Professor Andrew Boothroyd

Professor of Physics, University of Oxford, and Tutorial Fellow of Oriel College, Oxford
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Education

1974–1981 Formby High School, Liverpool, UK ('A' Levels in Physics, Math, Further Math, Chemistry and General Studies)
1984 MA in Natural Sciences, Cambridge University, UK (*1st class honours, Physics & Theoretical Physics*)
1988 PhD in Physics, Cambridge University, UK (*Advisor: Dr Gordon Squires*)

Academic Career

1988–1989	Research Associate, University of Warwick
1989–1991	Lecturer in Physics, University of Warwick
1992–Present	Lecturer in Physics, University of Oxford, and Tutorial Fellow of Oriel College, Oxford
2000	Awarded title of Reader in Physics
2006	Awarded title of Professor of Physics
2004–2008	Head of Condensed Matter Physics at Oxford University
2011–2015	Vice Provost of Oriel College, Oxford (also 2020–2021)
2019–present	Associate Head of Department of Physics, Oxford University

Research interests

Novel phenomena in quantum materials that exhibit complex forms of electronic order, such as unconventional superconductivity and magnetic materials whose properties depend on a delicate interplay between the spin, charge and orbital degrees of freedom of the electron; structure and dynamics of quantum materials; emergent phenomena; topological electronic band structures; neutron and X-ray scattering techniques, and magnetic, thermodynamic and transport measurements; crystal growth

Awards

2011 Institute of Physics Brian Pippard Prize (formerly Superconductivity Group Prize)

2017 Outstanding Referee for the journals of the American Physical Society

Professional Activities

1999–Present	Member of EPSRC Peer Review College; member of Programme Evaluation and Prioritisation panels
2001–2007	Member of Institute of Physics Magnetism Group Committee
2002–2011	Member of ISIS User Committee
2004–2013	Chair of SINQ Scientific Advisory Committee, Paul Scherrer Institut, Switzerland
2007–2011	Member of Editorial Advisory Board of J. Phys.: Condens. Matter
2007–2017	Member of PMC for XMaS, the UK's magnetic scattering beamline at the ESRF
2009–2011	Deputy Chair of STFC's Neutron Advisory Panel (NAP)
2009–2011	Deputy Chair of STFC's Facilities Research and Development Panel (FRDP)
2011–2014	Chair of ISIS proposal review committee FAP4
2010–Present	Member of Diamond beamlines I05 (ARPES) and I21 (RIXS) User Working Groups
2011–2017	UK Representative of IUPAP Commission C9 (Magnetism)
2015–2018	Member of ORNL Neutron Sciences Science Review Committee
2016–Present	Member of ESS Science & Technology Advisory Panels (Sample Environment & Spectroscopy)
2012–2015	External Examiner in Physics, University of Warwick
2015–2018	External Examiner for Condensed Matter Physics CDT, University of Bristol
2017–2021	Chair of ILL College 4 proposal review panel, and member of ILL Scientific Council
2022–Present	Member of the Scientific Advisory Board of the Lund Institute of Neutron and X-ray Science

Invited talks at national and international conferences and seminars (last 3 years)

10. *Magnetic topological metals, semimetals and insulators: neutron and x-rays scattering studies*, Workshop on Topology in Magnetic Materials, Herzberg, Switzerland, Nov 2022
9. *Neutron scattering and quantum materials: questions and answers*, Xth International Meeting of the Spanish Society on Neutron Techniques, University of Almeria, Spain, July 2022
8. *Topology: a new twist to electrons in quantum materials*, LNS Seminar, Paul Scherrer Institut, June 2022
7. *Magnetic order in topological metals and semimetals*, NSLS-II and CFN Users Meeting (Remote), May 2022

6. *Magnetic order in topological semimetals*, Small Seminar, Diamond Light Source (Remote), Feb 2022
5. *Non-collinear magnetic order in topological metals,* Theoretical and Experimental Magnetism Meeting, Abingdon, July 2021
4. *Magnetic structure of Mn_3Ge*, M_3X Workshop (Remote), Center for the Advancement of Topological Semimetals, Ames Laboratory, USA, Aug 2020
3. *Magnetically-induced Weyl semimetals,* Theoretical and Experimental Magnetism Meeting, Abingdon, July 2019
2. *The EPN Campus and its extraordinary contribution to materials physics,* Grenoble, May 2019
1. *Ferroelectric-like transitions in metallic osmates,* Gordon Research Conference, Hong Kong, May 2019

