

# Zakhar Shumaylov

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[LinkedIn](#)  
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## Education

University of Cambridge <b>PhD in Mathematics of Information</b> Thesis: "Structure preserving physics informed neural networks for inverse problems" Supervised by: Prof Carola-Bibiane Schönlieb Awarded the <i>Trinity Henry Barlow Scholarship</i> (£81,000) at Christs College. Funded by Christs College Bursary (£15,000) and CCIMI (£50,000).	CAMBRIDGE, UK 2022 – 2026
University of Cambridge <b>Mathematics BA/MMath (1st Class/Distinction)</b> Awarded the <i>Cambridge Trust Scholarship</i> (£40,000) to read Mathematics at Churchill College. Courses included: Quantum Field Theory, General Relativity, Statistical Field Theory, Black Holes, Cosmology.	CAMBRIDGE, UK 2018 – 2022
Brighton College <b>A-Level(5A*) STEP 2,3 (S,S)</b>	BRIGHTON, UK 2016 – 2018
Governor's Physics and Mathematics Lyceum 30 <b>Year 9 - Year 11 (4.53/5)</b>	ST-PETERSBURG, RUSSIA 2013 – 2016

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## Publications and Preprints

- Z. Shumaylov**, J. Budd, S. Mukherjee, C. Schönlieb (2024).  
Weakly Convex Regularisers for Inverse Problems: Convergence of Critical Points & Primal-Dual Optimisation.  
*Under review; arxiv*
- S. Mukherjee, S. Dittmer, **Z. Shumaylov**, S. Lunz, O. Öktem, C. Schönlieb (2024).  
Data-Driven Convex Regularizers for Inverse Problems.  
**Accepted to IEEE ICASSP (2024); arxiv**
- Z. Shumaylov**, J. Budd, S. Mukherjee, C. Schönlieb (2023).  
Provably Convergent Data-Driven Convex-Nonconvex Regularization.  
**Accepted (Oral) to NeurIPS Workshop on Deep Learning and Inverse Problems (2023); arxiv**
- Z. Shumaylov\***, I. Shumailov\*, Y. Zhao, Y. Gal, N. Papernot, R. Anderson (2023).  
The Curse Of Recursion: Generated Data Makes Models Forget.  
*Under review; arxiv*  
PUBLICITY: [NEW SCIENTIST](#); [INDEPENDENT](#); [THE ATLANTIC](#); [MIT TECH](#); [FINANCIAL TIMES](#); [NEW YORK TIMES](#); [WALL STREET JOURNAL](#);
- Z. Shumaylov\***, M. Letey\*, F. Agocs, W. Handley, M. Hobson, A. Lasenby (2022).  
Quantum Initial Conditions for Curved Inflating Universes.  
*Under review; arxiv*
- Z. Shumaylov**, W. Handley (2021).  
Primordial power spectra from  $k$ -inflation with curvature.  
**Accepted to Physical Review D (2022); arxiv**
- I. Shumailov, **Z. Shumaylov**, D. Kazhdan, Y. Zhao, N. Papernot, M. A. Erdogdu, R. Anderson (2021).  
Manipulating SGD with data ordering attacks.  
**Accepted to NeurIPS (2021); arxiv**

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## Talks and Conferences

NeurIPS @ Cambridge Presented on "The Curse Of Recursion: Generated Data Makes Models Forget"	CAMBRIDGE, UK
Workshop: Integrating acquisition and AI in tomography Presented on "Learned reconstruction methods in inverse problems"	LEIDEN, NETHERLANDS
ICIAM 2023 Presented on "Learned weakly convex regularizers in inverse problems"	TOKYO, JAPAN
C.I.M.E. School on 'Machine Learning: From Data to Mathematical Understanding' Received full grant and prepared lecture notes to be published in the C.I.M.E. Springer series.	CETRARO, ITALY

