

Curriculum Vitae: Ben Dudson

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Reader (Associate Professor) in plasma physics, Department of Physics, University of York. My research area is magnetic confinement fusion, particularly tokamaks.

I have led development of the BOUT++ plasma simulation code for 10 years, and been involved in experiments on the Mega-Amp Spherical Tokamak (MAST). I collaborate with Lawrence Livermore National Laboratory (LLNL) USA, Argonne National Laboratory (ANL) USA, General Atomics, USA and the Culham Center for Fusion Energy (CCFE) in the UK. My research is funded by the UK EPSRC, and the EUROfusion consortium.

I teach undergraduate lecture courses on mathematical techniques (3rd year), and computational methods (2nd year). I have taught courses on Magnetic Confinement Fusion (MSc/PhD), computational plasma physics (MSc/PhD), Fluid Dynamics (4th year), Environmental Physics (2nd year), and Programming (1st year Python, MSc/PhD python, C and Fortran). I currently supervise three PhD students, two Postdocs, and have six graduated PhD students.

Employment

Year	Establishment	Description
October 2017 - Present	University of York, UK	Reader
October 2014 - October 2017	University of York, UK	Senior Lecturer
April 2009 - September 2014	University of York, UK	Lecturer in plasma physics Post-Doctoral Research Assistant, studying Explosive instabilities in tokamaks
Feb 2007 - April 2009	University of York, UK	DPhil on "Edge turbulence in the Mega-Amp Spherical Tokamak". Accepted April 2008, awarded the 2009 Culham thesis prize
Oct 2003 - Jan 2008	UKAEA Fusion, and Trinity college Oxford	Physics MSci (1st)
Oct 1999 - June 2003	Imperial College London	

Experience

- Invited talks to national and international conferences (2018 KSTAR conference, 2016 Varenna-Lausanne international workshop, 2015 IAEA technical meeting, 2013 IAEA technical meeting, 2013 ICCP, 2012 EFPW, 2011 EFPW, 2010 Joint Varenna-Lausanne international workshop; 2009 IoP, 2008 EPS), seminars (NCKU 2012, IPP Greifswald 2010, Courant Institute NYU 2009, Warwick 2009), oral presentations to the ITER Physics Advisory pedestal group (Oct 2011, Oct 2009, April 2009, Oct 2008), and other contributed oral and poster presentations.
- Planned and took part in running experiments on the Mega-Amp Spherical Tokamak in the capacity of Physicist In Charge.
- 55 publications spanning experimental and computational plasma physics, with an h-factor of 25.

Positions

- Chair of the University Research Computing Working Group, which coordinates training and advises on policy related to research computing.
- Member, Institute of Physics Plasma Physics Group management committee, April 2015 - present. One of 10 members, elected to represent the plasma physics community to policy makers and funders, and to coordinate activities across UK plasma physics, in particular the annual IoP Plasma Physics conference.

- Member, HEC computing consortium management board, 2013-present. This board agrees a strategy for allocation of computing time on the UK national supercomputing facilities (Archer) valued at 2.8M over 5 years.
- Member, Plasma-CCP management board, 2014-present. The role of this board is to take a strategic view of the UK computational plasma physics community activities.
- EPSRC Software Outlook project member, October 2016 - present. This national project supports the UK collaborative computational project (CCP) communities by exploring and advising on future developments in hardware and software.

Skills

- Development and use of experimental data analysis codes to study edge plasma phenomena
- Large-scale plasma simulations, in particular the study of ELMs and plasma fluid turbulence
- Design and delivery of undergraduate and graduate lecture courses
- Programming in C, C++, Python, IDL, Fortran, Assembler and Lisp. Some Perl and Julia

Research Grants

(Bold are currently active)

