

## David A. Egolf

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### Research Interests

Theoretical and computational soft condensed matter and biological physics; Statistical physics; Nonlinear and nonequilibrium dynamical systems; Large-scale scientific computing; Effective theories of QCD

### Education

- Ph.D. 12/94 Duke University, Physics, Advisor: H. S. Greenside  
Thesis: *Characterization of Extensively Chaotic States and Transitions*
- M.S. 5/93 Duke University, Physics
- B.S. 5/90 Duke University, Physics/Chemistry  
Thesis: *Calculation of  $^1\text{H}$  Chemical Shifts Using the Locally Dense Basis Set Approach*

### Scientific Employment History

- Aug. 2006 – Associate Professor, Department of Physics, Georgetown University  
Director of Undergraduate Studies, 2009 – present
- July 2000 – July 2006 Assistant Professor, Department of Physics, Georgetown University
- Jan. 1999 – Sept. 2001 Richard P. Feynman Fellow for Theory & Computing, Theoretical Division,  
Center for Nonlinear Studies, Los Alamos National Laboratory
- June 1998 – Dec. 1998 Director's Postdoctoral Fellow, Theoretical Division, Center for  
Nonlinear Studies, Los Alamos National Laboratory
- June 1997 – May 1998 Instructor/Research Associate, Laboratory of Atomic and Solid State  
Physics, Cornell University with Professor Eberhard Bodenschatz  
Taught Physics 216: *Introduction to Special Relativity*
- June 1995 – May 1997 Research Associate, Cornell Theory Center, Cornell University  
with Professor Eberhard Bodenschatz  
Taught Physics 481/681: *Pattern Formation and Spatiotemporal Chaos*
- Dec. 1994 – May 1995 Postdoctoral Research Associate, Department of Physics, Duke University
- July 1990 – Nov. 1994 Graduate Student, Department of Physics, Duke University
- Summer 1989 Research Assistant, Department of Chemistry, Princeton University  
with Professor Leland C. Allen

### Short Term Appointments

- Summer 2013 Visiting Researcher, Duke University Department of Physics
- Summer 2008 Visiting Professor, Penn State Center for Neural Engineering
- Oct. 1998 Visiting Scholar, Institute for Nuclear Theory, University of Washington

**Academic and Scientific Honors**

- 2008 Dean's Award for Excellence in Teaching, Georgetown College
- 2003–2007 Cottrell Scholar Award, Research Corporation
- 2002–2005 Alfred P. Sloan Research Fellowship, Alfred P. Sloan Foundation
- 2001–2003 Research Innovation Award, Research Corporation
- 2001–2006 CAREER Award, National Science Foundation
- 1999–2002 Richard P. Feynman Fellowship in Theory & Computing, Los Alamos National Lab.
- 1998 Director's Postdoctoral Fellowship, Los Alamos National Laboratory
- 1995–1997 National Science Foundation Postdoctoral Research Associateship in Computational Science and Engineering
- 1994 Fritz London Graduate Fellowship for Excellence in Condensed Matter Physics
- 1990–1993 Office of Naval Research National Defense Science and Engineering Fellowship
- 1990–1993 Townes–Perkin–Elmer Graduate Fellowship
- 1991 *Computers in Physics* Innovative Software in Physics Education Award for *Workshop Physics* series
- 1990 Graduated magna cum laude and with distinction in Physics and Chemistry from Duke University
- 1989 Elected Phi Beta Kappa
- 1986–1990 Angier B. Duke Scholarship (full-tuition merit-based academic scholarship)
- 1986–1990 National Merit Scholarship
- 1984 *Classroom Computer Learning* Software of the Year Award for the *AtariLab Science Series*

**Editorial Board**

- 2014 - Scientific Reports (Nature Publishing Group)

