

**Ocean Wong** (Hoi Yeung Wong)  
Dr in physics (neutron spectrum unfolding)  
Organizations: Culham Centre for Fusion Energy/ Sheffield Hallam University  
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Physicist with specialist knowledge in machine learning, inverse problems, analytical error propagation, iterative algorithms, and neutron spectrum measurement; as well as a strong aptitude and a unique approach to problem-solving.

## 1 Research experience

PhD project: Modernising neutron spectrum unfolding for fusion applications Oct 2019—Sep 2023

- Developed a software to systematically select foils for activation foil neutron spectrum unfolding experiments, to replace the current *ad hoc* approach of foil selection. Oversaw the complete software development lifecycle, beginning from stakeholders engagement to software quality control.
- Derived more mathematically rigorous algorithms for unfolding, which were implemented into an unfolding code suite.
- Developed a new visualization technique for presenting gamma-ray spectra based on the statistics underlying their noise distributions (Poisson distribution).
- Performed an activation experiment, using GENIE to perform the nuclide identification and analysis, and then using the neutron spectrum unfolding suite developed at UKAEA to perform the unfolding.
- Collaborated with other organizations to perform neutron spectrum measurements and unfold their neutron spectra to satisfactory quality.
- Presented at various physics conferences, including the IoP and FuseNet.

Master's project: Neutron spectrum unfolding suite developer (using Neural Networks) Jun—Sep 2019

- Developed a novel approach to the long-standing problem of inferring the neutron spectrum in a underdetermined system.
- Collaborated with other programmers on the same repository using Git.
- Developed and optimized a Neural Network using Google's TensorFlow framework, which is then incorporated into the unfolding suite along with the appropriate documentations.

Nuclear Physics Laboratory

Oct—Dec 2019, Oct—Dec 2018

- Identified unknown elements using neutron activation analysis and gamma spectroscopy using a High Purity Germanium detector.
- Measured the neutron flux in neutron bath using a BF<sub>3</sub> detector.
- Analysed the results using Python's numerical processing capability; and then visualized them graphically via Python as well.

Systematic study of the effect of neighbours on the evolution of intragrain misorientation Jun—Dec 2018

- Extracted the simulation results from Abaqus, a commercial thermomechanical modelling software, using Python; and subsequently optimized the extraction speed.
- Researched and investigated various mathematical methodologies for finding the average orientation, which is a previously un-explored problem in material science.
- Reported simulation result and comparison with results in literature in a paper.
- Gained theoretical understanding of and practical experience with Finite Element Modelling.

#### Modelling of void collapse in 316L stainless steel (final year project)

Jan—Mar 2018

- Developed the code for plotting (spatial and temporal) variation in grain orientation extracted from Abaqus and calibration of model parameters, as well as animation for the orientation evolution; all automated via Python.
- Collaborated with other group members to steer the course of the project using the plotting results, as well as explained the relevant results in the group project report and viva.

#### Nuclear Talent course on Machine Learning and Data Analysis for Nuclear Physics —Jul2020

- A 2 weeks course on machine learning techniques applicable to nuclear physics.
- Neural network: Universal approximation theorem, backprop, autoencoders, GANs
- Supervised learning techniques: Random forest, logistic regression
- Unsupervised learning techniques: PCA
- Reinforced learning
- Exercises include: Classifying the particle tracks found in a time projection chamber TPC, classifying the number and location of events in a detector
- Extracurricularly: created methods of classifying that does not rely on machine learning techniques, reducing the required computational time and resources massively.

#### Culham Plasma Physics Summer School

Jun—Jul2017

- Learned about the relevant background knowledge in plasmas physics so to put the importance of fusion materials research in context.
- Allows me to take on projects that require background understanding in plasma physics in the future.

#### Summer Physics internship, School of Physics and Astronomy, University of Birmingham Jul—Aug 2018

- Worked on a group project to produce a working prototype of a radiation detection drone.
- Gained relevant specialist knowledge about the workings of cyclotron, GPS and radiation detector, as well as radiation protection procedures.

#### Fusor Group Project, University of Birmingham

Oct 2015—Sep 2019

- Recruited as part of Fusor Project team, following from an interview selection process.
- Worked with 7 other more senior students to build a Farsworth nuclear fusor.

- Successfully applied for a grant of £2800 on behalf of the group to cover the cost of the power supply.

Formula Student member, University of Birmingham

Oct 2015—Jul 2016

- Manufactured, shaped and resized steel and aluminium components of the test car (including Catch can holder, chassis and aluminium arches) based on the technical specification.
- Researched the cost model and produced report to demonstrate manufacturing cost of a component.
- Produced the cost report (in Microsoft Excel) and collected data for planning to set up factories in Europe.

