UNIVERSITÀ DEGLI STUDI DI MILANO

Curriculum vitae

AL MAGNIFICO RETTORE
DELL'UNIVERSITA' DEGLI STUDI DI MILANO **COD. ID: 4911**

Il sottoscritto chiede di essere ammesso a partecipare alla selezione pubblica, per titoli ed esami, per il conferimento di un assegno di ricerca presso il Dipartimento di Matematica "Federigo Enriques"

Responsabile scientifico: Dott. M. Sansottera

Rocio Isabel PAEZ

CURRICULUM VITAE

INFORMAZIONI PERSONALI

Cognome	PAEZ
Nome	Rocio Isabel
Data Di Nascita	26/11/1985

OCCUPAZIONE ATTUALE

Incarico	Struttura
Assegnista di Ricerca	Dip. di Matematica "Tullio Levi-Civita", Università degli Studi di Padova

ISTRUZIONE E FORMAZIONE

Titolo	Corso di studi	Università	anno conseguimento titolo
Laurea Magistrale o equivalente	Astronomia	Universidad Nacional de La Plata (Argentina)	2012
Specializzazione			
Dottorato Di Ricerca	Matematica	Università degli Studi di Roma "Tor Vergata"	2016
Master			
Diploma Di Specializzazione Medica			
Diploma Di Specializzazione Europea			
Altro			

LINGUE STRANIERE CONOSCIUTE

lingue	livello di conoscenza
Spagnolo	Madrelingua
Inglese	C1
Italiano	B2
Greco	A2

PREMI, RICONOSCIMENTI E BORSE DI STUDIO

anno	Descrizione premio
2012	*Distinguished Graduate Student* - Facultad de Ciencias Astronómicas y Geofísicas, Universidad de La Plata, Argentina. Awarded to the top mark students for the degree in Astronomy.
2012	*'Joaquín V. Gonzalez' Prize*, Universidad Nacional de La Plata, Argentina. Awarded to the best averaged mark for the degree in Astronomy

anno	Borse di Studio
2017-2018	Grants of the Research Committee of the Academy of Athens "Nonlinear phenomena in galactic discs - Quantum dynamic systems: chaos and coupling measures", Research Center for Astronomy and Applied Mathematics, Athens, Greece.
2016	Post-Laurea grant "Dynamics of the celestial bodies in the neighborhood of the Lagrangian points", Dep. of Mathematics, Università di Roma "Tor Vergata".
2011	BENTR11 grant for advanced university students. Topic: "Diffusion studies in symplectic multidimensional mappings", Comisión de Investigaciones Científicas (CIC) de la Provincia de Buenos Aires, Argentina.

ATTIVITÀ DI FORMAZIONE O DI RICERCA

The main field of my research is the study of dynamics in systems of interest in dynamical astronomy, such as planetary systems, or asteroids, using both analytical and numerical techniques. In particular, I have focused on systems where the configuration of the main disturbing bodies (e.g. sun-planet configuration) turns to be resonant. Such systems exhibit a high degree of complexity and new interesting dynamical properties related, for example, to escapes, various levels of stability and chaos.

In my Ph.D. thesis, I studied the case of bodies in the 1:1 mean motion resonance (known as Trojan bodies). From the analytical point of view, I proposed a new method of Hamiltonian normal form as well as a new Hamiltonian decomposition allowing to study the effect of secondary resonances in the long-term stability of Trojan motions. Using these tools, I have investigated the problem of dynamical stability of hypothetical Trojan exoplanets. Other applications in the Solar System include Trojan asteroids or moons of the giant planets. My numerical studies employed the use of chaotic indicators in order to obtain stability maps and estimate the rate of chaotic diffusion and/or escapes of small bodies from the resonant domain.

During my first postdoctoral position in the Research Center for Astronomy and Applied Mathematics in Athens, I studied the implementation of the invariant manifold modelling of spiral arms in high quality

N-body experiments of disc galaxies. The project included the computation of unstable periodic orbits in the neighborhood of the Lagrangian points L1 and L2 in the corotation region of modeled bars, as well as the computation of unstable manifolds of such orbits and comparison with the dynamics of particles in chaotic orbits in the same region. Additionally, in that period, in collaboration with Acad. Prof. G. Contopoulos, we analysed the dynamical behavior around unstable periodic orbits in simple symplectic mappings, such as the hyperbolic Hénon map or the standard map, by means of the so-called Moser

normal forms. The latter allow to define convergent series transformations to new canonical variables, allowing to explicitly compute a hyperbolic integral of motion. We studied the behavior of such integrals in both normalized and non-normalized variables (Moser curves), as well as the so-induced mechanisms of chaotic diffusion and transport in such mappings.