**Grants as Principal Investigator or Co-Investigator**

- 2014 Georgetown University Summer Academic Grant, *Nonlinear dynamics of jamming in granular materials*, \$9,500
- 2003 – 2007 NASA, *Non-equilibrium dynamics and statistical mechanics of excited granular media in the absence of gravitational barriers*, \$463,000 (Co-I)
- 2003 – 2005 Research Corporation, Cottrell Scholars Award, *Computational Science in the Heart and in the Classroom*, \$75,000
- 2003 Georgetown University Junior Faculty Research Fellowship
- 2002 – 2005 Alfred P. Sloan Foundation, Alfred P. Sloan Research Fellowship, \$40,000
- 2001 – 2003 Research Corporation, Research Innovation Award, *Nonlinear Dynamical Analysis of Fluctuations and Jamming in Granular Media*, \$35,000
- 2001 – 2006 National Science Foundation, Division of Materials Research, Program in Materials Theory, *CAREER: Computational Science: Far-from-equilibrium and in the Classroom*, \$300,000

### Conferences Organized

- Dynamics Days 2002: 21st Annual International Conference on Chaos and Nonlinear Dynamics, Baltimore, MD, January 4–7, 2002. *Co-organizer*
- The Physics of Soft Matter: 21st Annual International Conference of the Center for Nonlinear Studies, Santa Fe, NM, May 21–25, 2001. *Lead Organizer*
- Soft Matter as a Nonlinear Science, Laguna Beach, CA, February 2–4, 2001. *Co-organizer*
- Dynamics Days 2001: 20th Annual International Conference on Chaos and Nonlinear Dynamics, Chapel Hill, NC, January 3–6, 2001. *Co-organizer*
- Dynamics Days 2000: 19th Annual International Conference on Chaos and Nonlinear Dynamics, Santa Fe, NM, January 5–8, 2000. *Lead Organizer*
- Spatiotemporal Characterization of Spiral Defect Chaos, Los Alamos, NM, January 4–5, 1999. *Lead Organizer*

### Invited Conference Talks

- Gordon Research Conference on Granular & Granular-Fluid Flow, *The Chaotic Dynamics of Jamming*, Easton, MA, July 2014.
- Dynamics Days 2005: 24th Annual International Conference on Chaos and Nonlinear Dynamics, *Dynamical Analysis of Spatiotemporal Chaos in Physics and Biology*, Long Beach, CA, January 2005.
- Kavli Institute of Theoretical Physics Program: Pattern Formation in Physics and Biology, *Diagnosing Patterns*, Santa Barbara, CA, August 2003.
- Kavli Institute of Theoretical Physics Conference: Pattern Formation in Physics and Biology, *Dynamical Analysis of Spatiotemporal Chaos in Physics and Biology*, Santa Barbara, CA, August 2003.
- March Meeting of the American Physical Society, *Mechanisms and Building Blocks of Extensive Chaos*, Seattle, March 2001.
- Stochastic and Chaotic Dynamics in the Lakes, *KPZ Growth and Mesoscopic Equilibrium in Extensive Chaos*, Ambleside, U.K., August 1999.
- Fifth SIAM Conference on Applications of Dynamics Systems, Minisymposium: Dynamics of the Complex Ginzburg-Landau Equation: Experiment and Theory, *Long Wavelength Behavior in the 1D Complex Ginzburg-Landau Equation*, Snowbird, Utah, May 1999.
- Centennial Meeting of the American Physical Society, *Understanding Extensive Chaos Through Statistical Physics*, Atlanta, March 1999.
- Fourth SIAM Conference on Applications of Dynamical Systems, Minisymposium: Spatiotemporal Chaos: Characterization and Control, *Using Finite-Time Lyapunov Dimensions to Measure the Dynamical Complexity of Topological Defects*, Snowbird, Utah, May 1997.
- Measures of Spatio-Temporal Dynamics, *Fractal Dimensions and Correlation Lengths of Extensive Chaos*, Bryn Mawr, PA, June 1995.

