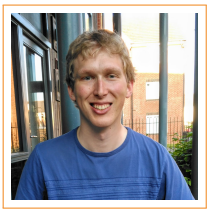

163 Pinnocks Way,
Oxford, OX2 9DF, UK
+44 75216 55595
tom.farley@ukaea.uk
www-users.york.ac.uk/~tpmf500
tom-farley-49021a98
github.com/TomFarley

Tom Farley

I am an experimental plasma physicist interested in the study of the tokamak scrape-of layer. I have experience analysing visible and infra-red camera data for the study of particle and energy transport respectively. I also have hands on experience working on small scale RF plasma experiments performing Langmuir probe measurements.

Education

PhD

Fusion Centre for Doctoral Training (Fusion CDT), **2013–**
University of Liverpool.

- Received a broad grounding in fusion research through taught courses at The University of York:
  - Courses included MCF and ICF relevant plasma physics, diagnostic techniques, data analysis, materials science, statistics, high performance computing and project management.
  - Qualified to receive the FuseNet Certificate of Doctoral Training.

Integrated Masters

Masters in Physics with Industrial Experience (F305), **2009–2013**
The University of Bristol, First Class Honours.

- Received letters of commendation from the head of the School of Physics in 1st and 2nd years and a project commendation for my MSci project.

Research Experience

PhD

Visual camera measurements of filamentary transport in MAST, **Jan 2016–**
Culham Centre for Fusion Energy.

- Developed the Elzar suite of analysis tools for the identification, measurement and tracking of plasma filaments in fast camera data.
- Applied pseudo Langmuir probe techniques to fast camera analysis for like with like comparison to large body of literature.
- Joined trip to the HL-2A tokamak in Chengdu, China performing reciprocating probe measurements of the effects of fuelling on scrape-off layer profiles.
- Performed experiential work for PPCF paper [3] and assisted in [4].

Measurements of negative ion surface production from diamond materials, **Jan–March 2015**
PIIM Laboratory, Aix-Marseilles University, Marseilles, France.

- Measured negative ions produced upon positive ion bombardment of diamond surfaces with a mass spectrometer and energy analyser.
- Performed first of a kind measurements of monocrystaline diamond and extensively characterised temperature dependent properties of nanocrystaline diamond, contributing to publication [1].

Characterisation of Small Negative Ion Facility, **Sep–Dec 2014**
Culham Centre for Fusion Energy.
- Commissioned the Langmuir probe and high resolution visible spectrometer diagnostics on the Small Negative Ion Facility (SNIF).
- Identified and fixed RF earthing issues, improving performance of the plasma source.
- Performed spectroscopic measurements of the ion source plasma composition, contributing to publication [2].

Langmuir probe and laser photo-detachment measurements of electronegative plasmas, **March–Sep 2014**
University of Liverpool.
- Performed laser photo-detachment measurements of negative ion density in oxygen and hydrogen magnetron plasmas under various conditions.
- Performed langmuir probe measurements of plasma density and temperature in a weakly magnetised plasma.

Masters Project

DFT calculations of the superconducting properties of the YIr_2Si_2 polymorphs, **Sep 2012–Sep 2013**
University of Bristol.
- Performed Density Functional Theory (DFT) *ab initio* calculations of the band structure and Fermi surface properties of the polymorphs of YIr_2Si_2.
- Predicted a superconducting transition temperature of $T_c = 2.58$K explained by intermediate-strength conventional electron-phonon coupling, resulting in a publication [5].

Undergraduate

Infra-red measurements of scrape-off layer power decay length in JET, **Aug 2011–Aug 2012**
Culham Centre for Fusion Energy.
- Developed the tools required to measure the plasma scrape-off layer power decay length from infra-red images of the interior of the JET tokomak.
- Analysed a large dedicated pulse database, the results of which led to a publication in Nuclear Fusion [6] and were presented by my supervisor at the 2012 IAEA conference [7].
- Tools are now used by others and have initiated similar measurements on the COMPASS tokamak.