After my moving to the University of Padova, I deepened my collaboration with Prof. M. Guzzo, in two different topics:

i) in collaboration with Prof. C. Efthymiopoulos, we aimed to characterize quantitatively the speed of Arnold diffusion, by means of a very accurate computation of the slow time evolution of the actions in a Hamiltonian context. Our approach is based on a (quasi-) stationary phase approach to the analysis of the Nekhoroshev normal form and it provides an excellent agreement with numerical experiments.

ii) we focused on the study of the dynamics near the Lagrange equilibria L1 and L2 of both the Circular and the Elliptic Restricted Three-body Problem. In the circular problem, we studied the generation and shape of the tube manifolds originating from the horizontal Lyapunov orbits, for energy values considerably larger than those usually appearing in the bibliography. To this aim, we considered the Hamiltonian describing the planar three-body problem in the Levi-Civita regularization and we computed its normalization for the Sun-Jupiter reduced mass for an interval of energy which overcomes the convergence limit of Cartesian normalizations. For sufficiently large energies, we discovered a transition in the structure of the tube manifolds, which can contain orbits that collide with the secondary body. In the case of the Elliptic Restricted Three-Body problem, the analysis is perplexed by the lack of global integrals such as the Jacobi constant. By means of a combination of the Floquet theory with Birkhoff normalizations, we were able to conjugate the Hamiltonian of the problem to an integrable normal form with a small remainder. This normal form can be used to define approximate local first integrals and therefore to classify the transits of orbits according to the value of these integrals. Finally, we extended these results to the Spatial Elliptic problem, where the existence of a near conmensurability between the vertical and planar frequencies of oscillation plays an important role in the construction of the integrable approximation. For this case, construct a resonant normal form conjugating the Hamiltonian of the problem, and to compare the accuracy of this approximation with the one of non-resonant approximations and of other simpler models.

ATTIVITÀ PROGETTUALE

Anno	Progetto
07/2019 - 06/2021	Partecipante nel progetto: Project MIUR-PRIN 20178CJA2B "New frontiers of Celestial Mechanics: theory and applications", Dep. of Mathematics, Università degli Studi di Padova.
07/2018 - 06/2019	Partecipante nel progetto: Project 677793 - Stable and Chaotic Motions in the Planetary Problem, European Research Council (ERC), Dep. of Mathematics, Università degli Studi di Padova.
11/2012 - 10/2015	Partecipante nel progetto: Astronet-II Marie Curie Training Network “The AstroDynamics Network” (PITN-GA-2011-289240).

CONGRESSI, CONVEGNI E SEMINARI

CONGRESSI e CONVEGNI

Data	Titolo	Sede
3-7 Febbraio 2020	I-CELMECH Training School. Titolo della presentazione: “Study of large Lyapunov orbits and temporary captures via the Levi-Civita Hamiltonian normalization”.	Milano, Italia.
19-23 Maggio 2019	SIAM Conference on Applications of Dynamical Systems (DS19). Titolo della presentazione: “The speed of Arnold diffusion along single resonances: a	Snowbird, Utah, USA.

