

Experimental condensed matter physicist working in the fields of superconductivity and spintronics. Research exploring hybrid devices for highly energy efficient computation with extensive experience in cleanroom fabrication and advanced materials growth, supported by the use of large scale facilities.

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 the ISIS, NCNR, PSI, Diamond, ILL, and SNS facilities.

Work Experience

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

Education

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)

A Levels & GCSEs.
St Columba's College, St Albans

Selected Publications

Total peer-reviewed publications: 14. h-index: 6.

- [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)

- [N. Satchell](#), *et al.* “Control of superconductivity with a single ferromagnetic layer in Nb/Er bilayers” [Phys. Rev. Applied](#) **7**, 044031 (2017)

- M. G. Flokstra, [N. Satchell](#), *et al.* “Remotely induced magnetism in a normal metal using a superconducting spin-valve” [Nat. Phys.](#) **12**, 57-61 (2016)

Research Experience

Thin film growth

Extensive experience with thin film growth of metals including superconductors and ferromagnets in multilayer hybrid structures. Highlights include development of epitaxial sputter growth of rare earth ferromagnet Er on a superconducting epitaxial Nb seed. Additional experience with magnetic alloys by co-deposition, oxides and nitrides by RF and reactive sputter deposition, thermal and electron beam evaporation.

Cleanroom fabrication

Comprehensive experience of device fabrication for electrical transport measurements using photolithography, ion beam milling and electron beam lithography. Highlights include the development of multistage cleanroom process for Josephson junction fabrication from scratch to submitting publication on devices within 6 months during the incoming phase of SUPERSPIN project.

Large scale facility techniques

Expert user of polarized neutron reflectometry technique including all associated data processing and fitting with close collaborations at ISIS (UK) and NCNR (USA). Very experienced with low energy muon spin resonance (μ SR) at PSI (Switzerland).

Other characterisation techniques:

Broad experience with thin film and bulk characterisation techniques such as low temperature electrical transport in ^3He and ^4He systems and high magnetic fields, magnetometry including SQUID measurements, x-ray reflectometry and diffraction, etc.

Academic Experience

Teaching

As a postdoc I have taken every opportunity presented to gain experience in teaching including ad hoc lecture cover, mentoring of undergraduate project students and PhD students. As a graduate student I was the tutorial leader for Master’s level superconductivity students and demonstrator for first year undergraduate laboratory.

Outreach

Through a combination of self-arranged and group outreach activities, I have reached approximately 2,000 members of the public. I gave stage shows as part of the Science Theater group at MSU. I also run classroom based physics demonstrations for middle and high school students and contribute demonstrations and tours during university open days.

Peer Review

Active contributions to the peer review process as reviewer for the Physical Review (PRL, PRX, PRB) and Nature Research (Nat. Comms.) journals.

Collaborative Work

Consistent success in contributing to collaborative projects. 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. My PhD work formed a part of an EPSRC Critical Mass project between 5 UK universities.

Laboratory Management

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.

Publications List

- 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. Loloe, 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**)
- 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” *To appear in J. Vis. Exp.*
- N. Satchell, P. M. Shepley, M. Algarni, M. Vaughan, E. Darwin, M. Ali, M. C. Rosamond, L. Chen, E. H. Linfield, B. J. Hickey, and G. Burnell “Spin-valve Josephson junctions with perpendicular magnetic anisotropy for cryogenic memory” *Submitted to App. Phys. Lett.*

Invited Talks

- School of Electronic and Electrical Engineering, University of Leeds, UK, Dec. 2019
- Symposium on Spin, Coherence, and Topology, Royal Holloway University, UK, Jun. 2016
- Department of Materials Science and Metallurgy, University of Cambridge, UK, Jan. 2016
- Superconductor Ferromagnetic Metamaterials Annual Review, St. Andrews University, UK, Oct. 2013

Conference Presentations

- ★ 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
- 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 †
- ★ 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
- Institute of Physics, Magnetism 2015, University of Leeds, UK, Mar. 2015
- ★ Magnetism and Magnetic Materials (MMM), Honolulu, Hawaii, USA, Nov. 2014
- ★ Cold Atoms and Magnetism Conference (CAMaCon), University of Birmingham, UK, Jul. 2014
- 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
- ★ Denotes oral presentation. * Chaired sessions at these conferences. † Awarded the poster prize.

December, 2019