

Fabian Heitsch

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June 16, 2009

Education University of Münster, B.Sc. (Mathematics/Informatics), July 1993

University of Bonn: M.Sc. (Physics), June 1998

title: *The Metal-rich Globular Clusters of the Milky Way*

advisor: Tom Richtler

University of Heidelberg: PhD (Physics/Astronomy), July 2001

title: *Turbulence and Fragmentation in Molecular Clouds*

advisors: Andreas Burkert, Mordecai-Mark Mac Low

Employment Assistant Research Scientist

Department of Astronomy, University of Michigan, Ann Arbor

March 2009 – present

Research Fellow

Department of Astronomy, University of Michigan, Ann Arbor

March 2006 – February 2009

Research Staff Scientist (level C1)

University Observatory Munich

October 2003 – February 2006

Research Associate

Department of Astronomy, University of Wisconsin-Madison

January 2003 – September 2003

Research Associate

JILA, University of Colorado at Boulder

October 2001 – December 2002

Research Assistant (BAT IIa/2)

Max-Planck-Institute for Astronomy, Heidelberg

July 1998 – September 2001

Citizenship German

Areas of Interest	computational astrophysics, magnetohydrodynamics, galactic matter cycles, physics of Galactic and extra-galactic star formation, dynamics and physical processes of the interstellar medium, plasma physics, chemical enrichment and turbulent mixing
Fellowships and Awards	Science and Technology Facilities Council (STFC) Advanced Fellowship (UK) March 2008; declined Otto-Hahn Award of the Max-Planck-Society June 2002 Feodor-Lynen Fellowship of the Alexander-von-Humboldt Foundation (maximum support) November 2001 – September 2003 Scholarship of the State of Bavaria (Stipendium nach BayBFG §10, Abs.3; 100% support, maximum period) 1991 – 1997
Current and Pasts Grants	NSF AST 0807305 Flow-Driven Molecular Cloud Formation: An Origin of the IMF? awarded: \$300,273, 10/01/2008-09/30/2011 NCSA, AST 060034 (PI) Disruption of High Velocity Clouds in the Galactic Halo awarded: 350,000 hours, 01/01/2008-06/31/2009 NASA/Herschel, NHSC 1008 (Co-PI, PI: L. Hartmann) A Database of Turbulent Cloud Models awarded: \$73,500, 04/01/2008-03/31/2010 NCSA, AST 060031 (PI) Rapid Star Formation in Colliding Flows awarded: 131,500 hours, 10/01/2006-12/31/2007 NSF AST 0507164 (Co-I, PI: B. Whitney) Radiation Transfer in Aligned Grains: Probing Magnetic Fields in Molecular Clouds, Protostars and Disks awarded: \$112,016 NCSA, AST 040026 (Co-PI, PI: E. Zweibel) Turbulent magnetic diffusion during molecular cloud formation awarded: 9,000 hours NCSA, AST 030010 (PI) Magnetic Flux Transport in the Interstellar Medium awarded: 20,000 hours NCSA/NRAC, MCA99S024 (CO-I, PI: M.-M. Mac Low) The Turbulent Interstellar Medium and Star Formation awarded: 160,000 hours NCSA, AST 010002 (CO-I, PI: M.-M. Mac Low) Star Formation and Planetary Impacts awarded: 45,000 hours

Advising	<i>Graduate Students:</i>
Experience	Jennifer Stone (U Wisconsin, with E. Zweibel) magnetized corrugation instabilities
	Wen-Hsin Hsu (U Michigan, with M. Putman, L. Hartmann) disruption of high velocity clouds, gravitational fragmentation
	Jana Grcevich (U Michigan, with M. Putman) gas stripping of dwarf spheroidals
	Matthew Palotti (U Wisconsin, with E. Zweibel) shear flows in partially ionized plasmas
	Matthias Gritschneider (U Munich, with A. Burkert) ionization-driven turbulence
	Steffi Walch (U Munich, with A. Burkert) collapse of molecular cores and disk formation
	Christer Watson (U Wisconsin, with E. Zweibel) shear layers in weakly ionized plasmas
	<i>Undergraduate Students:</i>
	David Williams (U Michigan), molecular cloud formation in shear flows
	Holger Stiele (U Munich), thermal instability and ambipolar drift
	Audra Hernandez (U Colorado, with E. Zweibel), polarization maps of cores
	Queennie Taylor (U Wisconsin), turbulence in diffuse mid-infrared emission
Teaching	<i>Physics of the Interstellar Medium</i> (Ann Arbor, 2007)
Experience	graduate class; co-teaching with E. Bergin
	<i>Computational Methods in Astrophysics</i> (Munich, 2005)
	undergraduate/graduate lab course
	<i>Modern Numerical Methods for Astrophysics</i> (Munich, 2005)
	graduate seminar
	<i>Star Formation: A solved problem?</i> (Munich, 2004)
	graduate class
	<i>Cosmic Electrodynamics</i> (Munich, 2004)
	undergraduate/graduate class
	<i>Physical Processes in the Interstellar Medium</i> (Munich, 2003)
	graduate class
	Teaching Assistant
	classical mechanics, quantum mechanics, general astronomy

