

---

**Association schemes and applications**  
**Les schémas d'association et applications**

(Org: **Roghayeh Maleki** (University of Regina) and/et **Sarobidy Razafimahatratra** (University of Lethbridge))

---

---

**ROBERT BAILEY**, Memorial University of Newfoundland

---

**PIERRE-ANTOINE BERNARD**, University of Toronto

---

**DOUGLAS FARENICK**, University of Regina

---

**CHRISTOPHER FRENCH**, Grinnell College

---

**ALLEN HERMAN**, University of Regina

*On the second largest eigenvalue of certain graphs in the perfect matching association scheme*

The perfect matching association scheme  $\mathcal{M}_{2n}$  is the orbital scheme of  $Sym(2n)$  acting on the cosets of a hyperoctahedral subgroup of type  $B_n$ . Its relations and eigenspaces are naturally indexed by the even partitions of  $2n$  ( $2\lambda$  for  $\lambda \vdash n$ ), and the first eigenmatrix of the scheme is integral. It thus shares many parallels with the conjugacy class scheme  $cc(S_n)$ , whose rows and columns are naturally indexed by the partitions of  $n$  and whose first eigenmatrix is integral. While the eigenvalues of  $cc(S_n)$  can be computed using values of the symmetric functions  $s_\lambda(\mu)$ , the eigenvalues of  $\mathcal{M}_{2n}$  are less understood.

The talk will discuss recent progress on a conjecture of Meagher concerning the second largest eigenvalue of  $A_{2\lambda} \in \mathcal{M}_{2n}$ : if the partition  $\lambda$  has at least two 1's, then the second largest eigenvalue of  $A_{2\lambda}$  occurs on the  $2(n-1, 1)$ -eigenspace. This conjecture is analogous to the Aldous property for graphs in  $cc(S_n)$ , proved by Li, Xia, and Zhou in 2023: when  $\lambda$  corresponds to the conjugacy class of a permutation with at least two fixed points, then the second largest eigenvalue of  $A_\lambda \in cc(S_n)$  occurs on the  $(n-1, 1)$ -eigenspace.

This is joint work with Himanshu Gupta, Alice Lacaze-Masmontiel, Roghayeh Maleki, and Karen Meagher.

---

**SHUXING LI**, University of Delaware

---

**ROGHAYEH MALEKI**, University of Regina

---

**ADEBOLA OMOTOYE**, University of Regina

*On the Inclusion of the Terwilliger Algebra in the Centralizer Algebra of an Association Scheme*

We present the tools for analyzing the extent to which the algebraic structure of the Terwilliger algebra ( $T = T_x(\mathcal{S})$ ) of an association scheme  $(X, \mathcal{S})$  with respect to a vertex  $x \in X$  can be obtained from that of the centralizer algebra  $\tilde{T} = \tilde{T}_x(\mathcal{S})$  with respect to the same  $x$  of the scheme. Since  $T \subseteq \tilde{T}$  is known, it suffices to determine the decomposition of the restrictions of the irreducible  $\tilde{T}$ -modules to  $T$ . We demonstrate these calculations using schemes obtained from graphs, groups, and orbitals. In many cases, these restrictions remain irreducible, but as we will show, there are exceptions in the conjugacy class schemes of certain small groups.

---

**SAROBIDY RAZAFIMAHATRATRA**, University of Lethbridge  
*The group association scheme of the Möbius group*

In this talk, I will present results on the group association scheme of the Möbius group over finite field. First, I will show that the automorphism group of the scheme is generated by the left-regular and the right-regular representations of the Möbius group, together with the anti-automorphism mapping an element to its inverse. Then, I will discuss the triple transitivity of the scheme.

---

**ALYSSA SANKEY**, University of New Brunswick

---

**BLAKE SHIRMAN**, York University

---

**PAUL TERWILLIGER**, University of Wisconsin-Madison

---

**LUC VINET**, Université de Montréal