
Curriculum Vitae

Susan Kurien

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Employment

May 2004 – present: Staff Member, Mathematical Modeling and Analysis group (T-7, Theoretical Division), Los Alamos National Laboratory.

Jan 2002 – May 2004 : Postdoctoral Research Associate, Center for Nonlinear Studies (CNLS) and the Mathematical Modeling and Analysis group (T-7), Los Alamos National Laboratory.

Education

1995-2001: Yale University, New Haven, Connecticut
M. S., M. Phil., Physics, May 1998.
Ph.D., Physics, December 2001. Thesis title: *Anisotropy and the Universal Properties of Turbulence*. Thesis supervisor: Prof. Katepalli R. Sreenivasan (now Director of the Abdus Salam International Center for Theoretical Physics, Trieste, Italy).

1991-1995: University of Pennsylvania, Philadelphia, Pennsylvania.
B.S. *cum laude*, Computer Science and Engineering, dual major in Physics, minor in Mathematics. Benjamin Franklin Scholar (Honors).

Research interests

Statistical hydrodynamics and turbulence -- theory, computation, data analysis, modeling and experiments; anisotropy and helicity in turbulent flows; bottleneck and nonlocal effects in turbulence; rotating and stratified flows; non-hydrostatic flows; alpha-models for turbulence.

Peer reviewed publications

- Anisotropic constraints on energy distribution in rotating stratified turbulence, S. Kurien, B. Wingate and M.A. Taylor. To appear in *Europhysics Letters* (2008).
- Spectral scaling of the Leray- α model for two-dimensional turbulence, E. M. Lunasin, S. Kurien and E. S. Titi, *Journal of Physics A: Math. Theor.* vol 41, 344014, (2008).
- A study of the Navier-Stokes-alpha model for two-dimensional turbulence, E. Lunasin, S. Kurien, M.A. Taylor, E. S. Titi, *Journal of Turbulence* 8:30, 1-21 (2007).
- On the two-point correlation of potential vorticity in rotating and stratified flows, S. Kurien, L. Smith, B. Wingate, *Journal of Fluid Mechanics*, vol 555, 131 (2006).
- Anomalous scaling of low-order structure functions of turbulent velocity, S. Chen, B. Dhruva, S. Kurien, K. R. Sreenivasan and M.A. Taylor. *Journal of Fluid Mechanics*, vol 533, 183-192 (2005).
- Isotropic third-order statistics in turbulence with helicity: the 2/15-law, S. Kurien, M.A. Taylor and T. Matsumoto, *Journal of Fluid Mechanics*, vol. 515, 87 (2004).
- Sign-symmetry of temperature structure functions, K.G. Aivalis, S. Kurien, J. Schumacher and K.R. Sreenivasan, *Physical Review E*, vol. 69, 066315 (2004).
- Cascade time-scales of energy and helicity in homogeneous, isotropic turbulence, S. Kurien, M.A. Taylor, T. Matsumoto, *Physical Review E*, vol. 69, 066313 (2004).
- Recovering isotropic statistics in turbulence simulations: The Kolmogorov 4/5th- Law, M.A. Taylor, S. Kurien and G. L. Eyink, *Physical Review E*, vol. 68, 026310 (2003).
- Reflection antisymmetric counterpart of the Karman-Howarth dynamical equation, S. Kurien, *Physica D: Nonlinear Phenomena*, vol. 175/3-4, 167 (2003).
- Anisotropy of small-scale scalar turbulence, S. Kurien, K.G. Aivalis and K.R. Sreenivasan, *Journal of Fluid Mechanics*, vol. 448, 279 (2001).
- Dynamical equations for high-order structure functions, and a comparison of a mean field theory with experiments in three-dimensional turbulence, S. Kurien and K.R. Sreenivasan, *Physical Review E*, vol. 64, 6302, (2001).
- Anisotropic scaling contributions to high-order structure functions in high-Reynolds-number turbulence, S. Kurien and K.R. Sreenivasan, *Physical Review E*, vol. 62, 2206 (2000).
- Scaling structure of the velocity statistics in atmospheric boundary layers, S. Kurien, V.S. L'vov, I. Procaccia and K.R. Sreenivasan, *Physical Review E*, vol. 61, 407 (2000).
- Extraction of anisotropic contributions in turbulent flows, I. Arad, B. Dhruva, S. Kurien, V.S. L'vov, I. Procaccia and K.R. Sreenivasan, *Physical Review Letters*,

vol. 81, 5330 (1998).