Publications

[1] G. Cartry, D. Kogut, K. Achkasov, J.-M. Layet, T. Farley et al. *Alternative solutions to caesium in negative-ion sources: a study of negative-ion surface production on diamond in H 2 /D 2 plasmas*. New J. Phys., **19** (4):25010 (2017).

[2] J. Zacks, U. Fantz, T. Farley I. Turner, R. McAdams, et al. *Characterisation of the SNIF ion source*. **030047**:030047 (2017).

[3] F. Militello, N. R. Walkden, T. Farley W. A. Gracias, J. Olsen, et al. *Multi-code analysis of scrape-off layer filament dynamics in MAST*. Plasma Phys. Control. Fusion, **58** (10):105002 (2016).

[4] N. Walkden, F. Militello, J. Harrison, T. Farley S. Silburn, et al. *Identification of intermittent transport in the scrape-off layer of MAST through high speed imaging*. Nucl. Mater. Energy, **0**:1–6 (2016).

[5] D. Billington, S. Nickau, T. Farley and J. Ward. *ElectronâĂŞPhonon Coupling and Superconducting Critical Temperature of the YIr2Si2 and LaIr2Si2 High-Temperature Polymorphs from First-Principles*. J. Phys. Soc. Japan, **83** (4):1–5 (2014).

[6] G. Arnoux, T. Farley C. Silva, S. Devaux, M. Firdaouss, et al. *Scrape-off layer properties of ITER-like limiter start-up plasmas in JET*. Nucl. Fusion, **53** (7) (2013).

[7] G. Arnoux, C. Silva, M. Brix, H. Bufferand, S. Devaux, et al. *Scrape-off Layer Properties of ITER-like Limiter Start-up Plasmas at JET*. In *Scrape-off Layer Prop. ITER-like Limiter Start-up Plasmas JET* (2012).

[8] I. Nunes, V. Riccardo, P. J. Lomas, P. D. Vries, D. Alves, et al. *Be tile power handling and main wall protection*. In *24th IAEA Fusion Energy Conf.*, pages CN–197. San Diego, USA (2012).

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Conferences and Workshops

Oral

Fusion Frontiers and Interfaces Workshop, *York*, **May 2017**
Fast Camera Analysis of Plasma Filaments.

Posters

59th Annual Meeting of the APS Division of Plasma Physics), **Oct 2017**
Milwaukee, Wisconsin, USA,
Fast Camera Analysis of Plasma Filaments.

44th IOP Plasma Physics Conference, *Oxford, UK*, **April 2017**
An Algorithm for the Analysis of Filaments in Fast Camera Data.

Fusion Frontiers and Interfaces Workshop, *York, UK*, **May 2016**
Pseudo Langmuir Probe Analysis of Filaments in MAST Using Fast Cameras.

FuseNet PhD Workshop, *Lisbon, Portugal*, **Nov 2014**
The SNIFF Caesium Free Negative Ion Source.

4th International Symposium on Negative Ions, Beams and Sources, **Oct 2014**
IPP Garching, Germany,
Caesium Free Negative Ion Sources.

Fusion Frontiers and Interfaces Workshop, *York, UK*, **May 2014**
Laser Photo-detachment Measurements of Negative Ion Density.

Responsibilities

Groups

Software Developers Working Group, *Member of the Culham Software Developers Working Group (SDWG)*. **2017–**
Site wide body responsible for coordinating resources for software developers.

Meetings

Coding Discussion Group, *Founder and coordinator of the Culham Coding Discussion Group (CDG).* **2017–**
Fortnightly meetings with online resources to share programming knowledge, expertise and resources.

Supervision

Masters student, Supervised masters student from University of Rome, Italy working on filament tracking for masters project. **4 months**

Undergraduate project, Supervised 3rd year undergraduate student from University of Cagliari, Italy working on filament detection for BSc project. **3 months**

Outreach

MAST-U tours: Frequently lead MAST-U tours for visitors, open evening and open day attendees.

GCSE work experience: Supervised GCSE work experience student on placement at CCFE.

Sun dome: Helped with sun dome science workshop at local primary school.

