Joshua P. Ellis

Physics PhD Candidate

Melbourne VIC 3004, Australia

josh@jpellis.me | jpellis.me | JP-Ellis | joshuapellis

Education

Doctor of Philosophy (Physics) — Jan 2017–Present

The University of Melbourne, Australia — Rust, Python, Data Analysis and Visualisation

- Under the supervision of Prof. Volkas.
- Extended the research started in masters on an E_6–inspired seesaw model requiring the generation and visualisation of large amount of data to explore relevant parameter space.
- Created a new computation tool to solve Boltzmann equations in order to calculate the evolution of particles in the early Universe and resulting matter–anti-matter asymmetry. These involve highly coupled differential equations with up to hundreds of terms and rates spanning many orders of magnitude. Optimisation of the library required deep understanding of a number of numerical algorithms.
- Using the above tool in order to investigate the validity of common simplifying assumptions as well as previously difficult to explore parameter space in two-Higgs doublet models.

Masters of Science (Physics) — Feb 2015–Dec 2016

The University of Melbourne, Australia — Python, LaTeX, C, C++, Fortran, Cloud Compute

- 50% research under the supervision of Prof. Volkas. I investigated the phenomenology of an E_6–inspired seesaw model. This required the ability to use a broad range of physics frameworks in order to check constraints from the LHC and cosmological sources which were run on large cloud clusters.
- 50% coursework, achieving a 1st class honours average.

Bachelor of Science & Diploma of Mathematical Sciences — Feb 2011–Nov 2014

The University of Melbourne, Australia

- Studied a physics major with concurrent diploma in pure mathematics; achieving a 1st class honours average in both.

Professional Experience

University Tutor & Laboratory Demonstrator — Mar 2013–Nov 2021

The University of Melbourne, Melbourne, Australia — Python, LaTeX, Teaching

- Approached professor with summary notes for the 1st year physics course which were used in 2013.
- Rewrote of all 3rd year computational labs in order to provide a more unified experience and incorporating modern coding practices. The lab notes were made to be language agnostic in order to teach the skill of translating a conceptual problem into code whilst providing a skeleton code in Python. The labs now also introduce the students to object-oriented programming.
- Head tutor for electromagnetism in 2017–2018. Required rewriting all tutorials problems due to a change in teaching direction, and wrote all assignments and exams.
- Taught tutorials and labs, including: 1st year labs (2015–2017); 1st year tutorials (2017–2020); 3rd year labs (2017–2021), and 2nd year electromagnetism (2017–2018). Also provided consultations for a number of these subjects.
- Marking of exams for subjects spanning 1st year to masters level (2015–2021).

Database Administrator — Jun 2014–Aug 2021

Indigo North Health, Rutherglen, Australia — Python, Django, SQL

- Upgraded the previous single-user Access database to a multi-user system in Django with SQL backend and continued to provide support to accommodate for changing needs.
- Created and incorporated a training and development module into the staff database to aid the training and development coordinator.

Administrative Assistant Jun 2011–Jul 2012

Indigo North Health, Rutherglen, Australia Database, Audit

- Re-organised all personnel files in preparation for an audit and performed a gap analysis for managers.
- Consolidate various spreadsheets/ad-hoc lists and created three databases in Access to store staff details and training records, volunteers' details, and residents' information.
- Created an assets register and consolidated the numerous existing ad-hoc lists. Introduced systems and procedures to record assets into the future.

Publications

2019 T. E. Levens, K. Łasocha, T. Lefevre, M. Gąsior, R. Jones, T. Włostowski, J. P. Ellis, and R. J. Steinhagen, **Automatic detection of transverse beam instabilities in the large hadron collider**, Phys. Rev. Accel. Beams 22, 112803 10.1103/PhysRevAccelBeams.22.112803.

2017 J. P. Ellis and R. R. Volkas, **Phenomenological analysis of an E_6-inspired seesaw model**, Phys. Rev. D 96, 10.1103/PhysRevD.96.095016 10.1103/PhysRevD.96.095016, arXiv:1709.01203.

2016 J. P. Ellis, **TikZ-Feynman: Feynman diagrams with TikZ**, Comput. Phys. Commun., 10.1016/j.cpc.2016.08.019 10.1016/j.cpc.2016.08.019, arXiv:1601.05437.

Other Experiences

Personal Projects Ongoing

github.com/JP-Ellis Rust, Python, LaTeX,

- Contributor to a number of open source projects, and published a number of open source tools. Also maintainer of a number of AUR packages for Arch Linux.
- Created the TikZ-Feynman LaTeX library
- Uses Google Cloud Platform to personal projects, and have a couple of small scale servers at home.

Synchrotron Beam Halo Measurement Aug–Nov 2013

The University of Melbourne, Australia

- Conducted a research project at the Australian Synchrotron as part of a Melbourne University course. Used a metal-semiconductor-metal photodiode in order to observe the beam halo whilst also using a coronograph so as to reduce glare from main bunches.

LHC Level 1 Trigger Jul–Aug 2013

CERN, Geneva, Switzerland C++, ROOT

- Developed a level-1 trigger for the multiband instability monitor providing detection of instabilities during their onsets and estimates of their lifetime. Report available at http://cds.cern.ch/record/1595013.

Cosmological Velocity Fluctuations Dec 2012–Feb 2013

Swinburne University, Australia Python, NumPy, SciPy

- Worked under Prof. Chris Blake and Dr. Jun Koda through a research scholarship. Studied cosmological velocity field fluctuations, trying to determine how to best measure a particular constant both through theory and by analysing simulated data.

Volunteer Teacher Jun–Dec 2010

Pentecost Island, Vanuatu

- Volunteered in a primary school in a remote village on the island of Pentecost, Vanuatu. Lived in a bamboo house with thatched roof, no running water and only a firepit to cook with. Taught students English, music, and some general sciences.

Honours & Awards

2018 **Science Abroad Travelling Scholarship** The University of Melbourne

2015 **N. D. Goldsworthy Scholarship for Physics** The University of Melbourne

2011 **Dean's Honour List for Science** The University of Melbourne

2009 **Dux** Rutherglen High School

2007 **Kwong Lee Dow Young Scholar** University of Melbourne