

Date of the CVA

14/01/2020

## Section A. PERSONAL DATA

Name and Surname	Blai Casals Montserrat		
DNI/NIE/Passport		Age	
Researcher's identification number	Researcher ID	N-3698-2015	
	Scopus Author ID	56951279900	
	ORCID	0000-0002-2941-1861	

### A.1. Current professional situation

Institution	University of Cambridge		
Dpt. / Centre	Department of Earth Sciences / University of Cambridge		
Address			
Phone		Email	
Professional category	Research associate	Start date	2018
UNESCO spec. code	220000 - Physics; 220208 - Magnetism; 221107 - Dielectrics; 221124 - Optical properties; 221194 - Materials piezo-electric		
Keywords	Defects; Optical properties; Phase transition; Physics - Complex systems		

### A.2. Academic education (Degrees, institutions, dates)

Bachelor/Master/PhD	University	Year
Programa Oficial de Doctorado en Ciencia de Materiales	Universitat Autònoma de Barcelona	2017
Master in Biophysics	Universitat de Barcelona	2013
Licenciado en Física	Universitat de Barcelona	2012

### A.3. General quality indicators of scientific production

Publications: 16, (9 in Q1) including 3 in high impact factor journals as Nature Physics and Physical Review Letters, one of them featured in Physics (online magazine), and named as editor's suggestion.

Total citations: 79 (scholar google), 63 (SCOPUS).

h-index: 5 (SCOPUS).

Conferences (as presenting author): 1 invited talk (Xi'an Jiaotong University 2019), 7 oral communications in international conferences (EMRS2015, ICM2015, MMM2016, JEMS2016, ISFD2018, ...) and 6 talks in national conferences (3 in Spain, 3 in UK).

## Section B. SUMMARY OF THE CURRICULUM

Since my PhD, I focused my research on the ferroic properties of transition metal oxides. These materials show a large variety of properties –magnetism, ferroelectricity, superconductivity– that makes them interesting to explore novel devices beyond today's electronic and photonic technologies.

Through magneto-optical spectroscopy and domain imaging I explored electron-lattice interactions, ferroelectricity, ferroelasticity and magnetoelastic interactions in complex piezoelectric/magnetic systems. Under the supervision of Dr. Gervasi Herranz (ICMAB-CSIC) I have performed my PhD thesis (cum laude qualification) entitled "Magneto-optical spectroscopy and domain imaging of functional oxides".

In order to explore new material functional properties, after my PhD I have worked in two lines of research. Firstly, during my first postdoc under the direction of Dr. Ferran Macià (UB), I have studied the dynamical manipulation (GHz) of magnetic states by surface acoustic waves (on piezoelectrics). As a highlight of this period, I have successfully generated and observed

(stroboscopic XMCD) spin waves originated by surface acoustic waves propagating over millimetres.

Domain walls can exhibit completely different physical properties compared with domains, such as polarity in nonpolar materials. In order to take advantage of its properties in a device, it is a requirement to know how to create, move, and erase domain walls at wish. Currently, I am investigating the properties of the domain wall motion and its avalanche behaviour as a research associate at the University of Cambridge under the direction of Prof. Ekhard Salje.

In the near future, I will continue exploring the domain wall properties and their response in a strain gradient environment. Flexoelectric effect, inherent in all domain walls and cracks, bring new properties in apparently non-functional materials such as antiferroelectrics and antiferromagnets. My skills on optical spectroscopy and imaging can be a complement, together with the scanning techniques, to track the dynamical behaviour of the domain walls and its optical properties.

During my career, I have presented my research in 7 talks in international conferences (ICM, JEMS, EMRS, MMM, ...), 6 in national conferences and one invited talk (Xi'an Jiaotong University). I have performed research stays at the Università degli Studi di Perugia (10 days in 2018, Perugia, Italy), at the Aalto University (5 months in 2016, Helsinki, Finland) and at the Xi'an Jiaotong University (10 days in 2019, Xi'an, China). I have been co-author of 12 synchrotron beamtime projects (in Spain and UK).

Technical achievements: I have designed, mounted and programmed a Kerr microscope in order to visualize ferromagnetic domains and I have developed an image processing software to identify the avalanche behaviour of domain motion or phase transition in time image sequences.

Teaching: Currently directing a student master thesis at the University of Cambridge. Seminars at ICMAB-CSIC on computer programming for instrument control (Labwindows) and data processing (Matlab).

Grants: FPI2012 for the PhD at ICMAB-CSIC. Short term scientific mission Cost action for a short PhD stay in Finland. Master fellow (2012, IBEC).

Outreach: I have been participating in different dissemination activities at the ICMAB-CSIC and two talks at "science in your neighbourhood" program.

Others: Attendance at the International School of Oxide Electronics (Corsica, 2-14/9/2013).

## Section C. MOST RELEVANT MERITS (ordered by typology)

### C.1. Publications

- 1 Scientific paper.** Blai Casals; et al. (4/1). 2020. Avalanches from charged domain wall motion in BaTiO<sub>3</sub> during ferroelectric switching APL materials. American Institute of Physics. 8-011105. ISSN 2166-532X.
- 2 Scientific paper.** Blai Casals; et al. (4/1). 2019. Electric-field-induced avalanches and glassiness of mobile ferroelastic twin domains in cryogenic SrTiO<sub>3</sub> Physical Review Research. 1-032025. ISSN 2643-1564.
- 3 Scientific paper.** Lorenzo Vistoli; et al. (18/5). 2019. Giant topological Hall effect in correlated oxide thin films Nature Physics. Nature. 15, pp.67-72. ISSN 17452473.
- 4 Scientific paper.** Blai Casals; et al. (8/1). 2018. Low-Temperature Dielectric Anisotropy Driven by an Antiferroelectric Mode in SrTiO<sub>3</sub> Physical Review Letters. American Physical Society. 120-217601. ISSN 00319007.

