PERSONAL

- **Name**: Dr. Simon A. Haine
- **Contact Details**:

email: simon.a.haine@gmail.com
mobile: (+61) 0474 964 745 (preferred)

EDUCATION

- **Doctor of Philosophy**: The Australian National University, (December 2007).

  Thesis: *'An Atom Laser for Quantum-Atom Optics'*.

- **Undergraduate**: BSc (1st class hons), The Australian National University, 2002.

  Honours thesis: *'The Stability of a Continuously Pumped Atom Laser'*.

EMPLOYMENT HISTORY

- Marie Curie-Sklodowska Fellow, University of Sussex (August 2016 to present).
- Australian Research Council Discovery Early Career Research Fellow, University of Queensland (01/01/2013 - 20/05/2016).
- Lecturer of Physics, University of Queensland (01/01/2012 - 31/12/2012).
- Australian Research Council Postdoctoral Fellow, University of Queensland (01/01/2009 - 31/12/2011).
- University of Queensland Postdoctoral Research Fellow (01/01/2008 - 31/12/2009).
- Postdoctoral Research Fellow (University of Queensland) (01/05/2007 - 31/12/2007).

RESEARCH INTERESTS

- Quantum Gasses
- Quantum Optics
- Quantum Metrology
- Quantum Information
- Quantum Devices
- Tests of Quantum Decoherence.
- Numerical Modelling

TEACHING

Lecturing at the University of Queensland:

- PHYS2041 (2nd year Quantum Physics, approx. 85 students)
  - Course Coordinator and Lecturer.
  (Semester 2, 2009, 2010, 2011, 2012, 2013, 2014 and 2015).
  - Student evaluation of teaching (out of 5): 4.35, 4.64, 4.69, 4.65, 4.83, 4.79, 4.70.

- PHYS4040 (Honours level Advanced Quantum Mechanics, approx. 15 students)
  - Course Coordinator and Lecturer.
  (Semester 1, 2012 and 2013).
  - Student evaluation of teaching (out of 5): 5.00, 4.91.

- PHYS3020 (3rd year Statistical Mechanics, approx. 40 students)
  - Lecturer.
  (Semester 2, 2012).
  Student evaluation of teaching (out of 5): 4.50.

- Coordinator of undergraduate laboratory program for 2nd year physics (approx. 65 students)
  (Semester 2, 2012).

COMPETITIVE GRANTS

- **Fellowships**
  - "*A Quantum Boost for Atomic Sensors*"
    S. A. Haine, Marie Curie Sklodowska Fellowship (2016-2018).
    (€195,000). Role: Chief Investigator.
  - "*Quantum Enhancement for Ultra-Precise Atomic Sensors*"
    S. A. Haine, ARC Discovery Early Career Researchers Award (DECRA) (2013-2015).
    (DE130100575, $375,000). Role: Chief Investigator.
  - "*Fundamental tests of Quantum Mechanics with the Atom Laser*"
    S. A. Haine, ARC Postdoctoral Fellowship (2009-2011).
    (DP0986893, $240,000). Role: Chief Investigator.
  - University of Queensland Postdoctoral Fellowship
    S. A. Haine, (2008-2010, terminated in 2009 due ARC fellowship success).
    ($240,000). Role: Chief Investigator.

- **Other Grants**
  - "*Superfluidity and Metrology with Ring-Shaped Bose-Einstein Condensates*"
    H. Rubinsztein-Dunlop, N. R. Heckenberg, **S. A. Haine**, G. J. Milburn, W. D. Phillips, C. M. Caves, ARC Discovery (2009-2011).
    (DP098512, $635,000). Role: Chief Investigator.
  - "*Advanced Superfluid Physics Facility*"
    W. Bowen, M. Bromley, M. Davis, A. Fedorov, **S. A. Haine**, K. Kheruntsyan, I. McCulloch, L. Madsen, D. McAuslan, G. Milburn, E. Moore, E. Namdas, A. Naesby,

T. Plakhotnik, B. Powell, A. Rakic, H. Rubinsztein-Dunlop, E. Sheridan, T. Stace, M. Vanner, A. White. (2015).
(UQ Major Equipment and Infrastructure Grant, $161,000). Role: Chief Investigator.

- "*University of Queensland Res-Teach Program*"
  S. A. Haine (2009, 2010, 2011, 2013, and 2014)
  ($45,000). Role: Chief Investigator.
- "*Embedding Computational Skills in Core Physics Courses*"
  J. Corney, **S. A. Haine**, T. J. McIntyre (UQ SMP Teaching and Learning Committee grant, 2015). ($2,000). Role: Chief Investigator.

