Yeshiva University

Department of Mathematical Sciences Colloquia and Seminars: 2014–2015

Wednesday, April 29, 2015
1:30 to 2:30 PM, room 506 of 215 Lexington Avenue, video-conferenced to BH 206
Speaker: Edward Belbruno of Orbital Design, Princeton University, and Courant Institute of Mathematical Sciences
Title: A new route to Mars
Abstract:A new type of transfer trajectory from the Earth to Mars is described that employs ballistic capture, unlike all previous transfers. It has an interesting dynamics from a dynamical systems perspective and provides a completely different methodology for getting to Mars. A mission is being considered by NASA to use it.

Wednesday, January 21, 2015
12p.m. to 1p.m. Belfer Hall, Room 516
Speaker: Pablo Roldan, University of Maryland
Title: Instabilities in the Restricted Three Body Problem Along Mean Motion Resonances
Abstract: In this talk I will present a recent result related to the stability of the Solar System, namely the preprint: Jacques Fejoz, Marcel Guardia, Vadim Kaloshin and Pablo Roldan: Kirkwood gaps and diffusion along mean motion resonances in the restricted planar three-body problem (2013), available here.

Wednesday, December 17, 2014
12p.m. to 1p.m. Belfer Hall, Room 205
Speaker: Mina Teicher, Professor, Department of Mathematics and Gonda Brain Research Center, Director, Emmy Noether Institute for Mathematics, Bar-Ilan University
Title: How Does the Brain Work?
Abstract: "How does the brain work?" -- is the most intriguing question for the 21st century. In this talk I will elaborate on the question in general and report on a project of synchronization in brain activity and on some medical applications.

Wednesday, December 10, 2014
12p.m. to 1p.m. Belfer Hall, Room 205
Speaker: Ernesto Perez-Chavela, Universidad Autonoma Metropolitana Iztapalapa
Title: A geometric approach for relative equilibria solutions in the curved N-body problem with negative curvature
Abstract: We extend the Newtonian potential to spaces of constant curvature. The relative equilibria solutions are motions where the mutual distance among the particles remain constant for all time. In this talk, using the Poincare upper semiplane model of the hyperbolic geometry, in the case of negative curvature, we describe all relative equilibria solutions in the three body problem. We also describe some relative equilibria in the five body problem.

Yeshiva University

Wednesday, December 3, 2014
12p.m. to 1p.m. Belfer Hall, Room 205
Speaker: Jaime Burgos-Garcia, Yeshiva University
Title: Hill's approximations to study the dynamics of satellites in the solar system
Abstract: G.W. Hill developed his lunar theory as an alternative approach for the study of the motion of the Moon around the Earth. This approach is a special case of the three body problem for the dynamics of the Earth and the Moon with a gravitational perturbation produced by a far away massive body considered as the Sun. If the perturbation due to other body is considered, an extension of the former theory is required. In this talk we introduce the required extension and we show that the resulting problem produces a new Hamiltonian that inherits some basic features of the restricted three-and-four-body problems. The main motivation for this model is the study of the motion of a satellite near one of the Trojan asteroids of Jupiter. We show some basic results on this model which is a joint work with Marian Gidea.

Wednesday, November 5, 2014
12p.m. to 1p.m. Belfer Hall, Room 516.
Speaker: Adria Simon, of the Departament de Matematica Aplicada I, Universitat Politeenica de Catalunya
Title: Diffusion through non-transversal transition chains
(joint work with Amadeu Delshams and Piotr Zgliczcynski
Abstract: The main goal of our work is to understand the geometric mechanism that gives rise to the instability shown by Colliander et al (2010) in the Nonlinear Schrodinger Equation with cubic defocusing. It can be seen as a diffusion mechanism, but it appears that the geometric skeleton of the system is not the standard for Arnold Diffusion: instead of having a sequence of non-resonant invariant tori connected along transverse heteroclinic orbits we have a non-transversal situation. We expose that the instability (diffusion) can be achieved due to the large dimension of the system, while we try to generate a scheme for this new kind of diffusion that could be applied to other infinitely dimensional Hamiltonian systems.

September 2014
Speaker: Dr. Sven Jarohs, Goethe-Universitat, Frankfurt, Germany
Title: The moving plane method in nonlocal problems
Abstract: In this talk I present recent results which use the moving plane method in a nonlocal framework. After giving a short introduction to the fractional Laplacian, I will explain the main ideas for this example and explain the main differences to the local case. In particular, I will show that the nonlocal setting admits symmetry results which are not true for local operators. As part of the proof idea I will also present the fractional Hopf Lemma. Following this, I will state an over-determined problem with fractional Laplacian and show that again the nonlocal case admits more general results than the nonlocal case. Finally I will show how the main idea easily can be applied to general nonlocal operators of possible varying order which may also be anisotropic. The presented results are part of joint works with Mouhamed Moustapha Fall and Tobias Weth.

Yeshiva University

April 2014

Speaker: Tere Seara, Universitat Politecnica de Catalunya, Barcelona, Spain

Title: Oscillatory motions and Arnold diffusion in the restricted planar three body problem

The restricted (elliptic) three body problem considers the motion of a particle with zero mass under the effects of two bodies called primaries which move in elliptic orbits around their center of mass. The circular case is a particular case of the elliptic case where the primaries move in circular orbits. The first part of this talk proves the existence of oscillatory motions for the restricted planar circular three body problem, that is, we will show that there exist orbits which leave every bounded region but which return infinitely often to some fixed bounded region. Our work does not need to assume any smallness about the mass ratio.

We show that, for large enough Jacobi constant, there exist transversal intersections between the stable and unstable manifolds of infinity which guarantee the existence of a symbolic dynamics that creates the so called oscillatory orbits. The main achievement is to rigorously prove the transversality of the invariant manifolds without assuming the mass ratio small, since then this transversality cannot be checked by using classical perturbation theory respect to the mass ratio.

The second part of the talk extends these results about the invariant manifolds to the elliptic case, taking the mass ratio and the eccentricity of the primaries small enough. As a consequence we obtain orbits of the elliptic restricted three body problem whose angular momentum increases. This behavior is usually called Arnold diffusion.