Curriculum vitae

Isaac C. D. Lenton

e-mail: isaac@isuniversal.com
Website: http://isaac.isuniversal.com

Education

2017–present **Doctorate of Philosophy (Physics)** The University of Queensland
Expected completion date: 25 January 2021.
Thesis topic: Optical tweezers: experiments and modelling.

2016–2017 **Bachelor of Science (Honours)** The University of Queensland
Research & Coursework, Physics Field of Study
Thesis topic: Finite difference time domain method for modelling optical tweezers.

2012–2015 **Bachelor of Science** The University of Queensland
Physics and Computational Science dual major
Completed Advanced Studies Program in Science (ASPInS)

Research fields and interests

- Computational science and physics
  - Modelling physical/optical phenomenon
  - Writing high performance computer codes
  - Procedural computer graphics and rendering
  - Novel/interesting computing hardware (Intel Phi coprocessors, GPUs, HPC architectures)
  - Computer languages and design patterns
  - Writing codes for computer controlled experiments
- Experimental physics
  - Optical tweezers
  - Engineered light fields
  - Two photon photo-polymerization
  - Lab-on-a-chip optical tweezers systems
  - Imaging through fibres
- Computation in physics education and learning
  - Computer simulations to demonstrate physical concepts
  - Computational exercises in undergraduate physics education

Technical skills

- Competent in various programming languages including C/C++, MATLAB and Python.
- Familiar with computer aided design (CAD) programs (AutoCAD and Autodesk Inventor).
- Experienced using Linux based operating systems. Fedora is currently my operating system of choice.
- Familiar with version management systems (experience using `git` and `svn`).
- Experience using Word, Powerpoint, LaTeX and various spreadsheet programs.
- Familiar with website tools such as WordPress and Jekyll (see https://physics.uq.edu.au/omg for an example of a Jekyll website I developed). Competent with CSS and HTML.

Personal Interests/Hobbies

→ Rock climbing → Scuba-diving → Hiking → Programming/Languages → Computer graphics

Research experience

2017–present **PhD** with Optical Micro-manipulation Group, The University of Queensland.
Working on simulations of optical tweezers including a new release of our groups Optical Tweezers Toolbox and a new toolbox for simulating and controlling spatial light modulators (OTSLM). Gained experience co-supervising undergraduate/honours/masters students and collaborating with other research groups.

2016–2017 **Honours** with Optical Micro-manipulation Group, The University of Queensland.
Developed a finite difference time domain computer code in C++ for simulating optical tweezers. The code extends the range of problems that can be simulated by the optical micro-manipulation group.

2013–2015 **Research projects** with EQuS Atom Optics Lab, The University of Queensland.
Various projects related to incorporating a digital micromirror device (DMD) for generating interesting optical potentials for manipulating Bose-Einstein Condensates (BEC). The projects involved:

- Determining project feasibility by assembling an optical system using a DMD evaluation module.
- Selecting and purchasing a high speed/high resolution DMD for incorporation into the BEC experiment.
- Installing the DMD and BEC imaging system.
- Designing and installing a cooling system for the DMD and laser system.
- Writing computer codes to control the DMD and optimise DMD patterns.
- Building electronics for controlling parts of the system.

The project included components for the ASPInS program and capstone physics course including multiple reports and a forum style presentation at UQ.

2013 **Research project** with Dr Michael Bromley at The University of Queensland.
Working on a Joomla based web interface for computing dipole- and hyper- polarizabilities for different atomic energy levels. Completed as part of the ASPInS program including forum style poster presentation.

2012–2013 **Research project** with Dr Michael Bromley at The University of Queensland.
Developing a pipeline for visualising 5-dimensional wave functions. Involved working with FORTRAN, Python and ParaView.

Employment

2015–2019 **Equipment manager and risk assessor for UQ Science Demo Troupe**
School of Mathematics and Physics, The University of Queensland.
Responsibilities involved writing risk assessments, maintaining equipment and demonstrations, planning new experiments, working in department chemistry lab.

2017–2018 **Casual Learning Designer**
School of Mathematics and Physics, The University of Queensland.
Development of simulations for the Science and Mathematics Simulations (SciMS) project, https://teaching.smp.uq.edu.au/scims/. Development of simulations and teaching material for PHYS2055 and PHYS1171.

2013–2018 **Casual Physics Tutor**
School of Mathematics and Physics, The University of Queensland.
Further details under tutoring experience.

2014–2015 **Casual Research Assistant**
EQuS Atom Optics Lab, The University of Queensland.
Further details under research experience.

