# Number Theory - key research area in UK mathematics

Rough decomposition, underlying undergraduate courses, driving problems:

- **Algebraic NT**
  Algebraic Number Theory, Galois Theory, Local Fields
  Inverse Galois Problem, Class groups
- **Arithmetic Geometry**
  Elliptic Curves, Algebraic Number Theory, Algebraic curves/geometry
  Birch-Swinnerton-Dyer conjecture, integral and rational points
- **Automorphic forms**
  Modular forms, Complex analysis, Representation theory
  Langlands Programme
- **Analytic NT / Discrete analysis**
  Analytic Number Theory, Complex analysis, Combinatorics
  Distribution of primes, Riemann Hypothesis, Prime gaps

+ Additional dimension: Theoretical - Explicit - Algorithmic
+ Cryptography [Elliptic curves, Lattices, Number fields]

## Number theorists in the UK (possibly incomplete!)

| | |
|---|---|
| Bath: | Loughran |
| Bristol: | Bober, Booker,T Dokchitser, Klurman, Lee, Maistret, Martindale |
| Glasgow: | Bartel, Sofos |
| Cambridge: | Coates, Fisher, Scholl, Thorne |
| Cardiff: | Aliev |
| Durham: | Abrashkin, Bouganis, Funke, Gangl, Shotton, Vishe |
| UEA: | Stevens |
| Edinburgh: | Smyth |
| Exeter: | Andrade, Byott, Jonhston, Langer, Saidi |
| Imperial: | Buzzard, Caraiani, Gee, Helm, Pal, Skorobogatov |
| KCL: | Burns,Diamond,Dogra,J Newton,R Newton,Pataschnick,Wigman |
| Queen Mary: | Saha, Sasaki |
| UCL: | V Dokchitser, Hill, Solomon, Yafaev |
| Manchester: | Bui, Coleman, Jones |
| Nottingham: | Fesenko, Wuthrich |
| Oxford: | Brown,Flynn,Green,Keating,Lauder,Maynard,Pila,Sanders,Wiles |
| Reading: | Daw |
| Sheffield: | Berger, Dummigan, Jarvis, Kurinczuk, Manoharmayum, Sengun |
| Warwick: | Chow, Cremona, Harper, Kim, Lazda, Loeffler, Siksek, Williams |
| York: | Beresnevich, Hughes, Levesley, Velani, Zorin |

# Major doctoral programmes

### London School of Geometry & Number Theory (LSGNT)

Imperial College / King's College / University College London

### CDT in Mathematics at Warwick

Pure, Applied, Interdisciplinary

### Heilbronn Doctoral Training Partnership

Bristol / Manchester / Oxford
Discrete mathematics (in broadest sense)

Optional summer placements at the Heilbronn Institute for Mathematical Research (HIMR) for classified research (UK Nationals)

# One story: elliptic curves

## Mordell (1922)

Points on an elliptic curve over $\mathbb{Q}$ form a finitely generated abelian group.

## Birch, Swinnerton-Dyer (1960s)

Computer experiments that led to the Birch–Swinnerton-Dyer conjecture.

Since then: Cassels, Birch, Swinnerton-Dyer, Coates, Wiles, Cremona, ...

## Wiles et al (1995)

Elliptic curves are modular, and Fermat's Last Theorem

## Current research

Siksek, Gee, Thorne, Caraiani (Modularity), V Dokchitser (Birch-Swinnerton-Dyer), Coates (Iwasawa theory of elliptic curves), Burns, Johnston, Bartel (Integral structure of points), Cremona, Fisher (Selmer groups), Wuthrich (Modular curves), Loeffler (Euler systems), ...