- Third SIAM Conference on Applications of Dynamical Systems, Minisymposium: Data Analysis for Spatiotemporal Chaos, *Relationship between Dimension Density and Spatial Correlation Lengths for Extensive Chaos*, Snowbird, Utah, May 1995.

### Invited Departmental Colloquia and Seminars

- Marietta College Physics Colloquium, *Hints of a statistical mechanics of spatiotemporal chaos*, Marietta, OH, February, 2012.
- Yale University, Department of Mechanical Engineering Departmental Seminar, *Far-from-Equilibrium: Close to a Theory?*, New Haven, CT, April, 2007.
- George Mason University, Krasnow Institute Nonlinear Science Seminar, *Dynamical Analysis of Spatiotemporal Chaos in Physics and Biology*, Fairfax, VA, January, 2004.
- Johns Hopkins University, Condensed Matter Physics Seminar, *Far-From-Equilibrium: Close to a Theory?*, Baltimore, MD, April, 2003.
- Wesleyan University, Physics Department Colloquium, *Far-From-Equilibrium: Close to a Theory?*, Middletown, CT, April, 2002.
- University of Maryland, Statistical Physics Seminar, *Far-From-Equilibrium: Close to a Theory?*, College Park, MD, November, 2001.
- Northwestern University, Interdisciplinary Seminar on Nonlinear Science, *Toward a Predictive Theory of Far-from-equilibrium, Spatially Extended, Chaotic Systems*, Evanston, IL, February 2001.
- Northwestern University, Special Interdisciplinary Seminar on Nonlinear Science, *A Sampling of Nonlinear Dynamics: from Low-Dimensional Systems to Extensive Chaos*, Evanston, IL, February 2001.
- Georgetown University, Department of Physics Colloquium, *Far-From-Equilibrium: Close to a Theory?*, Washington, D.C., March 2000.
- University of California, Irvine, Department of Physics Colloquium, *Far-From-Equilibrium: Close to a Theory?*, Irvine, California, March 2000.
- Duke University, Theoretical Physics Seminar, *Equilibrium Regained: From Nonequilibrium Chaos to Statistical Mechanics*, Durham, NC, November, 1999.
- Bowling Green State University, Department of Physics Colloquium, *Understanding Extensive Chaos Through Statistical Physics*, Bowling Green, Ohio, April 1999.
- Cornell University, Laboratory of Atomic and Solid State Physics Seminar, *Understanding Extensive Chaos Through Statistical Physics*, Ithaca, NY, May 1999.
- University of Pennsylvania, Soft Condensed Matter Seminar, *Dynamics of Extensive Chaos: Dimensions, Lengthscales, and Langevin Descriptions*, Philadelphia, October 1998.
- University of Bayreuth, *Dynamics of the Complex Ginzburg-Landau Equation: Lengthscales, Defect Dimensions, and Langevin Descriptions*, Bayreuth, Germany, May 1998.

- Istituto Nazionale di Ottica, *Toward an Understanding of Defect Chaos*, Florence, Italy, April 1998.
- Los Alamos National Laboratory, Center for Nonlinear Studies, *Toward an Understanding of Defect Chaos*, Los Alamos, NM, January 1998.
- University of Arizona, Arizona Center for Mathematical Sciences, *Quantifying Spatiotemporal Chaos*, Tucson, AZ, March, 1997.
- Max Planck Institute for Complex Physical Systems, *Lyapunov Dimensions and Building Blocks of Spatiotemporal Chaos*, Dresden, Germany, June 1996.
- Cornell University, Laboratory for Atomic and Solid State Physics, *Characterization of Extensive Chaos*, Ithaca, NY, April 1994.

