

Work Experience and Education

2017 - Ongoing, Marie Skłodowska-Curie Global Fellowship.

Michigan State University, Birge Group

University of Leeds, Condensed Matter Group

Grant title: "SUPERSPIN"

Hosted by Prof. N. O. Birge (MSU) and Dr. G. Burnell (Leeds)

2016 - 2017, Post Doctoral Research Assistant. EPSRC funded post-doctoral position.

ISIS Neutron and Muon Source, Nano-Magnetism Group

Project title: "Generation, Imaging and Control of Novel Coherent Electronic States in Artificial Ferromagnetic-Superconducting Hybrid Metamaterials and Devices"

Grant Investigators: Dr. C. J. Kinane and Prof. S. Langridge

2012 - 2016, PhD Physics. Funding from JEOL Europe and ISIS Neutron and Muon Source.

University of Leeds, Condensed Matter Group

Thesis title: "Hybrid Superconducting/Ferromagnetic Thin Films for Super-Spintronics"

Supervisors: Dr. G. Burnell (Leeds) and Prof. S. Langridge (ISIS Neutron and Muon Source)

2008 - 2012, MPhys BSc Physics.

University of Leeds (2:1 Honours)

Masters Thesis title: "Magneto-Transport through Nanomagnets Embedded in an Insulator"

Supervisor: Prof. C. H. Marrows

A Levels & General Certificate of Secondary Education.

St Columba's College, St Albans

Successful Funding Applications

All the awarded funding below was as principle investigator, where I detailed the work packages, wrote the grant applications, and coordinated the submissions.

Marie Skłodowska-Curie Global Fellowship MSCA-IF-GF Grant No. 743791-SUPERSPIN.

Prestigious 3 year postdoctoral fellowship. 251,858 EUR.

ISIS Neutron and Muon Facility Proposal No. 1620297 and 1610423.

Funded 5 and 7 days use of polarized neutron reflectometry. Equivalent value of over 100,000 GBP.

NIST Center for Neutron Research (NCNR) Proposal No. 25152.

Funded 4 days use of polarized neutron reflectometry. Equivalent value of approximately 20,000 USD.

I am also co-investigator on successfully funded beamtime proposals to use PNR, μ SR, SANS and XMCD at multiple facilities.

Publications

★ Denotes high profile publication.

Published on SUPERSPIN MSCA:

- M. G. Flokstra, R. Stewart, N. Satchell, G. Burnell, H. Luetkens, T. Prokscha, A. Suter, E. Morenzoni, S. Langridge, and S. L. Lee “Manifestation of the electromagnetic proximity effect in superconductor-ferromagnet thin film structures” *App. Phys. Lett.* **115**, 072602 (2019) (**Featured, Editor’s Pick**)
- R. Stewart, M. G. Flokstra, M. Rogers, N. Satchell, G. Burnell, D. Miller, H. Luetkens, T. Prokscha, A. Suter, E. Morenzoni, S. L. Lee “Controlling the electromagnetic proximity effect by tuning the mixing between superconducting and ferromagnetic order” *Phys. Rev. B* **100**, 020505(R) (2019) (**Rapid Communication**)
- N. Satchell, R. Loloee, and N. O. Birge “Supercurrent in ferromagnetic Josephson junctions with heavy metal interlayers. II. Canted magnetization” *Phys. Rev. B* **99**, 174519 (2019)
- N. Satchell “Controlled superconducting vortex creation raises hope for a dissipationless memory device” *Supercond. Sci. Technol.* **32**, 020501 (2019) (**Invited Viewpoint**)
- ★ N. Satchell and N. O. Birge “Supercurrent in ferromagnetic Josephson junctions with heavy metal interlayers” *Phys. Rev. B* **97**, 214509 (2018)
- ★ M. G. Flokstra, R. Stewart, N. Satchell, G. Burnell, H. Luetkens, A. Suter, T. Prokscha, E. Morenzoni, S. Langridge, and S. L. Lee “Observation of anomalous Meissner screening in Cu/Nb and Cu/Nb/Co thin films” *Phys. Rev. Lett.* **120**, 247001 (2018) (**Editors’ Suggestion**)

