# Mathematics Seminar

# Rocky Mountain Algebraic Combinatorics Seminar

## Large Erdős-Ko-Rado Sets in Polar Spaces

Ferdinand Ihringer
University of Regina

An *Erdős-Ko-Rado set* (EKR set) $Y$ of $\{1, \ldots, n\}$ is a family of $k$-sets, which pairwise intersect non-trivially. A non-trivial problem is to provide tight upper bounds on $Y$ and classify all examples, which obtain that bound. Erdős, Ko and Rado proved $|Y| \leq \binom{n-1}{k-1}$ for $n \geq 2k$. Equality holds for $n \geq 2k + 1$ if and only if $Y$ is the family of all $k$-sets, which contain one fixed element.

If we equip the vector space $\mathbb{F}_q^n$ with a reflexive, non-degenerate sesquilinear form, then the subspaces that vanish on that form are a polar space, so-called *isotropic subspaces*. The largest isotropic subspaces of a polar space are called generators. We say that two generators intersect trivially if the dimension of their intersection is 0. An *EKR set of a polar space* is a set of pairwise non-trivially intersecting generators. We present various results on EKR sets for polar spaces, in particular we will discuss some recent so-called weak Hilton-Milner type results.

## Searching for Balanced Sets

Gavin King
University of Wyoming

Let X be a finite set of unit vectors in some Euclidean space. Define $R_{\alpha,\beta}(x, y)$ for $\alpha, \beta \in \mathbb{R}$ and $x, y \in X$ as $R_{\alpha,\beta}(x, y) = \{z \in X : \langle z, x\rangle = \alpha, \langle z, y\rangle = \beta\}$satisfying:

- For each $x, y$, $|R_{\alpha,\beta}(x, y)| = |R_{\alpha,\beta}(y, x)|$.
- For any $\alpha$, there is a constant $p_\alpha$ such that for all $x$, $\sum R_{\alpha,\alpha}(x, x) = p_\alpha x$.
- For each $\alpha, \beta, \gamma$ there exists a constant $m^\alpha_{\beta,\gamma}$ such that for any pair of vectors $v_i, v_j$ with $\langle v_i, v_j\rangle = \alpha$, we have $\sum R_{\beta,\gamma}(v_i, v_j) - \sum R_{\gamma,\beta}(v_i, v_j) = m^\alpha_{\beta,\gamma}(v_i - v_j)$, regardless of our choice of $v_i$ and $v_j$.

Balanced sets are a notion intricately tied to the concept of association schemes, and especially to the association schemes with the $Q$-polynomial property. I will be discussing the existing work on balanced sets as well as my own, such as a classification of balanced sets with small numbers of inner products, and ways to search for balanced sets connected to permutation groups.

Weber 223
4–6 pm
Friday, May 5, 2017
(Refreshments in Weber 117, 3:30–4 pm)
Colorado State University

This is a joint Denver U / UC Boulder / UC Denver / U of Wyoming / CSU seminar that meets biweekly.
Anyone interested is welcome to join us at a local restaurant for dinner after the talks.

Colorado State University
Department of Mathematics
Fort Collins, Colorado 80523