### Undergraduate Senior Theses

Joseph Conahan (with J. Urbach), Honors in Physics, 2001

Justin Sporrer (Biology), Physics Dept. Undergrad. Research Award and Chapman Medal for biology research, 2003

Andrew Wilkis, Honors in Economics for the thesis, 2003

Daniel Rogers (with J. Urbach), 2004

J. Cameron Booth, Physics Dept. Undergraduate Research Award and Honors in Physics, 2005

Matthew Fishman, Honors in Physics, 2005

Pramukta Kumar (with J. Urbach), Honors in Physics, 2006

Edward Banigan, Physics Dept. Undergraduate Research Award and Honors in Physics, 2007

Nicholas Malaya (with J. Urbach), Honors in Physics, 2007

Thomas Esposito (with J. Urbach), Honors in Physics, 2008

Matthew Illich, Physics Dept. Undergraduate Research Award and Honors in Physics, 2011

Chris Ballard, Physics Dept. Undergraduate Research Award and Honors in Physics, 2012

C. Clark Esty, Honors in Physics, 2013

### Graduate Students Supervised

Brad Burns, Spring 2005 (Primary: J. Urbach)

Brendan Brelford, 2005 – 2009 (Primary: J. Urbach)

Julie Schöning, 2010 – present

Patrick Cox (Neuroscience, with R. Dzakpasu), Spring 2011

Justin Stimatze, 2012 – present (Primary: J. Urbach)

### Post-docs Supervised

Paul Melby, Fall 2002–Fall 2004 (with J. Urbach), now a Senior Researcher at Qbit working on data compression algorithms

**Refereed Publications (with undergraduates I mentored indicated by bold)**

- [1] Jared Vanasse, David A. Egolf, **John Kerin**, Sebastian König, and Roxanne P. Springer.  $^3\text{He}$  and  $pd$  scattering to next-to-leading order in pionless effective field theory. *Phys. Rev. C*, 89:064002, 2014.
- [2] **Edward J. Banigan**, **Matthew K. Illich**, **Derick J. Stace-Naughton**, and David A. Egolf. The chaotic dynamics of jamming. *Nat. Phys.*, 9:288–292, 2013.
- [3] Paul Melby, Alexis Prevost, David A. Egolf, and Jeffrey S. Urbach. Depletion force in a bi-disperse granular layer. *Phys. Rev. E*, 76:051307, 2007.
- [4] **Matthew P. Fishman** and David A. Egolf. Revealing the building blocks of spatiotemporal chaos: Deviations from extensivity. *Phys. Rev. Lett.*, 96:054103-1–4, 2006.
- [5] Paul Melby, Francisco V. Reyes, Alexis Prevost, Rae Robertson, **Pramukta Kumar**, David A. Egolf, and Jeffrey S. Urbach. The dynamics of thin vibrated granular layers. *J. Phys. Cond. Matt.*, 17: S2689–S2704, 2005.
- [6] Alexis Prevost, Paul Melby, David A. Egolf, and Jeffrey S. Urbach. Nonequilibrium two-phase coexistence in a confined granular layer. *Phys. Rev. E*, 70:050301-1–4, 2004.
- [7] David A. Egolf, Roxanne P. Springer, and Joerg Urban. SU(3) predictions for weak decays of doubly heavy baryons, including SU(3) breaking terms. *Phys. Rev. D*, 68:013003-1–33, 2003.
- [8] Alexis Prevost, David A. Egolf, and Jeffrey S. Urbach. Forcing and velocity correlations in a vibrated granular monolayer. *Phys. Rev. Lett.*, 89:084301-1–4, 2002.
- [9] David A. Egolf, **Ilarion V. Melnikov**, Werner Pesch, and Robert E. Ecke. Mechanisms of extensive spatiotemporal chaos in Rayleigh-Bénard convection. *Nature*, 404:733–736, 2000.
- [10] David A. Egolf. Equilibrium regained: from nonequilibrium chaos to statistical mechanics. *Science*, 287:101–104, 2000.
- [11] Christopher Harrison, Paul M. Chaikin, David Huse, Richard Register, Douglas H. Adamson, Abishai Daniel, E. Huang, P. Mansky, T.P. Russell, C. Hawker, David A. Egolf, **Ilarion V. Melnikov**, and Eberhard Bodenschatz. Depinning block copolymer microdomains from substrates with lubricating layers. *Macromolecules*, 33:857–865, 2000.
- [12] **Ilarion V. Melnikov**, David A. Egolf, Sebastien Jeanjean, Brendan Plapp, and Eberhard Bodenschatz. Invasion of Spiral Defect Chaos into straight rolls in Rayleigh-Bénard convection. *Stochastic Dynamics and Pattern Formation in Biological and Complex Systems*, ed. S. Kim, K. J. Lee, T. K. Lim, and W. Sung, Melville, NY, 2000.
- [13] David A. Egolf, **Ilarion V. Melnikov**, and Roxanne P. Springer. Weak nonleptonic  $\Omega^-$  decay in chiral perturbation theory. *Phys. Lett. B*, 451:267–274, 1999.
- [14] David A. Egolf. The dynamical dimension of defects in spatiotemporal chaos. *Phys. Rev. Lett.*, 81:4120–4123, 1998.
- [15] David A. Egolf and Joshua E. S. Socolar. Failure of linear control in noisy coupled map lattices. *Phys. Rev. E*, 57:5271–5275, 1998.
- [16] David A. Egolf, **Ilarion V. Melnikov**, and Eberhard Bodenschatz. The importance of local pattern properties in spiral defect chaos. *Phys. Rev. Lett.*, 80:3228–3231, 1998.

