Dr Matthew Duff

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Research Interests

The focus of my research career to date has been intense laser-matter interactions, specifically, the influence of quantum electrodynamics (QED) effects in laser-solid interactions. My research has involved a combination of experimental, computational and theoretical investigations.

Education

PhD in ultra-intense laser-plasma interactions - University of Strathclyde (10/2015-03/2019)
Research topic: High-fields physics effects in ultra-intense laser-plasma interactions

MSc Fusion Energy - University of York (09/2014-09/2015)
Subjects read: Plasma physics, computational methods, nuclear physics

BSc (Hons) Mathematical Physics - University of Edinburgh (09/2010-05/2014)
Subjects read: Quantum physics, quantum theory, electrodynamics, computational physics

Research Experience

- Theoretical modelling – Experience in developing analytical models of intense light-matter interactions
- Computer languages – Matlab, Python, Visual Basic, C
- International experience – Delivered oral and poster presentations at numerous national and international conferences
- Experimental experience – Participated in numerous high-power laser experiments at facilities including the Rutherford Appleton Laboratory and GSI, Darmstadt
- Numerical simulations – Skilled in the design and running of numerical simulations, including the use of supercomputing facilities such as ARCHER and ARCHIE-WEST
- Project management – Experienced in the Agile and waterfall management strategies

Employment History

- University of Strathclyde - Research Assistant (04/2019-09/2019)
  Continued theoretical and computational investigations of high-field physics phenomena, planned and participated in high-power laser experiments
- University of York - Teaching Assistant (09/2014-03/2015)
  Marked assessments and provided feedback on undergraduate assignments
- Culham Centre for Fusion Energy - Summer Research Student (06/2014-08/2014)
  Ran and analysed numerical simulations of MHD instabilities, produced report and presented results

Leading author publications

1. **M. J. Duff**, R. Wilson, M. King, B. Gonzalez-Izquierdo, R. Gray, A. Higginson, S. D. R. Williamson, Z. E. Davidson, R. Capdessus, N. Booth, S. Hawkes, D. Neely and P. McKenna. `High power light emission with tunable modes and polarization via a laser-driven relativistic aperture', Scientific Reports 10, 105 (2020)

2. **M. J. Duff**, R. Capdessus, C. P. Ridgers and P. McKenna. `Multi-stage scheme for non-linear Breit-Wheeler pair-production utilising ultra-intense laser-solid interactions', Plasma Physics and Controlled Fusion 61, 094001 (2019)
3. **M. J. Duff**, R. Capdessus, D. Del Sorbo, C. P. Ridgers, M. King and P. McKenna. `Modelling the effects of the radiation reaction force on the interaction of thin foils with ultra-intense laser fields', Plasma Physics and Controlled Fusion 60, 064006 (2018)

Other notable publications

1. Dr R E Belford, K R Ross and **M. J. Duff**, "High Power Pulsed and CW Laser Damage, Understanding the Differences in Pulsed and CW Damage", Whitepaper, Electro Optics Magazine, (May 2020)
2. J. M. Cole, K. T. Behm, E. Gerstmayer, T. G. Blackburn, J. C. Wood, C. D. Baird, **M. J. Duff,** C. Harvery, A. Ilderton, A. S. Joglekar, K. Krushelnick, S. Kuschel, M. Marklund, P. McKenna, C. D. Murphy, K. Poder, C. P. Ridgers, G. M. Samarin, G. Sarri, D. R. Symes, A. G. R. Thomas, J. Warwick, M. Zepf, Z. Najmudin and S. P. D. Mangles, Phys. Rev. X 8, 011020 (2018)
3. K. Poder, M. Tamburini, G. Sarri, A. Di Piazza, S. Kuschel, C. D. Baird, K. Behm, S. Bohlen, J. M. Cole, D. J. Corvan, **M. J. Duff**, E. Gerstmayr, C. H. Keitel, K. Krushelnick, S. P. D. Mangles, P. McKenna, C. D. Murphy, Z. Najmudin, C. P. Ridgers, G. M. Samarin, D. R. Symes, A. G. R. Thomas, J. Warwick and M. Zepf, Phys. Rev. X 8, 031004 (2018)
4. R. Capdessus, M. King, D. Del Sorbo, **M. J. Duff**, C. P. Ridgers and P. McKenna, Sci. Rep. 8, 9155 (2018)
5. D. Del Sorbo, D. R. Blackman, R. Capdessus, K. Small, C. Slade-Lowther, W. Luo**, M. J. Duff**, A. P. L. Robinson, P. McKenna, Z. M. Sheng, J. Pasley and C. P. Ridgers, New J. Phys. 20, 033014 (2018)
6. D. Del Sorbo, D. R. Blackman, R. Capdessus, K. Small, C. Slade-Lowther, W. Luo**, M. J. Duff**, A. P. L. Robinson, P. McKenna, Z. M. Sheng, J. Pasley and C. P. Ridgers, Proc. SPIE 10241 (2017)
7. K. Behm, J. M. Cole, A. S. Jogelkar, E. Gerstmayr, J. C. Wood, C. D. Baird, T. G. Blackburn, **M. J. Duff**, C. Harvey, S. Kuschel, S. P. D. Mangles, M. Marklund, P. McKenna, C. D. Murphy, Z. Najmudin, K. Poder, C. P. Ridgers, G. Sarri, G. M. Samarin, D. Symes, J. Warwick, M. Zepf, K. Krushelnick and A. G. R. Thomas, Review of Scientific Instruments 89, 113303 (2018)