Curriculum of Massimiliano Berti

- **Formation**

1995. Degree in Physics at University of Milan, 110/110 cum laude.

1998. PhD in Mathematics at Scuola Normale Superiore in Pisa with best scores, 70/70 cum laude. Title: *"Perturbation techniques in critical point theory and chaotic dynamics in Hamiltonian systems"*. Supervisor: Prof. A. Ambrosetti.

- **Positions**

1999-2005. Researcher in Mathematical Analysis at International School for Advanced Studies SISSA, Trieste.

2005-2013. Associate Professor of Mathematical Analysis at Università Federico II, Napoli.

2013-2014. Associate Professor of Mathematical Analysis at SISSA.

2014– Full Professor of Mathematical Analysis at SISSA.

- **Awards**

2007. I won with best scores 10/10, the ERC-Starting Grants Ideas project "*Hamiltonian PDEs: new connections between dynamical systems and Hamiltonian PDEs with small divisors phenomena*", 2008-'12,

see http://www.dma.unina.it/hamiltonianPDE.

2010. Prize "*Calogero Vinti*" of the Italian Mathematical Union,

see http://www.dmi.unipg.it/ analisi/premio-vinti/

2014. Prize "*Bruno Finzi*" of Istituto Lombardo Scienze Lettere,

see http://www.istitutolombardo.it/pdf/premiati2014.pdf

2017. *UMI book Prize* for the Monograph "Almost global solutions for capillarity-gravity water waves equations with periodic spatial boundary conditions", M. Berti and J-M. Delort.

- **Editorial Activity:** 2016– Editor of the Journal "*Analysis and PDEs*".

- **Supervisor of PhD students**

1. Luca Biasco (SISSA, 1999-2002), title: *"Stability and Diffusion in Hamiltonian Systems via analytical and variational perturbative methods"*, currently Full Professor at Univ. Rome 3.

2. Pietro Baldi (SISSA, 2004-2007), title: *"Bifurcation of free and forced vibrations for nonlinear wave and Kirkhoff equations via Nash-Moser theory"*, currently Full Professor at Univ. Federico II, Naples.
3. Elisa Magistrelli (Univ.Federico II, 2009-2012), title: *"KAM theory for PDEs"*,
4. Riccardo Montalto (SISSA, 2011-2014) title: *"KAM for quasi-linear and fully nonlinear perturbations of Airy and KdV equations"*, currently Associate Professor at Milan University.
5. Alice Ambrosio (SISSA, 2013-16) title: *"Quasi-periodic solutions for a PDE model arising in hydrodynamics"*.
6. Filippo Giuliani (SISSA, 2014-17) title: *"KAM for quasi-linear PDEs"*, currently post-doc at University Politecnica of Barcelona.
7. Felice Iandoli (SISSA, 2015-2018) title: *"Local and almost global solutions for fully-nonlinear Schrödinger equations on the circle"*, currently post-doc at University of Sorbonne Université Paris.
8. Luca Franzoi (SISSA, 2017-2020) title: *"Long time dynamics of Hamiltonian PDEs: linear Klein-Gordon and water waves equations"*, currently post-doc at NYU Abu Dhabi.
9. Federico Murgante (SISSA, 2019-)
10. Paolo Ventura (SISSA, 2020-)

- **Mentoring of Post doc fellows**

1. Michela Procesi (SISSA, 2002-2004),
2. Pietro Baldi (Univ. Federico II, 2008-2009),
3. Gabriella Pinzari (Univ. Federico II, 2009-11),
4. Xindong Xu (Univ. Federico II, 2009-11),
5. Philipp Lorhmann (Univ. Federico II, 2010-12),
6. Livia Corsi (Univ. Federico II, 2012-13).
7. Roberto Feola, SISSA, 2015-18.
8. Alberto Maspero, SISSA, 2017-19.
9. Beatrice Langella, SISSA, 2021-.

- **Coordinator of research programs**. Most recent ones:

2007. Principal Investigator of the Project Gnampa "*La teoria di Mather per sistemi Lagrangiani finito e infinito dimensionali*".

2008-2012. Principal Investigator of ERC-project 204979 "*Hamiltonian PDEs: new connections between dynamical systems and PDEs with small divisors phenomena*", 400.000 euros.

2011-2013. Coordinator of the team in Naples of PRIN2009 grant "*Critical point theory and perturbative methods for nonlinear differential equations*". PI: Susanna Terracini.