Research Student Supervision

PhD students:

- Michail Kritsotakis (principal supervisor, 2016-present).
- Behnam Tonekaboni (principal supervisor, 2015-present).
- Samuel Nolan (principal supervisor, 2014-present).
- Geoffrey Lee (associate advisor, 2007-2012, Graduated Feb 2013).
- Jacopo Sabatini (associate advisor, 2008-2012, Graduated June 2012).

Masters Students:

- Jessica Butcher (associate advisor, 2009-2011, Graduated June 2012)

Honours Students:

- Joseph Lau (Graduated 2012, 1st Class Hons., University Medal).
- Christopher Raymond (Graduated 2013, 1st Class Hons.).
- Samuel Nolan (Graduated 2013, 1st Class Hons.).
- Sarah Lau (Graduated 2013, 1st Class Hons.).
- Samantha Hood (Graduated 2014, 1st Class Hons.).
- Jamie Feiss (Graduated 2016).

Undergraduate Research Students:

I have been the primary supervisor for approximately 20 undergraduate research projects as part of the University of Queensland's "Summer Research", "Advanced Studies Program in Science (ASPinS)", and "Capstone" undergraduate research programmes.

PUBLICATIONS

Peer-Reviewed Journals

(citation data from google scholar, 08/08/2018)

1. *'Using Interaction-Based Readouts to Approach the Ultimate Limit of Detection Noise Robustness for Quantum-Enhanced Metrology in Collective Spin Systems'*
   S. A. Haine
   arXiv:1806.00057 (2018) [0 citations]

2. *'Robustifying twist-and-turn entanglement with interaction-based readout'*
   S. S. Mirkhalaf, S. P. Nolan, **S. A. Haine**
   Physical Review A **97**, 053618 (2018) [3 citations]

3. *'Quantum Noise in Soliton Matterwave Interferometry'*
   S. A. Haine
   New Journal of Physics **20**, 033009 (2018) [2 citations]

4. *'Optimal Matterwave Gravimetry'*
   M. Kritsotakis, S. S. Szigeti, J. A. Dunningham, **S. A. Haine**
   arXiv:1710.06340 (2017) [1 citation]

5. *'Optimal and Robust Quantum Metrology Using Interaction-Based Readouts'*
   S. P. Nolan, S. S. Szigeti, and **S. A. Haine**
   Phys. Rev. Lett. 119, 193601 (2017) [11 citations]

6. *'Quantum Fisher information as a predictor of decoherence in the preparation of spin-cat states for quantum metrology'*
   S. P. Nolan and **S. A. Haine**
   Phys. Rev. A **95**, 043642 (2017). [7 citations]

7. *'Pumped-up SU11 interferometry'*
   S. S. Szigeti, R. J. Lewis-Swan, **S. A. Haine**
   Phys. Rev. Lett. 118, 150401 (2017). [24 citation]

8. *'Mean-field Dynamics and Fisher Information in Matterwave Interferometry'*
   S. A. Haine
   Phys. Rev. Lett. 116, 230404 (2016). [10 citations]

9. *'Bose-Einstein condensation in large time-averaged optical ring potentials'*
   T. A. Bell, J. Glidden, L. Humbert, M. Bromley, **S. A. Haine**, M. J. Davis, T. Neely, M. A. Baker, H. Rubinsztein-Dunlop
   New J. Phys. **18**, 035003 (2016). [36 citations]

10. *'Generation of Atom-Light Entanglement in an Optical Cavity for Quantum Enhanced Atom-Interferometry'*
    S. A. Haine and W. Y. S. Lau
    Phys. Rev. A **93**, 023607 (2016). [8 citations]

11. *'Quantum Enhanced Measurement of Rotations with a Spin-1 Bose-Einstein Condensate in a Ring Trap'*

S. P. Nolan, J. Sabbatini, M. W. J. Bromley, M. J. Davis, and **S. A. Haine**
Phys. Rev. A **93**, 023616 (2016). [8 citation]

12. *'Quantum metrology with mixed states: When recovering lost information is better than never losing it'*
S. A. Haine and S. S. Szigeti
Phys. Rev. A **92**, 032317 (2015). [16 citations]

13. *'Coherence and linewidth of a continuously pumped atom laser at finite temperature'*
G. M. Lee, **S. A. Haine**, A. S. Bradley, and M. J. Davis
Phys. Rev. A **92**, 013605 (2015). [1 citation]

14. *'Heisenberg-Limited Metrology with Information Recycling'*
S. A. Haine, S. S. Szigeti, M. D. Lang, and C. M. Caves
Phys. Rev. A **91**, 041802(**R**) (2015). [19 citations]