- Professional Associations** Astronomische Gesellschaft (German Astronomical Society)
American Astronomical Society
- Service** SOC member "From Stars to Galaxies", Gainesville/FL, 04/06-10/2010
colloquium organizer (at Dept. of Astronomy, U Michigan, 2006/07)
public outreach coordinator (at University Observatory Munich)
including guided tours and radio interviews
NASA Astrophysics Theory Program review panelist
NSF Astronomy Program panelist
referee for ApJ, MNRAS, A&A
- Art & Science** *Meanwhile, More Light and Here, I Am*
by U of Michigan Professor of Art & Design *Jim Cogswell*

Refereed

1. *The Fate of High Velocity Clouds: Warm or Cold Cosmic Rain?*
Heitsch, F., Putman, M.E. 2009, ApJ, 698, 1485
2. *Spitzer View of Young Massive Stars in the LMC HII Complex N 44*
Chen, C.-H.R., Chu, Y.-H., Gruendl, R., Gordon, K.D., **Heitsch, F.** 2009, ApJ, 695, 511
3. *Effects of Magnetic Field Strength and Orientation on Molecular Cloud Formation*
Heitsch, F., Stone, J.M., Hartmann, L.W. 2009, ApJ, 695, 248
4. *Driving Turbulence and Triggering Star Formation by Ionizing Radiation*
Gritschneder, M., Naab, T., Walch, S., Burkert, A., **Heitsch, F.** 2009, ApJL, 694, 26
5. *iVINE - Ionization in the parallel tree/SPH code VINE: First results on the observed age-spread around O-stars*
Gritschneder, M., Naab, T., Burkert, A., Walch, S., **Heitsch, F.**, Wetzstein, M. 2009, MNRAS, 393, 21
6. *Rapid Molecular Cloud and Star Formation: Mechanisms and Movies*
Heitsch, F., Hartmann, L.W. 2008, ApJ, 689, 290
7. *Fast Dynamos in Weakly Ionized Gases*
Zweibel, E.G., **Heitsch, F.** 2008, ApJ, 684, 373
8. *Fragmentation of Shocked Flows: Gravity, Turbulence and Cooling*
Heitsch, F., Hartmann, L.W., Burkert, A. 2008, ApJ, 683, 786
9. *Evolution of Unmagnetized and Magnetized Shear Layers*
Palotti, M., **Heitsch, F.**, Zweibel, E.G., Huang, Y.-M. 2008, ApJ, 678, 234
10. *Cooling, Gravity and Geometry: Flow-Driven Massive Core Formation*
Heitsch, F., Hartmann, L.W., Slyz, A.D., Devriendt, J.E.G., Burkert, A. 2008, ApJ, 674, 316
11. *Magnetized Nonlinear Thin-Shell Instability: Numerical Studies in Two Dimensions*
Heitsch, F., Slyz, A.D., Devriendt, J.E.G., Hartmann, L.W., Burkert, A. 2007, ApJ, 665, 445
12. *The Frequency of Mid-Infrared Excess Sources in Galactic Surveys*
Uzpen, B., Kobulnicky, H.A., Monson, A.J. et al. (+ **Heitsch, F.** and 26 co-authors) 2007, ApJ, 658, 1264
13. *Structure Generation by Irradiation: What can GLIMPSE teach us about the ISM structure?*
Heitsch, F., Whitney, B.A., Indebetouw, R. et al. (+ 3 co-authors) 2007, ApJ, 656, 227
14. *Cloud Dispersal in Turbulent Flows*
Heitsch, F., Slyz, A.D., Devriendt, J.E.G., Burkert, A. 2006, MNRAS, 373, 1379