2012-2013. Coordinator of the team at Federico II of the ERC-project 306414 "*Hamiltonian PDEs and small divisor problems: a dynamical systems approach*". PI: Michela Procesi (until 31 October 2013).

2015-2017. Coordinator of the team in SISSA of PRIN2012 , PI: Susanna Terracini.

2017-2020. Coordinator of the team in SISSA of PRIN2015, "Variational methods, with applications to problems in mathematical physics and geometry", PI: Andrea Malchiodi.

Books, Monographs.

1. M. Berti, "*Nonlinear Oscillations of Hamiltonian PDEs*", Progress in Nonlinear Differential Equations, book, Birkhäuser, 1-180 pages, Boston, 2008.

2. M. Berti, J-M. Delort, *"Almost global solutions for capillarity-gravity water waves equations on the circle"*, UMI Lecture Notes, 24, x+268 pages, 2018, Monograph awarded for the UMI book prize 2017.

   ISBN 978-3-319-99485-7

3. M. Berti, P. Bolle, *"Quasi-periodic solutions of nonlinear wave equations on* $\mathbb{T}^d$*"*, vii + 355, Monographs of the EMS, doi 10.4171/211

   ISBN print 978-3-03719-211-5.

Publications and preprints

1. M. Berti: *"Some remarks on a variational approach to Arnold diffusion"*, Discrete and Continuous dynamical systems, vol. 2, n. 3, 1996.

2. M. Berti, P. Bolle: *"Homoclinics and Chaotic Behaviour for Perturbed Second order Systems"*, Annali di Matematica Pura e Applicata, vol. CLXXVI, pp. 323-378, 1999.

3. M. Berti, P. Bolle: *"Variational construction of Homoclinics and Chaotic Behaviour in presence of a saddle-saddle equilibrium"*, Annali Scuola Normale Superiore di Pisa, serie IV, vol. XXVII, fasc. 2, 1998.

4. M. Berti, P. Bolle: *"Variational construction of Homoclinics and Chaotic Behaviour in presence of a saddle-saddle equilibrium"*, Rend. Mat. Acc. Naz. Lincei, s. 9, vol. 9, fasc. 3, 1998.

5. A. Ambrosetti, M. Berti: *"Homoclinics and Complex dynamics in slowly oscillating systems"*, Discrete and Continuous dynamical systems, vol. 4, n.3, 1998.

6. M. Berti: *"Heteroclinic solutions for perturbed second order systems"*, Rend. Mat. Acc. Naz. Lincei, s. 9, vol. 8, fasc.4, 1998.

7. M. Berti, P. Bolle: *"Diffusion time and splitting of separatrices for nearly integrable isochronous Hamiltonian systems"*, Rend. Mat. Acc. Naz. Lincei, s. 9, vol. 11, fasc. 4, pp. 235-243, 2000.

8. M. Berti, A. Malchiodi: *"Non-compactenss and multiplicity results for the Yamabe problem on S^n"*, Journal of Functional Analysis, vol. 180, n.1 febbraio 2001.

9. M. Berti, C. Carminati: *"Chaotic dynamics for perturbations of infinite dimensional Hamiltonian systems"*, Nonlinear Analysis TMA, 48, pp. 481-504, 2002.

10. M. Berti, P. Bolle: *"Fast Arnold diffusion in systems with three time scales"*, Discrete and Continuous Dynamical Systems, series A, Vol. 8, n. 3, pp. 795-811, 2002.

11. M. Berti, P. Bolle: *"A functional analysis approach to Arnold Diffusion Diffusion"*, Annales de l'Institute Henry Poincaré, Analyse non lineaire, 19, 4, 395-450, 2002.

12. M. Berti, L. Biasco, P. Bolle: *"Optimal stability and instability results for a class of nearly integrable Hamiltonian systems"*, Rend. Mat. Acc. Naz. Lincei, s. 9, vol. 13, fasc. 2, pp. 77-84, 2002.

13. M. Berti, L. Biasco, P. Bolle: *"Drift in phase space: a new variational mechanism with optimal diffusion time"*, Journal des Mathematiques Pures et Appliquées, 82/6, pp. 613-664, 2003.

14. M. Berti, P. Bolle: *"Periodic solutions of nonlinear wave equations with general nonlinearities"*, Communications in Mathematical Physics, Vol. 243, 2, pp. 315-328, 2003.

15. M. Berti, P. Bolle: *"Multiplicity of periodic solutions of nonlinear wave equations"*, Nonlinear Analysis, Theory Methods Applications, 56/7, pp. 1011-1046, 2004.

