

Graduate Talk

Random matrix theory and the Riemann zeta function

In this first lecture I will review some basic properties of the Riemann zeta function and some ideas from random matrix theory. I will then describe how these subjects are connected, conjecturally. This will be used to motivate a description of recent applications of random matrix theory to shed new light on some long-standing problems relating to the value distribution of the Riemann zeta function on the line where the Riemann Hypothesis places its zeros.

(The level will be suitable for graduate students)

Colloquium I

Random matrix theory, L-functions and elliptic curves

In this second lecture I will review some basic properties of L-functions and describe how random matrix theory can be used to explain the range of values these functions take at the centre of the critical strip. As an example, I will explain why this is important in the context of the theory of elliptic curves and the Birch-Swinnerton-Dyer conjecture.

(The level will be suitable for graduate students)

Colloquium II

Hybrid products and lower order terms

In my final lecture I will explain how hybrid Euler-Hadamard products can be used to combine arithmetic and random-matrix information in moment formulae. I will then explain how one can extend the connections between random matrix theory and number theory described in the previous lectures beyond leading-order asymptotic agreement to include all lower order terms.

(This lecture will be slightly more technical than the other two although not by much)