

University of Oregon  
Department of Mathematics  
2014 Niven Lectures  
April 3<sup>rd</sup> & 4<sup>th</sup>

# Mikhail Kapranov

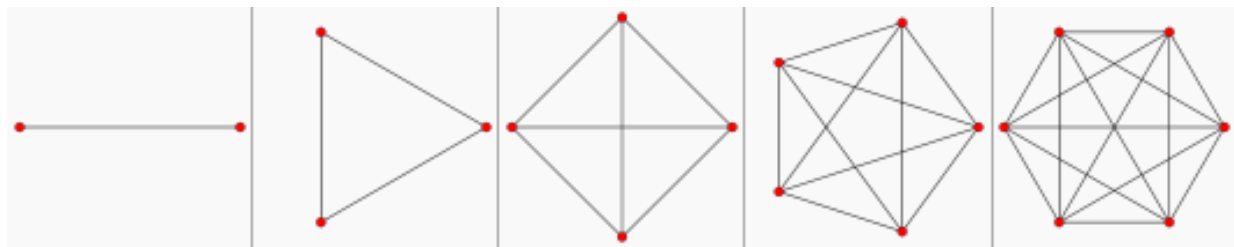
*Yale University*

## How simple is the simplex?

4:00 pm, Thursday, April 3, 2014 – 166 Lawrence

Reception to follow in Fenton 219

The simplex is, supposedly, one of the simplest geometric figures in higher dimensions. Decomposition into simplices is used in algebraic topology to define the homology of a space. Yes, despite the name, the simplex is really an object of astounding complexity. Natural orientations of the faces of a simplex, which are implicit in the definition of homology, give rise to a natural class of "membranes" inside the simplex. Study of triangulations of convex polytopes and curved manifolds can be understood in terms of movements of such membranes. The lecture will discuss some old and new results about this "hidden geometry"



## 2-dimensional symmetry of homological algebra

4:00 pm, Friday, April 4, 2014 – 208 Dady

3:15 Tea will precede the lecture in Fenton 219

Homological algebra in its traditional formulation, revolves around resolutions (long exact sequences) of algebraic objects. A more modern approach emphasizes exact triangles of complexes which give rise to "long exact sequences" of cohomology. It turns out that considering these triangles as actual 2-dimensional shapes and building more complicated 2-dimensional objects (such as surfaces) out of them, is deeply meaningful from the homological algebra point of view: one is led to objects that are defined in terms of a chosen triangulation but end up being independent on the choice. This leads naturally to Fukaya category-type objects in 2 dimensions. The lecture is based on a joint work with T. Dyckerhoff.