16. M. Berti, L. Biasco, E. Valdinoci: *"Periodic orbits close to elliptic tori and applications to the three-body problem"*, Annali Scuola Normale Superiore di Pisa, Cl. Sci. (V) 3, 87-138, 2004.

17. M. Berti, P. Bolle: *"Bifurcation of free vibrations for completely resonant wave equations"*, Bolletino Unione Mat. Italiana, 7, 2, 2004.

18. D. Bambusi, M. Berti: *"A Birkhoff-Lewis type theorem for some Hamiltonian PDEs"*, SIAM Journal on Mathematical Analysis, 37, 1, 83-102, 2005.

19. M. Berti, L. Biasco: *Periodic solutions of nonlinear wave equations with non-monotone forcing terms*, Rend. Mat. Acc. Naz. Lincei, s. 9, v. 16, fasc. 2, 117-124, 2005.

20. M. Berti, M. Procesi: *"Quasi-periodic oscillations for wave equations under periodic forcing"*, Rend. Mat. Acc. Naz. Lincei, 9, 16, 2, 109-116, 2005.

21. M. Berti, P. Bolle: *"Cantor families of periodic solutions for completely resonant nonlinear wave equations"*, Duke Mathematical Journal, 134, issue 2, 359-419, 2006.

22. M. Berti, L. Biasco: *"Forced vibrations of wave equations with non-monotone nonlinearities"*, Annales de l'Institute Henry Poincaré, Analyse non lineaire, Vol. 23, issue 4, 2006, 439-474.

23. M. Berti, M. Procesi: *"Quasi-periodic solutions of completely resonant forced wave equations"*, Communications in Partial Differential Equation, 31, 6, 959-985, 2006.

24. P. Baldi, M. Berti, *"Periodic solutions of wave equations for asympotically full measure sets of frequencies"*, Rend. Mat. Acc. Naz. Lincei, Volume 17, Issue 3, 257-277, 2006.

25. M. Berti, Lectures on "*Variational Methods for Hamiltonian PDEs*", Nato summer School "Hamiltonian Dynamical Systems and Applications", Montreal 391-420, chapter, Springer, W. Craig editor, 2007.

26. M. Berti, Monograph. "*Nonlinear Oscillations of Hamiltonian PDEs*", Progress in Nonlinear Differential Equations, book, Birkhäuser, 1-180, Boston, 2008.

27. M. Berti, P. Bolle, *"Cantor familites of periodic solutions for wave equations via a variational principle"*, Advances in Mathematics, 217, 1671-1727, 2008.

28. P. Baldi, M. Berti, *"Forced vibrations of a nonhomogeneous string"*, SIAM Journal in Mathematical Analysis, 40, 1, 382-412, 2008.

29. M. Berti, M. Matzeu, E. Valdinoci, *"On periodic elliptic equations with gradient dependence"*, Communications in Pure and Applied Analysis, 601-615, 7, 3, 2008.

30. M. Berti, P. Bolle, *"Cantor families of periodic solutions of wave equations with C^k nonlinearities"*, Nonlinear Differential Equations and Applications, 15, 247-276, 2008.

31. M. Berti, P. Bolle, *"Sobolev Periodic solutions for nonlinear wave equations in higher spatial dimensions "*, Archive for Rational Mechanics and Analysis, 195, 609-642, 2010.

32. M. Berti, P. Bolle, M.Procesi, *"An abstract Nash-Moser theorem with parameters and applications to PDEs"*, Annales de l'Institute Henry Poincaré, Analyse non lineaire, 27, 377 - 399, 2010.

33. M. Berti, M.Procesi, *"Nonlinear wave and Schrödinger equations on compact Lie groups and homogeneous spaces"*, Duke Mathematical Journal, 159, 3, 479-538, 2011.

34. M. Berti, L. Biasco, *"Branching of Cantor manifolds of elliptic tori and applications to PDEs"*, Communications in Mathematical Physics, 305, 3, 741-796, 2011.

35. M. Berti, P. Bolle, "*Quasi-periodic solutions of NLS on $\mathbb{T}^d$*" Rend. Mat. Acc. Naz. Lincei, 22, 223-236, 2011.

36. D. Bambusi, M. Berti, E. Magistrelli, *"Degenerate KAM theory for partial differential equations"*, Journal Differential Equations, 250, 3379-3397, 2011.

37. M. Berti, P. Bolle, *"Sobolev quasi periodic solutions of multidimensional wave equations with a multiplicative potential"*, Nonlinearity, 25, 2579-2613, 2012 (featured article).

