

## Abstracts

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Minimal Codes: Geometry and Combinatorics

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This lecture series is about the interaction of coding theory with finite geometry and combinatorics. The main topic is minimal codes, where recent advances have been made through these interactions. We will establish their link to strong blocking sets in finite geometry. We will study the recently resolved open problem concerning explicit constructions of asymptotically good minimal codes. This construction uses the connection with strong blocking sets and expander graphs. We will also study the connection between minimal codes and the well-known triffence problem.

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Fan Wei

*Duke University, USA*

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Regularity Lemmas and Removal Lemmas

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The tutorial is based on lectures from a minicourse at Duke University. We will quickly review some basic facts about regularity lemma, and then talk about some classical results for removal lemmas.

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Huy Tuan Pham

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First Moment Obstructions in Extremal, Probabilistic and Additive  
Combinatorics

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Recent developments in probabilistic combinatorics have brought about synergistic interactions across multiple disciplines, including extremal combinatorics, probability theory, and additive combinatorics. This tutorial aims to give an introduction to some of these developments, centered around first moment obstructions.

We will start by introducing first moment obstructions and describe their fundamental role in important phenomena such as the threshold phenomena (the Kahn-Kalai conjecture on location of thresholds), hypergraph containers, the sunflower conjecture, and selector processes in probability theory. We will then describe how this opens up a new avenue to tackle thresholds of interesting combinatorial properties, which crucially leverages synergistic interactions with the regularity method in extremal combinatorics.

Finally, we will describe some surprising connections to additive combinatorics and the study of structural and enumerative aspects of sets of small doubling inspired from probabilistic phenomena and first moment obstructions.

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