contributions to vortex physics relate the structure of vortex cores to the superconducting gap and have unveiled how the vortex lattice behaves as a whole, obtaining the first visualization of thermal de-pinning, of the vortex liquid and observing the critical behaviour of the order-disorder transition.
I developed new STM techniques, to visualize electronic correlations under an applied current or in a three axis vector magnetic field. I have also made considerable contributions to instrumentation, building superconducting magnets for the student laboratory and for advanced experiments or setting up new lines, such as the measurement of the critical temperature of superconductors at extremely high pressures (30 GPa), with pressure cells built in Madrid. In 2011, I set-up, together with P.C. Canfield, a new basic lab for the synthesis of quantum materials. We have made several works where we synthesized and measured new materials in Madrid and sent these abroad to collaborate with other groups.
109 publications, H index of 24, more than 50 invited contributions to international meetings, among them keynote talks in major conferences. Co-directed 6 PhD thesis and have been part of more than 20 PhD juries all over Europe. PI or co-PI of 13 projects (2 ACI, 5 Plan Estatal), co-PI in 2 Marie Curie projects. 7 organized workshops or summer schools.
President of the physics panel of the Spanish national funding agency from 2015-18, coordinator of IFIMAC-Materials Science, Director of the Nicolás Cabrera Institute since 2011, member of commissions (ANEP, COST, IIF, GEFES, C5 of IUPAP) and referee of funding agencies and journals. Coordinator of COST program with participants from 27 countries. APS Fellow 2017.

Part C. Relevant accomplishments

C.1. Publications

Tilted vortex cores and superconducting gap anisotropy in 2H-$NbSe_2$. J.A. Galvis, E. Herrera, Ch. Berthod, S. Vieira, I. Guillamon, H. Suderow. Communications Physics, **1**, 30 (2018). 2 cites ISI, 4 scholar. *This work builds on the development of scanning tunneling spectroscopy in tilted magnetic fields. We address using this novel technique the effect on vortex cores of modifications of the direction of the magnetic field.*

Direct visualization of phase separation between superconducting and nematic domains in Co-doped $CaFe_2As_2$ close to a first-order phase transition. A. Fente, A. Correa-Orellana, A.E. Bohmer, A. Kreyssig, S. Ran, S.L. Bud'ko, P.C. Canfield, F.J. Mompean, M. Garcia-Hernandez, C. Munuera, I. Guillamon, H. Suderow. Phys. Rev. B, **97**, 14505 (2018). Editors suggestion. 5 cites ISI, 6 scholar. *Biaxial strain produces coexistence of superconductivity and antiferromagnetic nematic order. By directly visualizing the spatial dependence of the superconducting properties, we demonstrate that magnetic and superconducting order separates forming an inhomogeneous sample with two phases.*

Nodeless multiband superconductivity in stoichiometric single-crystalline $CaKFe_4As_4$. K. Cho, A. Fente, S. Teknowijoyo, M.A. Tanatar, K.R. Joshi, N.M. Nusran, T. Kong, W.R. Meier, U. Kaluarachchi, I. Guillamón, H. Suderow, S.L. Bud'ko, P.C. Canfield, R. Prozorov, Phys. Rev. B Rapid Comm, **95**, 100502 (2017). 21 cites ISI, 25 scholar. *First measurements of the tunneling density of states of a new pnictide superconducting material (the first one showing optimal T_c without doping). We determine two-gap superconductivity and measure the bandstructure using electronic interference (in PRB 97, 134501 (2018)).*

Opening the gate on superconductivity. H. Suderow, Science **350**, 6266 (2015). *Very brief perspective about the possibilities of two-dimensional superconductivity.*

Magnetic field dependence of the density of states in the multiband superconductor β-Bi_2Pd. E. Herrera, I. Guillamón, J.A. Galvis, A. Correa, A. Fente, R.F. Luccas, F.J. Mompeán, M. García-Hernández, S. Vieira, J.P. Brison y H. Suderow, Phys. Rev. B, **92**, 054507 (2015). 22 cites ISI, 29 scholar. *Microscopy and spectroscopy of the novel superconductor β-Bi_2Pd, having first made at UAM the synthesis and characterization of this material. We determine the interaction between vortex and crystalline lattices.*

Enhancement of long range correlations in a 2D vortex lattice by incommensurate 1D disorder potential. I. Guillamón, R. Cordoba, J. Sesé, J.M. De Teresa, M.R. Ibarra, S. Vieira and H. Suderow, Nat. Phys. **10**, 851 (2014). 32 cites ISI, 46 scholar. *Order-disorder transition at T=0K in a two-dimensional vortex lattice. Determining the critical exponents of the transition by direct imaging.*