Tutoring experience

PHYS3071	Computational Physics	Semester 1, 2017 & 2018
COSC3000	Visualization, Computer Graphics & Data Analysis	Semester 1, 2017
COSC2500	Numerical Methods in Computational Science	Semester 2, 2013, 2015 & 2017
JPhO	UQ Junior Physics Olympiad (Volunteer)	June/July, 2010–2017

Selected feedback from students (COSC2500):

- "Mr Isaac Lenton is my favourite tutor for this course. He is well organised and come prepared to the class. He [was] able to answer any sort of questions well. He is very approachable. He has wide knowledge about this course."
- "Clearly explained concepts and clarified difficulties I was having in the material."
- "Didn't force everyone to solve a problem in the same way – helped us to solve the problems in our own ways."

Supervision experience

2019/2020	**Co-supervision of Oscar Smee, Lauren McQueen, Ling Xu, Connor Bennett, and Lachlan Hamilton.** 6-8 week summer projects. Developed project descriptions with Timo Nieminen. Gained experience running weekly meetings.
2019	**Co-supervision Olivier Neeb**, French masters student, experimental.
2018/2019	**Co-supervision Carter Fairhall**, summer student, experimental/computational.
2018	**Jackson Co-supervision Calvet-Lane**, SCIE/PHYS3051 projects, experimental.
2018	**Co-supervision Gabriel Hogie**, French masters student, experimental.
2018	**Co-supervision Declan Armstrong**, honours student, experimental.
2018	**Co-supervision Kyriakos Tapinou**, capstone student, computational.

Outreach, Talks & Volunteer experiences

- **Lab tours** various groups ranging from 4 to 15 students with varying ages from high-school to post-graduate.
- **Science outreach trips** Multi-day road trips to schools and community centres in rural and costal Queensland talking about and demonstrating physics.
- **Public speaking/workshops**
  * UQ Science demo troupe, multiple performances and workshops for different age groups ranging from primary-school to faculty events. Various group sizes between 10 and 100 people.
  * *Life as a PhD student*, panel discussion for approximately 30 high school students (2020).
  * Assistant at `getafix` (the school of Mathematics and Physics faculty cluster) information session. (multiple years).
  * Speaking to perspective honours students about my experience doing honours (approx. 20 students, Sep. 2018).
- **Contributions to course notes** for COSC2500.

Publications

Summary of citations (as listed on Google Scholar):

- Total citations: 142
- h-index: 4

Peer-reviewed journal articles

1. **ICD Lenton**, AB Stilgoe, TA Nieminen, H Rubinsztein-Dunlop
OTSLM Toolbox for Structured Light Methods
Computer Physics Communications, 107199 (2020)

2. **ICD Lenton**, D Armstrong, AB Stilgoe, TA Nieminen, H Rubinsztein-Dunlop
Orientation of swimming cells with annular beam optical tweezers
Optics Communications 459, 124864 (2020)

3. YL Pan, A Kalume, **ICD Lenton**, TA Nieminen, AB Stilgoe, H Rubinsztein-Dunlop, LA Beresnev, C Wang, JL Santarpia
Optical-trapping of particles in air using parabolic reflectors and a hollow laser beam
Optics Express 27 (23), 33061-33069 (2019)

4. **ICD Lenton**, AB Stilgoe, H Rubinsztein-Dunlop, TA Nieminen
Visual guide to optical tweezers
European Journal of Physics **38**, 034009 (2017)

5. AAM Bui, AB Stilgoe, **ICD Lenton**, LJ Gibson, AV Kashchuk, S Zhang, H Rubinsztein-Dunlop, TA Nieminen
Theory and practice of simulation of optical tweezers
Journal of Quantitative Spectroscopy and Radiative Transfer (2016)

6. G Gauthier, **ICD Lenton**, N McKay Parry, M Baker, MJ Davis, H Rubinsztein-Dunlop, TW Neely
Direct imaging of a digital-micromirror device for configurable microscopic optical potentials
Optica **3**(10), 1136-1143 (2016)

Open source software & contributions

1. **ICD Lenton** et al. *Optical tweezers toolbox*
Updated release of the optical tweezers toolbox including a more user-friendly object orientated interface, graphical user interface and additional features.
https://github.com/ilent2/ott

2. **ICD Lenton** et al. *OTSLM Toolbox for Structured Light Methods*
Toolbox for simulating and controlling spatial light modulators with a focus on optical tweezers experiments.
https://github.com/ilent2/otslm

