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An ideal associated to any cometric association scheme

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Association schemes arise in the study of permutation groups, in algebraic graph theory, in coding theory and combinatorial design theory, but also in such areas as numerical integration and knot theory. If X is a finite set of points on the unit sphere in $\mathbb{R}^m$, the *Gram matrix* of X is the $|X| \times |X|$ matrix E_1 of all pairwise inner products of members of X. The set X forms an *association scheme* if the vector space spanned by the entrywise powers of this matrix is a commutative algebra: i.e., this space is closed under matrix multiplication. A particularly nice family to study is the family of *cometric (or Q-polynomial) association schemes*, where the first $d+1$ powers of E_1 form a basis for this "Bose-Mesner algebra". Interesting examples arise from the shortest vectors in E_6, E_7, E_8 and the Leech lattice as well as from well-behaved error-correcting codes. In this talk, I will explore the known examples and consider the ideal of m-variate polynomials which vanish on X.