

# QIAORONG YU

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## EDUCATION

**Balliol College, University of Oxford** Oct 2021 - June 2025  
*Master of Mathematical and Theoretical Physics* (Integrated BSc & MSc)

- **First Class (GPA: 4.0)** in Part A & B exams (undergraduate 2<sup>nd</sup> and 3<sup>rd</sup> years final exams)
- **Distinction (GPA: 4.0)** in preliminary exams (undergraduate 1<sup>st</sup> year final exams)

Thesis: “**XXX**”

Advisor: Prof Vijay Balasubramanian

## HONORS & GRANTS

- *Dr Prosser’s Trust* (undergraduate project grants), received from Balliol College, Oxford 2024
- *JT Hamilton Legacy Fund*, received from Balliol College, Oxford 2024
- *Lubbock Fund*, received from Balliol College, Oxford 2023
- *Reynolds Scholarship*, received from Balliol College, Oxford 2023
- *Prosser Exhibition*, received from Balliol College, Oxford 2022
- British Physics Olympiad (BPhO) Round One Top Gold (Global Ranking) 2020
- Duke of Edinburgh Award (DofE) Silver and Bronze Medals 2020

## TALKS & POSTERS

- “*The measurements of the splashback features of dark matter halos using TNG300 and MillenniumTNG simulations*” 16/08/24  
MIT Kavli Institute for Astrophysics and Space Research
- “*Attempting dream decoding with generalizable visual EEG encoding models*” 14/04/24  
2024 Cognitive Neuroscience Society (CNS) Annual Meeting

## RESEARCH EXPERIENCE & INTERNSHIPS

**Staresina Lab, University of Oxford** Oxford, UK  
**Research Assistant** Feb 2024 - Oct 2024  
*Memory transformation during sleep*

- Investigated the memory transformation during sleep by analyzing the changes in lower and higher-level visual representations of episodic memories pre- and post-sleep.
- Implemented different visual and semantic deep neural networks (e.g., Alexnet, ResNeXt, BLIP-2, CLIP, GPT-Neo) and encoding models (e.g., Linear regression, Ridge regression), and attempted various feature selection and encoding methods to study episodic memory representations. Correlated EEG sleep data with encoding model predictions and conducted the permutation test using both Python and Matlab.
- Assisted in-lab EEG-fMRI data collections, including EEG setup, capping and localization, fMRI scanning monitoring and data preprocessing (e.g., MVPA, diffusion MRI analysis and modeling)
- Manuscript in preparation.

**Vogelsberger Lab, Massachusetts Institute of Technology**

Cambridge, MA, USA

**Research Assistant**

Jan 2024 - Ongoing

*The measurements of the splashback features of dark matter halos using cosmological simulations*

- Measured the splashback radius and the splashback features of cold dark matter (CDM) halos and investigated physical factors affecting them using cosmological galaxy formation simulations IllustrisTNG and MillenniumTNG.
- Conceptualised and independently conducted comprehensive data analysis, including computing the density profiles, bootstrapping the splashback features of dark matter halos, and applying curve fitting techniques to derive mathematical formulas of the splashback features.
- Solved technical challenges on remote servers, including remote visualization, parallel computing, and job submission. Managed complex computations by utilizing GPU acceleration and parallel computing, and proficiently handled tasks in the Linux terminal using SSH, Git, and screen-related commands.
- Manuscript in preparation.

**Dream Engineering Laboratory, University of Montreal**

Montreal, Canada

**Research Assistant**

Feb 2023 - Oct 2023

*Dream decoding with generalizable visual EEG encoding models*

- Attempted using EEG signals to decode visual dream content by leveraging an encoding model to generate EEG signals from convolutional neural networks (CNNs) (e.g., AlexNet) trained on naturalistic images, and then testing the ability of the encoding model to generate EEG signals from dream images generated from a text-to-image AI pipeline (ChatGPT, Stable Diffusion) designed in the study.
- Conceptualised the project and accumulated skills including EEG preprocessing, extracting visual feature maps from CNNs, representative similarity analysis (RSA), principal component analysis (PCA), and statistical analysis (e.g., permutation tests, correlational analysis) via Python (e.g., MNE, scikit-learn).
- Poster presented at 2024 Cognitive Neuroscience Society (CNS) Annual Meeting