Public outreach

I have given several public lectures on superconductivity and quantum materials, and I have given talks on similar topics to university and high school student science societies. During 1990–1993 I wrote the annual entry entitled "Physics" in the Encyclopaedia Britannica Book of the Year. In 2014 & 2015 I lectured at a UNIQ summer school at Oxford University for Year 12 students from state schools. I jointly led a STFC-funded project to develop and deliver two workshops entitled *Levitate!* and *Fantastic Fields*, on Superconductivity and Magnetism for Years 8–10 in secondary schools. In 2014, I demonstrated superconducting levitation on the BBC2 celebrity quiz show QI.

Conferences, workshops and summer schools (last 3 years)

1991–2022 Co-organiser and lecturer, Oxford Neutron Scattering Summer School (odd years)
2019 Co-organiser of *Floating-zone Techniques Workshop*, Oxford, UK

Publications

260 peer-reviewed papers; 6920 total citations; h-index = 46 (source: Web of Science, Dec 2022).
Papers in high impact journals: 28 PRL, 3 *Science*, 2 *Nature*, 8 other *Nature* titles (*Physics*, *Materials*, *Communications*).

Recent publications (last 3 years)

26. Impact of mixed anion ordered state on the magnetic ground states of $S = 1/2$ square-lattice quantum spin antiferromagnets, Sr_2NiO_3Cl and Sr_2NiO_3F
Yoshihiro Tsujimoto, Jun Sugiyama, Masayuki Ochi, Kazuhiko Kuroki, Pascal Manuel, Dmitry D. Khalyavin, Izumi Umegaki, Martin Mnsson, Daniel Andreica, Shigeo Hara, Takahiro Sakurai, Susumu Okubo, Hitoshi Ohta, Andrew T. Boothroyd, Kazunari Yamaura
Phys. Rev. Materials **6** (2022) 114404

25. Room-Temperature Type-II Multiferroic Phase Induced by Pressure in Cupric Oxide
Noriki Terada, Dmitry D. Khalyavin, Pascal Manuel, Fabio Orlandi, Christopher J. Ridley, Craig L. Bull, Ryota Ono, Igor Solovyev, Takashi Naka, Dharmalingam Prabhakaran, Andrew T. Boothroyd
Phys. Rev. Lett. **129** (2022) 217601

24. Magnetic structure of the topological semimetal $Co_3Sn_2S_2$
Jian-Rui Soh, ChangJiang Yi, Ivica Zivkovic, Navid Qureshi, Anne Stunault, Bachir Ouladdiaf, J. Alberto Rodríguez-Velamazán, YouGuo Shi, Henrik M. Rønnow, Andrew T. Boothroyd
Phys. Rev. B **105** (2022) 094435 (arXiv:2110.00475)

23. Metamagnetism and crystal-field splitting in pseudohexagonal $CeRh_3Si_2$
Andrea Amorese, Dmitry Khalyavin, Kurt Kummer, Nicholas B. Brookes, Clemens Ritter, Oksana Zaharko, Camilla Buhl Larsen, Orest Pavlosiuk, Adam P. Pikul, Dariusz Kaczorowski, Matthias Gutmann, Andrew T. Boothroyd, Andrea Severing, and Devashibhai T. Adroja
Phys. Rev. B **105** (2022) 125119 (arXiv:2202.13195)

22. Model for coupled 4*f*-3*d* magnetic spectra: A neutron scattering study of the Yb-Fe hybridization in $Yb_3Fe_5O_{12}$
Viviane Peçanha-Antonio, Dharmalingam Prabhakaran, Christian Balz, Aleksandra Krajewska, and Andrew T. Boothroyd
Phys. Rev. B **105** (2022) 104422 (Editors' Suggestion) (arXiv:2111.04707)

21. Inhomogeneous spin excitations in weakly coupled spin-1/2 chains
L. Shen, E. Campillo, O. Zaharko, P. Steffens, M. Boehm, K. Beauvois, B. Ouladdiaf, Z. He, D. Prabhakaran, A. T. Boothroyd, and E. Blackburn
Phys. Rev. Res. **4** (2022) 013111 (open access)

