Berlin Mathematical School

BMS Friday Colloquium

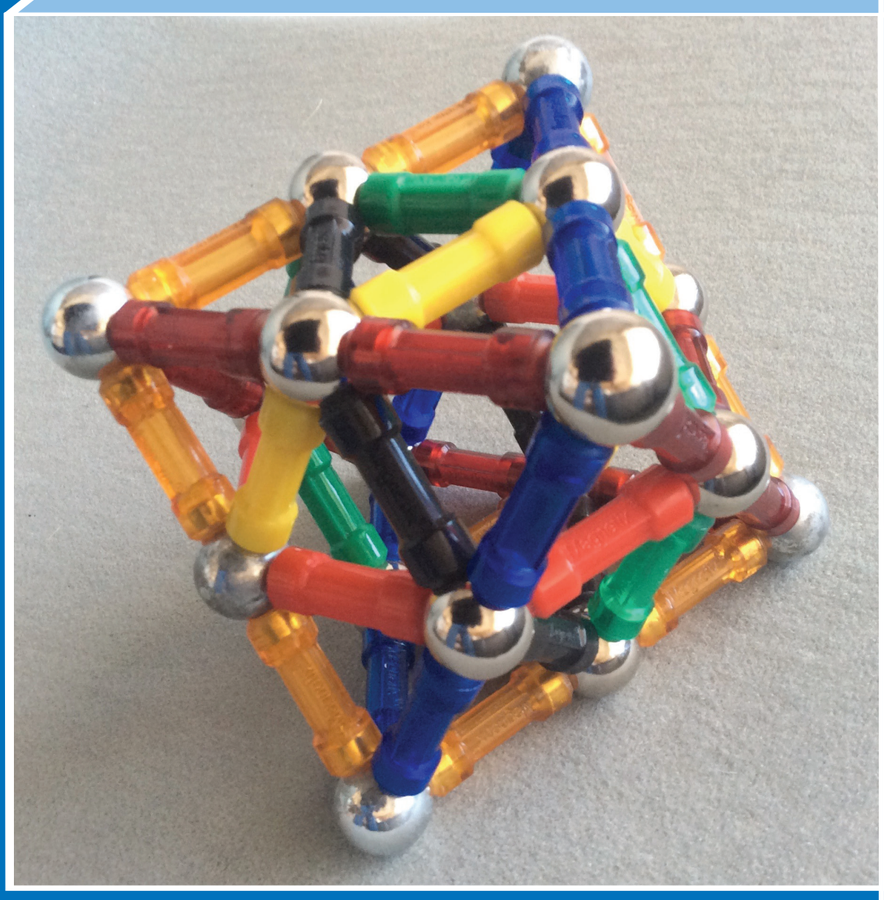
Friday 27 April 2018 at 14:15

Tea & Cookies starting at 13:00

BMS Loft, Urania, An der Urania 17, 10787 Berlin

Louis J. Billera

(Cornell University)



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In pursuit of a white whale: On the real linear algebra of vectors of zeros and ones

We are interested in the real linear relations (the real *matroid*) on the set of all 0-1 n-vectors. This fundamental combinatorial object is behind questions arising over the past 50 years in a variety of fields, from economics, circuit theory and integer programming to quantum physics, and has connections to an 1893 problem of Hadamard. Yet there has been little real progress on some of the most basic questions.

Some applications seek the number of regions in $\mathbf{R}^n$ that are determined by the $2^n - 1$ linear hyperplanes having 0–1 normals. This number, asymptotically 2^{n^2}, can be obtained exactly from the characteristic polynomial of the geometric lattice of all real subspaces spanned by these 0–1 vectors. These polynomials are known only through $n = 7$, while the number of regions is known through $n = 8$.

In his talk, Billera will discuss some contexts where this number has arisen, describe some general approaches, ranging from topological to number theoretic, for obtaining the characteristic polynomial, and give some very partial results toward a general solution. His goal is to stimulate interest in this area.

Louis Billera is a professor of mathematics at Cornell University. His research focuses on the application of algebraic techniques to combinatorial problems. Billera got his PhD at the City University of New York in 1968 and joined the Cornell faculty in the same year. He is a Fellow of the AMS and a member of the MAA. In 1994 he was awarded the Fulkerson Prize, and in 2010 he gave an invited lecture at the ICM in Hyderabad.