15. *'Heisenberg-limited metrology with a squeezed vacuum state, three-mode mixing, and information recycling'*
B. Tonekaboni, **S. A. Haine** and S. S. Szigeti
Phys. Rev. A **91**, 033616 (2015). [7 citations]

16. *'Squeezed-light-enhanced atom interferometry below the standard quantum limit'*
S. S. Szigeti, B. Tonekaboni, W. Y. S. Lau, S. N. Hood, and **S. A. Haine**
Phys. Rev. A **90**, 063630 (2014). [23 citations]

17. *'Self-induced spatial dynamics to enhance spin squeezing via one-axis twisting in a two-component Bose-Einstein condensate'*
S. A. Haine, J. Lau, R. P. Anderson, and M. T. Johnsson
Phys. Rev. A **90**, 0023613 (2014). [11 citations]

18. *'Information recycling beam-splitters for atom-interferometry with enhanced sensitivity'*
S. A. Haine
Phys. Rev. Lett. 110, 053002 (2013). [21 citations]

19. *'Surpassing the standard quantum limit in an atom interferometer with four-mode entanglement produced from four-wave mixing'*
S. A. Haine and A. J. Ferris,
Phys. Rev. A **84**, 043624 (2011). [14 citations]

20. *'Optically trapped atom interferometry using the clock transition of large Rb-87 Bose-Einstein condensates'*
P. A. Altin, G. McDonald, D. Doring, J. E. Debs, T. Barter, N. P. Robins, J. D. Close, **S. A. Haine**, T. M. Hanna, R. P. Anderson
New Journal of Physics, **13**, 065020 (2011). [22 citations]

21. *'Dynamic scheme for generating number squeezing in Bose-Einstein condensates through nonlinear interactions'*
S. A. Haine and M. T. Johnsson
Phys. Rev. A, **80**, 023611, (2009). [32 citations]

22. *'Observation of shock waves in a large Bose-Einstein condensate'*

R. Meppelink, S. B. Koller, J. M. Vogels, P. van der Straten, E. D. van Ooijen, N. R. Heckenberg, H. Rubinsztein-Dunlop, **S. A. Haine**, and M. J. Davis, Phys. Rev. A, **80** 043606 (2009). [49 citations]

23. *'From Squeezed Atom Lasers to Teleportation of Massive Particles'* M. K. Olsen, **S. A. Haine**, A. S. Bradley, and J. J. Hope Eur. Phys. J. Special Topics, **160**, 331-342 (2008). [7 citations]

24. *'Generating Quadrature Squeezing in an Atom Laser through Self-Interaction'* M. T. Johnsson and **S. A. Haine** **Phys. Rev. Lett. 99** 010401 (2007). [38 citations]

25. *'Raman scheme to measure the quantum statistics of an atom laser beam'* A. S. Bradley, M. K. Olsen, **S. A. Haine** and J. J. Hope Phys. Rev. A **76**, 033603 (2007). [14 citations]

26. *'Quantum Statistical measurements of an atom laser beam'* M. K. Olsen, A. S. Bradley, **S. A. Haine** and J. J. Hope Nuclear Physics A, **790**, 733c (2007). [1 citations]

27. *'Semiclassical limits to the linewidth of an atom laser'* M. T. Johnsson, **S. A. Haine**, J. J. Hope, N. P. Robins, C. Figl, M. Jeppesen, J. Dugue, and J. C. Close Phys. Rev. A **75**, 043618 (2007). [17 citations]

28. *'Generating controllable atom-light entanglement with a Raman atom laser system'* **S. A. Haine**, M. K. Olsen, and J. J. Hope **Phys. Rev. Lett. 96**, 133601 (2006). [51 citations]

29. *'Achieving peak brightness in an atom laser'* N. P. Robins, C. Figl, **S. A. Haine**, A. K. Morrison, M. Jeppesen, J. J. Hope, J. D. Close **Phys. Rev. Lett. 96**, 140403 (2006). [57 citations]

30. *'A multi-mode model of a non-classical atom laser produced by outcoupling from a Bose-Einstein condensate with squeezed light'* **S. A. Haine** and J. J. Hope Laser Phys. Lett. **2** No. 12, 597-602 (2005). [14 citations]

31. *'Outcoupling from a Bose-Einstein condensate with squeezed light to produce entangled atom laser beams'* **S. A. Haine** and J. J. Hope Phys. Rev. A. **72**, 033601 (2005). [67 citations]

32. *'Stabilizing an atom laser using spatially selective pumping and feedback'* M. Johnsson, **S. A. Haine**, and J. J. Hope. Phys. Rev. A **72** 053603 (2005). [12 citations]