- **EPSRC [EP/R029148/1](#)** - Plasma Physics HEC Consortium
- **EUROfusion AWP17-ENR-IFE-CCFE-01** - Non-local thermal transport in inertial and magnetic confinement fusion plasmas
- **EUROfusion AWP17-ENR-MFE-CCFE-01** - Understanding the role of reconnection in filament separation and its impact on plasma exhaust in tokamaks
- **EPSRC [EP/N023846/1](#)** - The influence of magnetic geometry on the plasma edge region of future fusion reactors
- EUROfusion ER15-CCFE-03 - Predictive model for pedestals
- EUROfusion ER15-EPFL-05 - Synergetic numerical-experimental approach to fundamental aspects of turbulent transport in the tokamak edge
- EPSRC [EP/M022463/1](#) - The Plasma-CCP Network
- EPSRC [EP/M001423/1](#) - Dust in magnetized plasmas
- EUROfusion Enabling Research CfP-WP14-ER-01/Swiss Confederation-01 - Synergetic numerical-experimental approach to fundamental aspects of turbulent transport in the tokamak edge
- EUROfusion Enabling Research CfP-WP14-ER-01/CEA-01 - MHD modelling of MHD instabilities and their control in existing tokamaks and ITER
- EPSRC [EP/L000237/1](#) - Plasma Physics HEC Consortia.
- EPSRC [EP/K006940/1](#) - Plasma turbulence in complex environments
- EFDA Task Agreements WP11-MHD-02/02, WP10-MHD-03/02, WP09-MHD-04/01

Publications

2018

- Fil, A. M. D., Dudson, B. D., Lipschultz, B., Moulton, D., Verhaegh, K. H. A., Fevrier, O. & Wensing, M. "Identification of the primary processes that lead to the drop in divertor target ion current at detachment in TCV" Contributions to plasma physics (2018)

2017

- Ryan, D. A., Liu, Y., Kirk, A., Suttrop, W., Dudson, B. D., Dunne, M. & Willensdorfer, M. "Experimental validation of coil phase parametrisation on ASDEX Upgrade, and extension to ITER" Plasma Physics and Controlled Fusion (2017)
- Leddy, J. & Dudson, B. D. "Intrinsic suppression of turbulence in linear plasma devices" 2017 Plasma Physics and Controlled Fusion. 59, 12, p. 1-5 125011 (2017)
- Militello, F., Dudson, B. D., Easy, L., Kirk, A. & Naylor, P. "On the interaction of Scrape Off Layer filaments" Plasma Physics and Controlled Fusion (2017)
- Brodrick, J. P., Kingham, R., Marinak, M., Patel, M. V., Chankin, A., Omotani, J. T., Umansky, M. V., Del Sorbo, D., Dudson, B. D., Parker, J. T., Kerbel, G. D., Sherlock, M. & Ridgers, C. P. "Testing nonlocal models of electron thermal conduction for magnetic and inertial confinement fusion applications" Physics of Plasmas. 24, 092309, 14 p. (2017)
- Meyer, H., Dudson, B. D., Lipschultz, B., Leddy, J., Leyland, M. J., Shanahan, B. W. & Verhaegh, K. H. A. "Overview of progress in European medium sized tokamaks towards an integrated plasma-edge/wall solution" Nuclear Fusion. 57, 102014, p. 1-16 16 p. (2017)
- Kirk, A., Dickinson, D., Dudson, B. D., Easy, L., Gibson, K., Imada, K., Leddy, J., Lipschultz, B., Reinke, M. L., Thomas, D. A., Vann, R. G. L., Walkden, N. R. & Wilson, H. R. "Overview of recent physics results from MAST" Nuclear Fusion. 57, 10, p. 1-17 17 p., 102007 (2017)
- **Dudson, B. D.** & Leddy, J. "Hermes: Global plasma edge fluid turbulence simulations" Plasma Physics and Controlled Fusion. 59, 5, 12 p. (2017)
- Schworer, D., Walkden, N. R., Leggate, H., Dudson, B. D., Militello, F., Downes, T. & Turner, M. "Influence of plasma background including neutrals on scrape-off layer filaments using 3D simulations" Nuclear Materials and Energy. 7 p. (2017)
- Ryan, D. A., Liu, Y., Li, L., Kirk, A., Dunne, M. G., Dudson, B. D., Piovesan, P., Suttrop, W. & Willensdorfer, M. "Numerically derived parametrisation of optimal RMP coil phase as a guide to experiments on ASDEX Upgrade" Plasma Physics and Controlled Fusion. 59, 2, 20 p. (2017)

