

Massimiliano Guzzo

Associate Professor

October 21, 2016

Profile

Massimiliano Guzzo is Associate Professor at the University of Padova. His research activity concerns Hamiltonian Dynamics, Deterministic Dynamical Systems and Celestial Mechanics; his researches have been published on *Science*, *Communications in Mathematical Physics*, *Nonlinearity*, *Icarus*, *Annales Henry Poincaré*, *SIAM Journal on Applied Mathematics*, *Astronomy & Astrophysics*, *Monthly Notices of the Royal Astronomical Society*, *Physica D*, and many other specialized journals; he has been invited speaker at many international conferences; he has been director of the scientific committee of the Italian Society for Celestial Mechanics SIMCA; he is member of the Course Board of the Phd Course in Space Sciences, Technologies and Measurements of the University of Padova; he has been consultant of the International Astronomical Union; he is member of the Association of Italian and Serbian Scientists and Scholars AIS3; asteroid 34716 (2001 PC14) has been named: 34716 Guzzo. He has obtained the award of the Italian National Scientific Qualification to the full professor class (Abilitazione Scientifica Nazionale a professori di prima fascia), in the Mathematical Physics scientific area.

As a student, he has been in the Italian national team at the 20th International Physics Olympiad.

Personal

Born on September 30, 1970, in Conegliano (Italy).
Italian Citizen.

Employment

2010-2015	Permanent Position-Professore Associato	<i>Università degli Studi di Padova</i>
2001-2010	Permanent position-Ricercatore universitario	<i>Università degli Studi di Padova</i>

Post-doctoral experience

2000	Research grant-Assegno di Ricerca	<i>Università degli Studi di Padova</i>
1999	Marie Curie Fellowship	<i>Observatoire de la Côte d'Azur, CNRS, Nice</i>

Education

1995-1999	Phd in Mathematics	<i>Università degli Studi di Padova, Thesis "Nekhoroshev stability of quasi-integrable systems with singularities and degeneracy".</i>
1990-1994	Laurea cum laude in Physics	<i>Università degli Studi di Padova.</i>

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Scientific Activity

Keywords

Dynamical Systems-Hamiltonian Mechanics-Celestial Mechanics.

Nekhoroshev Theorem-KAM theorem-Lyapunov Exponents-Chaos Indicators-Three Body Problem-Asteroid belt-Planetary Systems.

Preprints

Guzzo M. and Lega E.: "Geometric chaos indicators, computations, and guided visualizations of the spherical hypertube manifolds of the spatial circular restricted three-body problem", preprint, available at: <https://hal-insu.archives-ouvertes.fr/hal-01343970v1>

Articles in Refereed Journals

Lega E. and Guzzo M.: "Three-dimensional representations of the tube manifolds of the planar restricted three-body problem", *Physica D*, 352:41-52, 2016.

Guzzo M., Chierchia L. and Benettin G.: "The steep Nekhoroshev's Theorem", *Communications in Mathematical Physics*, Volume 342, Issue 2, pp 569-601, 2016.

Guzzo M. and Lega E.: "A study of the past dynamics of comet 67P/Churyumov-Gerasimenko with Fast Lyapunov Indicators", *Astronomy & Astrophysics*, vol. 579, A79, 1-7, 2015.

Guzzo M.: "The Nekhoroshev theorem and long-term stabilities in the Solar System", *Serbian Astronomical Journal*, invited review, pp. 1-10, n. 190, 2015.

Schirizzi G. and Guzzo M.: "Numerical verification of the steepness of three and four degrees of freedom Hamiltonian systems", *Regular and Chaotic Dynamics*, vol. 20, No. 1, pp. 1-18, 2015.

Guzzo M. and Lega E.: "Evolution of the tangent vectors and localization of the stable and unstable manifolds of hyperbolic orbits by Fast Lyapunov Indicators", *SIAM J. Appl. Math.*, vol. 74, n. 4, 1058-1086, 2014.

Guzzo M., Chierchia L. and Benettin G.: "The steep Nekhoroshev's Theorem and optimal stability exponents (an announcement)", *Rendiconti Lincei-Matematica e Applicazioni*, 25, Issue 3, 293-299, 2014.

Schirizzi G. and Guzzo M.: "On the formulation of new explicit conditions for steepness from a former result of N.N. Nekhoroshev." *Journal of Mathematical Physics*, 54, 072702, 2013.

Guzzo M. and Lega E.: "The numerical detection of the Arnold web and its use for long-term diffusion studies in conservative and weakly dissipative systems", *Chaos*, vol. 23, 023124, 2013.