15. *Thermal Instability in a Weakly Ionized Plasma*
Stiele, H., Lesch, H., **Heitsch, F.** 2006, MNRAS, 372, 862
16. *The Birth of Molecular Clouds: Formation of Atomic Precursors in Colliding Flows*
Heitsch, F., Slyz, A.D., Devriendt, J.E.G., Hartmann, L.W., Burkert, A. 2006, ApJ, 648, 1052
17. *The Formation of Turbulent Molecular Clouds: A Modeler's View*
Heitsch, F. 2006, Reviews in Modern Astronomy, 19, 157
18. *Formation of Structure in Molecular Clouds: A Case Study*
Heitsch, F., Burkert, A., Hartmann, L., Slyz, A.D., Devriendt, J.E.G. 2005, ApJL, 633, 113
19. *Identification of Main-Sequence Stars with Mid-Infrared Excess Using GLIMPSE: β Pictoris Analogs?*
Uzpen, B., Koblunicky, H.A., Olsen, K.A.G. et al. (+ **Heitsch, F.** and 22 co-authors) 2005, ApJ, 629, 512
20. *RCW 49 at Mid-Infrared Wavelengths: A GLIMPSE from the Spitzer Space Telescope*
Churchwell, E., Whitney, B.A., Babler, B.L. et al. (+ **Heitsch, F.** and 17 co-authors) 2004, ApJS, 154, 322
21. *A GLIMPSE of Star Formation in the Giant HII Region RCW 49*
Whitney, B.A., Indebetouw, R., Babler, B.L. et al. (+ **Heitsch, F.** and 17 co-authors) 2004, ApJS, 154, 315
22. *Dust Heating by the Interstellar Radiation Field in Models of Turbulent Molecular Clouds*
Bethell, T., Zweibel, E.G., **Heitsch, F.**, Mathis, J.S. 2004, ApJ, 610, 801
23. *Magnetic Flux Transport in the ISM Through Turbulent Ambipolar Diffusion*
Heitsch, F., Zweibel, E.G., Slyz, A. D., Devriendt, J.E.G. 2004, ApSS, 292, 45
24. *Canals beyond Mars. Beam Depolarization in Radio Continuum Maps of the Warm ISM*
Haverkorn, M., **Heitsch, F.** 2004, A&A, 421, 1011
25. *Kelvin-Helmholtz-Instability in a Weakly Ionized Medium*
Watson, C., Zweibel, E.G., **Heitsch, F.**, Churchwell, E. 2004, ApJ, 608, 274
26. *The Formation of Protostellar Cores out of a Turbulent Cloud*
Li, P.S., Norman, M.L., Mac Low, M.-M., **Heitsch, F.** 2004, ApJ, 605, 800
27. *Turbulent Ambipolar Diffusion: Numerical Studies in 2D*
Heitsch, F., Zweibel, E.G., Slyz, A.D., Devriendt, J.E.G. 2004, ApJ, 603, 165
28. *Suppression of Fast Reconnection by Magnetic Shear*
Heitsch, F., Zweibel, E.G. 2003, ApJ 590, 291

29. *Fast Reconnection in a Two-Stage Process*
Heitsch, F., Zweibel, E.G. 2003, ApJ, 583, 229
30. *Numerical Simulations of Magnetic Fields in Astrophysical Turbulence*
Zweibel, E.G., **Heitsch, F.**, Fan, Y. 2003, Lecture Notes in Physics, 614, 101
31. *On the Structure of Self-gravitating Molecular Clouds*
Ossenkopf, V., Klessen, R.S., **Heitsch, F.** 2001, A&A, 379, 1005
32. *Magnetic Field Diagnostics Based on Far-Infrared Polarimetry: Numerical Simulations*
Heitsch, F., Zweibel, E.G., Mac Low, M.-M., Li, P.S., Norman, M.L. 2001, ApJ, 561, 800
33. *Gravitational Collapse in Turbulent Molecular Clouds II. MHD Turbulence*
Heitsch, F., Mac Low, M.-M., Klessen, R.S. 2001, ApJ, 547, 280
34. *The distribution of shock waves in driven supersonic turbulence*
Smith, M.D., Mac Low, M.-M., **Heitsch, F.** 2000, A&A, 362, 333
35. *Gravitational Collapse in Turbulent Molecular Clouds I. Gasdynamical Turbulence*
Klessen, R.S., **Heitsch, F.**, Mac Low, M.-M. 2000, ApJ, 535, 887
36. *The Metal-rich Globular Clusters of the Milky Way*
Heitsch, F., Richtler, T. 1999, A&A, 347, 455

Submitted

37. *Numerical Star Formation Studies – A Status Report*
Klessen, R.S., Krumholz, M.R., **Heitsch, F.**, Advanced Science Letters
38. *Faraday Tomography of an MHD-simulated Volume of Galactic ISM*
Schnitzeler, D.H.F.M., **Heitsch, F.**, Katgert, P., Haverkorn, M., A&A