2016

- H Seto, M Yagi, N Aiba, A Matsuyama, B D Dudson, X Q Xu "Non-ideal Ballooning Mode Instability with Real Electron Inertia" Plasma and Fusion Research (2016)
- D A Ryan, Y Liu, L Li, A Kirk, M G Dunne, B D Dudson, P Piovesan, W Suttrop, M Willensdorfer "Numerically derived parametrisation of optimal RMP coil phase as a guide to experiments on ASDEX Upgrade" Plasma Phys. Control. Fusion
- B W Shanahan, P A Hill, B D Dudson, "Towards nonaxisymmetry; initial results using the Flux Coordinate Independent method in BOUT++" Journal of Physics: Conference Series (2016) [Preprint here](#)
- A Thornton, A Kirk, S Allen, B Dudson, S Elmore, G Fishpool, J Harrison, "The role of ELM filaments in setting the ELM wetted area in MAST and the implications for future devices" Plasma Phys. Control. Fusion (2016).
- **B D Dudson**, J Leddy "Hermes: Global plasma edge fluid turbulence simulations" submitted to PPCF (2016). [Preprint here](#)
- J Leddy, B Dudson "Simulation of the interaction between plasma turbulence and neutrals in linear devices" submitted to the Journal of Nuclear Materials and Energy (2016)
- P Hill, B Shanahan, B Dudson [Dirichlet boundary conditions for arbitrary-shaped boundaries in stellarator-like magnetic fields for the Flux-Coordinate Independent method](#). Computer Physics Communications (2016). [Preprint here](#)
- **B D Dudson**, J Madsen, J Omotani, P Hill, L Easy, M Loiten [Verification of BOUT++ by the Method of Manufactured Solutions](#) Accepted in Physics of Plasmas (2016). [Preprint here](#).
- B Shanahan, B Dudson [Blob dynamics in TORPEX poloidal null configurations](#) Plasma Phys. Control. Fusion 58 125003 (2016). [Preprint here](#).
- J Leddy, B Dudson, M Romanelli, B Shanahan, N Walkden [A novel flexible field-aligned coordinate system for tokamak edge plasma simulation](#) Computer Physics Communications (2016). [Preprint here](#).
- S Y Allan, S Elmore, G Fishpool, B Dudson, the MAST Team and the EUROfusion MST1 Team [lon temperature measurements of L-mode filaments in MAST by retarding field energy analyser](#) Plasma Phys. Control. Fusion 58 045014 (2016)

- L Easy, F Militello, J Omotani, N Walkden, B Dudson [Investigation of the Effect of Resistivity on Scrape Off Layer Filaments using Three Dimensional Simulations](#) Physics of Plasmas 23 012512 (2016) [Preprint here](#)

2015

- I T Chapman et al [Overview of MAST results](#) Nucl. Fusion 55 (2015), 104008
- N Walkden, B Dudson, L Easy, G Fishpool, J Omotani [Numerical investigation of isolated filament motion in a realistic tokamak geometry](#). Nucl. Fusion 55 (2015), 113022. [Preprint here](#)
- J R Harrison, G M Fishpool, B D Dudson "Filamentary transport in the private flux region in MAST" J. Nucl. Mat. 463, 757-760 (2015)
- D Ryan, Y Liu, A Kirk, W Suttrop, B Dudson, M Dunne, R Fischer, J Fuchs, M Garcia-Munoz, B Kurzan, P Piovesan, M Reinke, M Willensdorfer [Toroidal modelling of RMP response in ASDEX-Upgrade: coupling between field pitch aligned response and kink amplification](#) PPCF 57, 095008 (2015). [Preprint here](#)
- J Leddy, B Dudson, M Romanelli [On the validity of drift-reduced fluid models for tokamak plasma simulation](#). To be submitted to PPCF 2015. [arXiv preprint](#)
- J T Omotani, B D Dudson, E Havlickova, M Umansky [Non-local parallel transport in BOUT++](#) Journal of Nuclear Materials 463, 769-772 (2015) [doi:10.1016/j.jnucmat.2014.10.040](#). [Preprint here](#).
- N Walkden, J Adamek, S Allan, B Dudson, S Elmore, G Fishpool, A Kirk, M Komm "Profile measurements in the plasma edge of MAST using a ball pen probe" Rev. Sci. Inst. 86(2) 023510 (2015)

