

BARINDER SINGH BANWAIT

✉ barinder.s.banwait@gmail.com

🔗 barinderbanwait.github.io

🌐 github.com/barinderbanwait

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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 PREPRINT

- **Towards strong uniformity for isogenies of prime degree**, with M. Derickx. Preprint 2023, *arXiv:2302.08350*.
- **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. *arXiv:2301.02222*. To appear, *LMFDB, Computation, and Number Theory (LuCANT) 2023*.
- **Modularity over \mathbb{C} implies modularity over \mathbb{Q}** . *arXiv:2212.14412*. 2022, submitted.
- **Explicit isogenies of prime degree over number fields**, with M. Derickx. *arXiv:2203.06009*. 2022, submitted.
- **Cyclic isogenies of elliptic curves over fixed quadratic fields**, with O. Adascalitei and F. Najman. *arXiv:2206.08891*. 2022, submitted.
- **Explicit isogenies of prime degree over quadratic fields**. *International Mathematics Research Notices*. (2022)
- **Examples of abelian surfaces failing the local-global principle for isogenies**. *Research in Number Theory*. 7(55) (2021)
- **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.

- **Tetrahedral Elliptic Curves and the local-global principle for isogenies**, with J. Cremona. *Algebra and Number Theory*. 8:5 (2014) 1201-1229.

INDUSTRY EXPERIENCE

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

PhD Mathematics

University of Warwick

📅 Jan 2010 – Sep 2013

📍 Coventry, UK

Supervisor: Prof. John Cremona

Thesis: On some local to global phenomena for abelian varieties

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

(recent)

- 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
- Number Theory Seminar, Indian Institute of Science Education and Research, Pune, Jan 2020

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} .
- Scheduled for inclusion into sage-9.5.

TEACHING EXPERIENCE

Course Lecturer

Computational Number Theory

📅 Oct 2021 - present

📍 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

Abelian Varieties

📅 Oct 2021 - present

📍 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	●●●●●●	Python	●●●●●●
ਪੰਜਾਬੀ (Punjabi)	●●●●●●	Sage	●●●●●●
Deutsch	●●●●●●	C	●●●●●●
हिंदी (Hindi)	●●●●●●	PARI/GP	●●●●●●
Français	●●●●●●	Magma	●●●●●●