Finite Geometries and Applications
(Org: **Sam Mattheus** (Vrije Universiteit Brussel))

JOZEFIEN D'HAESELEER, Universiteit Gent
Projective solids pairwise intersecting in at least a line

In the last decades, projective subspaces, pairwise intersecting in at least a t-space were investigated. The case with $t = 0$ (the Erdös-Ko-Rado-sets), received special attention. Let PG(n, q) be the projective space of dimension n, over the finite field of order q. In this talk, I discuss the structure of maximal sets of 3-spaces of PG(n, q), $n \geq 5$, pairwise intersecting in at least a line, and give an overview of the largest examples of these sets. We also generalize these results to a maximal set of k-dimensional spaces, mutually intersecting in at least a $(k-2)$-dimensional space in PG(n, q), where $n \geq k + 2$.

JAN DE BEULE, Vrije Universiteit Brussel
A lower bound on the size of linear sets on a projective line of finite order

A set S of points of the finite projective space $\mathrm{PG}(\mathbb{F}_q^{n+1})$ is a *linear set* of rank t if $S = \{\langle u\rangle_F | u \in U\}$ for some set $U \subset \mathbb{F}_q^{n+1}$ that is a t-dimensional vector space over a subfield of $\mathbb{F}_q$.

The following result was obtained jointly with Geertrui Van de Voorde: *An $\mathbb{F}_q$-linear set of rank $k \leq n$ in $\mathrm{PG}(1, q^n)$ which contains at least one point of weight one, contains at least $q^{k-1} + 1$ points.*

This result, its connection with direction problems in affine spaces, and some applications will be discussed.

LINS DENAUX, Universiteit Gent
Small weight code words in the code of points and hyperplanes of PG(n,q)

This topic concerns small weight code words of the code $C_{n-1}(n, q)$, the vector space generated by the incidence matrix of points and hyperplanes of PG(n, q) $(n \in \mathbb{N} \setminus \{0, 1\}$, $q = p^h$, p prime, $h \in \mathbb{N}^\times)$. Polverino and Zullo proved that the second minimum weight of $C_{n-1}(n, q)$ is $2q^{n-1}$: code words matching this weight are precisely the scalar multiples of the difference of the incidence vectors of two hyperplanes. We have characterised all code words up to weight $4q^{n-1} - \Theta(q^{n-2}\sqrt{q})$ as linear combinations of hyperplanes having a fixed $(n-3)$-dimensional subspace in common. Furthermore, other results related to codes arising from substructures in projective spaces will be discussed.

LISA HERNANDEZ LUCAS, Vrije Universiteit Brussel
Dominating sets in finite generalized quadrangles

The domination number is the smallest size of a dominating set, a set D of vertices in a graph such that each vertex of the graph is either an element of D, or is adjacent to an element of D. When considering the domination number in the incidence graph of a finite generalized quadrangle $GQ(s, t)$, it seems obvious that this number is at least $2st + 2$, the size of the union of an ovoid and a spread. In this talk, I'll tell you the story of how Tamás Héger and I made the surprising discovery that this is not true.

SAM MATTHEUS, Vrije Universiteit Brussel
Number theory in finite fields from a geometrical point of view

Facing insurmountable obstacles regarding questions about digits of natural numbers, researchers have explored the concept of digits of elements in finite fields. In doing so, they try to gain insight into the same questions for this easier case, in order to apply this to the question in the original setting. In this new setting, classical techniques rely heavily on finite field machinery such as character theory and estimates of exponential sums. In this talk, we will reformulate the problem in graph theoretical and geometrical terms in order to obtain new proofs of known theorems and extend them.