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- L Easy, F Militello, J Omotani, B Dudson, E Havlickova, P Tamain, V Naulin, A H Nielsen [3D Simulations of Plasma Filaments in the Scrape Off Layer: A Comparison with Models of Reduced Dimensionality](#) Phys. Plasmas 21, 122515 (2014). [arXiv preprint](#)
- **B D Dudson**, A.Allen, G.Breyiannis, E.Brugger, J.Buchanan, L.Easy, S.Farley, I.Joseph, M. Kim, A.D.McGann, J.T.Omotani, M.V.Umansky, N.R.Walkden, T.Xia, X.Q.Xu [BOUT++: Recent and current developments](#) Journal of Plasma Physics 2014. [arXiv preprint](#)
- J F Ma, X Q Xu, B D Dudson "Linear peeling-ballooning mode simulations in snowflake-like divertor configuration using BOUT++ code" Nucl. Fusion 54 (2014) 033011

2013

- S A Myers, B D Dudson, H R Wilson "Nonlinear MHD simulations of the gravitational ballooning mode close to marginal stability" Accepted in Plasma Phys. Control. Fusion (2013)
- H Meyer et al. [Overview of physics results from MAST towards ITER/DEMO and the MAST Upgrade](#) Nuclear Fusion 53 (2013) 104008
- N R Walkden, B D Dudson, G Fishpool [Characterization of 3D filament dynamics in a MAST SOL flux tube geometry](#). Plasma Phys. Control. Fusion 55 (2013) 105005. Also available as an [arXiv preprint](#).
- D R Smith, S E Parker, W Wan, Y Chen, B D Dudson, R J Fonck, G R McKee, S M Kaye, D S Thompson, R E Bell, A Diallo, W Guttenfelder, B P LeBlanc, M Podesta "Measurements and simulations of low wavenumber pedestal turbulence in the National Spherical Torus Experiment" [Nuclear Fusion 53 \(2013\) 113029](#)
- X Xu, P W Xi, A Dimits, I Joseph, M V Umansky, T Y Xia, B Gui, S S Kim, G Y Park, T Rhee, H Jhang, P H Diamond, B Dudson, P B Snyder "Gyro-fluid and two-fluid theory and simulations of edge-localized-modes". Phys. Plasmas 20 (2013) 056113
- J T Omotani, B D Dudson [Non-local approach to kinetic effects on parallel transport in fluid models of the scrape-off layer](#). Plasma Phys. Control. Fusion **55** (2013) 055009. Preprint arXiv [plasm-phys/1302.0676](#)

2012

- **B Dudson**, S Farley, L Curfmann McInnes [Improved Nonlinear Solvers in BOUT++](#). Submitted to Computer Physics Communications August 2012. Preprint arXiv [plasm-phys/1209.2054](#), report [ANL/MCS-P3025-0812](#)
- B Friedman, T A Carter, M V Umansky, D Schaffner, B Dudson [Energy dynamics in a simulation of LAPD turbulence](#). Physics of Plasmas 19 (2012) 102307
- T Y Xia, X Q Xu, B D Dudson, J Li [Nonlinear Simulations of Peeling-Ballooning Modes with Parallel Velocity Perturbation](#) Contrib. Plasma Phys., **52** (2012) 353-359

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- B Lloyd et al [Overview of physics results from MAST](#) 2011 Nucl. Fusion **51** 094013 doi:[10.1088/0029-5515/51/9/094013](#)
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- **B D Dudson**, X Q Xu, M V Umansky, P.B.Snyder, H.R. Wilson [Simulation of Edge Localised Modes using BOUT++](#). Invited paper to the 2010 Joint Varenna-Lausanne international workshop. Plasma Phys. Control. Fusion **53** (2011) 054005 doi: [10.1088/0741-3335/53/5/054005](#)

