Luke Shingles, PhD

Location	Belfast, Northern Ireland, UK	**LinkedIn**	linkedin.com/in/lukeshingles
Citizenship	Australian, Irish	**GitHub**	github.com/lukeshingles
Email	luke.shingles@gmail.com	**Mobile**	+44 7462 625 608

Personal Statement

I am an experienced researcher with skills in scientific software development, data analysis, and visualisation.

Some of my highlights in research software engineering have included writing high-performance parallel code to numerically solve systems of differential equations (to model chemical enrichment of stellar clusters and high-energy particle interactions), using matrix-based methods for solving large systems of linear equations (to determine atomic level populations), and applying Monte Carlo techniques to simulate photon interactions (radiative transfer) in three dimensions. I have also ported code to run on GPU hardware with Nvidia CUDA, contributed to open source software used by other researchers, and advocated for software engineering best-practices in collaborative projects.

I have a strong track record of obtaining scientific insights from computationally demanding theoretical work, having given over 17 scientific talks at professional conferences and institutes, and published 12 articles in peer-reviewed science journals.

I have contributed as a co-investigator on successful research grant and HPC computing time proposals for international facilities. I enjoy teaching and have chosen to gain experience tutoring and giving lectures for undergraduate physics courses, and co-supervised PhD, Master's, and Google Summer of Code students on a variety of projects in astrophysics and software development.

I expertise in:

- Leading the development of numerically-intensive software in C/C++ (> four years experience full-time employed)

- Multithreading and parallel algorithms (using OpenMP, MPI, and CUDA)

- Debugging, performance profiling, and optimisation (gdb, perf)

- Collaborative development using version control (Git), continuous integration, and automated testing

- Scientific research with publications in peer-reviewed journals (over nine years experience)

- Developing tools to process and visualise large data sets to extract meaningful insights (Python with numpy, pandas, and matplotlib)

- Statistics, differential equations, and linear algebra (machine learning fundamentals)

Education and Employment

Aug 2015 - **Astrophysicist and Software Engineer (Postdoctoral Researcher)**
Mar 2021 *Queen's University Belfast, Northern Ireland*

- Lead developer on a radiative transfer code for large-scale simulations ($\sim$50k core-hour) and associated set of analysis/visualisation tools used by a group of researchers.

- Implemented several matrix-based numerical solvers and Monte Carlo statistical estimators to model the physical conditions and radiation transport.

- Developed an initial port of the simulation to GPU-accelerated CUDA C++ that resulted in 4-5x speedup.

- Other tasks include giving conference presentations and lectures, writing research papers, reports, and grant applications, supervision of Masters and PhD students, and volunteering as the Postdoctoral Representative for the School of Mathematics & Physics.

  Technologies: C/C++, Git, Python (Numpy/Pandas/Matplotlib), OpenMP, MPI, CUDA

2012-2015 **Doctor of Philosophy (Astrophysics)**
Australian National University

Thesis: Neutron-Capture Nucleosynthesis and the Chemical Evolution of Globular Clusters
Primary Supervisor: Dr. Amanda Karakas

- Computed numerical simulations of low-mass stars on Linux-based high-performance compute clusters (NCI Raijin system).

- Developed Fortran/OpenMP code to solve a system of differential equations to model chemical production in galaxies.

- Published insights from simulation results in peer-reviewed journals with implications for the evolution of low-mass stars and the origins of chemical elements in the universe.

- Teaching assistant for courses on first-year physics, third-year astrophysics, and online courses on cosmology and exoplanets.

  Technologies: Fortran, OpenMP, Git, Python (Matplotlib), Mathematica

2008-2011 **Bachelor of Science with Honours (First Class)**
Australian National University

Honours Thesis: The Sulfur Anomaly in Planetary Nebulae and Post-AGB Stars
Honours grade: 86% (First Class)
Majors: Astronomy & Astrophysics, Theoretical Physics, Mathematics
Course grade average: 80% (High Distinction)
Selected results:

Games, Graphs, and Machines	85% High Distinction
Maths Methods 1 Honours: Ordinary differential equations and advanced vector calculus	85% High Distinction
Maths Methods 2 Honours: Partial differential equations, Fourier analysis, and complex analysis	78% Distinction
Theoretical Physics	87% High Distinction
Applied Algebra 1 Honours: Groups rings, and advanced linear algebra	78% Distinction
Number theory and cryptography	83% High Distinction

2003-2007 **Bachelor of Information Technology**
Queensland University of Technology
Major: Software Engineering

Refereed Journal Articles

- **Nebular [Fe II] emission as a constraint on Type Ia supernova progenitors**
  L. Shingles, Stuart Sim, Andreas Floers, et al.
  Monthly Notices of the Royal Astronomical Society, (2020, in preparation).