38. M. Berti, P. Bolle, *"Quasi-periodic solutions with Sobolev regularity of NLS on $\mathbb{T}^d$ and a multiplicative potential"*, Journal European Mathematical Society, 15, 229-286, 2013.

39. M. Berti, L. Biasco, M. Procesi, *"Existence and stability of quasi-periodic solutions for derivative wave equations"*, Rend. Lincei Mat. Appl., 24, 1-16, 2013.

40. M. Berti, L. Biasco, M. Procesi, *"KAM theory for the Hamiltonian derivative wave equation"*, Annales Scientifiques de l' École Normale Supérieure, Volume 46, fascicule 2, p. 299-371, 2013.

41. P. Baldi, M. Berti, R. Montalto, "*A note on KAM theory for quasi-linear and fully nonlinear KdV*", Rend. Lincei Mat. Appl. 24, 437-450, 2013.

42. M. Berti, L. Biasco, M. Procesi, *"KAM for reversible derivative wave equations"*, Archive Rational Mechanics and Analysis, 212, 905-955, 2014.

43. P. Baldi, M. Berti, R. Montalto *"KAM theory for quasi-linear and fully nonlinear forced perturbations of Airy equations"*, Mathematische Annalen, 359, 1, 471-536, 2014.

44. P. Baldi, M. Berti, R. Montalto *"KAM for quasi-linear KdV"*, Comptes rendus Mathematique C. R. Acad. Sci. Paris, Ser. I 352, 603-607, 2014.

45. M. Berti, L. Corsi , M. Procesi, "*An abstract Nash-Moser theorem and quasi-periodic solutions for NLW and NLS on compact Lie groups and homogeneous spaces*", Communication in Mathematical Physics, 334, no. 3, 1413-1454, 2015.

46. Berti M., Bolle P., *A Nash-Moser approach to KAM theory*, Field Institute Communications, 255-284, special volume 'Hamiltonian PDEs and Applications", 2015.

47. P. Baldi, M. Berti, R. Montalto, *"KAM for autonomous quasi-linear perturbations of KdV"*, Annales I.H. Poincaré, analyse nonlineaire, 33, 1589-1638, 2016.

48. P. Baldi, M. Berti, R. Montalto, *"KAM for autonomous quasi-linear perturbations of mKdV"*, Bollettino Unione Matematica Italiana, 9, no. 2, 143-188, 2016.

49. M. Berti, *"KAM for PDEs"*, Bollettino Unione Matematica Italiana, 9, no. 2, 115-142, 2016.

50. M. Berti, R. Montalto, *"Quasi-periodic water waves"*, Journal Fixed Point Theory Applications, Volume 19, Issue 1, pp 129–156, 2017.

51. M. Berti, T. Kappeler, R. Montalto, *"Large KAM tori for perturbations of the dNLS equation"*, Asterisque, 403, viii+148, 2018.

ISBN 978-2-85629-892-3

52. P. Baldi, M. Berti, E. Haus, R. Montalto, *"KAM for gravity water waves in finite depth"*, Rendiconti Lincei Matematica e Applicazioni, n. 2, 215-236, 29, 2018.

53. P. Baldi, M. Berti, E. Haus, R. Montalto, *"Time quasi-periodic gravity water waves in finite depth"*, Inventiones Mathematicae, 214, 739–911, 2018.

54. M. Berti, *"KAM theory for partial differential equations"*, Analysis in Theory and Applications, 35, no. 3, 235–267, 2019.

55. M. Berti, A. Maspero, *"Long time dynamics of Schrödinger and wave equations on flat tori"*, Journal Differential Equations 267, no. 2, 1167–1200, 2019.

56. M. Berti, R. Montalto, *"KAM for gravity capillary water waves"*, Memoires American Mathematical Society, Volume 263, 1273, ISSN 0065-9266, 2020.

57. M. Berti, R. Feola, F. Pusateri, *"Birkhoff normal form and long time existence for periodic gravity water waves"*, to appear Communications Pure Applied Mathematics, Courant.

58. M. Berti, R. Feola, F. Pusateri, *"Birkhoff normal form for gravity water waves"*, https://doi.org/10.1007/s42286-020-00024-y Water Waves, 2020.

59. M. Berti, R. Feola, L. Franzoi, *"Quadratic life span of periodic gravity-capillary water waves"*, https://doi.org/10.1007/s42286-020-00036-8 Water Waves, 2020.

