

# Departamento de Matemáticas

## Representations of Rank-Metric and Gabidulin Codes

Rank-metric codes were introduced in 1978, but only in the last decade they have gained a lot of interest due to their application to network coding. These codes are linear subspaces of  $n \times m$  matrices over a finite field  $F_q$ , but they can be also seen as subspaces of vectors of length  $n$  over an extension field  $F_{q^m}$ . Codes that are optimal with respect to this metric are called **Maximum Rank Distance (MRD) codes**. The first and most studied construction of rank-metric codes was proposed in the seminal works of Delsarte (1978), Gabidulin (1985) and Roth (1991). These codes are known as *generalized Gabidulin codes*.

In this talk we will give an overview on various representations of rank-metric codes. When one considers codes in  $F_{q^m}^n$ , then it is natural to represent them via their generator matrix. However, in the case of codes in  $F_q^{m \times n}$ , the natural representation is using 3-tensors  $T$  in  $F_q^{k \times m \times n}$ . We will analyze how these representations are useful for extrapolating information about the underlying codes, and why they are more convenient in terms of storage and encoding complexity.

Moreover, we will examine the structure of generalized Gabidulin codes, that are the analogue of *Generalized Reed-Solomon codes* in the rank metric. The study of these codes and their encoders leads to matrices with a deep structure in the context of finite fields and finite geometry.

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**Lugar:** Seminario de Matemáticas.

**Biography:** Alessandro Neri received both his Bachelor's and Master's degree in Mathematics from University of Pisa (Italy). Since 2015, he is currently a PhD student in the Applied Algebra group at University of Zurich, under the supervision of Prof. Joachim Rosenthal.

His main research interests are Algebraic Coding Theory and Combinatorics. The main topic of his PhD project concerns rank-metric codes, their algebraic structure and their invariants.