- 5 **Scientific paper.** Blai Casals; et al. (10/1). 2016. Giant Optical Polarization Rotation Induced by Spin-Orbit Coupling in Polarons *Physical Review Letters*. American Physical Society. 117-026401. ISSN 00319007.
- 6 **Scientific paper.** Blai Casals; et al. (8/1). 2016. Untangling the contributions of cerium and iron to the magnetism of Ce-doped yttrium iron garnet *Applied Physics Letters*. American Institute of Physics (AIP). 108-102407. ISSN 00036951.
- 7 **Scientific paper.** Blai Casals; et al. (10/1). 2019. Generation and imaging of magnetoacoustic waves over millimetre distances *arXiv*. Cornell University. arXiv:1908.11674v2.
- 8 **Scientific paper.** Enric Menéndez; et al. (13/5). 2019. Disentangling Highly Asymmetric Magnetolectric Effects in Engineered Multiferroic Heterostructures *Physical Review Applied*. American Physical Society. 12-014041. ISSN 23317019.
- 9 **Scientific paper.** Yu Chen; et al. (4/2). 2019. Solid-State Synapses Modulated by Wavelength-Sensitive Temporal Correlations in Optic Sensory Inputs *ACS Applied Electronic Materials*. American Chemical Society. 1, pp.1189-1197. ISSN 2637-6113.
- 10 **Scientific paper.** Yu Chen; Blai Casals; Gervasi Herranz. (3/2). 2019. Plasticity of Persistent Photoconductance of Amorphous LaAlO<sub>3</sub>/SrTiO<sub>3</sub> Interfaces under Varying Illumination Conditions *ACS Applied Electronic Materials*. American Chemical Society. 1, pp.810-816. ISSN 2637-6113.
- 11 **Scientific paper.** David Pesquera; et al. (6/2). 2019. Elastic anomalies associated with domain switching in BaTiO<sub>3</sub> single crystals under in situ electrical cycling *APL Materials*. American Institute of Physics. 7-051109. ISSN 2166532X.
- 12 **Scientific paper.** Michael Foerster; et al. (7/4). 2019. Disclosing odd symmetry, strain driven magnetic response of Co on Pt/PMN-PT (0 1 1) *Journal of Physics Condensed Matter*. Institute of Physics Publishing. 31-084003. ISSN 09538984.
- 13 **Scientific paper.** Michael Foerster; et al. (9/3). 2019. Quantification of propagating and standing surface acoustic waves by stroboscopic X-ray photoemission electron microscopy *Journal of Synchrotron Radiation*. Wiley-Blackwell. 26, pp.184-193. ISSN 09090495.
- 14 **Scientific paper.** Hari Babu Vasili; et al. (10/2). 2017. Direct observation of multivalent states and 4f→3d charge transfer in Ce-doped yttrium iron garnet thin films *Physical Review B*. American Physical Society. 96-014433. ISSN 24699950.
- 15 **Scientific paper.** Noelia Campillo; et al. (8/4). 2016. A novel chip for cyclic stretch and intermittent hypoxia cell exposures mimicking obstructive sleep apnea *Frontiers in Physiology*. Frontiers Media S.A.. 7-319. ISSN 1664042X.
- 16 **Scientific paper.** Ondrej Vlasin; et al. (5/2). 2015. Optical Imaging of Nonuniform Ferroelectricity and Strain at the Diffraction Limit *Scientific Reports*. Nature. 5-15800. ISSN 20452322.

## C.2. Participation in R&D and Innovation projects

- 1 EP/P02453X/1, Ferroelectric, ferroelastic and multiferroic domain walls: a new horizon in nanoscale functional materials *Engineering and Physical Sciences Research Council*. Marty Gregg. (University of Cambridge, St. Andrews, Warwick and Queen's University of Belfast). 24/01/2017-31/05/2021. 608.106 €. Team member.
- 2 MAT2017-85232-R, Oxide Responses Inspired by Nature *Plan Nacional de Materiales*. Gervasi Herranz. (Instituto de Ciencia de los Materiales de Barcelona). 2018-2020. 242.000 €. Team member.
- 3 Functional Magnonic Crystals: Manipulating Dynamical Magnetic States in Nanostructures with Surface Acoustic Waves *Ferran Macia*. (ICMAB-CSIC through Severo Ochoa.). 01/01/2017-01/12/2018. 69.999 €. Team member.
- 4 MAT2014-56063-C2-1-R, Metals and Oxides for a Sustainable Electronics *Plan Nacional de Materiales*. Gervasi Herranz. (Instituto de Ciencia de los Materiales de Barcelona). 2015-2017. 423.500 €. Team member.
- 5 MAT2011-29269-C03-01, Responsive Multifunctional Oxides and Hybrid Structures *Plan Nacional de Materiales*. Florencio Sanchez. (Instituto de Ciencia de los Materiales de Barcelona). 2012-2014. 350.000 €. Team member.

## C.3. Participation in R&D and Innovation contracts

## C.4. Patents