Dr. Matthew Lilley

http://mattlilley.com/ | enquiries@mattlilley.com

Highly accomplished plasma physicist with extensive experience working in a collaborative research environment on non-linear phenomenon, instabilities and dynamical systems. Experienced in analytical and numerical problem solving techniques. Passionate about pursuing fusion as a sustainable energy source for the future.

Education and Training:

October 2005 - August 2009
Imperial College London, PhD in Plasma Physics

October 2001 – June 2005
University of Warwick, MPhys 1st Class (89%, top of class) in Mathematics and Physics

Research Experience:

Imperial College London, UK

Junior Research Fellow
September 2011 - August 2014
Research focus - Fusion energy: nonlinear modelling of plasma instabilities, electrostatic confinement and particle dynamics in systems with discrete symmetry.

Achievements:

- Published 7 peer reviewed articles in world leading journals in collaboration with national and international laboratories, including an Editor's Highlight Physical Review Letter [8-14]
- Discovered a new class of high frequency instability on the MAST tokamak [14]
- Invited to lecture at York University [F] and UCL [G] and to present invited talks at national [H] and international [I,J] conferences.
- Fostered collaboration with industrial partner, Tokamak Energy, securing a gift of a £1M experimental device
- Constructed and costed a research proposal worth £1.6M involving negotiations with multiple stakeholders
- Coordinated experiments with senior scientists at CCFE and the International Tokamak Physics Activity panel to gather data to foresee and assess risks to ITER

Responsibilities:

- Manage a personal research budget of £25,000 and a student research budget of £12,000
- Supervise research of a PhD student, 2 Masters students and 1 third year student
- Manage and execute personal research programme
- Train postgraduates: lectures in advanced mathematical methods

Chalmers University of Technology, Sweden

Research Associate
September 2009 - August 2011
Research focus - Fusion energy: nonlinear modelling of plasma instabilities

Achievements:

- Successfully built open source MatLab software now used by several laboratories (https://github.com/mklilley/BOT)
- Worked with Integrated Modelling Group Leader at the ITER Organisation to incorporate my theory into modelling tools
- Published peer reviewed articles in world leading journals [6,7]
- Invited to give a summer school lecture [C] and present invited talks at two international conferences [D,E]
- Received a highly competitive Junior Research Fellowship position at Imperial College

Responsibilities:

- Manage and execute personal research programme
- Mentoring and informal supervision of a PhD student
- Training masters students: lectures in electromagnetic waves

Imperial College London, UK

PhD student
September 2005 - August 2009
Research focus - Fusion energy: Compressional Alfvén eigenmodes in spherical tokamaks

Achievements:

- Published several peer reviewed articles on both theoretical and experimental topics in collaboration with national and international laboratories, including a Physical Review Letter [1-5].
- Presented prize winning poster and oral presentations [A] at national and international conferences. Was invited to lecture at the Culham theory meeting [B].
- Organised the 2008 Institute of Physics conference on plasma physics.
- Engaged with MP to promote the importance of fusion to the public.

Responsibilities:

- Manage and execute personal research programme
- Running problem solving classworks for undergraduates
- Mentoring a student with learning difficulties

Other Professional Experience:

Retail Insight, UK

Senior Analyst - Decision Science
July 2015 – December 2015

- Created an algorithm in python to optimise price reductions and times in order to minimise supermarket waste
- Provided informal training for employees to introduce mathematical rigour into their data analysis techniques
- Helped to create a research framework for the company
- Presented results to clients

Level 8 Ltd, UK

Founder
November 2013 – Present

- Founded a company with 2 fellow physicists in order to fund our fusion energy ideas
- Created a hybrid app called Squidler (https://squidler.com) which uses the Ionic framework to run on web, Android and iOS. Server side has been implemented with a node API server using the ActionHeroJS framework and a very fast Redis database for text and MongoDB for media files.

