

LTCC Advanced Course

Title: Arithmetic Statistics

Basic details:

- Core audience: 2nd/3rd year, pure, interested 1st years also encouraged to attend
- Course format: extended (5 x 2 hour lectures)

Course description:

Arithmetic statistics encompasses a broad range of quantitative problems involving the distribution of number theoretic objects. This course is an introduction to the area through the problem of counting number fields by discriminant. After reviewing some preliminaries from algebraic number theory, we will explore how to count extensions of small degree by discriminant with prescribed Galois group, with the goal of covering in detail Davenport and Heilbronn's famous results on S_3 -cubic extensions. We will then touch on some of Bhargava's more recent innovations in this area and their applications, and get a sense of the current state of the art for higher degrees.

- Keywords: number theory, geometry of numbers, counting number fields, Malle's conjecture
- Recommended reading:
 - Neukirch's *Algebraic Number Theory* (or similar text)
 - Davenport and Heilbronn's *On the density of discriminants of cubic fields. II*
- Additional optional reading:
 - Bhargava's 2009 Arizona Winter School notes
 - Bhargava–Shankar–Tsimmerman's *On the Davenport–Heilbronn theorems and second order terms*
 - Melanie Wood's 2014 Arizona Winter School notes
- Prerequisites: Fields and Galois theory. Some basic knowledge of algebraic number theory (orders and their class groups, discriminants, p -adic numbers) will be helpful, but we will review these briefly.

Format:

- Discussion/problem sheets: 4 problem sheets with partial solutions
- Electronic lecture notes: Yes

Lecturer details:

- Lecturer: Christopher Keyes
- Lecturer home institution: King's College London
- Lecturer email: christopher.keyes@kcl.ac.uk