Curriculum Vitae - Dr Leigh Howard Whitehead

Personal Details

Date of Birth	11$^{\text{th}}$ August 1986
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Employment History

01/2019 – Present	Senior Research Associate, Cambridge
10/2016 – 12/1018	Research Fellow, CERN
04/2012 – 09/2016	Research Associate, University College London

Education

Postgraduate	*A Measurement of the Electron Neutrino Component of the T2K Beam using the Near Detector*, PhD thesis, University of Warwick, 2012
Undergraduate	1st Class Master of Physics Degree (Hons), University of Warwick, 2008

Awards

2016	Awarded a CERN Research Fellowship
2015	Breakthrough Prize in Fundamental Physics, as part of the T2K collaboration
2008	The Styles Prize, for excellence in the 4$^{\text{th}}$ year, University of Warwick

Positions of Responsibility

2019 – Present	Convenor of the DUNE simulation and reconstruction group
2018 – Present	Convenor of the ProtoDUNE reconstruction group
2017 – 2018	Convenor of CERN Neutrino Near Detector Sensitivities Working Group
2016 – 2017	MINOS/MINOS+ Analysis Coordinator
2015 – 2016	MINOS/MINOS+ Deputy Analysis Coordinator
2015 – 2016	MINOS/MINOS+ Sterile Neutrino Group Convenor
2014 – 2015	Responsible for the running of the CHIPS-M prototype detector, including data acquisition, calibration and processing of the data
2013 – 2016	Led the CHIPS simulation and reconstruction software development
2012 – 2015	MINOS/MINOS+ Reconstruction Group Convenor

Research Experience

Analysis

- Coleading the DUNE ν_e analysis using a convolutional neural network
- Analysis coordinator responsible for all MINOS+ analyses
- Convenor overseeing the MINOS/MINOS+ sterile neutrino and antineutrino searches
- Lead analyser of the first combined MINOS and MINOS+ ν_μ disappearance analysis
- Performed rock and anti-fiducial muon part of the final MINOS ν_μ disappearance analysis
- Used the T2K ND280 ν_e and ν_μ selections to constrain the beam flux uncertainties
- Measured the intrinsic ν_e component of the beam using the T2K ND280
- Led the analysis of the T2K ND280 Downstream ECal CERN test-beam data

Simulation and Event Reconstruction

- Invented a new type of neural network for physics-based, configurable, fast simulations
- Developer of the protoDUNE liquid argon TPC event reconstruction software.
- Produced the interface between LArSoft and the protoDUNE beam simulation
- Wrote the detector simulation for the CHIPS water Cherenkov detector
- Led the reconstruction effort for the CHIPS experiment
- Led the upgrade of the MINOS Near Detector reconstruction software for the MINOS+ era
- Developer of the T2K ECal reconstruction algorithms

Software

- Keras and Tensorflow deep learning frameworks
- The LArSoft framework for liquid argon TPCs
- C++ and Python programming, software design and development
- The ROOT data analysis package
- The GEANT4 simulation framework
- The LINUX, Mac-OS and Windows operating systems, including bash shell scripting
- Python and Java programming languages
- The GENIE neutrino event generator, and the CRY cosmic ray generator

Hardware

- Involved in a project to use a hardware pattern recognition chip (WRM) for trigger-less running of LArTPCs
- Spent two summers building, then refurbishing, the CHIPS-M detector:
    - Constructed the main detector frame and body, including light- and water-tight seals
    - Tested and commissioned the PMTs
    - Developed and prototyped a water purification system

- I was an active participant in the building phase of T2K:
    - Built some of the T2K ND280 ECal detector modules
    - Took part in the T2K ND280 ECal test-beam run at CERN
    - Designed, built and ran an optical fibre quality assurance scanning system

Teaching and Supervision

Teaching

- Head-of-class fully responsible for the Particle Tracks experiment
- Undergraduate mathematics problem classes for 20 students for 40 hours over 4 years
- Undergraduate physics problems class for 10 students for 26 weeks

Supervision

I have provided supervision for at least thirty students, with experience including:

