TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

Room 617 Wachman Hall

Wednesday, 6 October 2010, 4:00 p.m.

Resonance Phenomena in (Micro)Fluids and (Huge)Plasma

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Abstract.

In my talk I discuss several aspects of transport phenomena in near-integrable multiscale dynamical systems. I will start with an introduction into what makes a system chaotic and how these properties can be quantified. In the next part of the talk I consider mixing via resonances-induced chaotic advection in volume-preserving flows. I show that proper characterization of the mixing quality requires introduction of two different metrics. The first metric determines the relative volumes of the domain of chaotic streamlines and the domain of regular streamlines. The second metric describes the time for homogenization inside the chaotic domain. In the second part of the talk I present results on the resonant interaction between monochromatic electromagnetic waves and magnetized electrons in configurations with magnetic field reversals (e.g. in the earth's magnetotail). We discuss two resonant phenomena occurring during slow passages of a particle through a resonance: capture into resonance and scattering on resonance. These processes result in destruction of an adiabatic invariant, chaotization, and almost free acceleration of particles. Using the statistics from a single passage, we calculate the characteristic times of mixing due to resonant effects.