

# BARINDER SINGH BANWAIT

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🔗 [barinderbanwait.github.io](https://barinderbanwait.github.io)

🌐 [github.com/barinderbanwait](https://github.com/barinderbanwait)

🇬🇧 British

## RESEARCH INTERESTS

Algebraic Number Theory

Arithmetic Geometry

Abelian Varieties

Modular Forms

## ACADEMIC APPOINTMENTS

Postdoctoral researcher in Mathematics

**Boston University**

📅 Sep 2022 – present

📍 Boston, USA

Mentor: Prof. Jennifer Balakrishnan

Postdoctoral researcher in Mathematics

**Ruprecht-Karls-Universität Heidelberg**

📅 Oct 2021 – Apr 2022

📍 Heidelberg, Germany

Mentor: Prof. Dr. Gebhard Böckle

Postdoctoral researcher in Mathematics

**Harish-Chandra Research Institute**

📅 Feb – Sep 2021

📍 Prayagraj, India

Visiting Scientist

**Max-Planck-Institut für Mathematik**

📅 Oct 2016 – Nov 2016

📍 Bonn, Germany

Host: Prof. Alex Bartel

Postdoctoral researcher in Mathematics

**Universität Duisburg-Essen**

📅 Jan 2015 – Jan 2017

📍 Essen, Germany

Mentor: Prof. Dr. Ulrich Görtz

Postdoctoral researcher in Mathematics

**Institut national de recherche en informatique et en automatique (INRIA)**

📅 Jan – Dec 2014

📍 Bordeaux, France

Mentor: Dr. Andreas Enge

## PAPERS AND PREPRINTS

1. **Towards strong uniformity for isogenies of prime degree**, with M. Derickx. Preprint, *arXiv:2302.08350*, 2023, submitted.
2. **Computing nonsurjective primes associated to Galois representations of genus 2 curves**, with A. Brumer, H. J. Kim, Z. Klagsbrun, J. Mayle, P. Srinivasan and I. Vogt. To appear, *LMFDB, Computation, and Number Theory (LuCANT)*, 2023. *arXiv:2301.02222*.
3. **Modularity over  $\mathbb{C}$  implies modularity over  $\mathbb{Q}$** . To appear, *Modularity and the Generalised Fermat Equation*, 2022. *arXiv:2212.14412*.
4. **Explicit isogenies of prime degree over number fields**, with M. Derickx. 2022, submitted to *Algebra and Number Theory*. *arXiv:2203.06009*.
5. **Cyclic isogenies of elliptic curves over fixed quadratic fields**, with F. Najman and O. Padurariu. To appear, *Mathematics of Computation*, 2023. *arXiv:2206.08891*.
6. **Explicit isogenies of prime degree over quadratic fields**. *International Mathematics Research Notices*. 2023(14):11829–11876, 2023.

7. **Examples of abelian surfaces failing the local-global principle for isogenies.** *Research in Number Theory*. 7(55) (2021)
8. **Correction: Examples of abelian surfaces failing the local-global principle for isogenies.** *Research in Number Theory*. 8(98) (2022)
9. **Del Pezzo surfaces over finite fields and their Frobenius traces**, with F. Fité and D. Loughran. *Mathematical Proceedings of the Cambridge Philosophical Society*. 167(1) (2019) 35-60.
10. **Tetrahedral Elliptic Curves and the local-global principle for isogenies**, with J. Cremona. *Algebra and Number Theory*. 8:5 (2014) 1201-1229.
11. **On some local to global phenomena for abelian varieties.** PhD Thesis, University of Warwick, 2013.

## INDUSTRY EXPERIENCE

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### Quantitative Analyst

#### Quantile

📅 Sep 2019 – Mar 2020

📍 London, UK

- Linear, mixed-integer, and multi-objective optimisation for compression of interest-rate derivative portfolios using Gurobi.
  - Visualisation of FX trading datasets across several client investment banks.
  - Modelling of reset risk and PV01 for swaptions.
  - Git code management with Bitbucket.
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### Research Engineer

#### CMR Surgical

📅 Jan 2018 – Sep 2019

📍 Cambridge, UK

- Research and optimisation of robotic control algorithms, including inverse kinematics and mass-spring-damper models.
- Mathematical modelling in Matlab, with Robotics and Control Systems toolboxes.
- Writing production-level, safety-critical embedded C code, compliant with MISRA C and International Standard IEC 62304.
- Time-series telemetry processing in Python, using pandas, numpy, and matplotlib.
- Analysis and visualisation of system log messages with Elasticsearch and kibana.
- Development with Amazon Web Services, including Lambda, S3, and Athena.
- Implementing machine learning algorithms for robot arm condition monitoring, using scikit-learn and Tensorflow.
- Unit and Regression tests in C, C++, and Matlab, including Google Test framework, continuously integrated with TeamCity.
- Agile software development with SVN and Git.