Key Competencies

- **Experimental experience**
  - Experience working with r.f. plasma sources, compressed gas, vacuum systems and pumps and lasers.
  - Experience performing plasma measurements with langmuir probes, mass spectrometers and visible spectrometers.
- **Programming experience**
  - Experienced python programmer, OOP, TDD and HPC principals.
  - Experience with C, IDL and MATLAB.
  - Familiarity with C++, Bash scripting, Perl, Visual Basic and Fortran.
  - Experienced user of git version control and the the LaTeX typesetting language.
- **Organisational skills**
  - Excellent organisational skill, drawing up plans, maintaining detailed records and managing time effectively.
- **Communication skills**
  - Communicate technical information in a competent and accessible manner, both verbally and in writing.
  - Perform well in a team, integrating readily into different teams and environments.

Affiliations

Member of the **Institute of Physics**. **2013–**

Member of the **American Physical Society**. **2017–**

References

Prof. James Bradley
Professor and Head of Group
Department of Electrical Engineering and Electronics
University of Liverpool
Liverpool, L69 3GJ, UK
J.W.Bradley@liverpool.ac.uk
+44 (0)151 794 4545

Dr James Harrison
Deputy Head of Tokamak Science
Culham Centre for Fusion Energy
Office: D3/2.04
Culham Science Centre
Abingdon, OX14 3DB, UK
James.Harrison@ukaea.uk
+44(0) 1235 46 6209

Professor Antony Carrington
Personal tutor
HH Wills Physics Laboratory
University of Bristol
Tyndall Avenue
Bristol
BS8 1TL
A.Carrington@bristol.ac.uk
+44 (0)117 928 8713

Upd
web

Tom Farley
163 Pinnocks Way,
Oxford, OX2 9DF, UK
+44 75216 55595
tom.farley@ukaea.uk
www-users.york.ac.uk/~tpmf500

UKAEA recruitment team
Culham Centre for Fusion Energy
Culham Science Centre
Abingdon
OX14 3EB

February 4, 2018

Application for position of *Scrape-Off Layer Turbulence Physicist*

Dear Sir or Madam,

I should like to express my interest in the role of *Scrape-Off Layer Turbulence Physicist*, for which I feel I am particularly well suited and I hope to demonstrate why. I see MAST-U with its unique visible imaging capabilities, cutting edge fast framing cameras, versatile divertor science facility and powerful mid-plane reciprocating probe system as an extremely exciting opportunity for significantly advancing our understanding of scrape-off layer (SOL) physics. In particular, it will be fascinating to investigate the effects of the super-X divertor and varied divertor and detachment regimes on both upstream and divertor SOL dynamics.

My PhD project as part of the Fusion CDT, entitled '*Analysis of Scrape-Off Layer Plasma Filaments Through Fast Visible Imaging*', has given me a strong background in SOL physics, particularly filamentary transport of particles. I am already an expert in the analysis of fast visible camera data on MAST and I see this position as the perfect opportunity to develop this expertise further, particularly in taking advantage of the stereoscopic imaging measurements that will be possible on MAST-U. My existing familiarly with the MAST-U tokamak and its visual camera and Langmuir probe systems will enable me to quickly start applying MAST-U's diagnostics to their full potential.

My work performing novel SOL power decay length measurements using IR thermography on JET further demonstrates my experience with SOL physics, imaging measurements and working within different groups. My work on neutral beam negative ion sources has provided me with valuable experience working hands on with vacuum systems and performing Langmuir probe measurements in weakly magnetised RF plasmas. I am highly proficient in python and have developed the large, sophisticated Elzar suite of tools for enhancing, analysing and reviewing fast camera data. I am extremely organised and believe I will operate the diagnostic systems with efficiency, applying good practises and maintaining good records of measurements, adaptations and changes. I appreciate my experience with electrical probes is not at the same level as that with imaging techniques, but I believe I can rapidly develop these skills. My strong record of publications at this early stage in my career, with contributions towards 8 publications and a first author paper in preparation, demonstrate my proven ability to conduct high quality scientific research.

While my anticipated thesis submission date is early 2019, I hope my strengths and experience in the area will justify a later start date for the position. I attach my CV with further evidence of my suitability for this position and I would be grateful for the opportunity to demonstrate my capabilities further at interview. I look forward to hearing from you.