Other publications

- Helicity within the Kolmogorov phenomenology of turbulence, S. Kurien, “*Proceedings of the IUTAM Symposium on Computational Physics and New Perspectives in Turbulence, Nagoya 2006*”. Ed.: Y. Kaneda. *Springer*, (2008).
- The LANS-alpha model for computing turbulence: Origins, Results and Open Problems, D. D. Holm, D. Livescu, C. Jeffery, S. Kurien, M. A. Taylor and B. A. Wingate, *Los Alamos Science*, No. 29, 152 – 171 (2005).
- Direct Numerical Simulation of Turbulence: Data Generation and Statistical Analysis, S. Kurien and M. A. Taylor, *Los Alamos Science*, No. 29, 142 – 151 (2005).
- Measures of anisotropy and the universal properties of turbulence, S. Kurien and K.R. Sreenivasan, In “*Les Houches 2000: New Trends in Turbulence*, Eds.: M. Lesieur, A. Yaglom and F. David, *Springer EDP-Sciences*, (2001).

Total number of citations: 267 as of August 12, 2008 (Source: SciSearch citation index)

Papers submitted or in preparation

- Hyperviscosity, Galerkin-truncation and Bottlenecks. U. Frisch, S. Kurien, W. Pauls, R. Pandit, S.S. Ray, A. Wirth and J.-Z. Zhou. Submitted to *Physical Review Letters* (2008).
- Potential enstrophy constraints on energy in various limits of Rossby and Froude numbers, S. Kurien.

Talks/Presentations

- “Anisotropic constraints on energy in rotating and stratified flows”, American Physical Society, NCAR-IMAGE Workshop on Turbulent Theory and Modeling, Boulder, February 2008.
- “Thermalization and bottleneck in turbulence”, (co-author, presented by J.-Z. Zhu), American Physical Society, 60th Annual meeting of the Division of Fluid Dynamics, Salt Lake City, November 2007.
- “Spectral scaling of the two-dimensional Navier-Stokes-alpha and Leray-alpha models”, (co-author, presented by E. Lunasin) American Physical Society, 60th Annual meeting of the Division of Fluid Dynamics, Salt Lake City, November 2007.

- “Anisotropic constraints on energy in rotating and stratified flows”, American Physical Society, 60th Annual meeting of the Division of Fluid Dynamics, Salt Lake City, November 2007.
- “A study of the Navier-Stokes α -model for two-dimensional turbulence”, SIAM Conference on Mathematical and Computational Issues in the Geosciences, March 2007.
- “Turbulence: from theoretical prediction to numerical verification”, TSC Capability Workshop, Los Alamos National Laboratory, February 2007.
- “Helicity within the Kolmogorov phenomenology of turbulence”, IUTAM symposium, Nagoya University, Japan, September 2006.
- “Potential enstrophy cascades in rotating and stratified flows”, invited, Research Institute of Mathematical Sciences, Kyoto University, Japan, September 2006.
- “Potential enstrophy cascades in rotating and stratified flows”, invited, CNLS workshop on New directions in two-dimensional turbulence, Center for Nonlinear Studies, Los Alamos National Laboratory, August 2006.
- “On the existence of potential enstrophy inertial ranges”, (co-author, presented by B. Wingate), American Geophysical Union, 13th Ocean Sciences Meeting, Honolulu, February 2006.
- “Cascade timescales for energy and helicity in isotropic homogeneous turbulence”, American Physical Society, 58th Annual Meeting of the Division of Fluid Dynamics, Chicago, November 2005.
- “The two-point correlation correlation of potential vorticity in rotation and stratified turbulence”, (co-author, presented by B. Wingate), American Physical Society, 58th Annual Meeting of the Division of Fluid Dynamics, Chicago, November 2005.
- “Helicity and the Kolmogorov Phenomenology of Turbulence”, Mathematics department seminar, University of California, Irvine, invited speaker, November 2005.
- “Timescales and Intermittency in Statistical Turbulence”, P-24 seminar, Physics Division, LANL, June 2005.
- “Cascade timescales for energy and helicity in isotropic homogeneous turbulence”, University of New Mexico, American Mathematical Society Sectional Meeting, October 2004.
- “Anomalous scaling of low-order turbulence velocity statistics”, Center for Nonlinear Studies Seminar, Los Alamos National Laboratory, July 2004.
- “Helicity and the Kolmogorov Phenomenology of Turbulence”, Center for Nonlinear Studies Colloquium, April 2004.