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Bernardi O., Cardin F. and Guzzo M.: New Estimates for Evans' Variational Weak KAM Approach, *Communications in Contemporary Mathematics*, 15, 1250055, 2013.

Bernardi O., Cardin F. and Guzzo M.: Convergence to the time average by stochastic regularization, *Journal of Nonlinear Mathematical Physics*, vol. 20, n. 1, 9-27, 2013.

Lega E., Guzzo M. and Froeschlé C.: "Close encounters and resonances detection in three body problems through Levi-Civita regularization". *Monthly Notices of the Royal Astronomical Society*, 2011.

Todorović N., Guzzo M., Lega E. and Froeschlé C.: "A numerical study of the stabilization effect of steepness". *Celestial Mechanics and Dynamical Astronomy*, 2011.

Guzzo M., Lega E. and Froeschlé C.: "First numerical investigation of a conjecture by N.N. Nekhoroshev about stability in quasi-integrable systems". *Chaos*, vol. 21, Issue 3, 2011.

Lega E., Guzzo M. and Froeschlé C.: "Numerical studies of hyperbolic manifolds supporting diffusion in symplectic mappings." *The European Physical Journal, Special Topics*, vol. 186; p. 3-31, 2010.

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Lega E., Guzzo M. and Froeschlé C.: "A numerical study of the hyperbolic manifolds in a priori unstable systems. A comparison with Melnikov approximations." *Celestial Mech. and Dyn. Astron.*, vol. 107; p. 115-127, 2010.

Lega E., Guzzo M. and Froeschlé C.: "A numerical study of the size of the homoclinic tangle of hyperbolic tori and its correlation with Arnold diffusion in Hamiltonian Systems." *Celestial Mech. and Dyn. Astron.*, vol. 107; p. 129-144, 2010.

Guzzo M., Lega E. and Froeschlé C.: "A numerical study of the topology of normally hyperbolic invariant manifolds supporting Arnold diffusion in quasi-integrable systems." *Physica D*, vol. 238; p. 1797-1807, 2009.

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Celletti A. and Guzzo M.: "Cantori of the dissipative sawtooth map." *Chaos*, vol. 19, 2009.

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Bernardi O., Cardin F., Guzzo M. and Zanelli L.: "A PDE approach to finite time indicators in Ergodic Theory". *Journal of nonlinear mathematical Physics*, vol. 16; p. 195-206, 2009.

Namouni F., Guzzo M. and Lega E.: "On the integrability of stellar motion in an accelerated logarithmic potential". *Astronomy and Astrophysics*, 489, Issue 3, pp.1363-1367, 2008.

Benettin G., Guzzo M. and Marini V.: "Adiabatic chaos in the spin-orbit problem". *Celestial Mech. and Dyn. Astron.*, Vol. 101, n 1-2, 203-224, 2008.

Benettin G., Guzzo M. and Neishtadt A.: "A new problem of adiabatic invariance related to the rigid body dynamics". *Discrete and Continuous Dynamical Systems A*, 21, n 3, 959-975, 2008.

Pavlović R. and Guzzo M.: "Fullfilment of the conditions for the application of the Nekhoroshev theorem to the Koronis and Veritas asteroid families". *Monthly Notices of the Royal Astronomical Society*, 384, 1575-1582, 2008.

Guzzo M., Bernardi O. and Cardin F.: "The experimental localization of Aubry-Mather sets using regularization techniques inspired by viscosity theory". *Chaos*, vol. 17, n. 3, 2007.

Namouni F. and Guzzo M.: "The accelerated Kepler problem". *Celestial Mechanics and Dynamical Astronomy*, vol 99, n. 1, 31-44, 2007.

Guzzo M., Lega E. and Froeschlé C.: "Diffusion and stability in perturbed non convex integrable systems". *Nonlinearity*, Vol. 19, 5, 1049-1067, 2006.

Froeschlé C., Lega E. and Guzzo M.: "Analysis of the Chaotic Behaviour of Orbits Diffusing along the Arnold Web". *Celestial Mechanics and Dynamical Astronomy*, Vol. 95, 1-4, 141-153, 2006.

Guzzo M.: "The web of three-planet resonances in the outer solar system II: a source of orbital instability for Uranus and Neptune". *Icarus*, vol. 181, 475-485, 2006.

Benettin G., Fassò F. and Guzzo M.: "Long term stability of proper rotations and local chaotic motions in the perturbed Euler rigid body". *Regular and Chaotic Dynamics*, vol. 11, 1-17, 2006.