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- X Q Xu, B D Dudson, P.B.Snyder, M V Umansky, H.R. Wilson [Nonlinear simulations of peeling-ballooning modes with anomalous electron viscosity and their role in ELM crashes](#) Phys. Rev. Lett. **105** (2010) 175005
- A. Kirk, E. Nardon, R. Akers, M. Becoulet, G. De Temmerman, B. Dudson, B. Hnat, Y.Q. Liu, R. Martin, P. Tamain, D. Taylor and the MAST team: [Resonant magnetic perturbation experiments on MAST using external and internal coils for ELM control](#) Nucl. Fusion **50** (2010) 034008 doi:[10.1088/0029-5515/50/3/034008](#)
- P Tamain, A Kirk, E Nardon, B Dudson, B Hnat and the MAST team: [Edge turbulence and flows in the presence of resonant magnetic perturbations on MAST](#) Plasma Phys. Control. Fusion **52** (2010) 075017

2009

- H Meyer et al [Overview of physics results from MAST](#) 2009 Nucl. Fusion **49** 104017 doi:[10.1088/0029-5515/49/10/104017](#)
- E Nardon, A. Kirk, M. Becoulet, P. Cahyna, G de Temmerman, B. Dudson, B.Hnat, Y.Q. Liu, R. Martin, H. Meyer, P. Tamain, D. Taylor, D. Temple and the MAST Team: [Edge localized mode control experiments on MAST using resonant magnetic perturbations from in-vessel coils](#). Plasma Phys. Control. Fusion **51** (2009) 124010
- **B. D. Dudson**, M. V. Umansky, X. Q. Xu, P. B. Snyder, H. R. Wilson: [BOUT++: a framework for parallel plasma fluid simulations](#). Computer Physics Communications **180** (2009), pp. 1467-1480 doi:[10.1016/j.cpc.2009.03.008](#). Also available as an [arXiv pre-print](#)
- N. Ben Ayed, A. Kirk, B. Dudson, S. Tallents, R. G. L. Vann, H. R. Wilson and the MAST team: [Inter-ELM filaments and turbulent transport in the Mega-Amp Spherical Tokamak](#). Plasma Phys. Control. Fusion **51** (2009) 035016. doi:[10.1088/0741-3335/51/3/035016](#)
- M. V. Umansky, X. Q. Xu, B. Dudson, L. L. LoDestro, and J. R. Myra: *Status and verification of Edge Plasma Turbulence Code BOUT*. Computer Physics Communications **180**(6) (2009) p887-903 doi:[10.1016/j.cpc.2008.12.012](#)

2008

DPhil thesis [Edge turbulence in the Mega-Amp Spherical Tokamak](#) Trinity college, University of Oxford. Accepted 28th April 2008

- B Hnat, B. D. Dudson, R. O. Dendy, G. F. Counsell, A. Kirk, The MAST Team *Characterization of edge turbulence in relation to edge magnetic field configuration in Ohmic L-mode plasmas in the Mega Amp Spherical Tokamak* Nucl. Fusion, **48**(8). (August 2008), 085009
- X.Q. Xu, M. V. Umansky, B. Dudson and P. B. Snyder: [Boundary Plasma Turbulence Simulations for Tokamaks](#). Review article, Commun. Comput. Phys., **4** (2008), pp. 949-979
- **B. D. Dudson**, N. Ben Ayed, A. Kirk, H. R. Wilson, G. Counsell, X. Xu, M. Umansky, P. B. Snyder, B. Lloyd, and the MAST team: [Experiments and simulation of edge turbulence and filaments in MAST](#). Invited paper for the 35th EPS conference 2008, published Plasma Phys. Control. Fusion **50** (2008) 124012

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- B. Lloyd, R. J. Akers, F. Alladio et. al. [Overview of physics results from MAST](#) 21st IAEA Fusion Energy Conference 2006, Chengdu, China. Published 2007 in Nucl. Fusion **47** (10) S658-S667 doi:[10.1088/0029-5515/47/10/S14](#)
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- G. F. Counsell et. al. *Overview of MAST results* 20th IAEA Fusion Energy Conference 2004. Published 2008 in Nucl. Fusion **45** (10) (Oct 2005) S157-S167
- **B. D. Dudson**, R. O. Dendy, A. Kirk, H. Meyer and G. F. Counsell: [Comparison of L- and H-mode plasma edge fluctuations in MAST](#), PPCF **47** (6) (June 2005) 885 - 901

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2003

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