Published prior to SUPERSPIN:

- P. J. Curran, J. Kim, N. Satchell, G. Burnell, M. G. Flokstra, S. L. Lee, and S. J. Bending “Continuously tuneable critical current in superconductor-ferromagnet multilayers” *App. Phys. Lett.* **111**, 262601 (2017)
- ★ N. Satchell, J. D. S. Witt, M. G. Flokstra, S. L. Lee, J. F. K. Cooper, C. J. Kinane, S. Langridge, and G. Burnell “Control of superconductivity with a single ferromagnetic layer in Nb/Er bilayers” *Phys. Rev. Applied* **7**, 044031 (2017)
- E. Marchiori, P. J. Curran, J. Kim, N. Satchell, G. Burnell, and S. J. Bending “Reconfigurable superconducting vortex pinning potential for magnetic disks in hybrid structures” *Sci. Rep.* **7**, 45182 (2017)
- N. Satchell, J. D. S. Witt, G. Burnell, P. J. Curran, C. J. Kinane, T. R. Charlton, S. Langridge, and J. F. K. Cooper “Probing the spiral magnetic phase in 6 nm textured erbium using polarised neutron reflectometry” *J. Phys. Condens. Matter* **29**, 055801 (2017)
- J. D. S. Witt, J. F. K. Cooper, N. Satchell, C. J. Kinane, P. J. Curran, S. Langridge, L. J. Heyderman, and G. Burnell “Magnetic phases of sputter deposited thin-film erbium” *Sci. Rep.* **6**, 39021 (2016)
- ★ M. G. Flokstra, N. Satchell, J. Kim, G. Burnell, S. J. Bending, P. J. Curran, S. Langridge, C. J. Kinane, J. F. K. Cooper, M. Eschrig, A. Isidori, N. Pugach, H. Luetkens, T. Prokscha, and S. L. Lee “Remotely induced magnetism in a normal metal using a superconducting spin-valve” *Nat. Phys.* **12**, 57-61 (2016)
- P. J. Curran, J. Kim, N. Satchell, G. Burnell, M. G. Flokstra, S. L. Lee, J. F. K. Cooper, C. J. Kinane, S. Langridge, A. Isidori, N. Pugach, M. Eschrig, and S. J. Bending “Irreversible magnetization switching at the onset of superconductivity in a superconductor ferromagnet hybrid” *App. Phys. Lett.* **107**, 262602 (2015)
- M. G. Flokstra, T. C. Cunningham, J. Kim, N. Satchell, G. Burnell, P. J. Curran, S. J. Bending, C. J. Kinane, J. F. K. Cooper, S. Langridge, A. Isidori, N. Pugach, M. Eschrig, and S. L. Lee “Controlled suppression

of superconductivity by the generation of polarized Cooper pairs in spin-valve structures” *Phys. Rev. B* **91**, 060501(R) (2015) (**Editors’ Suggestion**)

To be published:

- N. Satchell, C. J. Kinane, J. F. K. Cooper, G. Stenning, T. R. Charlton, J. D. S. Witt, M. Batley, G. Burnell, P. J. Curran, S. J. Bending, and S. Langridge “Studying the structural and magnetic properties of textured thin film erbium by reflectometry and diffraction of x-rays and (polarized) neutrons” *Submitted to J. Vis. Exp. (JoVE)*

- N. Satchell, J. Miao, Z. Yang, D. Yue, H. Zhou, X. Jin, A. Suter, T. Prokscha, C. J. Kinane, J. F. K. Cooper, S. Langridge, S. Zhang, N. J. Steinke, and A. J. Drew “Direct observation of the spatial extent of superconductivity in epitaxial Ni-Bi bilayers” *In preparation*

Research Experience

- **Thin film growth:**

Epitaxial and polycrystalline metals by DC sputter deposition
Metallic alloys by co-deposition
Oxides and nitrides by RF and reactive sputter deposition
Additional experience in thermal and electron beam evaporation

- **Cleanroom fabrication:**

Nano-patterning of devices for electrical transport measurements using:
Electron beam lithography (EBL)
Photolithography
Ion beam milling