Froeschlé C., Guzzo M. and Lega E.: "Local and global diffusion along resonant lines in discrete quasi-integrable dynamical systems", *Celestial Mechanics and Dynamical Astronomy*, vol. 92, n. 1-3, 243-255, 2005.

Guzzo M., Lega E. and Froeschlé C.: "First Numerical Evidence of Arnold diffusion in quasi-integrable systems". *DCDS B*, vol. 5, n. 3, 2005.

Guzzo M.: "The web of three-planet resonances in the outer Solar System". *Icarus*, vol. 174, n. 1., pag. 273-284, 2005.

Guzzo M.: "A direct proof of the Nekhoroshev theorem for nearly integrable symplectic maps". *Annales Henri*

Poincaré', vol. 5, n. 6, 1013-1039, 2004.

Benettin G., Fassò F. and Guzzo M.: "Long-term stability of proper rotations of the Euler perturbed rigid body". *Commun. Math. Phys.* 250, 133-160, 2004.

Lega E., Guzzo M. and Froeschlé C. : "Detection of Arnold diffusion in Hamiltonian systems". *Physica D*, vol. 182, p. 179–187, 2003.

Guzzo M.: "Long-Term Stability Analysis of Quasi Integrable Degenerate Systems Through the Spectral Formulation of the Nekhoroshev Theorem ". *Celest. Mech. Dyn. Astr.*, 83, Issues 1-4, 2002.

Guzzo M., Knezević Z. and Milani A.: "Probing the Nekhoroshev Stability of Asteroids ". *Celest. Mech. Dyn. Astr.*, 83, Issues 1-4, 2002.

Guzzo M., Lega E. and Froeschlé C. : "On the numerical detection of the effective stability of chaotic motions in quasi-integrable systems ". *Physica D*, 163, Issues 1-2, 1-25, 2002.

Guzzo M. : "Improved Leap-Frog Symplectic Integrators for Orbits of Small Eccentricity in the Perturbed Kepler Problem". *Celestial Mechanics and Dynamical Astronomy*, 80, n. 1, 63-80, 2001.

Guzzo M. and Benettin G. : "A spectral formulation of the Nekhoroshev theorem and its relevance for numerical and experimental data analysis". *Discrete and Continuous Dynamical Systems-Series B*, 1, n. 1, 2001.

Froeschlé C., Guzzo M. and Lega E. : "Graphical Evolution of the Arnold Web: From Order to Chaos". *Science*, 289, n. 5487, 2000.

Guzzo M.: "Nekhoroshev stability of quasi-integrable degenerate Hamiltonian systems". *Regular and chaotic dynamics*, 4, n. 2, 1999.

Benettin G., Fassò F. and Guzzo M.: "Nekhoroshev-stability of L4 and L5 in the spatial restricted three-body problem", *Regular and chaotic dynamics*, 3, n. 3, 1998.

Guzzo M., Fassò F. and Benettin G.: "On The Stability of Elliptic Equilibria", *Mathematical Physics Electronic Journal*, 4, 1998;

Fassò F., Guzzo M. and Benettin G.: "Nekhoroshev-Stability of Elliptic Equilibria in Hamiltonian Systems", *Communications in Mathematical Physics*; 197: 347-360, 1998;

Guzzo M. and Morbidelli A.: "Construction of a Nekhoroshev-like result for the asteroid belt dynamical system", *Celestial Mechanics and Dynamical Astronomy* 66: 255-292, 1997;

Morbidelli A. and Guzzo M.: "The Nekhoroshev thorem and the asteroid belt dynamical system", *Celestial Mechanics and Dynamical Astronomy* 65: 107-136, 1997;

Benettin G., Fassò F. and Guzzo M.: "Fast rotations of the rigid body: a study by Hamiltonian Perturbation Theory. Part II: Gyroscopic rotations", *Nonlinearity*, 10, 1695-1717, 1997.

Contributions to Books, Proceedings and Transactions

Lega E. and Guzzo M.: "Theory and Applications of the Fast Lyapunov Indicator (FLI) Method", chapter in: *Chaos Detection and Predictability*, pp.35-54, 2016.

Benettin G., Fassò F. and Guzzo M.: "Il corpo rigido in rapida rotazione", in "Complementi alle Lezioni di Meccanica Razionale di T. Levi Civita e U. Amaldi (VOL.3)", Edizioni CompoMat, 281-299, 2012.

Guzzo M.: "Mechanisms for the Production of Chaos in Dynamical Systems." In: *Extra-Solar Planets The Detection, Formation, Evolution and Dynamics of Planetary Systems*, edited by B. Steves, M. Hendry, A. C. Cameron, 2010.