20. Magnetic monopole density and antiferromagnetic domain control in spin-ice iridates
M. J. Pearce, K. Götze, A. Szabó, T. S. Sikkenk, M. R. Lees, A. T. Boothroyd, D. Prabhakaran, C. Castelnovo and P. A. Goddard
Nature Communications **13** (2022) 444 (open access)

19. Real Space Imaging of Spin Stripe Domain Fluctuations in a Complex Oxide
Longlong Wu, Yao Shen, Andi M. Barbour, Wei Wang, Dharmalingam Prabhakaran, Andrew T. Boothroyd, Claudio Mazzoli, John M. Tranquada, Mark P. M. Dean, and Ian K. Robinson
Phys. Rev. Lett. **127** (2021) 275301

18. Magnetic structure of the topological semimetal $YbMnSb_2$
J-R. Soh, S. M. Tobin, H. Su, I. Zivkovic, B. Ouladdiaf, A. Stunault, J. A. Rodríguez-Velamazán, K. Beauvois, Y-F. Guo, and A. T. Boothroyd
Phys. Rev. B **104** (2021) L161103 (Editors' Suggestion) (arXiv:2107.02857)

17. Charge Condensation and Lattice Coupling Drives Stripe Formation in Nickelates
Y. Shen, G. Fabbris, H. Miao, Y. Cao, D. Meyers, D. G. Mazzone, T. A. Assefa, X. M. Chen, K. Kisslinger, D. Prabhakaran, A. T. Boothroyd, J. M. Tranquada, W. Hu, A. M. Barbour, S. B. Wilkins, C. Mazzoli, I. K. Robinson, and M. P. M. Dean
Phys. Rev. Lett. **126** (2021) 177601 (arXiv:2104.00082)

16. Magnetically induced metal-insulator transition in Pb_2CaOsO_6
H. Jacobsen, H. L. Feng, A. J. Princep, M. C. Rahn, Y. F. Guo, J. Chen, Y. Matsushita, Y. Tsujimoto, M. Nagao, D. Khalyavin, P. Manuel, C. A. Murray, C. Donnerer, J. G. Vale, M. Moretti Sala, K. Yamaura, and A. T. Boothroyd
Phys. Rev. B **102** (2020) 214409 (Editors' Suggestion) (arXiv:2009.04196)

15 Magnetically driven loss of centrosymmetry in metallic Pb_2CoOsO_6
A. J. Princep, H. L. Feng, Y. F. Guo, F. Lang, H. M. Weng, P. Manuel, D. Khalyavin, A. Senyshyn, M. C. Rahn, Y. H. Yuan, Y. Matsushita, S. J. Blundell, K. Yamaura, and A. T. Boothroyd
Phys. Rev. B **102** (2020) 104410 (arXiv:1902.04482)

14. Resonant x-ray scattering study of diffuse magnetic scattering from the topological semimetals $EuCd_2As_2$ and $EuCd_2Sb_2$
J.-R. Soh, E. Schierle, D. Y. Yan, H. Su, D. Prabhakaran, E. Weschke, Y. F. Guo, Y. G. Shi, and A. T. Boothroyd
Phys. Rev. B **102** (2020) 014408 (arXiv:2005.04952)

13. Approaching the quantum critical point in a highly correlated all-in–all-out antiferromagnet
Y. Wang, T. F. Rosenbaum, D. Prabhakaran, A. T. Boothroyd, and Y. Feng
Phys. Rev. B **101** (2020) 220404(R) (Editors' Suggestion) (arXiv:1912.11640)

12. Ground-state magnetic structure of Mn_3Ge
J.-R. Soh, F. de Juan, N. Qureshi, H. Jacobsen, H.-Y. Wang, Y.-F. Guo, and A. T. Boothroyd
Phys. Rev. B **101** (2020) 140411(R) (Editors' Suggestion) (arXiv:2001.02601)

11. Strong quantum fluctuations from competition between magnetic phases in a pyrochlore iridate
H. Jacobsen, C. D. Dashwood, E. Lhotel, D. Khalyavin, P. Manuel, R. Stewart, D. Prabhakaran, D. F. McMorrow, and A. T. Boothroyd
Phys. Rev. B **101** (2020) 104404 (arXiv:1909.07819)