Self employed, UK

Freelance Physicist,Tutor & Developer
September 2014 - Present

- Taught maths and physics to students with a variety of abilities
- Designed and created a brand http://mattlilley.com/ for my services and for others (http://rchapmanharris.com/)
- Became Chief Technology Officer for The Curtain Works. Added new and extended existing features to flesh out the initial site design and took the site live
- Published a peer reviewed article with international collaborators [15]

Publications – Peer Reviewed:

[15] Eriksson F, Nyqvist R M, **Lilley M K**, 2015, Kinetic theory of phase space plateaux in a non-thermal energetic particle distribution, **Physics of Plasmas**, Vol: 22, 092126

[14] Sharapov, S E, **Lilley M K**, et.al, 2014, Bi-directional Alfvén Cyclotron Instabilities in the Mega-Amp Spherical Tokamak, **Physics of Plasmas** Vol:21, 082501

[13] **Lilley M K**, Nyqvist R M, Formation of Phase Space Holes and Clumps, 2014, **Physical Review Letters**, Vol:112, 155002 **- Editor's Highlight**

[12] Meyer H, et.al, 2013, Overview of physics results from MAST towards ITER/DEMO and the MAST Upgrade, **Nuclear Fusion**, Vol:53, 104008

[11] Sharapov S E, et.al, 2013 Energetic Particle Instabilities in Fusion Plasmas, **Nuclear Fusion**, Vol:53, 104022

[10] Gryaznevich M, Svoboda V, Stockel J, et al., 2013, Progress in application of high temperature superconductor in tokamak magnets, **Fusion Engineering and Design**, Vol:88, 1593

[9] Nyqvist R M, **Lilley M K**, Breizman BN, 2012, Adiabatic description of long range frequency sweeping, **Nuclear Fusion**, Vol:52, 094020

[8] **Lilley M K**, Breizman B N, 2012, Convective transport of fast particles in dissipative plasmas near an instability threshold, **Nuclear Fusion**, Vol:52, 094002

[7] Lloyd B, Akers RJ, Alladio F, et al., 2011, Overview of physics results from MAST, **Nuclear Fusion**, Vol:51, 094013

[6] **Lilley M K**, Breizman BN, Sharapov SE, 2010, Effect of dynamical friction on nonlinear energetic particle modes, **Physics of Plasmas**, Vol:17, 092305

[5] Meyer H, Akers RJ, Alladio F, et al., 2009, Overview of physics results from MAST, **Nuclear Fusion**, Vol:49, 104017

[4] **Lilley M K**, Breizman B N, Sharapov SE, 2009, Destabilizing Effect of Dynamical Friction on Fast-Particle-Driven Waves in a Near-Threshold Nonlinear Regime, **Physical Review Letters**, Vol:102, 195003

[3] Zhang Y, Heidbrink WW, Zhou S, et al., 2009, Doppler-shifted cyclotron resonance of fast ions with circularly polarized shear Alfven waves, **Physics of Plasmas**, Vol:16, 055706

[2] Gryaznevich M P, Sharapov SE, **Lilley M**, et al., 2008, Recent experiments on Alfven eigenmodes in MAST, **Nuclear Fusion**, Vol:48, 084003

[1] **Lilley M K**, Sharapov S E, 2007, Compressional Alfven and ion-ion hybrid modes in the deuterium-tritium plasma of a spherical tokamak power plant**, Physics of Plasmas**, Vol:14, 082501

Invited Talks:

[J] 55th Sherwood Fusion Theory Conference, On the Formation of Phase Space Holes and Clumps, 2014

[I] European Physical Society Plasma Physics Conference, Energetic Particle Modes from bump on tail to tokamak, 2012

[H] Institute of Physics Plasma Physics Conference, Nonlinear wave-particle interactions in plasmas, 2012

[G] UCL, Feeling the Fusion Burn, 2013

[F] York Plasma Institute, Dynamics of a nonlinear resonance, 2011

[E] European Fusion Theory Conference, Nonlinear energetic particle modes: from bump on tail to tokamak, 2011

[D] 12th IAEA TCM on Energetic Particles in Magnetic Confinement Systems, Nonlinear energetic particle modes: from bump on tail to tokamak, 2011

[C] ITER Summer School, Nonlinear energetic particle modes: from bump on tail to tokamak, 2011

[B] Culham Theory Meeting – January, Destabilizing effect of dynamical friction on fast particle driven waves, 2009

[A] 50th Sherwood Fusion Theory Conference, Destabilizing effect of dynamical friction on fast particle driven waves – PRIZE WINNER, 2009