PCMI 2017 - Introduction to Random Matrix Theory
Class meets every day 1:00 pm–2:00 pm, Venue: TBA

Instructor: Prof. Mihai Stoiciu, Williams College
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Office Hours: By appointment.

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TA Sessions: Every day, 4:15–6:00 pm

Course Webpage: http://sites.williams.edu/mstoiciu/pcmi/

Course Description: Initiated by research in multivariate statistics (Wishart, 1928) and nuclear physics (Wigner, 1955), the study of random matrices is nowadays an active and exciting area of mathematics, with numerous applications to theoretical physics, number theory, functional analysis, optimal control, and finance. Random Matrix Theory provides understanding of various properties (most notably, statistics of eigenvalues) of matrices with random coefficients.

This course will provide an introduction to the basic theory of random matrices, starting with a quick review of Linear Algebra and Probability Theory. We will continue with the study of Wigner matrices and prove the celebrated Wigner’s Semicircle Law. After this, we will turn our attention to Gaussian ensembles and investigate the Gaussian Orthogonal Ensemble (GOE) and the Gaussian Unitary Ensemble (GUE). In particular, we will derive the joint distribution of eigenvalues for GOE and GUE and discuss the spacing distributions of the spectrum for these ensembles. The last lectures of the course will be dedicated to random Schrödinger operators and their spectral properties (in particular, the phenomenon called Anderson localization).