- [17] Brendan B. Plapp, David A. Egolf, Eberhard Bodenschatz, and Werner Pesch. Dynamics and selection of giant spirals in Rayleigh-Bénard convection. *Phys. Rev. Lett.*, 81:5334–5337, 1998.
- [18] Raha Cakmur, David A. Egolf, Brendan B. Plapp, and Eberhard Bodenschatz. Bistability and competition of spatiotemporal chaotic and fixed point attractors in Rayleigh-Bénard convection. *Phys. Rev. Lett.*, 79:1853–1856, 1997.
- [19] **Corey S. O’Hern**, David A. Egolf, and Henry S. Greenside. Lyapunov spectral analysis of a nonequilibrium Ising-like transition. *Phys. Rev. E*, 53:3374–3386, 1996.
- [20] David A. Egolf and Henry S. Greenside. Characterization of the transition from defect- to phase-turbulence. *Phys. Rev. Lett.*, 74:1751–1754, 1995.
- [21] David A. Egolf and Henry S. Greenside. Relation between fractal dimension and spatial correlation length for extensive chaos. *Nature*, 369:129–131, 1994.
- [22] David A. Egolf and Henry S. Greenside. Spatial variation of correlation times for 1d phase turbulence. *Phys. Lett. A*, 185:395–400, 1994.
- [23] David A. Egolf and Henry S. Greenside. Stochastic to deterministic crossover of fractal dimensions for a Langevin equation. *Phys. Rev. E*, 47:3753–3756, 1993.
- [24] D. B. Chesnut, B. E. Rusiloski, K. D. Moore, and D. A. Egolf. The use of locally dense basis sets for NMR shielding calculations. *J. Comp. Chem.*, 14:1364–1375, 1993.
- [25] D. Talbi, D. J. DeFrees, D. A. Egolf, and Eric Herbst. Calculations concerning the reaction  $C + H_3^+ \rightarrow CH^+ + H_2$ . *The Astrophysical Journal*, 374:390–393, 1991.
- [26] Leland C. Allen, David A. Egolf, Eugene T. Knight, and Congxin Liang. Bond polarity index. *J. Phys. Chem.*, 94:5602–5607, 1990.

### Invited Publication

- [27] David A. Egolf. Far-from-Equilibrium. *Science*, 296:1813–1815, 2002.