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## Work Experience

- GSK** CAMBRIDGE, UK  
**Project collaboration** June 2022 - Sept 2022  
Project collaboration on 'Self-discovery of mechanistic equations for a data-driven smart simulator' as part of CMI programme with Dr Matthieu Duvinage.
- University of Cambridge** CAMBRIDGE, UK  
**Supervisor for University of Cambridge Undergraduates** Oct 2022 - Now  
Supervising undergraduate students in a variety of courses.  
(2022/2023): Part IA Vectors and Matrices: 18 students (48h)
- Ryff AI** CAMBRIDGE, UK  
**Summer Research Intern** July 2022 - Sept 2022  
Work under supervision of Dr Mike Roberts. During the internship I worked on the problem of unsupervised video motion segmentation. During the project, I used variational and learned methods from the optical flow literature for foreground-background separation using motion signals.
- University of Cambridge: Institute of Astronomy** CAMBRIDGE, UK  
**Summer Internship Programme** August 2021 - Sept 2021  
Work under supervision of Dr Amy Bonsor (IoA): "Gas disk imaging around white dwarves"  
During the internship I investigated gas disk light curve imaging around white dwarves, by modelling gas geometry. Funded by the Institute of Astronomy.
- University of Cambridge: Kavli Institute for Cosmology** CAMBRIDGE, UK  
**Summer Research Intern** June 2021 - August 2021  
Work under supervision of Dr Will Handley (KICC): "Primordial power spectra from k-inflation with curvature"  
During the internship I investigated the problem of interplay between inflationary sound speed and primordial curvature using analytical approximations. Funded by the CMP.
- University of Cambridge: Department of Applied Mathematics and Theoretical Physics** CAMBRIDGE, UK  
**Summer Research Assistant** June 2020 - Sept 2020  
Work under supervision of Prof Carola Schonlieb (DAMTP), Prof Ozan Oktem (KTH) and Prof Par Kurlberg (KTH): "3DEM: Representation of atomic models"  
During the internship I investigated the problem of protein fitting inside of atomic volumes acquired via cryo electron microscopy. During the project I used learned techniques and variational methods to obtain protein reconstructions. Funded by the CSRIM.
- University of Cambridge: Department of Applied Mathematics and Theoretical Physics** CAMBRIDGE, UK  
**Summer Research Assistant** June 2019 - Sept 2019  
Work under supervision of Prof Carola Schonlieb (DAMTP).  
During the internship I worked primarily in the field of inverse problems. In particular, I researched how Deep Learning can be used to help solve physics-based inverse imaging problems. This led to a joint work "Learned convex regularizers for inverse problems". Funded by the CSRIM and the Tizard Fund.
- Cambridge Coding Academy** CAMBRIDGE, UK  
**Teaching Assistant** July 2018  
Supporting and leading coding sessions of the 'Coding++' course, covering the basics of AI using python and the pygame library.
- Brighton College** BRIGHTON, UK  
**After-school Teaching Assistant** Sept 2017 - June 2018  
Tutoring Year 9 - Year 13 students during after-school Mathematics classes.
- University Of Sussex** UK  
**Research Assistant to Professor Madzvamuse** July 2017 - August 2017  
I reviewed and extended the one-dimensional cell model of Shenoy(2016) by modelling cell contractility and strain with partial differential equations in Matlab.

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## Subject Olympiads

- British Physics Olympiad Round 2** UK, 2018  
Gold Award (Top 15).  
Invited to the University of Oxford Training Camp to compete for a spot on the UK IPhO team.
- British Astronomy and Astrophysics Olympiad** UK, 2018  
Gold Award.
- British Physics Olympiad Round I** UK, 2017  
Gold Award (Top 50).
- British Mathematics Olympiad Round I** UK, 2017  
Certificate of Distinction.
- AS Physics Challenge** UK, 2017  
Gold Award.

British Physics Olympiad Round I Gold Award.	UK, 2016
Senior Mathematics Challenge Gold Award (100%).	UK, 2016
School Mathematics Olympiad Winner of the inter-school team challenge.	RUSSIA, 2016
Russian Computer Science Olympiad Winner of the district challenge.	RUSSIA, 2015
Russian Physics Olympiad Winner of the district challenge.	RUSSIA, 2015
Russian Computer Science Olympiad Winner of the district challenge.	RUSSIA, 2014

### Positions of Responsibility

NeurIPS at Cambridge meetup Helped organise the NeurIPS 2023 at Cambridge meetup	CAMBRIDGE
Treasurer and Membership officer Keeping proper accounts of the income and expenditure of the Society.	CAMBRIDGE UNIVERSITY ASTRONOMICAL SOCIETY
Deputy Head of School House Coordinating and overseeing the House Prefects, attending and ensuring smooth running of House events.	BRIGHTON COLLEGE
Founder and President of Brighton College STEM Society Promoting an active interest in natural sciences, technology, engineering and mathematics at Brighton College.	BRIGHTON COLLEGE
Leader of the House Chess Team I have been practicing chess for 7 years and became a part of the House Chess Team.	BRIGHTON COLLEGE

### Awards

C.I.M.E. full grant Awarded 1,000€ grant to attend the C.I.M.E. School 'Machine Learning: From Data to Mathematical Understanding'.	ITALY, 2023
Trinity Henry Barlow Scholarship Awarded £81,000 scholarship to pursue PhD in Mathematics of Information at University of Cambridge.	UK, 2022
Cambridge Christs Bursary Awarded £15,000 to pursue PhD in Mathematics of Information at University of Cambridge.	UK, 2022
CCIMI Awarded £50,000 to pursue PhD in Mathematics of Information at University of Cambridge.	UK, 2022
Churchill College Prize Scholarship Awarded £120 in recognition of excellent academic performance.	UK, 2021
Churchill College Honorary Scholarship Awarded £100 in recognition of excellent academic performance.	UK, 2020
Churchill College Prize Scholarship Awarded £120 in recognition of excellent academic performance.	UK, 2019
Cambridge Trust Scholarship Awarded £40,000 to read Mathematics at University of Cambridge.	UK, 2018
Brighton College Governors Award for Independent Study Awarded £500 for a piece of work outside of the A-Level curriculum.	UK, 2018
Brighton College Physics Prize: Bayliss-Smith prize Prize to recognise sustained excellence and scientific endeavor.	UK, 2018
Brighton College Science Essay Competition 2018 Winning essay: "The Tale of Cell Modelling".	UK, 2018
Brighton College Science Prize: Newton's Cup Prize to recognise sustained excellence and scientific endeavor.	UK, 2017
Brighton College Science Essay Competition 2017 Winning essay: "Brief History of Exoplanets".	UK, 2017

### Skills

**Programming languages:** Python . C

**Software packages:** pyTorch . odl . Matlab . Maple . Mathematica . LaTeX

**OS & computing:** Linux, MacOS, unix, bash, slurm, HPC, vim

**Languages:** English, Russian