

Modular Hadamard Matrices

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A Hadamard matrix is a square matrix H of order n , with coefficients ± 1 , satisfying the orthogonality condition $H \cdot H^T = nI$. There are two classical conjectures about them:

- Hadamard's conjecture, according to which there should exist a Hadamard matrix of order n for every n divisible by 4.
- Ryser's conjecture, stating that there exists no *circulant* Hadamard matrix of size n for $n > 4$.

In this talk we will consider the somewhat weaker notion of *modular* Hadamard *matrices*. These are also square matrices of size n with coefficients ± 1 , but for which the above orthogonality condition is only required to hold modulo some fixed integer m .

We will discuss the above two problems in the modular context, and present some results obtained in joint work with M. Kervaire. These include a complete solution of the 32-modular analogue of Hadamard's conjecture, and the construction of intriguing families of circulant modular Hadamard matrices.