## EDUCATION

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### PhD Mathematics

#### University of Warwick

📅 Jan 2010 – Sep 2013

📍 Coventry, UK

Supervisor: Prof. John Cremona

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### BA and MMath Mathematics

#### University of Cambridge - Christ's College

📅 Oct 2005 – June 2009

📍 Cambridge, UK

MMath (*Part III of the Mathematical Tripos*) - Distinction

Part III Essay: Class Field Theory (Cohomological Approach), supervised by Dr. Tim Dokchitser

## INVITED TALKS

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(recent)

- Rational points on Modular Curves, ICTS, Bangalore (online), Sep 2023
- Modular curves and Galois representations, Zagreb, Croatia, Sep 2023
- Rational Points, Schney, Germany, Jul 2023
- MIT Number Theory Seminar, Cambridge MA, Nov 2022
- Boston University Number Theory Seminar, Boston MA, Nov 2022

- Séminaire de Théorie des Nombres, Université de Strasbourg, France, Apr 2022
- Séminaire de Théorie des Nombres, ENS de Lyon, France, Apr 2022
- Séminaire de Théorie des Nombres, Université Blaise-Pascal, Clermont-Ferrand, France, Apr 2022
- Bhaskaracharya Pratishthana, Pune (online), Feb 2022
- Atelier PARI/GP 2022, Besançon, France (online), Jan 2022
- Arithmetic Geometry Seminar, Universität Bayreuth (online), July 2021
- VaNTAGe Seminar (online), June 2021
- Effective Methods in Algebraic Geometry (online conference), June 2021
- Algebra Seminar, Rijksuniversiteit Groningen (online), June 2021
- Mathematics Colloquium, Indian Institute of Technology, Hyderabad (online), June 2021
- University of Washington Number Theory Seminar (online), June 2021
- Séminaire de Théorie Algorithmique des Nombres, Bordeaux (online), May 2021
- Stat-Math Unit, Indian Statistical Institute, Delhi (online), Apr 2021
- Mathematics Colloquium, Indian Institute of Science Education and Research, Mohali (online), Apr 2021
- Joining Seminar, Harish-Chandra Research Institute, Prayagraj (online), Feb 2021
- Zagreb Number Theory Seminar (online), Jan 2021

## ACADEMIC MEMBERSHIPS



Member of the *L-functions and Modular Forms Database*. 15 pull requests merged since October 2020 across the codebase, including Classical and Bianchi Modular Forms, Testing utilities, and Dirichlet Characters.

## OPEN SOURCE SOFTWARE CONTRIBUTIONS

### Absolutely simple endomorphism rings - Sage

📅 2021

- First functionality to check for geometric simplicity of Jacobians of genus 2 curves over  $\mathbb{Q}$ . Appeared in sage-9.5.

## TEACHING EXPERIENCE

### Course Lecturer

#### Computational Number Theory

📅 Oct 2021 - Feb 2022

📍 Heidelberg, Germany

Masters course covering algorithmic and computational topics in elliptic curves, modular forms, and algebraic number theory.

#### Vertiefung Zahlentheorie

📅 Apr - July 2016

📍 Essen, Germany

Representability of primes via quadratic forms - from Fermat, Euler, Gauss, and to Artin Reciprocity. Three hours per week for 15 weeks. Lectures given in German.

#### Einführung in das Computer-Algebra-Paket Sage

📅 Sep 2015

📍 Essen, Germany

Introductory week-long course on Sage aimed at final year undergraduates. Course given in German.

#### Algebraic Number Theory

📅 July 2009

📍 Linyi, China

Introductory course at summer school aimed at second year undergraduates.

### Seminar Organiser

#### Prime numbers and Cryptography

📅 Apr 2022

📍 Heidelberg, Germany

Bachelor's level seminar organised with Sriram Chinthalagiri

Abelian Varieties

Oct 2021 - Feb 2022 Heidelberg, Germany

Masters level seminar organised with Prof. Böckle.

Algebraic Surfaces

Oct 2015 - Jan 2016 Essen, Germany

Masters level seminar organised with Prof. Görtz.

Teaching Assistant

Linear Algebra	Apr - July 2015	Vytautas Paškūnas	Universität Duisburg-Essen
Modular Forms	Oct - Dec 2012	Mehmet Haluk Şengün	University of Warwick
Algebraic Number Theory	Jan - Mar 2012	Johan Bosman	University of Warwick
Elliptic Curves	Oct - Dec 2011	Lassina Dembélé	University of Warwick
Algebraic Number Theory	Jan - Mar 2010	William Hart	University of Warwick

Undergraduate Supervisor

Oct 2010 - Apr 2013 University of Warwick

Holding supervisions of groups of 5 undergraduates.

STEP Mentor

Apr 2007 – 2009 University of Cambridge

Coaching groups of 10 A-Level students in the STEP mathematics entrance exams to increase diversity and access at Cambridge.

REFeree DUTIES FOR JOURNALS

- Mathematics of Computation
- International Journal of Number Theory
- Algebra and Number Theory
- Research in Number Theory
- Acta Arithmetica

AWARDS

Engineering and Physical Sciences Research Council, UK

- Jan 2010
- Full funding for PhD studies.

Institute for Advanced Study, Princeton NJ, USA

- Jul 2008
- Full funding to attend Undergraduate Summer School Program of Park City Mathematics Institute on Algebraic Geometry in 2008.

Whelan Prize

- Oct 2007
- Awarded by Christ's College, University of Cambridge, for outstanding examination performance (top of college in mathematics).

Nuffield Trust, UK

Jul 2007

- Undergraduate Research Bursary to conduct summer research project.
- Supervisor: Dr. Jon Bevan, University of Surrey, UK.

# LANGUAGES

English	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>	Python	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>
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Deutsch	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>	C	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>
हिंदी (Hindi)	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>	PARI/GP	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>
Français	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>	Magma	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>