33. *'Fluctuations and flux: The limits of multi-state atom lasers'* N. P. Robins, C. M. Savage, J. J. Hope, J. E. Lye, C. S. Fletcher, **S. A. Haine** and J. D. Close. Phys. Rev. A **69** 051602(R) (2004). [37 citations]

34. *'Control of an atom laser using feedback'*
S. A. Haine, A. J. Ferris, J. D. Close, and J. J. Hope
Phys. Rev. A **69**, 013605 (2004). [23 citations]

35. *'Mode Selectivity and Stability of Continuously Pumped Atom Lasers'*
S. A. Haine and J. J. Hope
Phys. Rev. A **68**, 023607 (2003). [13 citations]

36. *'Stability of Continuously Pumped Atom Lasers'*
S. A. Haine, J. J. Hope, N. P. Robins, and C. M. Savage
Phys. Rev. Lett. 88, 170403 (2002). [29 citations]

Selected Commentaries of Research

- *'New Sensor Devices Recycle Atoms'*, Phys.org, (April 2017).
- *'Ultra-Precise Sensing Technology Could Benefit Environmental Hydrology Sectors'*, AZOsensors.com, (June, 2016).
- *'New research accelerates next-generation ultra-precise sensing technology'*, Phys.org, (June 2016).
- *'Technology of the Future'*, Feature on popular Australian radio program 'Hack', Triple J radio, (December, 2008).
- *'A step closer to a practical atom laser'*, Physorg.com, (July 2007).
- *'Teleportation, but not as we know it'*, New Scientist, (June 2007).
- *'Atom Lasers at the Limit'*, Nature Physics Portal, (April 2002).

Selected Presentations:

- *'Optimal Matterwave Gravimetry'*, ANZCOP conference, Queenstown (New Zealand), (December 2017).
- *'Quantum Metrology with Ultracold Atoms'*, Departmental Seminar, LENS, Florence (Italy), (November 2017)
- *'Matterwaves and Metrology'*, Departmental Seminar, University of Stathclyde, Glasgow (UK), (August 2017).
- *'Mean-Field Dynamics and Fisher-Information'*, Australian Institute of Physics, Brisbane (Aus), (December 2016).
- *'Matterwaves and Measurement'*, University of Melbourne Departmental Seminar, Melbourne (Aus), (November 2016).
- *'Fisher Information in Matterwave Interferometry'*, Joint Quantum Centre Symposium, Newcastle (UK), (September 2016).
- *'Adventures in Quantum Metrology'*, Departmental Seminar, Australian National University (Aus), (March 2016).

- *'My Research Rules'*, Public Debate as part of National Science Week, Queensland State Library (Aus), (Aug 2015).
- *'When Atoms Are Waves, and other adventures in Quantum Physics'*, Public Lecture, University of Queensland (Aus), (June 2015).
- *'Quantum Enhancement of Atomic Sensors'*, Frontiers of Matterwave Optics, (Greece), (October 2014).
- *'Information Recycling for Enhanced Quantum Metrology'*, Departmental Seminar, Griffith University (Aus), (August 2014).
- *'A Quantum Boost for Atomic Sensors'*, Departmental Seminar, Durham University (UK), (June 2014).
- *'Quantum Sensing with Ultra-Cold Atoms'*, Departmental Seminar, University of Nottingham (UK), (June 2014).
- *'Atomic-Photonic Hybrid Circuits'*, Atomtronics workshop, University of Queensland (Aus), (Nov 2012).
- *'The Theory of Quantum-Atom Optics'*, 3 lectures at the VSSUP summer-school, Melbourne (Aus), (July 2012).
- *'Squeezing the most out of your atom laser'*, International Atom Laser Conference (France), (April, 2010).
- *'Generating Number Squeezing in a Bose-Einstein Condensate through Self Interaction.'*, Quantum-Atom Optics Beyond Bells (Australia) (November 2008).
- *'Measurement and Teleportation of the Quantum State of an Atomic Matterwave'*, International workshop on quantum noise (Aus), (May, 2007).
- *'The Squeezed Atom Laser'*, European and Australian workshop on quantum-atom optics (Aus), (Feb, 2006).

Other Activities:

- University of Queensland LGBT *Ally* representative for the School of Mathematics and Physics (2013-2016).
- Member of the School of Mathematics and Physics Equity and Diversity Committee (2015-2016).
- University of Queensland School of Mathematics and Physics postgraduate day coordinator (2013-2014).
- Member of the University of Queensland Physics Curriculum Review Committee (2013).