Cal Poly Mathematics Colloquium

Triangulations in low dimensional geometry and topology

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Abstract

Geometric topology is the study of manifolds and maps between them. In low dimensions (dimensions 2 or 3) geometric topology is intimately connected to the fields of algebra and geometry. Given a low dimensional manifold, M, the former connection comes from passing to the fundamental group of M and the latter connection comes from "geometrizing" M (i.e. adding a nice metric to it). Left to their own devices, passage to the fundamental group and geometrization are abstract constructions that are not particularly suitable to computation (say on a computer). One highly useful tool that can cope with this difficulty is to triangulate M. Morally speaking, this consists of turning M into a combinatorial object by building it out of triangles (dimension 2) or tetrahedra (dimension 3). In this talk I will introduce triangulations and review some "classical" results concerning how they can be used to give nice presentations for the fundamental group and to construct nice metrics. I will conclude the talk by describing A. Casella and my recent generalizations of these ideas to produce more general types of geometric structures (projective structures) on 3-manifolds.

About the speaker: Sam Ballas earned his BS in mathematics from Emory University (2007) and his Ph.D. in mathematics from UT Austin (2013) under the supervision of Alan Reid. He was an RTG visiting assistant professor at UC Santa Barbara (2013-16). He is an Assistant Professor in the mathematics department at Florida State University (2016-Present). His primary area of research concerns locally homogeneous structures on manifolds. He is particularly interested in convex projective structures, which are a flexible generalization of complete hyperbolic structures. One part of his work that he finds particularly appealing is that it often touches on interesting nearby areas of math, such as dynamics, number theory, and mathematical physics.