

Curriculum Vitae

Matthias Schwarz

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Education

1995 PhD in Mathematics, ETH Zurich, Advisor: Prof. Dr. Helmut Hofer
1993-95 Graduate Studies of Mathematics
at the Federal Institute of Technology Zurich, Switzerland
1992 Diploma in Mathematics, Ruhr-Universität Bochum, Germany
1987-92 Study of Mathematics and Physics at Ruhr-Universität Bochum,
Germany

Academic Career

2011-17 Vice-Rector (Prorektor) for Research and Young Academics
at Leipzig University
2010-11 Dean (Dekan) of the Faculty for Mathematics and Computer
Science and Director of the Mathematics Institute
2005-08 Dean of Studies (Studiendekan) of the Mathematics Institute
2004-05 Director of the Mathematics Institute and Vice Dean (Prodekan) of the
Faculty for Mathematics and Computer Science
2000- Full professor (C4) for Mathematics in the Sciences
at Leipzig University
1999-2000 Head of Independent Research Group, Max-Planck-Institute for
Mathematics in the Sciences Leipzig
1998-99 Assistant Professor at University of Chicago, USA

- 1996-98 Szegoe Assistant Professor at Stanford University, USA
- 1995-96 Leibniz postdoctoral fellowship of European Union at DPMMS
Cambridge University, GB

Awards

- 2017-18 Member at the Institute for Advanced Study, Princeton
- 2015- Ordinary Member of the Saxonian Academy of Sciences
- 1999-01 Alfred P. Sloan Fellow
- 1996 Medal of the Federal Institute of Technology Zurich for PhD thesis

Research Profile

My research has covered various problems of Symplectic Topology and Hamiltonian Dynamical Systems. The main focus lies on variational and PDE methods based on Morse theory, Floer theory and pseudoholomorphic curves in symplectic manifolds. The central structure analyzed throughout the last ten years is a multiplicative structure on Floer homology closely related to topological field theories, string topology and Hamiltonian systems. The initial major result was to identify this structure as equivalent to quantum cohomology which enables to use algebraically computable data on Gromov-Witten invariants. This structure provides new existence and multiplicity results on periodic orbits of Hamiltonian systems, new symplectic capacities and invariants from the action spectrum. My research jointly with A. Abbondandolo shows that this ring structure is also isomorphic to the loop product in string topology, where Floer homology for cotangent bundles turns out to be isomorphic to loop space homology. Further research is currently carried out on other orbits types in Hamiltonian systems.

Grant-funded Research Projects and Activities

- Coordination of DFG-Priority Program “Globale Differentialgeometrie” (SPP 1154) jointly with Ch. Bär, B. Leeb and J. Lohkamp (managing), (LO 552/3-3), 2003-2010
- DFG-Project “Singularities of Lagrangian Mean Curvature Flow” (SCHW 892/1-1) , 2005-08
- DFG-Project “Analysis of Floer-Homology” (SCHW 892/2-1, SCHW 892/2-2, SCHW 892/2-3), 2003-2010
- DFG-Project “Construction of Functoriality for Floer Homology” (SCHW 892/3-1), 2005-2006
- DFG-Research Training Group GRK 597, 2000-2009

- Joint project on “Floer homology, loop space topology and polarizations” with A. Abbondandolo (Univ. Pisa, from 2008-09 visiting professor at Univ. Leipzig), funded 2008-09 by Alexander-v.-Humboldt foundation and 2009-10 by DAAD-Vigoni 0815177

Publications

- [1] A. Abbondandolo and M. Schwarz, The role of the Legendre transform in the study of the Floer complex of cotangent bundles”, *Comm. Pure Appl. Math.* 68 (2015), 1885-1945.
- [2] A. Abbondandolo and M. Schwarz, *Corrigendum: "On the Floer homology of cotangent bundles"*, *Comm. Pure Appl. Math.* 67 (2014), 670-691.
- [3] Ch. Bär, J. Lohkamp and M. Schwarz (eds.), *Global differential geometry*, Springer Proceedings in Mathematics 17, Springer, Berlin Heidelberg 2012.
- [4] A. Abbondandolo and M. Schwarz, On product structures in Floer homology of cotangent bundles, in: *Global differential geometry* (Ch. Bär et al. eds.), Springer 2012, pp. 491-521.
- [5] A. Abbondandolo and M. Schwarz, Floer homology of cotangent bundle and the loop product, *Geom. Top.* 14 (2010), no. 3, 1569-1722.
- [6] A. Abbondandolo and M. Schwarz, Estimates and computations in Rabinowitz-Floer homology, *J. Topol. Anal.* 1 (2009), no. 4, 307-405.
- [7] A. Abbondandolo and M. Schwarz, A smooth pseudo-gradient for the Lagrangian action functional, *Advanced Nonlinear Studies* 9 (2009), 597–624.
- [8] A. Abbondandolo, A. Portaluri, and M. Schwarz, The homology of path spaces and Floer homology with conormal boundary conditions, *J. fixed point theory appl.* 4 (2008), no. 2, 263–293.
- [9] K. Groh, M. Schwarz, K. Smoczyk, and K. Zehmisch, Mean curvature flow of monotone Lagrangian submanifolds, *Math. Z.* 257 (2007), no. 2, 295–327.
- [10] A. Abbondandolo and M. Schwarz, On the Floer homology of cotangent bundles, *Comm. Pure Appl. Math.* 59 (2006), 254–316.
- [11] A. Abbondandolo and M. Schwarz, Notes on Floer homology and loop space homology, *Morse theoretic methods in nonlinear analysis and in symplectic topology* (Montreal) (P. Biran, O. Cornea, and F. Lalonde, eds.), Springer, Berlin, 2006, pp. 75–108.
- [12] M. Schwarz, On the action spectrum for closed symplectically aspherical manifolds, *Pacific J. Math.* 193 (2000), no. 2, 419–461.
- [13] M. Schwarz, Equivalences for Morse homology, *Geometry and Topology in Dynamics* (M. Barge and K. Kuperberg, eds.), *Contemporary Mathematics*, vol. 246, AMS, Providence, RI 02904 USA, 1999, pp. 197–216.

[14] M. Schwarz, A quantum cup-length estimate for symplectic fixed points, Invent. math. 133 (1998), 353– 397.

[15] M. Schwarz, Morse Homology, Progress in Mathematics, vol. 111, Birkhäuser, Basel, 1993, 235 pp.

Supervised Theses

Diploma theses: completed 8

PhD theses: completed 13

Selected PhD Students

Peter Albers, PhD degree 2005,

2005-08 Courant Instructor at Courant Institute, NYU,

2008-09 Heinz-Hopf lecturer ETH Zurich,

2009-11 Assistant Prof. at Purdue Univ.,

2011-15 Professor at WWU Münster

2015- Professor at University of Heidelberg

Sonja Hohloch, PhD degree 2007,

2012-2015 Assistant prof. at EPFL Lausanne,

2015- tenure track professor at University Antwerp, Belgium

Kai Zehmisch, PhD degree 2009, W2-Professor at University Giessen