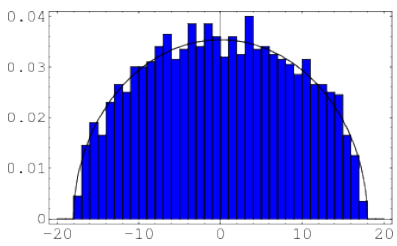
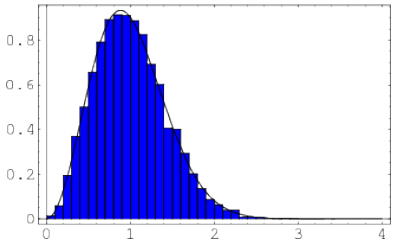
Course announcement: Math 689
Random Matrix Theory

Spring 2017, TR 12:45 - 2 p.m. in CVE 007.

Instructors: Michael Anshelevich, Blocker 533D, manshel@math.tamu.edu;
and Gregory Berkolaiko, Blocker 625C, berko@math.tamu.edu.

Prerequisites: undergraduate linear algebra, integration and measure. Background in probability, real analysis, or physics will facilitate understanding but will be supplied at different points in the course.





Learning Objectives: Over the last 50 years, the study of random matrices has grown into an independent field. Its techniques come from probability, functional analysis, and combinatorics; and it draws problems from and provides applications to a long list of fields, including statistics, physics, integrable systems, wireless communication etc. We will make no attempt to cover the whole field in depth in one semester (the course may be continued at a later date). Instead, we will discuss selected topics, the choice being influenced by the interests of students in the class. These will include the exact calculations for the Gaussian ensembles, concentration of measure techniques, Wigner and unitarily invariant ensembles, numerical modeling, Harish-Chandra-Itzykson-Zuber integral, graph enumeration, Dyson's Brownian motion, and connections to free probability. By the end of the course, students will become familiar with the principal ensembles of random matrices, the eigenvalue statistics on different scales, and methods of their derivation. They will also be able to generate random matrices numerically to obtain experimental confirmation of the observed mathematical laws.

The course should be of interest to mathematics students from the Mathematical Physics, Probability, Functional Analysis and Free Probability, and Combinatorics groups. In addition, physics and engineering are also welcome to register for the course.

Textbook: We will not follow a particular text very closely. There are numerous books on RMT, including

- (freely available online) AN INTRODUCTION TO RANDOM MATRICES, by Greg Anderson, Alice Guionnet and O. Zeitouni, Cambridge University Press.
- RANDOM MATRICES, by Madan Lal Mehta, Academic Press.
- (freely available online) TOPICS IN RANDOM MATRIX THEORY, by Terrence Tao, AMS.

Exams: None.

Grading: The grade will be based on 5 homework assignments. A total score of 90% or more guarantees an A, a score of 80% or more a B, 70% or more a C, 60% or more a D.