

Sascha Hilgenfeldt: Curriculum Vitae

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Personal Information

Citizenship: German

Marital status: married (wife is US citizen)

Current US visa status: J-1, B-1

Research Interests

- Bubbles in biomedical and biomechanical applications
- Bubble-powered microfluidics
- Structure and aging of cellular matter
- Viscous fluid dynamics in two-phase systems; fingering instabilities in foams and their relation to crack formation
- Colloidal particles at interfaces

Professional Experience

since July 2001 Visiting scholar at The University of Chicago (several visits per year)

since Oct 2000 Assistant professor (*universitair docent*, tenured position) at University of Twente. Supervision of internship, masters, and PhD students.

1998 – 2000 Postdoctoral fellow at Harvard University, with Howard Stone

1997 / 1998 Postdoctoral researcher at the Department of Theoretical Physics, University of Marburg, with Siegfried Grossmann and Detlef Lohse

Summer 1997 Research affiliate at the University of Chicago, with Leo Kadanoff and Todd Dupont

Spring 1997 Research affiliate at MIT, with Michael Brenner

Spring 1992 Visiting Scientist at the Center for Complex Systems Research, Beckman Institute, University of Illinois, Urbana-Champaign (Alfred Hubler)

Education

May 1997	Ph.D. in physics, University of Marburg, Germany, with Honors (summa cum laude): <i>Sonoluminescence and Bubble Dynamics</i>
1995 – 1997	Ph.D. student and teaching assistant at University of Marburg, with S. Grossmann and D. Lohse
Jul 1995	Bachelor's degree in mathematics at University of Munich, with Honors
Feb 1995	Diploma, Munich University of Technology (MUT), with Honors:
Oct 1991	Bachelor's degree in physics, very good

Scholarships and Honors

2001	Ehrenfest colloquium speaker at Leiden University
2000 – 2004	FOM stipend: “Phasing-in” grant for assistant professorship at University of Twente, Netherlands (position is university-paid after 2004)
1999 – 2000	Research scholarship of the German Research Foundation (DFG)
since 1994	Permanent member of the Studienstiftung des deutschen Volkes
1992 – 1995	Scholarship of the Studienstiftung des deutschen Volkes
1989 – 1994	Scholarship for outstanding students of the State of Bavaria

Experience in Teaching and Organization

2003 / 2004	Organizer and chairman of sessions at the APS March meeting 2004 (Montreal) and ICTAM 2004 (Warsaw)
since 2003	Organizer, Physics Department Colloquium Series at Univ. of Twente
since 2001	Lectures at undergraduate and graduate levels (introductory physics, fluid dynamics, thermodynamics, transport phenomena, biomechanics and two-phase systems) at University of Twente
since 2001	Supervisor for internship students, masters students (currently 4), and graduate students
since 2001	Coordinator and supervisor for undergraduate student projects in bio-medical technology and physics of transport phenomena
1997 / 1998	Teaching assistant for students of physics
1996 / 1997	Organization of the annual workshop of the SFB 185 <i>Nonlinear Dynamics</i>
1994	Teaching assistant at MUT (experiments and lectures)
1991 – 1993	Lecturer (engineering courses), Teaching Center, Siemens AG Munich

Other professional activities

Acted as referee for Physical Review Letters, Physical Review E, Physics Letters A, Physics of Fluids, Journal of Fluid Mechanics, European Physical Journal B, Proceedings of the Royal Society London, NASA, NSF, and others.

Sascha Hilgenfeldt: List of Publications

•• five most significant publications

Bubbles in Ultrasound Diagnostics and Biomedicine

Refereed journal articles:

1. S. Grossmann, S. H., D. Lohse, and M. Zomack,
“Sound radiation of 3-MHz driven gas bubbles”
J. Acoust. Soc. Am. **102**, 1223 (1997).
2. S. H., D. Lohse, and M. Zomack,
“Response of bubbles to diagnostic ultrasound: a unifying theoretical approach”,
Eur. Phys. J. B **4**, 247 (1998).
3. S. H. and D. Lohse,
“The acoustics of diagnostic microbubbles: dissipative effects and heat deposition”.
Ultrasonics **38**, 99 (2000).
4. S. H., D. Lohse, and M. Zomack,
“Sound scattering and localized heat deposition of pulse driven microbubbles”.
J. Acoust. Soc. Am. **107**, 3530 (2000).
5. •• P. Marmottant and S. H.,
“Controlled vesicle deformation and lysis by single oscillating bubbles”,
Nature **423**, 153 (2003).
6. S. H. and P. Marmottant
“Microbubbles: Tools for vesicle biomechanics”,
Acta Acustica **89**, 727 (2003).