Imaging superconducting vortex cores and lattices with a scanning tunneling microscope. H. Suderow, I. Guillamon, J.G. Rodrigo and S. Vieira, Superconductor Science and Technology, **27**, 063001 (2014). 30 cites ISI, 44 en scholar. *Review paper about vortex visualization in superconductors by tunneling spectroscopy.*

Magnetic field-induced dissipation-free state in superconducting nanostructures. R. Córdoba, T.I. Baturina, J. Sesé, Yu. Mironov, J.M. De Teresa, M.R. Ibarra, D.A. Nasimov, A.K. Gutakovskii, A.V. Latishev, I. Guillamón, H. Suderow, S. Vieira, M.R. Baklanov, J.J. Palacios and V.M. Vinokur Nat Comm, **4**, 1437 (2013). 48 cites ISI, 69 scholar. Madrimasd, 2physics.com, US Society of Hispanic Professional Engineers (p.24 in http://www.nxtbook.com/nxtbooks/shpe/fall13/index.php#/30), BES-DOE report 2013 (http://science.energy.gov/~/media/bes/pdf/reports/files/BES2014SR_rpt.pdf). *International collaboration (mostly promoted from UAM) where we show a new vortex pinning mechanism.*

Direct observation of melting in a two-dimensional superconducting vortex lattice. I. Guillamón, H. Suderow, A. Fernández-Pacheco, J. Sesé, R. Córdoba, J.M. De Teresa, M.R. Ibarra and S. Vieira. Nat Phys **5** 461 (2009). 65 cites ISI, 87 scholar. Physics Today (October 2009), Physics Update (http://blogs.physicstoday.org/update/2009/08/mapping-two-dimensional-meltin.html). *Direct observation of vortex melting and of vortex depinning.*

Superconducting density of states and vortex cores of 2H-NbS_2. I. Guillamón, H. Suderow, S. Vieira, L. Cario, P. Diener and P. Rodière. Phys. Rev. Lett. **101**, 166407 (2008). 89 cites ISI, 108 scholar. *Discovery of two-band superconductivity in 2H-NbS_2.*

Very low temperature scanning tunneling spectroscopy in the heavy fermion superconductor $PrOs_4Sb_{12}$. H. Suderow, S. Vieira, J.D. Strand, S. Bud`ko, P.C. Canfield. Phys. Rev. B Rapid Comm, **69**, 060504 (2004). 61 cites ISI, 79 scholar. *Measurement of superconducting properties of a heavy fermion superconductor at 100 mK.*

C.2. Research Projects and Grants

- Infrastructure project of the state research agency (AEI), *Increasing the delivery capabilities of the liquid Helium production and recovery system of the Campus UAM+CSIC*, EQC2018-004622-P. 105 725 €. PI: H. Suderow.
- Activity programs of the Comunidad de Madrid, P2018/NMT-4321 Solutions of nanomagnetism to social challenges. 1M€. PI: R. Miranda. Program comprising 5 research groups, among which the low temperature group, whose PI is H. Suderow, and 4 laboratories.
- Project of the state research agency (AEI, 2018-2020). *Integrating devices in nanoscale microscopy to visualize quantum materials under control*. QuM-CONTROSCOPY. FIS2017-84330-R. 272 000 € (costes directos). Co-PIs I. Guillamón and H. Suderow.
- COST program (2017-2021). *Nanoscale coherent hybrid devices for superconducting quantum technologies*. NANOCOHYBRI. Approx 150 000 € each year. Chairman H. Suderow. Over 100 participants from 27 countries.
- Internal project of IFIMAC (MDM-2014-0377). *Visualizing, understanding and controlling Andreev bound states down to atomic scale*. 160 000 € (costes directos). PIs H. Suderow and A.L. Yeyati.
- Project of the state research agency (AEI, 2015-2017). *Two-dimensional superconductivity, new phenomena for new applications*. FIS2014-54498-R. 130 000 € (costes directos). PI H. Suderow.
- Region of Madrid. *New frontiers of fundamental and applied magnetism*. Nanofrontmag-CM. P/2013-MIT2850. PI: R. Miranda. 894k€. PI of the low temperature group: H. Suderow
- Project of the state research agency (AEI, 2012-2014). Direct observation of collective and individual properties of superconducting vortices using scanning tunneling microscopy. FIS2011-23488. 234 000 € (costes directos). PI H. Suderow.