	predictive semi-analytical approach"	
18-22 Giugno 2018	Perspectives in Hamiltonian Systems. Titolo della presentazione: "Modeling chaotic diffusion along resonances: fastest drift orbits"	Venezia, Italia.
4-8 Settembre 2017	CELMEC VII 'The Seventh International Meeting on Celestial Mechanics'. Titolo della presentazione: "Unveiling Nekhoroshev instabilities and chaotic diffusion along resonances."	San Martino al Cimino, Italia.
18-20 Maggio 2016	The Dynamics of Complex Systems. Titolo della presentazione: "Precise resonance location in the Trojan problem, by a new asymmetric expansion".	Coventry, UK.
15-19 Giugno 2015	Astronet-II International Final Conference. Titolo della presentazione: "Astrodynamics of Trojan asteroids from a perturbative approach".	Tossa de Mar, Spagna.
2-6 Febbraio 2015	Fourth Astronet-II Training School and Annual Meeting. Titolo della presentazione: "Internship experience at IEEC in Barcelona".	Milano, Italia.
15-18 Luglio 2014	ICNPAA 2014 World Congress: 10th International Conference on Mathematical Problems in Engineering, Aerospace and Sciences. Titolo della presentazione: "Exploring the marginal stability region in the planar circular restricted three-body problem".	Narvik, Norvegia.
7-11 Luglio 2014	Complex Planetary Systems IAU Symposium 310. Titolo della presentazione: "Modeling Trojan dynamics: resonant motions, chaotic diffusion and long term stability".	Namur, Belgio.
23-27 Giugno 2014	Third Astronet-II Training School and Workshop. Titolo della presentazione: "Moving in the marginal stability region of the tadpole orbits: an approach based on normal forms".	Zielona Góra, Polonia.
2-6 Settembre 2013	CELMEC VI 'The Sixth International Meeting on Celestial Mechanics'. Titolo della presentazione: "Exploring the border of the stability region in the PCR3BP".	San Martino al Cimino, Italia.
3-7 Luglio 2013	Second Astronet-II School 'Advanced Aspects of Spacecraft Control and Mission Design'. Titolo della presentazione: "Perturbation Theory at Work on Astrodynamics: Dealing with the Planar Restricted 3-Body Problem".	Glasgow, UK.
14-17 Gennaio	First Astronet-II School 'Astrodynamics of Natural and Artificial Satellites: from Regular to Chaotic Motions'. Titolo della	Roma, Italia.

2013	presentazione: "Perturbation theory at work on Astrodynamics".	

SEMINARI

Data	Titolo	Sede
11 Maggio 2020	"The Levi-Civita Hamiltonian normalization, the analytical construction of large Lyapunov orbits and their manifolds"	I-CELMECH (online seminar)
23 Novembre 2018	"Describing Trojan dynamics: resonant structure, stability and long term diffusion" (invito)	Astronomical Institute of the Czech Academy of Sciences, Praga, Repubblica Ceca.
20 Febbraio 2018	"Space mission designs for stable Lagrangian points"	Research Center for Astronomy and Applied Mathematics, Academy of Athens, Atene, Grecia.
4 Ottobre 2017	"A fully predictive model for the adiabatic evolution of the actions in Arnold diffusion"	Institute of Nanoscience and Nanotechnology, NCSR Demokritos, Atene, Grecia.
3 Ottobre 2017	"A fully predictive model for the adiabatic evolution of the actions in Arnold diffusion"	Research Center for Astronomy and Applied Mathematics, Academy of Athens, Atene, Grecia.
31 Gennaio 2017	"Resonant dynamics in the Trojan problem"	Research Center for Astronomy and Applied Mathematics, Academy of Athens, Atene, Grecia.
8 Dicembre 2016	"Dynamics of resonances in the Trojan problem: applications to extrasolar planetary systems" (invito)	Stellar Astrophysics Center, Dept. of Physics and Astronomy of Aarhus University, Aarhus, Danimarca.
23 Febbraio 2016	"New normal forms approaches adapted to the Trojan problem"	Dip. di Matematica Università degli Studi di Roma "Tor Vergata", Roma, Italia.
21 Maggio 2015	"Perturbation Theory for Trojan motions"	Dip. di Matematica Università degli Studi di Roma "Tor Vergata", Roma, Italia.
26 Maggio 2014	"Resonant dynamics of Trojan exoplanets"	Departament de Matematica Aplicada i Analisi Universitat de Barcelona, Barcelona, Spagna.

Data	Titolo	Sede
17 Marzo 2014	"Resonant dynamics of Trojan exoplanets"	Dip. di Matematica Università degli Studi di Roma "Tor Vergata", Roma, Italia.
21 Febbraio 2013	"Diffusion along resonances in a symplectic mapping"	Dip. di Matematica Università degli Studi di Roma "Tor Vergata", Roma, Italia.

