

Matthias Schwarz

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16.10.1967 Born in Tübingen, Germany

1987 - 92 Study of Mathematics and Physics at Ruhr-Universität Bochum, Diploma in Mathematics
1987 - 92 Scholarship of the Studienstiftung des deutschen Volkes
1993 - 95 Graduate Studies of Mathematics at the Federal Institute of Technology Zurich, Switzerland
1995 PhD in Mathematics, ETH Zürich
1995 - 96 Leibniz postdoctoral fellowship of European Union at DPMMS Cambridge University, GB
1996 - 98 Szegoe Assistant Professor at Stanford University, USA
1998 - 99 Assistant Professor at University of Chicago, USA
1999 - 00 Head of Independent Research Group, Max-Planck-Institute for Mathematics in the Sciences
Leipzig
2000 - Full professor (C4) for Mathematics in the Sciences at University of Leipzig
2004 - 05 Director of the Mathematics Institute and Vice Dean (Prodekan) of the Faculty for Mathematics
and Computer Science
2005 - 08 Dean of Studies (Studiendekan) of the Mathematics Institute
2010 - Dean (Dekan) of the Faculty for Mathematics and Computer Science and Director of the
Mathematics Institute

Awards

1996 Medal of the Federal Institute of Technology Zurich for PhD thesis
1999 - 01 Alfred P. Sloan Fellow

Editorial Board Member

Journal of Fixed Point Theory and Applications

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. Recent research joint with Abbondandolo shows that this ring structure is also isomorphic to the loop product in string topology. Further research is currently carried out on Symplectic Field Theory and other orbits types in Hamiltonian systems.

Grant-funded Research Projects and Activities

- Coordination of Priority Program "Globale Differentialgeometrie" (SPP 1154) jointly with Ch. Bär, B. Leeb and J. Lohkamp (managing), (LO 552/3-3)
- DFG-Project "Singularities of Lagrangian Mean Curvature Flow" (SCHW 892/1-1)
- DFG-Project "Analysis of Floer-Homology" (SCHW 892/2-1, SCHW 892/2-2, SCHW 892/2-3)
- DFG-Project "Construction of Functoriality for Floer Homology" (SCHW 892/3-1)

- 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
- Member of CAST, a Research Networking programme (RNP) of the European Science Foundation (ESF)

Selected Publications and Recent Preprints

- [1] A. Abbondandolo and M. Schwarz, On product structures in Floer homology of cotangent bundles, preprint MPI MIS 76/2010, December 2010.
- [2] A. Abbondandolo and M. Schwarz, Floer homology of cotangent bundle and the loop product, *Geom. Top.* 14 (2010), no. 3, 1569-1722.
- [3] A. Abbondandolo and M. Schwarz, Estimates and computations in Rabinowitz-Floer homology, *J. Topol. Anal.* 1 (2009), no. 4, 307-405.
- [4] A. Abbondandolo and M. Schwarz, A smooth pseudo-gradient for the Lagrangian action functional, *Advanced Nonlinear Studies* 9 (2009), 597–624.
- [5] 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.
- [6] K. Groh, M. Schwarz, K. Smoczyk, and K. Zehmisch, Mean curvature flow of monotone Lagrangian submanifolds, *Math. Z.* 257 (2007), no. 2, 295–327.
- [7] A. Abbondandolo and M. Schwarz, On the Floer homology of cotangent bundles, *Comm. Pure Appl. Math.* 59 (2006), 254–316.
- [8] 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.
- [9] M. Schwarz, On the action spectrum for closed symplectically aspherical manifolds, *Pacific J. Math.* 193 (2000), no. 2, 419–461.
- [10] 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.
- [11] M. Schwarz, A quantum cup-length estimate for symplectic fixed points, *Invent. math.* 133 (1998), 353–397.
- [12] M. Schwarz, *Morse Homology*, Progress in Mathematics, vol. 111, Birkhäuser, Basel, 1993, 235 pp.

Supervised Theses

Diploma theses: completed 7, currently 2
 PhD theses: completed 5, currently 8

Selected PhD Students

Peter Albers, submitted 2005, 2005-08 Courant Instructor at Courant Institute, NYU, 2008-09 Heinz-Hopf lecturer ETH Zurich, from 2009 Assistant Prof. at Purdue Univ.
 Sonja Hohloch, submitted 2007, currently visiting researcher at Stanford University