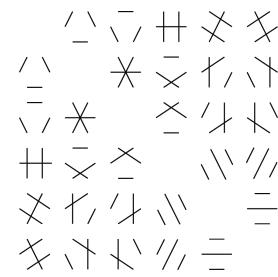


# Mathematics Seminar



## 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  $\{1, \dots, n\}$  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  $m_{\beta,\gamma}^\alpha$  such that for any pair of vectors  $v_i, v_j$  with  $\langle v_i, v_j \rangle = \alpha$ , we have  $\sum R_{\beta,\gamma}(v_i, v_j) - \sum R_{\gamma,\beta}(v_i, v_j) = m_{\beta,\gamma}^\alpha (v_i - v_j)$ , 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.



Department of Mathematics  
Fort Collins, Colorado 80523