Title: The cap set problem.

Abstract: Out of the 81 cards in the game of Set, what is the largest numer of cards you can put down without forming a set? You can formulate this mathematically as: out of the 81 vectors in the vector space F34, what is the largest subset that does not contain any line? (the answer: 20 cards/vectors).

The cap set problem, which has been open for many decades, asks: as n goes to infinity, can we find subsets of F3n containing no line that occupy a greater and greater proportion of these vector spaces? Or is there an exponential gap that cannot be crossed? Two weeks ago, there was a huge breakthrough: it turns out they cannot be larger than 2.8n. This completely solves the cap set problem.

The most amazing thing about this breakthrough is that the proof is COMPLETELY elementary; all that is necessary is factoring of polynomials, basic linear algebra, and the central limit theorem. In this self-contained talk I will give the entire proof of the solution to the cap set problem. This talk should be accessible to anyone familiar with linear algebra and polynomials over Fp.