C.3. Contracts

Work for several companies in the field of cryogenics (Easylab, Oxford Instruments, EADS, …). Instrumentation developed will be made available at Open Science Framework, DOI:10.17605/OSF.IO/E6K7R and the software in github.

C.4. Patents and other IPR

Procedure and thermometer to measure low temperatures, Hermann Suderow, Sebastián Vieira Díaz, Ana Isabel Maldonado Cid, ES2380989B1, https://patents.google.com/patent/ES2380989B1/.

Positioning device for microscopes in cryogenic environments, ES2396331B1. Hermann Suderow, Sebastián Vieira, Isabel Guillamón, Andrés Buendía, Manuel Pazos, https://patents.google.com/patent/ES2396331B1/.

C.5 Conferences

63 invited talks in workshops and international meetings.
- Workshop "New platforms for topological superconductivity with magnetic atoms". Dresden. April 2018, *Bound states and unconventional low energy electronic behavior in superconductors*.
- March meeting. New Orleans. March 2017. *Visualizing the vortex lattice in two-effective-band, stoichiometric high Tc CaKFe4As4 superconductor*.
- 3rd Toyota Riken International Workshop on vortex matter. Nagoya. May 2016. *Vortex core size from very low temperature scanning tunneling microscopy in one and two gap superconductors*.
- Bad Honnef, Germany. WE Heraeus seminar Frontiers in Scanning Probe Microscopy. November 2015. *Scanning tunneling microscopy in strongly correlated electron systems*.
- Moscow, Russia. Landau Institute. International workshop on localization, interactions and superconductivity. June 2015. *Scanning tunneling spectroscopy of two-dimensional superconductors at very low temperatures*.
- Semi-plenary at the international conference on low temperature physics (LT27, Buenos Aires 2014), *Scanning tunneling microscopy and spectroscopy in superconductors at very low temperatures*.
- Semi-plenary at the EPS Condensed Matter Division and SFP meeting (Paris 2014), *Very low temperature scanning tunneling microscopy observation of the 2D vortex order-disorder transition*.
More than 30 invited seminars at laboratories and other institutions, such as Antwerp (2011), Max-Planck Stuttgart (2018, 2011) or Ames Laboratory (2012, 2017 and 2018).
Organizer or co-organizer of three Symmer schools, one meeting with over 100 participants (vortex2015.org) and two international workshops. Co-chair of condensed matter EPS meeting 2020 in Madrid.

C.6 Awards and service

- APS Fellow 2017.
- President of the Physics Panel of the Spanish state Funding Agency (AEI) 2015-2018.
- Director Nicolás Cabrera Institute, transforming it into a support for excellent science, with the organization of prizes, student support activities (grants and video contests), meetings and colloquia and improvements in the organization of the Nicolás Cabrera Summer School. www.uam.es/inc.
- Scientific coordination of SEGAINVEX and UAM+CSIC helium liquefier www.uam.es/segainvex.
- IUPAP C5 commission member.
- National Habilitation contest in Condensed Matter Physics 2003.
- Member of several scientific committees, such as the scientific park of Madrid or the commission A1 of the International Institute of Refrigeration.
- Coordinator for Materials Science of IFIMAC, www.uam.es/ifimac.
- Referee of Science, Nat. Comm., Physical Review (Letters and B), Europhysics Letters, Physica B, IOP (Journal of Physics Condensed Matter, Superc. Sci. Technolog., New Journal of Physics).
- Referee of ERC (StG), DFG, ANR (France), Royal Society (UK), FWO (Belgium) and AEI.
- Elected member of the Faculty and University senates.
- Member of APS, DPG, RSEF and EPS.
- Director of a teaching innovation project (implementing english teaching) and co-director of another one. Teaching Statistical Physics (2015-2017), low temperature physics (2004-2014), solid state physics (2003), Physics laboratory for Boston University exchange students (2012-14), advanced physics lab (since 2002, coordinator since 2016).
- Committees of International Conference on Magnetism 2015, 28th International Conference on Low Temperature Physics, minisymposia organizer at EPS meeting and invited session organizer at March meeeting.

C.6 Dissemination activities

- Co-organizer of open days activities within the "week of science" of the Region of Madrid, with yearly participation of 100-200 scholars.
- Dissemination articles in Investigación y Ciencia, notiweb, 2Physics.com, US Society of Hispanic Professional Engineers y Basic Energy Sciences DOE report 2013.
- Wepages lbtuam.es, nicolascabrera.es, citecnomik.es, or vídeos as https://www.youtube.com/watch?v=l9MYUdYgeXs.