# ALGEBRAIC AND COMBINATORIAL CODING THEORY (THU 8/1/26)

ROOM S203 (14-15.50)

**Tuomo Valtonen** (Aalto University)
***Automorphisms of Complex Hadamard Matrices*** **(14-14.20)**

Symmetry in the context of equivalence or isomorphism is a fundamental and natural concept in any study of discrete structures. Symmetries are also important for non-discrete structures, but their treatment can be more challenging and is perhaps therefore often overlooked. This holds for many studies of complex Hadamard matrices, that is, matrices with unimodular complex entries satisfying the equation $HH^* = nI$. In the current work, equivalence of complex Hadamard matrices is considered, and algorithms for determining equivalence of matrices and the automorphism group of a matrix are presented.

**Tuomo Lehtilä** (Turku University)
***On the intersection of $q$-ary Hamming balls*** **(14.30-14.50)**

I present results on the intersection of multiple $q$-ary Hamming balls for $q \geq 3$. Given a set of center points $S$ of $t$-radius Hamming balls, a link between the radius of the set $S$, the center region of the set $S$, and the size of the intersection is established. In the case of three balls, the maximum cardinality of the intersection is investigated. The intersection of multiple Hamming balls has become interesting lately due to the emergence of DNA-based data storage systems which often use a quaternary alphabet.

**Johan Vester Dinesen** (Aalto University)
***The Star Product of Uniformly Random Codes*** **(15-15.20)**

The star product (also known as the Schur or Hadamard product) of two linear codes is the subspace spanned by the component-wise products of codewords from the two codes. This operation is attracting increasing attention because of its connections with several areas of coding theory, information theory, and cryptography. We consider the problem of determining the expected dimension of the star product of two uniformly random linear codes. We show that asymptotically in both the field size and the dimensions of the two codes, the expected dimension reaches its maximum.

**Patricija Šapokaitė** (Aalto University)
***Derived matroids and coadjoints*** **(15.30-15.50)**

Matroids arise naturally in coding theory (as the combinatorial data of linear dependence between columns in a matrix), but can also be interpreted as a special class of hypergraphs. We generalize the recent notion of derived matroids (Freij-Hollanti, Jurrius, Kuznetsova 2023) to a novel notion of hypergraphical matroids, and identify an important special subclass of these, denoted natural hypergraphs and matroids. We show that if a natural matroid $M$ has a coadjoint, then its derived matroid is an example of such a coadjoint.