

**The Center for Control, Dynamical Systems, and Computation  
University of California at Santa Barbara  
Winter 2009 Seminar Series  
Presents**



**Using invariant manifolds to classify chaotic transport pathways in mixed phase space**

**Kevin Mitchell**

**UC Merced**

**Friday, January 30, 2009 3:00-4:00pm Chem 1171**

---

**Abstract:**

We describe how the topological structure of stable and unstable manifolds (so-called homo- or hetero-clinic tangles) embedded within a chaotic phase space can be used to extract a symbolic classification of chaotic transport and escape pathways. We pay particular attention to phase spaces that contain a mixture of both chaos and regularity. For such systems, the dynamics in the vicinity of “stable islands” is known to be particularly troublesome to analyze. We describe a technique that utilizes the structure of invariant manifolds in the vicinity of such stable islands to extract a symbolic model for the islands’ influence on the transport process. Though our analysis focuses on Hamiltonian systems of two degrees-of-freedom, we also discuss the extension of our technique to higher dimensional phase spaces. We illustrate this technique with a few specific examples drawn from atomic physics.

**About the Speaker:**

Kevin Mitchell is an assistant professor and founding faculty member in the School of Natural Sciences at the newly opened University of California at Merced. Dr. Mitchell’s areas of interest range from fundamental techniques in nonlinear dynamics and chaos, including quantum chaos, to their applications, especially in the area of atomic physics. Most recently, he has been studying the development and applications of symbolic dynamics techniques, which can be used to classify pathways to mixing, transport, and escape in chaotic atomic systems. Dr. Mitchell received his undergraduate degree in Physics and Math from Carnegie Mellon University and his doctorate in Physics from the University of California, Berkeley, studying geometric phase in the rovibrational coupling of molecular systems. After a postdoctoral position at the College of William and Mary, he joined the faculty at UC Merced, where he has helped to develop the Physics program. UC Merced is in its fourth year of full operation and currently has about 2800 students, at both the undergraduate and graduate levels.

---