Book contributions:

7. A. Bauer, M. Zomack, S. H., D. Lohse, A. Urbanke, and R. Schliefl,
“New concepts for ultrasound contrast imaging”.
In “Transcranial Ultrasound”, edited by R. Bogdahn, G. Becker, and F. Schlachetzky, Blackwell (1997).

Upcoming articles and preprints:

8. P. Marmottant and S. H.,
“A bubble-driven microfluidic transport element for bioengineering”,
submitted to Proc. Natl. Acad. Science USA (2003).

9. M. Postema, C. Lancee, N. de Jong, P. Marmottant, and S. H.,
“Ultrasound-induced fast coalescence of lipid-coated microbubbles”,
submitted to Langmuir (2003).
10. P. Marmottant, M. Versluis, N. de Jong, and S. H.,
“Microcirculation flow fields in biomedical applications: Direct observation
on the ns scale”,
preprint (2003).

Foam Structure and Aging

Refereed journal articles:

11. ●● S. H., A. M. Kraynik, S. A. Koehler, and H. A. Stone,
“An accurate von Neumann’s law for three-dimensional foams”,
Phys. Rev. Lett. **86**, 2685 (2001).
12. S. H., S. A. Koehler, and H. A. Stone,
“The dynamics of coarsening foams: accelerated and self-limiting drainage”,
Phys. Rev. Lett. **86**, 4704 (2001).
13. S. H.,
“Foam structure: The importance of bubble geometry”,
Nieuw Archief voor Wiskunde **5**, 224 (2002).

Upcoming articles and preprints:

14. A. van Doornum and S. H.,
“Measuring film thickness using bubble geometry”,
submitted to Phys. Rev. Lett. (2003).
15. S. H., A. M. Kraynik, D. A. Reinelt, and J. M. Sullivan,
“The structure of foam cells: Isotropic Plateau Polyhedra”,
submitted to Europhys. Lett. (2003).
16. S. H., A. M. Kraynik, and D. Weaire,
“Volume – face number correlations in random three-dimensional foam”,
manuscript in preparation (2003).

Foam Drainage

Refereed journal articles:

17. ●● S. A. Koehler, S. H. and H. A. Stone,
“Liquid flow through aqueous foams: The node-dominated foam drainage equation”.
Phys. Rev. Lett. **82**, 4232 (1999).
18. S. A. Koehler, S. H., and H. A. Stone,
“A generalized view of foam drainage: experiment and theory”,
Langmuir **16**, 6327 (2000).
19. S. A. Koehler, S. H., and H. A. Stone,
“Flow along two dimensions of liquid pulses in foams: experiments and theory “,
Europhys. Lett. **54**, 335 (2001).
20. S. A. Koehler, S. H., E. R. Weeks, and H. A. Stone,
“Drainage through single Plateau borders: rigid and mobile walls”,
Phys. Rev. E. **66**, 040601(R), (2002).
Also featured in: Virtual Journal of Biological Physics Research
(<http://vjbio.org>), issue October 15, 2002.
21. H. A. Stone, S. A. Koehler, S. H., and M. Durand,
“Perspectives on foam drainage and the influence of interfacial rheology”,
J. Phys.: Condens. Matter **15**, S283 (2003).

Book contributions:

22. S. A. Koehler, S. H. and H. A. Stone,
“Foam drainage: Experiments and a New Model”,
in: D. Weaire and J. Banhart (Ed.s) *Foams and Films*, Proceedings of the
International Workshop on Foams and Films, Leuven (Belgium), MIT-Verlag
Bremen (1999).
23. S. H., S. A. Koehler, and H. A. Stone,
“Analysis of pulsed drainage in a Hele-Shaw cell”.
In: Proceedings of the 3rd EuroConference on Foams, Emulsions and Appli-
cations, Delft (2000).

Upcoming articles and preprints:

24. S. A. Koehler, S. H., and H. A. Stone,
“Foam drainage on the microscale, Part I: Modeling flow through single
Plateau borders and films”,
J. Colloid Interface Sci., to appear (2003).

25. S. A. Koehler, S. H., E. R. Weeks, and H. A. Stone,
“Foam drainage on the microscale, Part II: Experiments on the scale of single
Plateau borders”, *J. Colloid Interface Sci.*, to appear (2003).

Colloids at interfaces

26. E. A. van Nierop, M. A. Stijnman and S. H.,
“Attractive forces between colloidal particles arise through particle eccentricity”, preprint (2003).

