Mathematics and Statistics Department

The University of Toledo, College of Natural Sciences and Mathematics

Shoemaker Lecture Series

Supported by the Richard Shoemaker Funds

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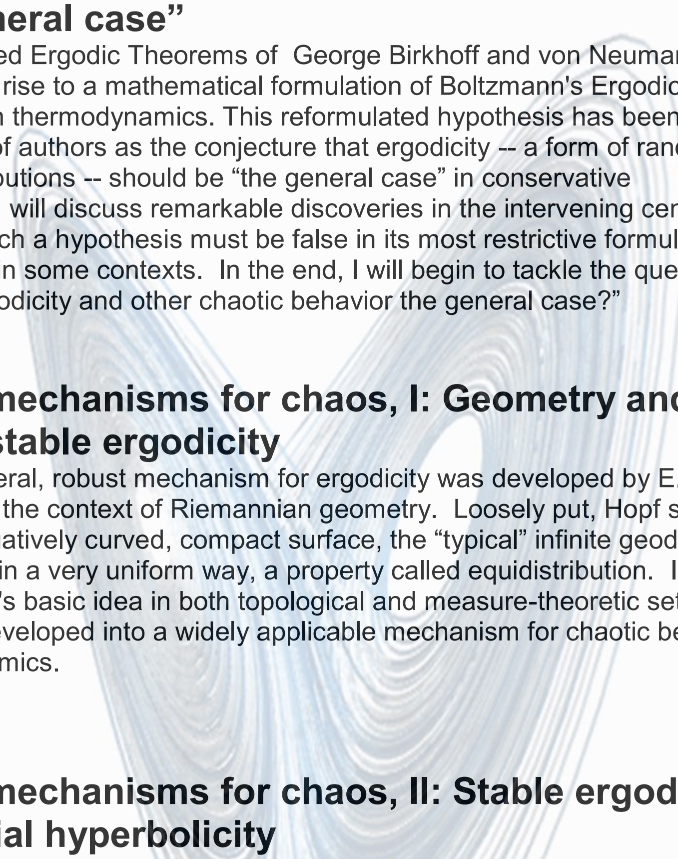
The Ergodic Hypothesis and Beyond



Lecture I:

Wednesday, Sept. 23, 2015
4:00-5:00 pm
UH 4440

"The general case"

The celebrated Ergodic Theorems of George Birkhoff and von Neumann in the 1930's gave rise to a mathematical formulation of Boltzmann's Ergodic Hypothesis in thermodynamics. This reformulated hypothesis has been described by a variety of authors as the conjecture that ergodicity -- a form of randomness of orbit distributions -- should be "the general case" in conservative dynamics. I will discuss remarkable discoveries in the intervening century that show why such a hypothesis must be false in its most restrictive formulation but still survives in some contexts. In the end, I will begin to tackle the question, "When is ergodicity and other chaotic behavior the general case?"

Lecture II:

Thursday, Sept. 24, 2015
4:00-5:00 pm
UH 4010

Robust mechanisms for chaos, I: Geometry and the birth of stable ergodicity

The first general, robust mechanism for ergodicity was developed by E. Hopf in the 1930's in the context of Riemannian geometry. Loosely put, Hopf showed that for a negatively curved, compact surface, the "typical" infinite geodesic fills the manifold in a very uniform way, a property called equidistribution. I will discuss Hopf's basic idea in both topological and measure-theoretic settings and how it has developed into a widely applicable mechanism for chaotic behavior in smooth dynamics.

Lecture III:

Friday, Sept. 25, 2015
10:00 – 11:00am
UH 4010

Robust mechanisms for chaos, II: Stable ergodicity and partial hyperbolicity

Kolmogorov introduced in the 1950's a robust mechanism for *non-ergodicity*, which is now known as the KAM phenomenon (named for Kologorov, Arnol'd and Moser). A current, pressing problem in smooth dynamics is to understand the interplay between KAM and Hopf phenomena in specific classes of dynamical systems. I will describe a class of dynamical systems, called the *partially hyperbolic systems*, in which the two phenomena can in some sense be combined. I'll also explain recent results that give strong evidence for the truth of a modified ergodic hypothesis in this setting, known as the Pugh-Shub stable ergodicity conjecture.