PUBBLICAZIONI

Articoli su riviste
Páez, R.I., Guzzo, M., (2020) 'Transits close to the Lagrangian solutions L1, L2 in the Elliptic Restricted Three-body Problem' (submitted to Nonlinearity). ArXiv: 2011.14957
Páez, R.I., Guzzo, M., (2020) 'A study of temporary captures and collisions in the Circular Restricted Three-Body Problem with normalizations of the Levi-Civita Hamiltonian', International Journal of Non-Linear Mechanics, 120, p. 103417.
Guzzo, M., Efthymiopoulos, C., Páez, R.I., (2020) 'Semi-analytic computations of the speed of Arnold diffusion along single resonances in a priori stable Hamiltonian systems', Journal of Nonlinear Science, 30, p. 851.
Páez, R.I., Contopoulos, G., (2019) 'Analytical description of chaos and the asymptotic behavior of chaotic orbits in symplectic mappings' (submitted to Communications in Nonlinear Science and Numerical Simulations).
Efthymiopoulos, C., Kyziropoulos, P., Páez, R.I., Zouloumi, K., Gravvanis, G., (2019) 'Manifold spirals, disc-halo interactions and the secular evolution in N-body models of barred galaxies', Monthly Notices of the Royal Astronomical Society, 484(2), p. 1487.
Páez, R.I., Efthymiopoulos, C. (2018) 'Secondary resonances and the boundary of effective stability of Trojan motions', Celestial Mechanics and Dynamical Astronomy, 130, p. 20.
Páez, R.I., Locatelli, U., Efthymiopoulos, C. (2016), 'New Hamiltonian expansion adapted to the Trojan problem', Celestial Mechanics and Dynamical Astronomy, 126, p. 519.
Páez, R.I, Locatelli, U. (2015), 'Trojan dynamics well approximated by a new Hamiltonian normal form', Monthly Notices of the Royal Astronomical Society, 453(2), p. 2177.

Atti di convegni
Páez, R. I., Locatelli, U., Efthymiopoulos, C. (2016), 'The Trojan problem from a perturbative perspective', Astrodynamics Network AstroNet-II, Astrophysics and Space Science Proceedings 44, G. Gómez at J.J. Masdemont, eds., p. 193.
Bacciotti, F., Locatelli, U., Páez, R.I., Volpi, M. (2015), 'Effects of asymmetric jets on the dynamics of protoplanetary disks: study of a simple model', "Jets, Disks and the Dawn of the Planets", Proceedings of the Second JEDI meeting (Jets and Disks at INAF), S. Antoniucci, J. Alcalá, C. Codella et B. Nisini, eds., p. 27.
Páez, R. I., Locatelli, U. (2014), 'Design of maneuvers based on new normal form approximations: the case study of the CPRTBP', ICNPAA 2014 Proceedings - AIP Conf. Proc., 1637, p. 776.
Páez, R.I., Efthymiopoulos, C. (2014), 'Modeling Trojan dynamics: diffusin mechanisms through resonances', Complex Planetary Systems, Proceedings IAU Symp. 310, Z. Knezevic et A. Lemaitre, eds.,

p. 96.
Efthymiopoulos, C., Páez, R.I. (2014), 'Modeling resonant trojan motions in planetary systems', Complex Planetary Systems, Proceedings IAU Symp. 310, Z. Knezevic et A. Lemaitre, eds., p. 70.
von Essen, C., Miculan, R., Páez, R. I. (2013), 'Orbital parameter refinement and transit timing variation analysis of the hot-Neptune Gliese 436b', BAAA, 56, p. 423.
von Essen, C., Páez, R. I., Schimitt, J.H.M.M. (2012), 'Búsqueda de exoplanetas: Cuán confiables son las observaciones obtenidas mediante telescopios terrestres?', BAAA, 55, p. 441.

ALTRE INFORMAZIONI

Collaborazione supervisione Tesi Magistrale in Matematica di Dott.ssa Mara Volpi: "Effects of stellar jets on protoplanetary disks: dynamical behavior of a simple model with gravitationally interacting rings", Dep. of Mathematics, Università degli Studi di Roma "Tor Vergata". Attività di referaggio per i journal: Celestial Mechanics and Dynamical Astronomy, Icarus, Astronomy and Astrophysics.

Le dichiarazioni rese nel presente curriculum sono da ritenersi rilasciate ai sensi degli artt. 46 e 47 del DPR n. 445/2000.

Il presente curriculum, non contiene dati sensibili e dati giudiziari di cui all'art. 4, comma 1, lettere d) ed e) del D.Lgs. 30.6.2003 n. 196.

Luogo e data: Padova, 10/03/2021

FIRMA _____Rocio Isabel PAEZ_____