Sonoluminescence

Refereed journal articles:

27. ●● S. H., D. Lohse, and M. P. Brenner,
“Phase diagrams for sonoluminescing bubbles”.
Phys. Fluids **8**, 2808 (1996).
28. M. P. Brenner, S. H., D. Lohse, and R. Rosales,
“Acoustic energy storage in single bubble sonoluminescence”.
Phys. Rev. Lett. **77**, 3467 (1996).
29. D. Lohse, M. P. Brenner, T. F. Dupont, S. H., and B. Johnston,
“Sonoluminescing bubbles rectify argon”.
Phys. Rev. Lett. **78**, 1359 (1997).
30. D. Lohse and S. H.,
“Inert gas accumulation in sonoluminescing bubbles”.
J. Chem. Phys. **107**, 6986 (1997).
31. M. P. Brenner, T. F. Dupont, S. H., and D. Lohse,
Reply to Comment on “Bubble Shape Oscillations and the Onset of Sonoluminescence”.
Phys. Rev. Lett. **80**, 3668 (1998).
32. S. H., D. Lohse, and W. C. Moss,
“Water temperature dependence of single bubble sonoluminescence”.
Phys. Rev. Lett. **80**, 1332 (1998).
33. S. H., M. P. Brenner, S. Grossmann, and D. Lohse,
“Analysis of Rayleigh-Plesset dynamics for sonoluminescing bubbles”.
J. Fluid Mech. **365**, 171 (1998).
34. S. H. and D. Lohse,
“Predictions for upscaling sonoluminescence”.
Phys. Rev. Lett. **82**, 1036 (1999).

35. ●● S. H., S. Grossmann, and D. Lohse,
“A simple explanation of light emission in sonoluminescence”,
Nature **398**, 402 (1999).
36. S. H., S. Grossmann, and D. Lohse,
“Sonoluminescence light emission”,
Phys. Fluids **11**, 1318 (1999).
37. S. H. and D. Lohse,
“Sonolumineszenz: ans Licht gebracht”.
Spektrum der Wissenschaft, Nov. 1999, p. 22.
(German edition of *Scientific American*)
38. S. H. and D. Lohse.
“Sonoluminescence: When bubbles glow”.
Current Science **78**, 238 (2000).
39. S. H., S. Grossmann, and D. Lohse.
“Sonolumineszenz”.
Phys. Blätt. **56**, 43 (2000).
40. S. H., S. Grossmann, and D. Lohse.
Reply to Comment on “Sonoluminescence light emission”.
Phys. Fluids **12** 474, (2000).
41. R. Toegel, S. H., and D. Lohse,
“The effect of surfactants on single bubble sonoluminescence”,
Phys. Rev. Lett. **84**, 2509 (2000).
42. D. Lohse and S. H.,
“Sonoluminescentie: Als bellen gloeien”,
Nederlands tijdschrift voor natuurkunde **66**, 348 (2000).
43. S. H. and D. Lohse,
“Dossier Sonoluminescence”,
La Recherche **354**, 22 (2002).
44. R. Toegel, S. H., and D. Lohse.
“Suppressing dissociation in sonoluminescing bubbles: The effect of excluded volume”.
Phys. Rev. Lett. **88**, 034301 (2002).
45. M. Brenner, S. H., and D. Lohse.
“Single-bubble Sonoluminescence”.
Rev. Mod. Phys. **74**, 425 (2002).

Book contributions:

46. M. P. Brenner, S. H., and D. Lohse,
“Why air bubbles in water glow so easily”.
In “Nonlinear Physics of Complex Systems – Current Status and Future Trends”, edited by J. Parisi, S. C. Müller, and W. Zimmermann (Springer Lecture Notes in Physics, Berlin, 1996), p. 79.
47. M. P. Brenner, S. H., and D. Lohse,
“Sonoluminescence: Why fiery bubbles have eternal life”.
In “Chaos und Strukturbildung 96”, Proceedings of the 6th Annual Conference on Chaos and Pattern Formation in Munich, edited by R. Meyer-Spasche. Akademischer Verlag, Munich (1997).
48. S. H. and D. Lohse,
“Predictions for upscaling sonoluminescence”.
In “Proceedings of the 16th International Congress on Acoustics and 135th Meeting of the Acoustical Society of America”, P. K. Kuhl and L.A. Crum (eds.), p. 2573, Acoustical Society of America, Woodbury, NY, 1998.
49. R. Toegel, S. H., and D. Lohse.
“Influence of surfactants on the intensity of single bubble sonoluminescence”.
In “Proceedings of the 16th International Congress on Acoustics and 135th Meeting of the Acoustical Society of America”, P. K. Kuhl and L.A. Crum (eds.), p. 2581, Acoustical Society of America, Woodbury, NY, 1998.
50. M. P. Brenner, S. H., and D. Lohse,
“The hydrodynamical/chemical approach to sonoluminescence”.
In: “Sonochemistry and Sonoluminescence”, NATO-ASI Series C, Vol. 524, edited by L. Crum, T. Mason, J. Reisse, and K. Suslick. Kluwer Academic Publishers, Dordrecht (1999).
51. D. Lohse and S. H.,
“Sonoluminescence: When bubbles glow”.
In “Festkörperprobleme”, edited by B. Kramer, Vieweg, Braunschweig (1999).
52. S. H. and D. Lohse,
Essay “Sonolumineszenz”.
In “Lexikon der Physik”, U. Kilian and C. Weber (eds.), Spektrum Akademischer Verlag, Heidelberg (2000).
53. R. Toegel, S. H., and D. Lohse.
“The drunken bubble”.
In “Proceedings of the 20th IUTAM congress, Chicago”, Kluwer (2001).
54. R. Toegel, S. H., and D. Lohse,
“How hot do sonoluminescing bubbles become?”.
In “Proceedings of the 17th International Congress on Acoustics, Rome, 2001.