Yours faithfully,

Tom Farley

Attached: curriculum vitæ

Describe a situation where you have had to deliver something, be it a project or service, to a high standard. How did you know it reached the standard required? Is there anything you could have done to improve what you delivered? (Please provide examples where appropriate)

At the commencement of my current PhD project, a deadline within the group was fast approaching for an Enabling Research project focusing on the benchmarking of a number of plasma turbulence codes. I was tasked with delivering the experimental camera measurements of scrape-off layer filaments with which to initialise the codes and compare their output. I thus had to get up to speed quickly with the project and develop the required analysis tools. I made sure to get clear descriptions of the requirements so as to ensure I delivered the required results. Regular checks with colleagues ensured the measurements met the standards requested, which were ultimately confirmed by the peer review process with which the resulting paper was assessed. This experience taught me how I could improve the recording of data and the settings used to produce them, for the purposes of data provenance and guiding subsequent work.

Describe a time when you have worked well and achieved success with a group of others. What was the outcome? What was your contribution? (Please provide examples where appropriate)

During training as part of the Fusion CDT course I undertook a group project with 4 others to design a hypothetical diagnostic which was not implemented on an existing or planned tokamak. We were located geographically across 4 universities and so had to plan, communicate, share resources and combine our output efficiently using online tools. I took a proactive role in scheduling our meetings, maintaining good communication and keeping the group to schedule. In the early stages of the project I reviewed possible diagnostic ideas and compared my findings with the other team members. From a shortlist, we decided the most feasible and effective option was a laser-induced breakdown spectroscopy diagnostic to study erosion, deposition and fuel retention in the ITER divertor. I produced a document on Google Drive summarising the physics case, technical requirements and key unsolved questions relating to the project, which the team used to collate our findings and update information as new literature was discovered. This enabled us to work as a cohesive team combining each individual's contribution effectively. We broke up the requirements for the project amongst the group and I took responsibility for the project management plan, formulating the work breakdown structure. This required learning to use new software and techniques and maintaining close contact with my fellow team members to coordinate component lead times and personnel effort to ensure the project schedule, critical path and costs would meet externally imposed ITER requirements. The project was assessed through a report and presentation to which we each contributed a section. The project was awarded a distinction with the highest marks in the project awarded to the management plan that I worked on, which was described in feedback as "extremely well thought through and presented".

Describe one of your biggest challenges where you had to persevere to succeed. What happened and what did you learn from this? (Please provide examples where appropriate)

During my PhD I collaborated with a group at PIIM Laboratory at Aix-Marseilles University, measuring negative ion surface production from diamond materials. I had been allocated 10 weeks of experimental time on a specialised mass-spectroscopy experiment, but on arrival was informed there was a backlog of users requiring time on the apparatus. As a result, it was not until 6 weeks into my visit that I had the planned exclusive access to the apparatus in order to make my measurements. This led to a great deal of time pressure to achieve my goals. Thus I learnt to apply the risk mitigation strategies developed in my grant proposal to achieve the best outcome. I took part in the other user's experiments to gain as much experience with the apparatus as possible before starting my measurements, assigned contingency time and switched to prioritising one of the two planned sets of measurements. The initial period was also used to perform modelling work to better inform the experiments. I formed detailed, structured plans and sought advice from others to ensure my experimental time was used as efficiently as possible. Despite being a hectic and stressful period, through effective planning, time management and perseverance, I succeeded in meeting my key goals. These included fully characterising the negative ion surface production properties of nanocrystalline diamond materials for the first time, eliciting interesting high temperature behaviour. The project had many valuable outcomes and led in part to a journal publication.

Please describe your motivation for working at UKAEA.

I see global warming and global energy security as two of the most pressing issues of our time and the pursuit of fusion energy as a vital endeavour in ensuring the most positive future. I see UKAEA with its two flagship fusion experiments and world leading expertise as the best place to contribute to this most valuable and rewarding of undertakings with the potential to benefit many generations to come. At MAST-U in particular the unique capabilities of its fast visible cameras, divertor science facility and super-X divertor present an exciting opportunity to make unique and challenging measurements to better inform our understanding of scape-off layer transport.