Selected Conference Proceedings

39. *Flow-Driven Formation of Massive Cores: Rapid & Efficient?*
Heitsch, F., Hartmann, L. 2008
in “Massive Star Formation: Observations Confront Theory”
eds: H. Beuther, H. Linz, & T. Henning; ASP Conference Series 387, 15
40. *Determining the Magnetic Field Strength From Polarimetry of Dense Molecular Cloud Cores: Theoretical Considerations*
Heitsch, F. 2005
in “Astronomical Polarimetry: Current Status and Future Directions”
eds: A. Adamson, C. Aspin, C. Davis, & T. Fujiyoshi; ASP Conference Series 343, 166
41. *Flux Transport in the ISM through Turbulent Ambipolar Diffusion*
Heitsch, F. Zweibel, E.G., Slyz, A.D., Devriendt, J.E.G. 2004
in “Magnetic Fields and Star Formation: Theory versus Observations”,
eds: A.I. Gómez de Castro, Kluwer Academic Press
42. *Alfvén-wave Driven Turbulence in Molecular Clouds*
Heitsch, F., Burkert, A. 2002
in “Modes of Star Formation and the Origin of Field Populations”,
eds. E. K. Grebel & W. Brandner; ASP Conference Series 285, 13
43. *Can Magnetized Turbulence Support Molecular Clouds?*
Heitsch, F., M.-M. Mac Low, Klessen, R. 2000
in “Proceedings of the 33rd ESLAB Symposium,
Star Formation from the Small to the Large Scale”,
ESTEC, Noordwijk, NL (ESA SP-445, Juni 2000); 391
44. *Effects of Magnetized Turbulence on the Structure and Dynamical Evolution of Molecular Clouds*
Heitsch, F., Mac Low, M.-M., Klessen, R. 1999
in “Plasma Turbulence and Energetic Particles” eds. Ostrowski, M. & Schlickeiser, R.,
Uniwersytet Jagiellonski, Kraków, 1999; 103

Invited Talks

1. *Setting the Star Formation Efficiency: Lessons from Detailed Numerical Simulations*
at *The SFR50*, Abbazia di Spineto, Italy; 07/07/2009
2. *The Making Molecular Clouds: The Role of Magnetohydrodynamical and Thermal Instabilities*
at *Turbulence and Hydrodynamical Instabilities*, Garching, Germany; 11/19/2008
3. *Rapid Star Formation in Colliding Flows: the Molecular Perspective*
at *HI Survival through Cosmic Times*, Abbazia di Spineto, Italy; 06/14/2007
4. *Magnetohydrodynamic Boltzmann Solvers*
at *Structure Formation in the Universe: Galaxies, Stars Planets*, Chamonix, France; 05/29/2007
5. *Formation of Small Scale Structure in Large Scale Flows in the ISM*
at *Microstructures in the Interstellar Medium*, Lake Geneva, WI; 04/24/2007
6. *Turbulence Generation in Filamentary Molecular Clouds: a modeler's view*
at *Annual Conference of the Astronomische Gesellschaft*, Cologne, Germany; 09/30/2005

Colloquia

Herzberg Institute of Astrophysics, Victoria (04/28/2009);
U Michigan (03/19/2009);
UNC Chapel Hill (03/16/2009);
U Oakland (02/19/2009);
Columbia U (02/04/2009);
U Arizona-Tucson/Steward Observatory (03/06/2008);
U Wyoming, Laramie (11/27/2007);
U Florida, Gainesville (10/10/2007);
UNAM Morelia (12/14/2006);
U Toledo (12/07/2006);
U Iowa (12/04/2006);
U Colorado-Boulder (11/29/2006);
U Michigan, Ann Arbor (11/09/2006);
U Illinois, Urbana-Champaign (10/24/2006);
USM Munich (05/31/2006);
U Tübingen (05/29/2006);
MPIfR Bonn (10/14/2005);
U Wisconsin-Madison (09/06/2005);
U Basel (06/21/2005);
AIP Potsdam (11/11/2004);
U Wisconsin-Madison (09/16/2003);
MPIA Heidelberg (01/28/2000, 06/01/2001);

Selected Seminars

U Oxford (05/31/2008);
U Princeton (09/24/2007);
Northwestern, Evanston/IL (01/22/2008);
U Virginia-Charlottesville (05/15/2007);
U Iowa (12/05/2006);
U Chicago (04/07/2004);
ENS Lyon (11/18/2003);
U Chicago (04/08/2003);
U Colorado-Boulder (11/21/2002);
AMNH, New York (08/19/2002);
MPIA Heidelberg (06/10/2002);
U Oxford (06/03/2002);
U Colorado-Boulder (10/26/2001)
U Illinois, Urbana-Champaign (04/24/2000);