- **Large scale facility techniques:**

Polarized neutron reflectometry (PNR) at the ILL (France) and ISIS (UK)
Low energy muon spin resonance (μ SR) at PSI (Switzerland)
Small angle neutron scattering (SANS) at PSI and the ILL
Associated data processing and fitting

- **Other characterisation techniques:**

Low temperature electrical transport on thin film superconductors in ^3He and ^4He systems in high magnetic fields
X-ray reflectometry and diffraction
Magnetometry (SQUID, VSM, MOKE)
Atomic force microscopy (AFM)

Academic Experience

Teaching

As a postdoc: Ad hoc lecture cover, mentor for undergraduate project students and PhD students where duties include training and supervision in the research laboratories. As a graduate student: Tutorial leader for Master’s level superconductivity students and demonstrator for first year undergraduate laboratory practicals for a variety of experiments.

Outreach

Through a combination of self-arranged and group outreach activities, I have reached approximately 2,000 members of the public. I give stage shows as part of the Science Theater group at MSU. I also run classroom based physics demonstrations for middle and high school students. At university open days I provide tours of the research facilities to prospective students. Previously, I organised a practical lithography session for young people participating in a nanotechnology summer school.

Peer Review

I actively contribute to the peer review process as reviewer for the Physical Review journal family including Physical Review Letters.

Collaborative Work

As my publication record shows, I am consistently successful in contributing to collaborative projects. My PhD work formed a part of an EPSRC Critical Mass project between 5 UK universities. As a postdoc I forged my

own national and international collaborations, leading to the award of grants and beamtimes where I am the principle investigator.

Laboratory Management

I have particular expertise in sputter deposition, x-ray diffractometry and low temperature electrical transport. I regularly undertake maintenance and upgrades on these equipment as needed. I also take responsibility for the training of new users on equipment, helping to optimise their measurements and aiding in data interpretation.

Invited Talks

- Symposium on Spin, Coherence, and Topology, Royal Holloway University, UK, Jun. 2016
- Department of Materials Science and Metallurgy, University of Cambridge, UK, Jan. 2016
- School of Electronic and Electrical Engineering, University of Leeds, UK, Aug. 2015
- Superconductor Ferromagnetic Metamaterials Annual Review, St. Andrews University, UK, Oct. 2013

Conference Presentations (Oral)

- Condensed Matter and Quantum Materials, St. Andrews, UK, Jul. 2019
- American Physical Society (APS) March Meeting, Boston, USA, Mar. 2019 *
- International Colloquium on Magnetic Films and Surfaces (ICMFS), Santa Cruz, USA, Jul. 2018
- International Conference on Superconductivity and Magnetism (ICSM), Antalya, Turkey, May 2018
- American Physical Society (APS) March Meeting, Los Angeles, USA, Mar. 2018
- American Physical Society (APS) March Meeting, New Orleans, USA, Mar. 2017
- Magnetism and Magnetic Materials (MMM), New Orleans, USA, Nov. 2016 *
- International Conference on Superconductivity and Magnetism (ICSM), Fethiye, Turkey, Apr. 2016
- American Physical Society (APS) March Meeting, Baltimore, USA, Mar. 2016
- Magnetism and Magnetic Materials (MMM), Honolulu, Hawaii, USA, Nov. 2014
- Cold Atoms and Magnetism Conference (CAMACon), University of Birmingham, UK, Jul. 2014

* I chaired sessions at these conferences.

Conference Presentations (Poster)

- Exotic New States in Superconducting Devices: the Age of the Interface, Mainz, Germany, Sept. 2017
- Institute of Physics, Magnetism 2017, University of York, UK, Mar. 2017 [†]
- Institute of Physics, Magnetism 2015, University of Leeds, UK, Mar. 2015
- International Conference on Superconductivity and Magnetism (ICSM), Antalya, Turkey, May 2014
- Institute of Physics, Magnetism 2014, University of Manchester, UK, Apr. 2014
- Physics and Astronomy Postgraduate Symposium, University of Leeds, UK, Apr. 2014
- PSI Summer School on Condensed Matter Research, Zuz, Switzerland, UK, Aug. 2013

[†] My poster was awarded the poster prize at this conference.