55. S. H. and D. Lohse,
“Upscaling single bubble sonoluminescence”.
In “Cavitation and bubble dynamics”, D. Leutloff and R. C. Srivastava (eds.),
Springer Verlag, Berlin (2002).

Low-dimensional nonlinear dynamics / Chaos

56. H.-C. Schulz and S. H.,
“Experimente zum Chaos” (“Experiments in Chaos”).
Spektrum der Wissenschaft, January 1994.
(German edition of Scientific American)
57. S. H. and A. Reeh (eds.),
“Instabilitäten und Strukturbildung in physikalischen Systemen” (“Instability and pattern formation in physical systems”), Proceedings of the 8th workshop of the SFB 185 *Nonlinear Dynamics*, Printed at the University of Frankfurt (1997).
58. S. H., R. Nicodemus, and A. Reeh (eds.),
“Instabilitäten und Strukturbildung in physikalischen Systemen” (“Instability and pattern formation in physical systems”), Proceedings of the 9th workshop of the SFB 185 *Nonlinear Dynamics*, Printed at the University of Frankfurt (1998).

Sparse-Grid Finite-Element Algorithms

59. S. H.,
“Numerical Solution of the Stationary Schrödinger Equation using Finite Element Methods on Sparse Grids”.
Proceedings of the 9th ICPS meeting, St. Petersburg, Russia, 1994.
60. S. H., R. Balder, and C. Zenger,
“Sparse Grids: Applications to Multi-dimensional Schrödinger Problems”.
Munich University of Technology, MUT report No.19507, SFB Nr. 342/05/95 A, 1995.

Selected Recent Presentations (invited unless otherwise noted)

1. "A generalized view of foam drainage: experiment and theory", MIT mechanical engineering seminar series. September 1999.
2. "Sonoluminescence: Light emission and more", Harvard University, Condensed Matter Theory Seminar. October 1999.
3. "Von Neumann's law in three dimensions", Soft condensed matter seminar, Harvard University, September 2000.
4. "Nonlinearity and its use in medical ultrasound", 6th European Symposium on Ultrasound Contrast Imaging. Rotterdam, January 2001.
5. "Sonoluminescence: applying familiar physics to an extraordinary phenomenon" MIT Physics Colloquium. March 2001.
6. "Bubble coarsening and foam structure", Physics Center workshop at Les Houches, France. June 2001.
7. "A three-dimensional von Neumann law", Workshop "Materials in motion", The University of Chicago. August 2001.
8. "The many facets of foam", Colloquium Ehrenfestii at University of Leiden, The Netherlands. September 2001.
9. "Foam drainage: Interfacial mobility and the consequences", Eurofoam 2002, Manchester (UK), July 2002.
10. "Foam coarsening: Bubble geometry and foam disorder", Workshop on Foams and Minimal Surfaces, Isaac Newton Institute for Mathematical Sciences, Cambridge (UK), August 2002.
11. "Bubble microstreaming: Guiding and destroying lipid vesicles" (contributed), APS DFD meeting, Dallas, November 2002.
12. "Microbubbles: A tool for vesicle micromechanics", 8th European Symposium on Ultrasound Contrast Imaging. Rotterdam, January 2003.
13. "Ultrasound-driven microbubbles: A tool for probing vesicle and cell mechanics" (contributed), APS spring meeting, Austin, March 2003.
14. "Foam bubbles: The importance of being isotropic", Euromech 2003 Fluid dynamics conference, Toulouse, August 2003.
15. "New results on the statistics of cellular materials", Dynamical Properties of Solids 2003, Trieste, September 2003.
16. "Towards bubble-powered microfluidics in biomaterials" (contributed), APS DFD meeting, East Rutherford, November 2003.
17. "Foam: Its structure and what we can learn from it", Eurofoam 2004, Marne-La Vallée (France), July 2004.