Guzzo M.: "Chaos and Diffusion in Dynamical Systems Through Stable-Unstable Manifolds." *Space Manifolds Dynamics*. p. 97-112, Springer, 2010.

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Guzzo M.: "An overflight on the Nekhoroshev theorem." In Lecture Notes in Physics, vol. 729, "Topics in gravitational dynamics", Benest, Froeschlé, Lega eds., Springer, 2007.

Lega E., Froeschlé C. and Guzzo M.: "Diffusion in Hamiltonian quasi-integrable systems." In Lecture Notes in Physics, vol. 729, "Topics in gravitational dynamics", Benest, Froeschlé, Lega eds., Springer, 2007.

Guzzo M.: "Fourier analysis of chaotic motions and applications to Celestial Mechanics", in "Chaotic Worlds: From Order to Disorder in Gravitational N-Body Dynamical Systems", Nato Science series II-Vol. 227. Edited by B.A. Steves, A.J. Maciejewski and M. Hendry, 2006.

Guzzo M.: "Fourier analysis of chaotic solutions of quasi-integrable systems", in "Hamiltonian Systems and Fourier Analysis: New Prospects For Gravitational Dynamics", Benest et al. editors, Cambridge Scientific Publishers Ltd, 2004.

Guzzo M.: "Nekhoroshev stability of asteroids", in the triennial report 2000-2003 of Commission 7-Celestial Mechanics and dynamical Astronomy of the IAU; Reports on Astronomy, 1999-2002. Transactions of the International Astronomical Union, Vol. XXVA, 2003.

Froeschlé C., Guzzo M. and Lega E.: "The Fast Lyapunov Indicator: detection of the Arnold web for Hamiltonian systems and symplectic mappings with 3 degrees of freedom". In SSUP Proceedings: The Restless Universe. Application of gravitational N-body dynamics to planetary, stellar and galactic systems. Editors B. A. Steves and A. J. Maciejewski, 2001.

Recent Invited Talks

"The three-body problem: the Lagrangian points and their spherical hypertube manifolds", Chaotic Phenomena in Mathematical Models, September 9-10, 2016, Pisa, Italy.

"A guided visualization of the tube manifolds of the three-body problem." Computational Perturbative Methods for Hamiltonian Systems in Physics and Astronomy. July 11-13, 2016, Athens, Greece.

"Numerical computation of stable and unstable manifolds with fast Lyapunov indicators. Applications to the three body problem." Dynamics, Topology and Computations, June 15-20, 2015, Bedlewo, Poland.

"Localization of stable-unstable manifolds with Fast Lyapunov Indicators and applications to the three body problem". XVII National Conference of Astronomers of Serbia, 23-27.09.2014, Belgrade, Serbia.

"Localization of stable-unstable manifolds with Fast Lyapunov Indicators and applications to the three body problem". Planetary Motions, Satellite Dynamics and Spaceship Orbits, 22-26 July 2013, Centre de recherches mathématiques, Montreal, Canada.

"Numerical investigations of a conjecture by N.N. Nekhoroshev about stability in quasi-integrable systems." Workshop on Instabilities in Hamiltonian Systems. Fields Institute, 13-17.06.2011, Toronto, Canada.

"Numerical investigations of a conjecture by N.N. Nekhoroshev about stability in quasi-integrable systems." 8th A. v. Humboldt Colloquium for Celestial Mechanics, Bad Hofgastein, Austria 20-26.03.2011.

"Dynamics in quasi-integrable systems: numerical examples.", Classical and Weak KAM Theorem, Padova, 14-19.02.2010, Montegrotto Terme, Italy.

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"Diffusion in quasi-integrable systems and the Nekhoroshev theorem", The Fifth international meeting on Celestial Mechanics, 6-12.09.2009, San Martino al Cimino, Italy.

"Hyperbolic manifolds and Arnold diffusion in a priori unstable systems", International Conference on the Dynamics of Celestial Bodies, 23-26.06.2008, Lithoro, Greece.

"Hyperbolic manifolds supporting Arnold diffusion in dynamical systems", 7th A. von Humboldt Colloquium for Celestial Mechanics, Bad Hofgastein, Austria, 30-3/05-04 2008.

"Chaos and diffusion in dynamical systems through stable-unstable manifolds", Novel Space-ways for scientific and exploration missions. Fucino Space Centre (Avezzano) and Scuola Superiore Reiss Romoli (L'Aquila), 15-10/17-10 2007.

"Mechanisms for the production of chaos in dynamical systems", Extra-Solar Planets: The detection, formation, evolution and dynamics of planetary systems, Skye, United Kingdom, 28-05/8-06 2007.

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