ABSTRACTS FOR WEEKS 7 AND 8

Abstracts are listed in order of the talks, starting in WEEK 7

Altan Erdnigor

TITLE: 3264

ABSTRACT: How many lines pass through two points? One. How many circles pass through three general points? Also one. How many conics pass through five general points? Again, one. These are easy. Let us ask more: How many lines meet four general lines in 3-space? Two. How many circles are tangent to three general circles in the plane? Eight.* These are less obvious, but still doable for a high school student. However, if we continue asking questions of this kind, we quickly get stuck. How many lines lie on a smooth cubic surface? Twenty-seven. How many conics are tangent to five general conics in the plane? 3264. How many twisted cubic curves are tangent to twelve general quadric surfaces in 3-space? 5819539783680. We will explain the classical a la Schubert solution to the penultimate problem and discuss a more modern moduli-space approach to enumerative geometry. *Depending on the configuration, some of the solutions may not be real. Over the complex numbers, however, the answer is always eight. Keywords: projective geometry, algebraic varieties, blow-ups, intersection theory, cohomology, moduli spaces.

Subhasish Mukherjee

TITLE: Entropy and the geometry of chaos

ABSTRACT: Consider the map $T(x) = 2x \mod 1$ on $\mathbf{R}/\mathbf{Z}$. Knowing x to n binary digits determines Tx to only $n-1$ digits, so T destroys one binary bit per iterate, i.e. the map "loses information" at a rate of $\log 2$. At the same time, the map expands space at an exponential growth rate of $log|T'| = \log 2$. That two seemingly unrelated computations return the same number is not a coincidence.

We define metric entropy, a gauge of how chaotic a system is, establish its basic properties, and see via the Brin–Katok theorem that it can be read off the measure of growth of dynamical Bowen balls. We then introduce Lyapunov exponents, which record the average rates at which a differentiable map expands and contracts. We tie entropy and exponents together with Pesin's entropy formula, which says for a sufficiently smooth system preserving a sufficiently smooth measure, the rate at which information is destroyed equals the total rate of expansion. We give the statement, the idea behind the proof, and how it can fail.

Some familiarity with measure theory would be handy :)

Jiasen Liu

TITLE: Unstable equivariant homotopy theory and Elmendorf's theorem

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ABSTRACT: Many spaces in topology come equipped with symmetries, and forgetting these symmetries can lose essential information. This is one of the motivations for studying equivariant homotopy theory. For a compact Lie group G, this information is captured by the fixed-point spaces X^H, as H ranges over closed subgroups of G, which gives a diagram over the orbit category of G. Explicitly, Elmendorf's theorem says that this fixed-point diagram contains the entire equivariant homotopy type: the homotopy theory of G-spaces is equivalent to the homotopy theory of space-valued diagrams on the orbit category. In this talk, I will introduce some motivations and basic notions for equivariant homotopy theory before stating Elmendorf's theorem and sketching the main idea of its proof. I will introduce some applications if time permits.

Peter May

TITLE: Topics in and around algebraic topology

ABSTRACT: I will mainly talk about homotopical monadicity and iterated loop spaces. I will try to be intelligible and to keep things reasonably independent of the previous weeks' talks. The last talks will likely deal with equivariant versions of homotopical monadicity and related work in progress.

PARTICIPANT TALKS Wednesday through Friday AUGUST 5, 6, 7