3. **ICD Lenton**. *sphinx-matlabdoc-builder*
Developed an extension for sphinx to build Matlab style HTML documentation.
https://github.com/ilent2/sphinx-matlabdoc-builder

4. Various contributors. *sphinxcontrib.matlabdomain*
Added `mlapp` documenter and package prefix options.
https://github.com/sphinx-contrib/matlabdomain

Other (non-peer-reviewed) publications

1. **ICD Lenton**
User manual: *OTSLM Toolbox for Structured Light Methods*
Available from http://otslm.readthedocs.org/ (2020)

2. **ICD Lenton**, AAM Bui, TA Nieminen, AB Stilgoe, H Rubinsztein-Dunlop
   Conference paper: *Optical tweezers toolbox: full dynamics simulations for particles of all sizes*
   Optical Trapping and Optical Micromanipulation XV 10723, 107232B (2018)

3. **ICD Lenton**, D Armstrong, J Calvert-Lane, TA Nieminen, AB Stilgoe, H Rubinsztein-Dunlop
   Conference paper: *Measuring the motility and drag forces acting on biological particles using optical tweezers*
   Optical Trapping and Optical Micromanipulation XV 10723 (2018)

4. IA Favre-Bulle, S Zhang, AV Kashchuk, **ICD Lenton**, LJ Gibson, AB Stilgoe, TA Nieminen, H Rubinsztein-Dunlop
   Optical tweezers bring micromachines to biology
   Optics and Photonics News 29 (4), 40-47 (2018)

Conference presentations

1. **ICD Lenton**, AB Stilgoe, TA Nieminen, H Rubinsztein-Dunlop, Understanding particle trajectories by mapping optical force vortices. **Talk** presented at SPIE Photonics West, San Francisco, California, USA (2020).

2. **ICD Lenton**, TA Nieminen, AB Stilgoe, and H Rubinsztein-Dunlop, Meta-trapping: optical forces on meta-materials. **Talk** presented at the 18th Electromagnetic and Light Scattering Conference, Hangzhou, China (2019).

3. **ICD Lenton**, G Volpe, TA Nieminen, AB Stilgoe, and H Rubinsztein-Dunlop, Shining light on particle dynamics with machine learning. **Talk** presented at the 18th Electromagnetic and Light Scattering Conference, Hangzhou, China (2019).

4. **ICD Lenton**, AB Stilgoe, TA Nieminen, H Rubinsztein-Dunlop. A new dynamic optical tweezers toolbox. **Talk** presented at AIP Congress, Perth, Australia (2018).

5. **ICD Lenton**, AB Stilgoe, TA Nieminen, H Rubinsztein-Dunlop. OTSLM: A toolbox for production of flexible structured light. **Poster** presented at AIP Congress, Perth, Australia (2018).

6. **ICD Lenton**, D Armstrong, J Calvert-lane, TA Nieminen, AB Stilgoe and H Rubinsztein-Dunlop. Measuring the motility and drag forces acting on biological particles using optical tweezers. **Poster** presented at SPIE, USA (2018).

7. **ICD Lenton**, AAM Bui, TA Nieminen, AB Stilgoe and H Rubinsztein-Dunlop. Optical Tweezers Toolbox: full dynamics simulations for particles of all sizes. **Poster** presented at SPIE, USA (2018).

8. **ICD Lenton**, AA Bui, A Kashchuk, T Nieminen, A Stilgoe and H Rubinsztein-Dunlop. *Optical tweezers for direct measurement of swimming forces of living cells.* **Poster** presented at IONS KOALA, The University of Queensland, Brisbane, Australia (2017).

9. **ICD Lenton**, AA Bui, A Kashchuk, T Nieminen, A Stilgoe and H Rubinsztein-Dunlop. *Optical tweezers simulations using finite difference time domain method.* **Poster** presented at Symposium on New Frontiers in Optical Trapping and Optical Manipulation, The Institute of Photonic Sciences (ICFO), Barcelona, Spain (2017).

10. **ICD Lenton**, TA Nieminen, AB Stilgoe, H Rubinsztein-Dunlop. *Finite difference time domain method for computationally modelling optical trapping.* **Talk** presented at the joint Asia Pacific Physics Conference and Australian Institute of Physics Congress, Brisbane, QLD, Australia (2016).

11. **ICD Lenton**, N McKay Parry, TW Neely, H Rubinsztein-Dunlop. *Optimisation of digital micromirror device patterns for optical trapping.* **Talk** presented at the Australian Institute of Physics Congress, Australian National University, Canberra, ANU, Australia (2014).