

Stefan Müller

Date of birth: 01 Jan 1970

Academic career

1989	PhD, Heriot-Watt University, Edinburgh
1989–1990	Visiting Ass. Prof., Carnegie Mellon University
1990–1993	Postdoc, SFB 256, Bonn University
1993–1994	Visiting Member, IAS Princeton
1994	Full Professor, Freiburg University
1995	Full Professor, ETH Zürich
1996–2008	Director, MPI Mathematics in the Sciences, Leipzig
2008–	Full Professor (C4), Bonn
1987	Diploma in Mathematics, Bonn
2010–	External scientific member, MPI Bonn



Honours

1992	Prize of the European Mathematical Society
1993	Max-Planck Research Prize (jointly with V. Sverák)
1999	Member of the Academy of Berlin-Brandenburg
1999	Collatz prize of CICIAM
2000	Leibniz prize
2002	Member of the Academy Leopoldina

Invited Lectures

1998	ICM, Berlin
2006	ICMP, Rio de Janeiro
1994	Plenary: German Math. Soc.
1996	ECM
1997	Austrian Math. Soc.
1998	GAMM
1999	ICIAM
2009	Annual Meeting of Leopoldina
1997	Andrejewski Lectures Berlin
2000	Ordway Lectures Minneapolis
2003	Landau Lectures Jerusalem
2006	Gauss Lecture Bremen

Research Projects and Activities

DFG SPP 1239: Magnetic Shape Memory; DFG FOR 718: Analysis and Stochastics in Complex

Physical Systems; DFG FOR 797: Microplast – Analysis and computation of microstructure in finite plasticity.

Research profile

My goal is to develop mathematical methods to describe and understand multiscale problems and the formation, evolution and macroscopic effects of microstructure, in particular in advanced materials. I have always been fascinated by the subtle interplay of geometry, analysis, and physics in nonlinear elasticity, both for conventional and for phase-transforming materials. Results include a qualitatively new homogenization formula in nonlinear elastic materials [Mü87], the first rigorous understanding of dimension reduction in nonlinear elasticity [FJM06, FJM02] and rigorous scaling laws for branching near austenite/martensite interfaces [KM94]. Implications for material design, e.g, for low-hysteresis shape memory alloys are explored in [ZJM09].

In turn estimates and constructions first discovered in elasticity led to new results in geometry [FMS97] and rather striking counterexamples to Hilbert's 19th problem in PDE [MS03]. Other important areas are micromagnetics, where a simple, yet subtle, energy functional describes a huge variety of magnetization patterns on very different scales [DKMO02] and plasticity [CGM11]. Recently

I have begun work on understanding the relation between atomistic and continuum theory of solids through statistical mechanics and rigorous renormalization.

Editorships

Archive of Rational Mechanics and Analysis; Interfaces and Free Boundaries; Journal of the European Mathematical Society; Bulletin, Journal and Proceedings of London Mathematical Society; Journal of Analysis and its Applications; M3 AS.

Research Area B Expertise in nonconvex problems in the calculus of variations and their applications to material microstructure, including recent extensions to atomistic models as well as in a broad range of rigorous multiscale methods, including homogenization [Mü87], singular perturbations [KM94, Mü93] and Γ -convergence [CGM11, FJM06, FJM02, DKMO02].

Research Area G Statistical mechanics of solids and thermodynamic limits through rigorous renormalization group methods. Relations between variational methods and small noise limits through capacity estimates and the theory of large deviations.

Supervised theses

PhD theses: 14, currently 1

Selected PhD students

Anja Schlömerkemper (2002), now Professor Würzburg; Christof Melcher (2002), now Professor

Aachen; László Székelyhidi (2004), now Professor Leipzig; Bernd Schmidt (2006), now Professor Augsburg.

Habilitations

B. Kirchheim (2001), now Professor Oxford; G. Dolzmann (2002), now Professor Regensburg; S. Conti (2004), now Professor Bonn.

Selected publications

- [CGM11] CONTI, Sergio ; GARRONI, Adriana ; MÜLLER, Stefan: Singular kernels, multiscale decomposition of microstructure, and dislocation models. In: *Arch. Ration. Mech. Anal.* 199 (2011), Nr. 3, S. 779–819. – ISSN 0003–9527
- [DKMO02] DESIMONE, Antonio ; KOHN, Robert V. ; MÜLLER, Stefan ; OTTO, Felix: A reduced theory for thin-film micromagnetics. In: *Comm. Pure Appl. Math.* 55 (2002), Nr. 11, S. 1408–1460. – ISSN 0010–3640
- [FJM02] FRIESECKE, Gero ; JAMES, Richard D. ; MÜLLER, Stefan: A theorem on geometric rigidity and the derivation of nonlinear plate theory from three-dimensional elasticity. In: *Comm. Pure Appl. Math.* 55 (2002), Nr. 11, S. 1461–1506. – ISSN 0010–3640
- [FJM06] FRIESECKE, Gero ; JAMES, Richard D. ; MÜLLER, Stefan: A hierarchy of plate models derived from nonlinear elasticity by gamma-convergence. In: *Arch. Ration. Mech. Anal.* 180 (2006), Nr. 2, S. 183–236. – ISSN 0003–9527
- [FMS97] FREIRE, Alexandre ; MÜLLER, Stefan ; STRUWE, Michael: Weak convergence of wave maps from (1+2)-dimensional Minkowski space to Riemannian manifolds. In: *Invent. Math.* 130 (1997), Nr. 3, S. 589–617. – ISSN 0020–9910
- [KM94] KOHN, Robert V. ; MÜLLER, Stefan: Surface energy and microstructure in coherent phase transitions. In: *Comm. Pure Appl. Math.* 47 (1994), Nr. 4, S. 405–435. – ISSN 0010–3640
- [MS03] MÜLLER, S. ; SVERÁK, V.: Convex integration for Lipschitz mappings and counterexamples to regularity. In: *Ann. of Math. (2)* 157 (2003), Nr. 3, S. 715–742. – ISSN 0003–486X
- [Mü87] MÜLLER, Stefan: Homogenization of nonconvex integral functionals and cellular elastic materials. In: *Arch. Rational Mech. Anal.* 99 (1987), Nr. 3, S. 189–212. – ISSN 0003–9527
- [Mü93] MÜLLER, Stefan: Singular perturbations as a selection criterion for periodic minimizing sequences. In: *Calc. Var. Partial Differential Equations* 1 (1993), Nr. 2, S. 169–204. – ISSN 0944–2669

[ZJM09] ZHANG, Z. Y. ; JAMES, R. D. ; MÜLLER, S.: Energy barriers and hysteresis in martensitic phase transformations. In: *Acta Materialia* 57 (2009), S. 4332–4352