Module: Elective Advanced Lectures: Theoretical Physics

Module No.: physics70c

Course: Introduction to Random Matrix Theory (T)

Course No.: physics7512

Category	Type	Language	Teaching hours	CP	Semester
Elective	Lecture with exercises	English	3+1	6	ST/WT

Requirements for Participation:

Preparation:
Complex Analysis, Theory I-IV is strongly recommended

Form of Testing and Examination:
Examination (written)

Length of Course:
1 semester

Aims of the Course:
Basic understanding of RMT and ist application

Contents of the Course:
Random matrix theory is a tool for understanding a wide variety of phenomena in physics and mathematics. It started with the idea of Wigner in the 1950's to describe the spectra of heavy nuclei with a random Hamiltonian. Surprisingly this idea worked and yielded some important physical information about this complicated system and lead to the notion of universality. RMT has wide range of applications in atomic physics, mesoscopic physics, QCD, quantum chaos, biophysics, number theory, finance and many others. The main topics of this course will be universality, symmetry classfication of RMTs, the logarithmic Coulomb gas,finite size effects, asymptotic analysis of the Riemann-Hilbert problem and applications to problems in quantum physics and statistical mechanics.

Recommended Literature:
Mehta M.L. Random matrices (3ed., Elsevier, 2004)
Potters M., Bouchaud J.P., A First Course in Random Matrix Theory (Cambridge University Press, 2020)