# SEMPARIS – Séminaires en région parisienne

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## Cours

**Vendredi 27 Novembre 2015, 10 :00**
IPHT, Salle Claude Itzykson, Bât. 774, Orme des Merisiers
Domaines : cond-mat—hep-th—math-ph—physics

Titre : *Introduction to Random Matrix Theory and its various applications (2/5)*

Orateur : **Satya Majumdar ( LPTMS )**


Résumé : *Outline of the course :*
*1) Brief historical introduction to RMT : 1applications.*
- *Discussion of basic properties of matrices, different random matrix ensembles, rotationally invariant ensembles such as Gaussian ensembles etc.*

*2) Gaussian ensembles : derivation of the joint probability distribution of eigenvalues, starting from the joint distribution of matrix entries.*
*3) Analysis of the spectral properties of eigenvalues : given the joint distribution of eigenvalues, how to calculate various observables such as :*
- *Average density of eigenvalues — Wigner semi-circle law*
- *Counting statistics, spacings between eigenvalues etc*
- *Distribution of the extreme (maximum or minimum eigenvalues)*

*4) Two complementary approaches to study spectral statistics :*
- *Large N (for an NxN matrix) method by the Coulomb gas approach : saddle point method*
- *Finite N method : for Gaussian unitary ensemble : orthogonal polynomial method (essentially quantum mechanics of free fermions at zero temperature).*

*5) Tracy-Widom distribution : prob. distribution of the top eigenvalue. Its appearance in a large number of problems, universality and an associated third order phase transition.*
*6) Perspectives and summary.*