**Department of Physics, University of Oxford**

Oxford, UK

**Undergrad Extended Practical in Astrophysics**

Jan 2023 – Mar 2023

*Analysis of Exoplanet Radial Velocity Observations*

- Implemented the radial velocity method to measure the orbital parameters of exoplanets 51 Peg b and hd80606 b, as part of second year physics course in Oxford.
- Manually implemented optimization, curve fitting, Lomb-Scargle periodogram and Markov Chain Monte Carlo (MCMC) algorithms to simulate and to fit radial velocity data to determine planetary parameters via Python (Astropy). Both circular and eccentric orbits are successfully analyzed.

**Motus VR**

Oxford, UK

**Internship in VR Game Design**

Mar 2022

- Developed 3D environments for an Endless Running game using Unreal Engine 4.27, enhancing skills in game engineering and art design, including mesh design, texture modification, and lighting.
- Demonstrated strong time management and stress-handling abilities during a short and intensive internship, successfully delivering a functional VR project and presented the project to employers by exporting and performing the Endless running via VR helmet.

## TEACHING EXPERIENCE

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### Comprehensive Oxford Maths and Physics Online School (COMPOS) Student Tutor

Oxford, UK  
Nov 2022 – May 2023

- As student tutor of Oxford Department of Physics led six UK high school students in weekly physics and mathematics sessions which are beyond A-Level syllabus.
- Marked students' assignments and provided feedback, and coordinated with other COMPOS tutors to improve the lesson plan and teaching structure.

## OTHER EXPERIENCE

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### Oxford University Pistol Club Secretary & Committee Member

Oxford, UK  
Mar 2023 – June 2024

- Served as Secretary and Committee Member, managing club documentation and organizing events, including membership, regular training sessions, varsity competitions, and the Freshers' Fair.
- Coordinated with the Rifle Associations in Britain and the Home Office, developing strong communication and administrative skills.

### Oxfam Volunteer

Oxford, UK  
April 2023 - May 2024

- Assisted in the operation of charity shops every weekend, including cashiering, ironing donated clothes, organizing shelves, managing the online store, and sorting second-hand records and CDs.
- Worked with elderly people in the UK, enhancing communication and cooperation skills while fostering awareness of social service and diverse cultural backgrounds.

## COMPUTATIONAL SKILLS

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- **Shell:** Skilled in Unix/Linux systems, remote server operations, SSH, job submission, and environment management with conda, and GPU acceleration.
- **Python:** Proficient in NumPy, pandas, SciPy, Matplotlib, PyTorch, h5py, Astropy, unyt, MNE, mpi4py (parallel computation), and Qiskit.
- **Matlab:** Proficient in data visualization, numerical analysis.
- **Unreal Engine:** Basic skills in 3D graphics and scene design.
- Extensive experienced with **VS Code**, **Git/GitHub**, **LaTeX**, and **Mathematica**.

## LANGUAGE SKILLS

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- **English** (proficient); **Chinese/Mandarin** (native); **French** (beginner/A1).

## CORE COURSES

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- First year: Classical Mechanics, Linear Algebra, Multivariate Calculus, Differential Equations, Functions of a Complex Variable, Basic Statistics.
- Second year: Mathematics Methods, Thermal Physics, Electromagnetism and Optics, Quantum Physics, Entrepreneurship for Physicists.
- Third year: Symmetry and Relativity, General Relativity, Atomic and Laser Physics, Nuclear and Particle Physics, Condensed-Matter Physics, Numerical Methods.

- Fourth year: Groups and Representations, Quantum Field Theory, Advanced Quantum Field Theory, Quantum Field Theory in Curved Spacetime, Conformal Field Theory, String Theory I, Networks, Machine Learning Fundamentals With Applications to Physics and Mathematics.
- Extra: Numerical Linear Algebra, Biophysics, fMRI bootcamp (by Rebecca Saxe), Supersymmetry and Supergravity, Advanced Philosophy of Physics.