The "cap set" problem asks the following question. Let $S$ be a subset of an $n$-dimensional vector space over $\mathbb{F}_3$ such that no three distinct elements of $S$ are collinear. How big can $S$ be? This is related to classical number theory questions about sets of integers with few arithmetic progressions, and to the popular card game Set. Progress on this popular problem was stalled for a long time until 2016, when a much-improved upper bound was obtained using a new form of the polynomial method due to Croot, Lev, and Pach. I'll explain how this works (the proof is very short!) and explain a beautiful and currently very influential idea of Terry Tao about what this has to do with new notions of "rank" for $3$-dimensional $n \times n \times n$ "matrices."

Jordan Ellenberg is the John D. MacArthur Professor of Mathematics at the University of Wisconsin. He is a Fellow of the AMS, a Guggenheim Fellow, and the author of 'How Not To Be Wrong' and 'The Grasshopper King'. His research connects number theory, algebraic geometry, and topology, among other fields.

**Related Links:**
- Pacific Institute for the Mathematical Sciences
- Jordan S. Ellenberg