The SUMO Speaker Series for Undergraduates

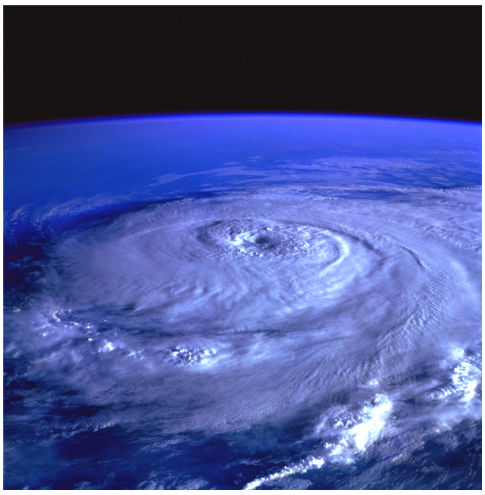
Thursday, February 6

4:15-5:05, Room 380C

(Food Provided)

The Hairy Ball Theorem

Daniel Alvarez-Gavela



Abstract

Imagine you had a ball covered with hair. Then no matter how hard you tried, you would never be able to comb it perfectly! Indeed the Hairy Ball Theorem (yes, it is called that way) says that every continuous tangent vector field on the sphere must vanish at some point. For example, right now there must be at least one location on planet Earth where the wind has zero tangential velocity (although the air could still be moving up or down).

In this talk we will use multivariable calculus to prove the Hairy Ball theorem via a clever and simple argument due to the great mathematician J.W.Milnor. We will then talk about combing other surfaces and touch on the Poincare-Hopf Index Theorem, a deep result which extends the Hairy Ball Theorem, relating the zeros of any vector field on a geometric object with a topological invariant called the Euler characteristic.

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