Light Pollution Surveyor (social study project)

Sep 2014—Jan 2015

- Surveyed and reported the light pollution situation in Hung Shui Kiu (a region of Hong Kong). It involved using a scientific instrument (luxmeter) on site to collect data about the brightness of the vicinity, and distributing and recollecting questionnaire.
- Gained valuable first-hand experience in designing and conducting a scientific investigation, building my positive attitude towards scientific investigation; and this gave me an intuitive understanding of how to operate scientific equipment with accuracy and consistency.

## 2 Software repertoire

- Programming languages: Python, Fortran, Bash, R, C++, PowerShell
- GIT: GitHub (@OceanNuclear) and GitLab(@OceanNuclear)
- Markdown language: LaTeX
- Proprietary software: Abaqus, Adobe Premiere Pro, Adobe InDesign, Vectr, Microsoft Excel, Word

## 3 Qualifications

PhD Physics, Sheffield Hallam University

Oct 2019—Sep 2023

Title: ENFUSE: Effective Neutron Spectrometry for FUSion Environment

- Reviewed existing algorithms and developed new algorithms for neutron spectrum unfolding in underdetermined condition
- Selected foils to be used according their unfolding effectiveness and feasibility
- Expected to design a module for neutron activation foil irradiation inside fusion reactors as part of the degree.

MSc Physics and Technology of Nuclear Reactors, University of Birmingham

Oct 2018—Oct 2019

Results: **distinction**; modules:

- Nuclear Instrumentation, Radiation Dosimetry and Protection
- Radiation Transport, Thermal Hydraulics and Reactor Engineering
- Reactor Materials, Reactor System and NDE

- Practical Skills
- Research Project

BSc Nuclear Science and Materials, University of Birmingham

Sep 2015—Jul 2018

Results: **2:1**; modules:

- Classical Mechanics and Relativity 1 & 2
- Electromagnetism I and Temperature and Matter (including Electric Circuits)
- Statistical Physics and Entropy
- Particles and Nuclei and Nuclear Physics
- Mathematics for Physicist 1A & 2
- Physics Laboratory 1 & 2
- Physics Communication Skills (including C++ Computing)

Shung Tak Catholic English College (Hong Kong)

Sep 2009—Jul 2015

HKDSE (Hong Kong Diploma of Secondary Education exam)

- Physics 5\*\*, English 5\*, Algebra and Calculus 5, Chemistry 5, Mathematics 4, Biology 4
- Equivalent to A\*A\*AABB in A levels

## 4 Other experiences

Secretary of Parkour Society at University of Birmingham

Sep 2017—Jun 2019

- As one of the three founding member of the society, built the foundation for the traceur community here at the University for through organizing the bi-weekly gatherings.

Library collection assistant, University of Birmingham Main Library

Jan—Sep 2017

- Carried out stock management tasks including re-locating stock, interfiling, re-boxing periodicals and searching for lost stock.
- Worked in a motivated manner with minimal supervision

Global Buddy (UoB Guild of Student scheme)

Sep 2016—Jan 2017

- Act as the mentor and point of contact for four, newly arrived international students, by assisting them to adjust into their new social and physical environment
- Received positive feedback from all four students

Student Librarian, Library club executive, Librarian Manager

Sep 2009—Aug 2014

- Helped students to borrow and return books, assisted students with using the photocopying machine, stocked and retrieved items from the shelf, collaborated with other student librarians to organise activities.
- Supervised other student librarians to perform their duties.

## 5 Continuous development

- Proactively taken, non-compulsory lecture courses
  - Quantum Mechanics I & II
  - Quantum Approach to Solids
  - Lagrangian Mechanics
  - Electromagnetism II
  - Eigenphysics
- Open Online Courses taken:
  - Advanced Data Science with IBM Specialization
  - IoT Devices
  - Emergent Phenomena in Science
  - Network Dynamics of Social Behaviour
- Hong Kong Biology Olympiad (First Honour) —Dec 2014
- Mysteries in the Atomic World (CUHK Science Academy for Young Talents) —Jul 2014
  - Course on Quantum Mechanics held for elite high school students
- Genetic Engineering Workshop —Apr 2014
  - Learned biological labs skills and in-depth knowledge of genome
- ‘Nanomaterials and Renewable Energy’ (HKU one-day course) —Apr 2014
- Out of curiosity and drive for self-improvement, took online courses on various topics to broaden my vision
  - Learnt R and Python in my leisure time
  - ‘Learning how to learn’ on COURSERA
  - ‘Information Theory’ on Khan Academy
  - ‘Nonlinear Dynamics and Chaos’ on MITOpenCourseWare