- “Helicity and the Kolmogorov Phenomenology of Turbulence”, University of Illinois at Urbana-Champaign, Mechanical Engineering Colloquium, Invited speaker, April 2004.
- Symmetry breaking in turbulent velocity statistics – Rotation and Reflection”, University of Central Florida, Mathematics Special Colloquium, Invited speaker, February 2004 .
- “Symmetry breaking in turbulent velocity statistics – Rotation and Reflection”, Purdue University, Mathematics Seminar, Invited speaker, February 2004.
- “Helicity and the Kolmogorov Phenomenology of Turbulence”, Purdue University, Earth and Atmospheric Sciences Seminar, Invited speaker, February 2004.
- “Parity-breaking statistics in homogeneous isotropic turbulence”, American Physical Society, 56th Annual Meeting of the Division of Fluid Dynamics, New Jersey, November 2003.
- “The Scaling Structure of Velocity Statistics in Turbulence”. Workshop for "Subgrid scale turbulence modeling in geophysical flows" at the Institute for Pure and Applied Mathematics, UCLA, August 2003.
- “The Scaling Structure of Velocity Statistics at High Reynolds Numbers”. Mini-symposium at the Society for Industrial and Applied Mathematics (SIAM) Conference on Applications of Dynamical Systems, Snowbird, Utah, May 2003.
- “The Scaling Structure of Velocity Statistics at High-Reynolds Numbers”. University of New Mexico, Department of Mathematics Navier-Stokes Seminar Series, Invited speaker, December 2002.
- “Karman-Howarth Dynamical Equation for Reflection-Symmetry Breaking in Turbulent Flows”. The "Geometrical Mechanics and Turbulence Modeling Workshop" , Santa Fe, New Mexico, November 2002.
- “Recovering isotropic statistics in turbulence simulations”. Center for Nonlinear Studies Postdoc Forum, Los Alamos, New Mexico, August 2002.
- “Equations for higher-order structure functions in turbulence: Experimental evaluation of a model for the pressure contributions”. Center for Nonlinear Studies "Arizona Days", Los Alamos, New Mexico, February 2002.
- “Scaling properties of statistical hydrodynamics”. Meeting for "Adaptive and High-Order Methods with Applications in Turbulence", National Center for Atmospheric Research, February 2002.
- “Anisotropy of small-scale scalar turbulence”, American Physical Society, 54th Annual Meeting of the Division of Fluid Dynamics, San Diego, California, November 2001.

- “Anisotropy and the Universal Properties of Turbulence”. Cornell University, Mechanical and Aerospace Engineering Colloquium, Invited speaker, October 2001.
- “Anisotropic contributions to scaling in high-Reynolds-number turbulence”. American Physical Society, 53rd Annual Meeting of the Division of Fluid Dynamics, Washington DC, November 2000.

Conference and Workshop Participation

- National Science Foundation Cyber-Fluid Dynamics Workshop, NSF Headquarters, Virginia, July 2007.
- “Euler Equations: 250 Years On”, Co-Organized by the Centre National de Recherche Scientifique, Aussois, France, June 2007.
- DOE Applied Mathematics Research, Principal Investigator Meeting, Lawrence Livermore National Laboratory, May 2007.

Teaching and mentoring

Student PhD thesis: Evelyn Lunasin (University of California, Irvine, Advisor: Prof. Edriss Titi), PhD, June 2007.

Postdoctoral fellow: Dr. Jian-Zhou Zhu (2006 - present).

Summer /Fall 2003-present: Mentor to PhD candidates who participate in the Summer Graduate Research Assistantship program at LANL. Advisory and collaborative role on projects.

1995-2001: Teaching Assistant and tutor at Yale University. Undergraduate Physics Laboratory courses and recitation sections for Physics, Astronomy and Mathematics.

Award

2003: Los Alamos Achievement Award for "Fundamental Breakthrough in Turbulence Theory and Data Analysis".

Grants

FY2006-2008: PI, DOE Office of Science, Advanced Scientific Computing Research,

Multiscale Mathematics Research and Education grant for proposal "Multiscale coupling in geophysical and climate models". (Joint with Leslie Smith, U. Wisconsin, Madison). See recent highlight in ASCR Discovery New Faces <http://ascr-discovery.science.doe.gov/newfaces/kurien1.html>

Other activities

Referee: Physical Review Letters, Physical Review E, Journal of Fluid Mechanics, Proceedings of the Royal Society A, Journal of Turbulence, Physics Letters A.

Review Team Member, DOE ASC Alliance Center for Integration Turbulence Simulations at Stanford University (2004-2005).

Co-organizer, 13th Annual Arizona Days Conference (January 30-31, 2004, Center for Nonlinear Studies, LANL).

Member: American Physical Society, American Geophysical Union.