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THE WEIZMANN INSTITUTE OF SCIENCE  
FACULTY OF MATHEMATICS AND COMPUTER SCIENCE  
Algebraic Geometry and Representation Theory Seminar

on Wednesday, Dec 23, 2020 at 16:30

[HTTPS://WEIZMANN.ZOOM.US/J/98304397425](https://weizmann.zoom.us/j/98304397425)

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Harmonic Analysis on  $GL_n$  over Finite Fields

Abstract:

There are many formulas that express interesting properties of a finite group  $G$  in terms of sums over its characters. For estimating these sums, one of the most salient quantities to understand is the character ratio

$\text{Trace}(\rho(g)) / \dim(\rho)$ ,

for an irreducible representation  $\rho$  of  $G$  and an element  $g$  of  $G$ . For example, Diaconis and Shahshahani stated a formula of the mentioned type for analyzing certain random walks on  $G$ .

Recently, we discovered that for classical groups  $G$  over finite fields there is a natural invariant of representations that provides strong information on the character ratio. We call this invariant rank.

Rank suggests a new organization of representations based on the very few "small" ones. This stands in contrast to Harish-Chandra's philosophy of cusp forms, which is (since the 60s) the main organization principle, and is based on the (huge collection of) "Large" representations.

This talk will discuss the notion of rank for the group  $GL_n$  over finite fields, demonstrate how it controls the character ratio, and explain how one can apply the results to verify mixing time and rate for random walks.

This is joint work with Roger Howe (Yale and Texas A&M). The numerics for this work was carried with Steve Goldstein (Madison) and John Cannon (Sydney).

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