- **The influence of line opacity treatment in STELLA on supernova light curves**
  A. Kozyreva, **L. Shingles**, Alexey Mironov, Petr Baklanov, Sergey Blinnikov
  Monthly Notices of the Royal Astronomical Society, (2020, in review).

- **Monte Carlo radiative transfer for the nebular phase of Type Ia supernovae**
  L. Shingles, S. A. Sim, M. Kromer, K. Maguire, M. Bulla, C. Collins, C. P. Ballance, A. S. Michel, C. A. Ramsbottom, F. K. Röpke, I. R. Seitenzahl, N. B. Tyndall
  Monthly Notices of the Royal Astronomical Society, Volume 492, Issue 2, p.2029-2043 (2020).

- **A year-long plateau in the late-time near-infrared light curves of Type Ia supernovae**
  Or Graur, Kate Maguire, Russell Ryan, Matt Nicholl, Arturo Avelino, Adam G. Riess, **Luke Shingles**, Ivo R. Seitenzahl, and Robert Fisher
  Nature Astronomy, Advanced Online Publication (2019).

- **Using late-time optical and near-infrared spectra to constrain Type Ia supernova explosion properties**
  K. Maguire, S. A. Sim, **L. Shingles**, J. Spyromilio, A. Jerkstrand, M. Sullivan, T.-W. Chen, R. Cartier, G. Dimitriadis, C. Frohmaier, L. Galbany, C. P. Gutiérrez, G. Hosseinzadeh, D. A. Howell, C. Inserra, R. Rudy, J. Sollerman
  Monthly Notices of the Royal Astronomical Society, Volume 477, Issue 3, p.3567-3582 (2018).

- **A kilonova as the electromagnetic counterpart to a gravitational-wave source**
  S. J. Smartt, T.-W. Chen, A.Jerkstrand, M. Coughlin, E. Kankare, S. A. Sim, M. Fraser, C. Inserra, K. Maguire, K. C. Chambers, M. E. Huber, T. Krühler, G. Leloudas, M. Magee, **L. J. Shingles**, and 107 additional authors
  Nature, Volume 551, Issue 7678, pp. 75-79 (2017)

- **Multi-messenger Observations of a Binary Neutron Star Merger**
  Joint-authored by several collaborations including ePESSTO (including **L. J. Shingles**)
  The Astrophysical Journal Letters, Volume 848, Issue 2, article id. L12, 59 pp. (2017).

- **A chemical signature from fast-rotating low-metallicity massive stars: ROA 276 in omega Centauri**
  David Yong, John E. Norris, Gary S. Da Costa, Laura M. Stanford, Amanda I. Karakas, **Luke J. Shingles**, Raphael Hirschi, Marco Pignatari
  The Astrophysical Journal, Volume 837, Issue 2, article id. 176, 8 pp. (2017).

- **Evolution and nucleosynthesis of helium-rich asymptotic giant branch models**
  Luke J. Shingles, Carolyn L. Doherty, Amanda I. Karakas, Richard J. Stancliffe, John C. Lattanzio, Maria Lugaro
  Monthly Notices of the Royal Astronomical Society, Volume 452, Issue 3, p.2804-2821 (2015).

- **Iron and s-element abundance variations in NGC 5286: comparison with anomalous' globular clusters and Milky Way satellites**
  A. F. Marino, A. P. Milone, A. I. Karakas, L. Casagrande, D. Yong, **L. Shingles**, G. Da Costa, J. Norris, P. B. Stetson, K. Lind, M. Asplund, R. Collet, H. Jerjen, L. Sbordone, A. Aparicio, & S. Cassisi
  Monthly Notices of the Royal Astronomical Society, Volume 450, Issue 1, p.815-845 (2015).

- **The s-process enrichment of the globular clusters M4 and M22**
  Luke J. Shingles, Amanda I. Karakas, Raphael Hirschi, Cherie K. Fishlock, David Yong, Gary S. Da Costa, & Anna F. Marino
  The Astrophysical Journal, Volume 795, Issue 1, article id. 34, 12 pp. (2014).

- **Iron and neutron-capture element abundance variations in the globular cluster M2 (NGC 7089)**
  David Yong, Ian U. Roederer, Frank Grundahl, Gary S. Da Costa, Amanda I. Karakas, John E. Norris, Wako Aoki, Cherie K. Fishlock, A. F. Marino, A. P. Milone, & **Luke J. Shingles**
  Monthly Notices of the Royal Astronomical Society, Volume 441, Issue 4, p.3396-3416 (2014).

- **Augmented reality in astrophysics**
  Frédéric Vogt & **Luke J. Shingles**
  Astrophysics and Space Science, Volume 347, Issue 1, pp.47-60 (2013).

- **Is the sulphur anomaly in planetary nebulae caused by the s-process?**
  Luke J. Shingles & Amanda I. Karakas
  Monthly Notices of the Royal Astronomical Society, Volume 431, Issue 3, p.2861-2871 (2013).