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IMPAN lectures 2017/2018

Free probability and random matrices

Lecture 0. October 5, 2017
What is this all about?

Suggested reading 0.

Persi Diaconis

"What is ... a random matrix?"

Notices of the AMS, vol. 52, number 11, pp. 1348–1349.

Suggested reading 1

Hint: PDF files with all books are legally available on authors' websites.

MS = James Mingo, Roland Speicher,
"Free probability and random matrices"

recommended!

NS = Alexandru Nica, Roland Speicher
"Lectures on the combinatorics of free probability"

Terrence Tao
"Topics in random matrix theory"

Tao offers interesting philosophical insight.
→ Section 2.5.

Suggested reading 2.

Anderson, Guionnet, Zeitouni

"An introduction to random matrices".

N. C. Snaith P. J. Forrester J. J. M. Verbaarschot

"Developments in random matrix theory"

J. Phys. A 36 (2003) R1

arXiv: cond-mat/0303207

good survey of topics which WILL NOT be covered by this series of lectures.

general plan of Lecture 1.

LECTURE 0.

→ general picture of the theory

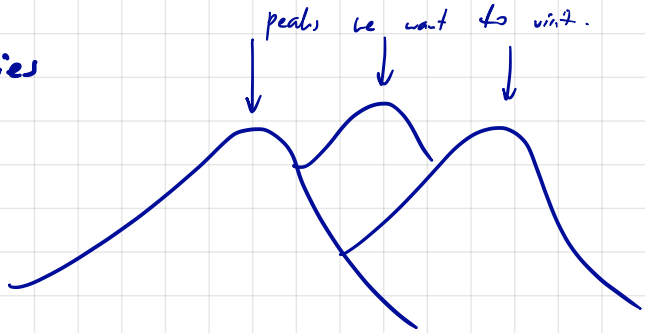
- universality, Riemann ζ, chaos,
- determinantal point processes, Bai-Deift-Johansson,

→ more specific picture of the series

- Voiculescu's free probability
- free cumulants
- combinatorics
- Weingarten calculus.
- Brown measure, non-hermitian random matrix

LECTURE 1.

Highlights of the series



mathematical landscape

* what happens to eigenvalues of large random matrices

* freeness - surprising abstract framework for random matrices

* combinatorics of non-crossing partitions and free cumulants

PROVERBIAL
"what happens to eigenvalues of a sum of two matrices".

* eigenvalues of nonhermitian matrices and Brown measure.

* operator algebras, free group factors, ...