60. M. Berti, T. Kappeler, R. Montalto, *"Large KAM tori for quasi-linear perturbations of KdV"*, Archive Rational Mechanics, 239, 1395-1500,
https://doi.org/10.1007/s00205-020-01596-2, 2021.

61. M. Berti, A. Maspero, F. Murgante, *"Local well posedness of the Euler-Korteweg equations on $\mathbb{T}^d$"*, Journal of Dynamics and Differential Equations,
https://doi.org/10.1007/s10884-020-09927-3, 2021.

62. M. Berti, L. Franzoi, A. Maspero, *"Traveling quasi-periodic water waves with constant vorticity"*, Archive Rational Mechanics, 240, 99-202,
https://doi.org/10.1007/s00205-021-01607-w, 2021.

63. M. Berti, L. Franzoi, A. Maspero, *"Pure gravity traveling quasi-periodic water waves with constant vorticity"*, preprint arxiv.

Proceedings

1. A. Ambrosetti, M. Berti: *"Applications of Critical Point Theory to Homoclinics and Complex Dynamics"*, Proc. of the International Conference on Dynamical Systems and Differential Equations, Discrete and Continuous Dyncamical systems, Added Vol. I, 72-78, W.Chen, S. Hu editors, 1998.

2. M. Berti: *"A functional analysis approach to Arnold diffusion"*, Proc. of the International conference SPT2001, World Scientific.

3. M. Berti: *"Arnold diffusion: a functional analysis approach"*, Proc. of Institute of Mathematics of Nas of Ukraine, Vol. 43, Part 2, 712-719, 2002. ISSN: 2167-5163.

4. M. Berti: *"Soluzioni periodiche di PDEs Hamiltoniane"*, Conf. invitata 30', XVII Congresso UMI, Milano, Bolletino Unione Matematica Italiana, 8, 7-B, pp. 647-661, 2004. ISSN: 0392-4041.

5. M. Berti: *"Nonlinear oscillations of Hamiltonian PDEs"*, Proceedings of Contributed talks Equadiff.11, Bratislava, invited by Rabinowitz, 2005, 9-16, ISBN 978-80-227-2624-5.

6. M. Berti: *"Nonlinear oscillations of completely resonant wave equations"*, for "Fixed point theory and Applications", 49-60, Banach Center Publ. 77, Polish Acad. Sci. Warsaw, 2007 ISSN: 2167-5163.

7. M. Berti, P. Bolle: "*Cantor families of periodic solutions in wave equations*", Frontiers Math. China, 3, 2008, 2, 151-165. ISSN: 2167-5163.

8. M. Berti "*Quasi periodic solutions of Hamiltonian PDEs*", 38-Journeé equations aux deriveés partielles, Biarritz, 2011.

9. M. Berti "*Quasi-periodic solutions of PDEs*", Seminaire Laurent Schwartz, IHES, invited by F. Merle, 2012.

10. M. Berti. "*KAM for quasi-linear KdV equations*", Oberwolfach reports. Dynamische Systeme. Volume 10, Issue 3, 2013.
    DOI: 10.4171/OWR/2013/34

11. M. Berti. "*KAM for water waves*", Oberwolfach reports. Dynamische Systeme. 2015.

• **Referee activity.** I have been Referee of many International Journals as well for MIUR (Ministero Italiano Unversità e Ricerca), for PRIN, FIRB, SIR, FARE projects, for ANVUR (Agenzia nazionale Valutazione Università e Ricerca), ANR (Agency National Research, France), NSERC (Natural Sciences and Engineering Research Council of Canada), ERC (European Research Council), and external Evaluator for the Padova University and Univ. Roma 2 Tor Vergata.

I have also been member of the PhD commissions of Laura Di Gregorio (Roma 3), Cristina Bardelle (Milano Statale), Gabriella Pinzari (Roma 3), Livia Corsi (Roma 3), Renato Lucá (Roma La Sapienza), Stefano Pasquali (Milano Statale), Chiara Khayamian (Univ. Avignon), Beatrice Langella (Milano Statale).

I have been nominated as Rapporteur for the Habilitation Thesis (Habilitation à diriger des recherches) of Laurent Thomann, Univ. Nantes, '13.

• **Administrative responsibilities**

2014-2016. Coordinator of Master Program at SISSA

2015–2018 and 2019–2020. Vice-deputy of the Area of Mathematics at SISSA,

2016–2018 and 2020– Coordinator of Phd Program at SISSA in Mathematical Analysis, Modeling, Applications.

Massimiliano Berti,

Trieste, 6/9/2021