10. Ideal Weyl semimetal induced by magnetic exchange
J.-R. Soh, F. de Juan, M. G. Vergniory, N. B. M. Schröter, M. C. Rahn, D. Y. Yan, J. Jiang, M. Bristow, P. Reiss, J. N. Blandy, Y. F. Guo, Y. G. Shi, T. K. Kim, A. McCollam, S. H. Simon Y. Chen, A. I. Coldea, and A. T. Boothroyd
Phys. Rev. B **100** (2019) 201102(R) (Editors' Suggestion) (arXiv:1901.10022)

9. Magnetic and electronic structure of Dirac semimetal candidate $EuMnSb_2$
J.-R. Soh, P. Manuel N. M. B. Schröter, C. J. Yi, F. Orlandi, Y. G. Shi, D. Prabhakaran, and A. T. Boothroyd
Phys. Rev. B **100** (2019) 174406 (arXiv:1907.05913)

8. Magnetic structure and excitations of the topological semimetal $YbMnBi_2$
J.-R. Soh, H. Jacobsen, B. Ouladdiaf, A. Ivanov, A. Piovano, T. Tejsner, Z. Feng, H. Wang, H. Su, Y.-F. Guo, Y.-G. Shi, and A. T. Boothroyd
Phys. Rev. B **100** (2019) 144431 (Editors' Suggestion) (arXiv:1908.04872)

7. Selective probing of magnetic order on Tb and Ir sites in stuffed $Tb_2Ir_2O_7$ using resonant x-ray scattering
C. Donnerer, M. C. Rahn, E. Schierle, R. S. Perry, L. S. I. Veiga, G. Nisbet, S. P. Collins, D. Prabhakaran, A. T. Boothroyd, and D. F. McMorrow
J. Phys.: Condens. Matter **31** (2019) 344001 (arXiv:1910.05551)

6. Evidence for a $J_{eff} = 0$ ground state and defect-induced spin glass behavior in the pyrochlore osmate $Y_2Os_2O_7$
N. R. Davies, C. V. Topping, H. Jacobsen, A. J. Princep, F. K. K. Kirschner, M. C. Rahn, M. Bristow, J. G. Vale, I. da Silva, P. J. Baker, C. J. Sahle, Y.-F. Guo, D.-Y. Yan, Y.-G. Shi, S. J. Blundell, D. F. McMorrow, and A. T. Boothroyd
Phys. Rev. B **99** (2019) 174442 (arXiv:1808.01530)

5. First-order valence transition: Neutron diffraction, inelastic neutron scattering, and x-ray absorption investigations on the double perovskite $Ba_2PrRu_{0.9}Ir_{0.1}O_6$
J. Sannigrahi, D. T. Adroja, C. Ritter, W. Kockelmann, A. D. Hillier, K. S. Knight, A. T. Boothroyd, M. Wakeshima, Y. Hinatsu, J. F. W. Mosselmans, and S. Ramos
Phys. Rev. B **99** (2019) 184440 (arXiv:1903.11096)

4. Tuning of the Ru^{4+} ground-state orbital population in the $4d^4$ Mott insulator Ca_2RuO_4 achieved by La doping
D. Pincini, L. S. I. Veiga, C. D. Dashwood, F. Forte, M. Cuoco, R. S. Perry, P. Bencok, A. T. Boothroyd, and D. F. McMorrow
Phys. Rev. B **99** (2019) 075125 (arXiv:1810.11044)

3. Role of defects in determining the magnetic ground state of ytterbium titanate
D. F. Bowman, E. Cernal, T. Lehner, A. R. Wildes, L. Mangin-Thro, G. J. Nilsen, M. J. Gutmann, D. J. Voneshen, D. Prabhakaran, A. T. Boothroyd, D. G. Porter, C. Castelnovo, K. Refson and J. P. Goff
Nature Communications **10** (2019) 637 (arXiv:1902.07179)

2. Monitoring ultrafast metallization in $LaCoO_3$ with femtosecond soft x-ray spectroscopy
M. Izquierdo, M. Karolak, D. Prabhakaran, A. T. Boothroyd, A. O. Scherz, A. Lichtenstein and S. L. Molodtsov
Communications Physics **2** (2019) 8

1. Paramagnon dispersion in β-FeSe observed by Fe L-edge resonant inelastic x-ray scattering
M. C. Rahn, K. Kummer, N. B. Brookes, A. A. Haghighirad, K. Gilmore, and A. T. Boothroyd
Phys. Rev. B **99** (2019) 014505 (arXiv:1808.08183)