- Principal supervisor for a DUNE PhD student at Cambridge
- Supervisor for a CERN technical PhD student working on deep learning software for DUNE
- Two CERN summer students working on protoDUNE each for a 13 week period
- Approximately fifteen MINOS/MINOS+ PhD students during my four leadership roles
- The team of fifteen PhD and undergraduate students who built CHIPS-M
- Three MINOS / CHIPS PhD students at UCL
- Seven final year undergraduate project students in the UCL group

- A secondary school student on a two week MINOS work experience project
- Two undergraduate summer students at Warwick working on T2K

Outreach

I strongly believe it is the responsibility of physicists to present their research to the general public and I have performed the following:

- Plan, organise and give protoDUNE facility tours with visitors including a Nobel Prize winner, MPs, high-school and university students, scientists and other dignitaries
- Produced materials for, and helped to organise, the viewing platform at the protoDUNE facility
- Gave interviews to two journalists following my presentation of the MINOS and Daya Bay sterile neutrino analysis at ICHEP 2016
- Gave a talk on the CHIPS experiment to a group of university students and showed them the under-construction prototype detector
- Designed a masterclass for high-school students using the T2K near detector simulation

Conference presenations

Plenary talks are denoted by an asterisk:

1. *Performance of the protoDUNE-SP liquid argon detector from a particle test-beam*, Lepton-Photon 2019, Toronto, Canada, 2019
2. **Accelerator neutrino searches for eV-scale sterile neutrinos*, Invited Contribution at European Strategy for Particle Physics Neutrino Town Meeting, CERN, 2018
3. *DUNE CVN Neutrino Event Classification*, LArTPC Calibration and Reconstruction Workshop, Fermilab, 2018
4. *Status of the ProtoDUNE Detectors* ICHEP 2018, Seoul, South Korea, 2018
5. *Sterile Neutrino Searches with MINOS and MINOS+*, EPS 2017, Venice, Italy, 2017
6. *Sterile Neutrino Searches with MINOS/MINOS+*, ICHEP 2016, Chicago, USA, 2016
7. **Recent Results from MINOS and MINOS+*, NNN15, Stony Brook, USA, 2015
8. *New results from MINOS and first results from MINOS+*, PANIC 2014, Hamburg, Germany, 2014
9. **The MINOS Experiment and MINOS+*, NNN13, Kashiwa, Japan, 2013
10. *Testbeam Performance of the T2K ND280 Downstream Calorimeter*, Institute of Physics Nuclear and Particle Physics Divisional Conference, Glasgow, UK, 2011

Posters

1. *The CERN Neutrino Platform*, NuPhys 2016, London, UK, 2016
2. *The CHIPS R&D Programme: Reconstruction*, ICHEP 2016, Chicago, USA, 2016
3. *The CHIPS R&D Programme: Reconstruction*, Neutrino 2016, London, UK, 2016

Invited Seminars

I have been invited to give the following one hour seminars:

1. *Model-Assisted Generative Adversarial Networks*, Imperial College London, UK, 2020
2. *Sterile Neutrino Searches with MINOS+*, University of Oxford, UK, 2019
3. *Sterile Neutrino Searches with MINOS+*, University of Cambridge, UK, 2019
4. *Sterile Neutrino Searches with MINOS and MINOS+*, UCL, London, UK, 2017
5. *The CHIPS Experiment*, University of Warwick, Coventry, UK, 2015
6. *The CHIPS Experiment*, Rutherford Appleton Laboratory, Didcot, UK, 2015

7. *The CHIPS Experiment*, University College London, London, UK, 2015
8. *The CHIPS Experiment*, University of Sheffield, Sheffield, UK, 2015
9. *The CHIPS Experiment*, University of Sussex, Brighton, UK, 2014
10. *The MINOS Experiment and MINOS+*, University of Sussex, Brighton, UK, 2013

Workshops

I have given invited tutorials at the following software workshops:

1. *Deep Learning*, 4th UK LArTPC Software Analysis Workshop, University of Manchester, UK, 2019
2. *Writing an analyser module*, 3rd UK LArTPC Software Analysis Workshop, University of Manchester, UK, 2018

Publications

I am an author on 24 refereed articles. A full list can be found on:
INSPIRE: `http://inspirehep.net/author/profile/L.H.Whitehead.1`
ORCID: `https://orcid.org/0000-0002-3327-2534`.
Those publications to which I have made a direct and significant contribution are indicated by *:

1. P. Adamson *et al.* (Daya Bay and MINOS+ Collaborations), Accepted by Phys. Rev. Lett., 2020, arXiv 2002.00301
2. *S. Alonso-Monsalve and L. H. Whitehead, IEEE Trans. Neural Netw. and Learn. Syst., 2020, doi: 10.1109/TNNLS.2020.2969327
3. *P. Adamson *et al.* (MINOS+ Collaboration), Phys. Rev. Lett. **122**, 091803, 2019
4. *A. Chatterjee *et al.*, Phys. Rev. **D**98, 075027, 2018
5. P. Adamson *et al.* (MINOS Collaboration), Phys. Rev. **D**95, 012005, 2017
6. P. Adamson *et al.* (MINOS Collaboration), Phys. Rev. **D**94, 111101, 2016
7. *F. Amat *et al.* (CHIPS Collaboration), Nucl. Inst. Methods Phys. Res. A, 2016
8. P. Adamson *et al.* (MINOS Collaboration), Phys. Rev. **D**94, 072006, 2016
9. *P. Adamson *et al.* (Daya Bay and MINOS Collaborations), Phys. Rev. Lett. **117**, 151801, 2016
10. *P. Adamson *et al.* (MINOS Collaboration), Phys. Rev. Lett. **117**, 151803, 2016
11. P. Adamson *et al.* (MINOS Collaboration), Phys. Rev. **D**93 052017, 2016
12. *L. H. Whitehead, Nucl. Phys. B. 908:130-150, 2016
13. P. Adamson *et al.* (MINOS Collaboration), Nucl. Inst. Methods Phys. Res. A, 806:279-306, 2015
14. *P. Adamson *et al.* (MINOS Collaboration), Phys. Rev. **D**92, 052005, 2015
15. P. Adamson *et al.* (MINOS Collaboration), Phys. Rev. **D**91, 112006, 2015
16. P. Adamson *et al.* (MINOS Collaboration), Phys. Rev. **D**91, 012005, 2015
17. P. Adamson *et al.* (MINOS Collaboration), Phys. Rev. **D**90, 012010, 2014
18. *P. Adamson *et al.* (MINOS Collaboration), Phys. Rev. Lett. **112**, 191801, 2014
19. *D. Allan *et al.* (T2K UK Collaboration), JINST 8(10): P10019, 2013
20. *P. Adamson *et al.* (MINOS Collaboration), Phys. Rev. Lett. **110**, 251801, 2013
21. K. Abe *et al.* (T2K Collaboration), Phys. Rev. **D**85, 031103, 2012
22. K. Abe *et al.* (T2K Collaboration), Nucl. Inst. Methods Phys. Res. A, 694:211-223, 2012
23. *K. Abe *et al.* (T2K Collaboration), Phys. Rev. Lett., **107**, 041801, 2011
24. K. Abe *et al.* (T2K Collaboration), Nucl. Inst. Methods Phys. Res. A, 659(1):106-135, 2011

Preprints

1. *B. Abi *et al.* (DUNE Collaboration), arXiv 2006.15052, 2020, submitted to Phys. Rev. D
2. *B. Abi *et al.* (DUNE Collaboration), arXiv 2006.16043, 2020, submitted to EJPC
3. *P. Adamson *et al.* (MINOS+ Collaboration), arXiv 2006.15208, 2020, submitted to Phys. Rev. Lett.
4. *De Roeck, A *et al.*, arXiv 2005.08979, 2020, submitted to Phys. Rev. D

Proceedings

1. Leigh H. Whitehead, PoS ICHEP2018 (2019) 300
2. Leigh H. Whitehead, PoS EPS-HEP 2017 (2017) 114
3. Leigh H. Whitehead, PoS ICHEP2016 (2016) 480
4. L. H. Whitehead and A. J. Perch, J.Phys.Conf.Ser. 888 (2017) no.1, 012153
5. A. Abdallah *et al.*, Springer Proc.Phys. 212 63-68, TIPP 2017, 2018

I have refereed two articles for Physical Review Letters and a proceedings contribution.