Samriddhi Sankar Ray

Curriculum Vitae

Personal Information

Date of Birth 13 November, 1981
Citizenship Indian

Current Position

Reader International Center for Theoretical Sciences (ICTS-TIFR),
Tata Institute of Fundamental Research,
Bangalore, India.

Contact Details

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Correspondence

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Tata Institute of Fundamental Research,
Survey No. 151, Shivakote,
Hesaraghatta Hobli,
Bangalore 560089, India.
Residence Platinum City Apartment,
Block A, Flat A/5/1
2 H. M. T. Watch Factory Road,
Bangalore 560022, India.

Education

2010 **PhD in Physics**
Department of Physics, Indian Institute of Science, Bangalore, India.
Thesis Title: *Statistical Studies of Fluid, Passive-Scalar, and Burgers Turbulence*
Thesis Advisor: *Professor Rahul Pandit*

2006 **MS in Physics**
Department of Physics, Indian Institute of Science, Bangalore, India.

2003 **BSc in Physics**
Presidency College, Calcutta University, Calcutta, India

Research Positions

July 2015 – present **Reader**
International Center for Theoretical Sciences (ICTS-TIFR)
Tata Institute of Fundamental Research,
Bangalore, India.

January 2013 – June 2015 **Junior Faculty**
International Center for Theoretical Sciences (ICTS-TIFR)
Tata Institute of Fundamental Research,
Bangalore, India.

April 2010 – December 2012 **Post-doctoral Fellow**
Laboratoire Lagrange,
Observatoire de la Côte d'Azur, CNRS,
Nice, France.
Mentor: *Dr Jérémie Bec*

Professional Experience

- Visitor to **University of Rome Tor Vergatta, Rome**, France, May 2015.
- Visitor to **Observatoire de la Côte d'Azur, CNRS, Nice**, France, May 2015.
- Visitor to **NORDITA, Stockholm**, Sweden, June 2014.
- Visitor to **Observatoire de la Côte d'Azur, CNRS, Nice**, France, May–June 2014.
- Visitor to **Observatoire de la Côte d'Azur, CNRS, Nice**, France, May–June 2013.
- Visitor to **Max-Plank-Institute for Dynamics and Self-Organization, Göttingen**, Germany, October-November 2011.
- Visitor to **Max-Plank-Institute for Dynamics and Self-Organization, Göttingen**, Germany, May 2010.
- Visitor to **Laboratoire Poncelet, Moscow**, Russia, September 2008.
- Referees for the journals such as **Physical Review Letters**, **Physical Review E**, **Europhysical Journal B**, **Physica D**, **Proceedings of the Royal Society**, and **Nonlinearity**.
- Scientific Secretary, **Problems of Turbulence: 50 years after the Turbulence Colloquium Marseille 1961**, **Marseille**, France, September, 2011.

Principal Research Interests

- Fluid, magnetohydrodynamic, passive-scalar, and Burgers turbulence.
- Inertial (finite-sized) particles in turbulent flows with special application to coalescence processes in clouds.
- Truncated systems, thermalization, and statistical mechanics of turbulent flows.
- Singularities in the Euler equation.
- Multiphase Flows.

List of Publications

30. *Exotic multifractal conductance fluctuations in graphene*
K. R. Amin, **Samriddhi Sankar Ray**, N. Pal, R. Pandit, and A. Bid.
Submitted.

29. *Enhanced droplet collision rates in turbulent flows: The effect of poly-dispersity and transient phases*
M. James and **Samriddhi Sankar Ray**.
Submitted.

28. *How Violent are the Collisions of Different Sized Droplets in a Turbulent Flow?*
M. James and **Samriddhi Sankar Ray**.
ArXiv:1603.05880; Submitted.

27. *The Onset of Thermalization in Finite-Dimensional Equations of Hydrodynamics*
D. Venkataraman and **Samriddhi Sankar Ray**.
Proceedings of the Royal Society, **473**, 20160585 (2017).

26. *Semi-flexible particles in isotropic turbulence*
A. Ali, E. L. C. M. Plan, **Samriddhi Sankar Ray**, and D. Vincenzi.
Physical Review Fluids (Rapid), **1**, 082402(R) (2016).

25. *Lagrangian Statistics for Navier-Stokes Turbulence under Fourier-mode reduction: Fractal and Homogeneous Decimations*
M. Buzzicotti, A. Bhatnagar, L. Biferale, A. S. Lanotte, and **Samriddhi Sankar Ray**.
New Journal of Physics, **18**, 113047 (2016).

24. *Dynamic multiscaling in magnetohydrodynamic turbulence*
Samriddhi Sankar Ray, G. Sahoo, and R. Pandit.
Physical Review E, **94**, 053101 (2016).

23. *Elastic turbulence in a shell model of polymer solution*,
Samriddhi Sankar Ray and D. Vincenzi.
Europhysics Letters, **114**, 44001 (2016).

22. *Intermittency in Fractal Fourier Hydrodynamics: Lessons from the Burgers Equation*,
M. Buzzicotti, L. Biferale, U. Frisch, and **Samriddhi Sankar Ray**.
Physical Review E, **93**, 033109 (2016).

21. *Abrupt growth of large aggregates by correlated coalescences in turbulent flow*,
J. Bec, **Samriddhi Sankar Ray**, E.-W. Saw, and H. Homann.
Physical Review E (Rapid), **93** 031102(R) (2016).

20. *Effect of Inertia on Model Flocks in a Turbulent Environment*,
A. Choudhary, D. Venkataraman and **Samriddhi Sankar Ray**.
Europhysics Letters, **112**, 24005 (2015) (*Editor's Choice*).

19. *Thermalised solutions, statistical mechanics and turbulence: An overview of some recent results*,
Samriddhi Sankar Ray.
Perspectives in Nonlinear Dynamics, **Pramana - Journal of Physics**, **84**, 395 (2015).

18. *Extreme fluctuations of the relative velocities between droplets in turbulent airflow*,
E.-W. Saw, G. P. Bewley, E. Bodenschatz, **Samriddhi Sankar Ray**, and J. Bec.
Physics of Fluids Letters, **26**, 111702 (2014).

17. *Transition from dissipative to conservative dynamics in equations of hydrodynamics*,
D. Banerjee and **Samriddhi Sankar Ray**.
Physical Review E (Rapid), **90**, 041001(R) (2014).

16. *Gravity-driven enhancement of heavy particle clustering in turbulent flow*,
J. Bec, H. Homann, and **Samriddhi Sankar Ray**.
Physical Review Letters, **112**, 184501 (2014).

15. *Multiscaling in Hall-Magnethydrodynamic Turbulence: Insights from a Shell Model*,
D. Banerjee, **Samriddhi Sankar Ray**, G. Sahoo, and R. Pandit,
Physical Review Letters, **111**, 174501 (2013).

14. *Sticky elastic collisions*,
J. Bec, S. Musacchio, and **Samriddhi Sankar Ray**,
Physical Review E, **87**, 063013 (2013).

13. *Real-space Manifestations of Bottlenecks in Turbulence Spectra*,
U. Frisch, **Samriddhi Sankar Ray**, G. Sahoo, D. Banerjee, and R. Pandit,
Physical Review Letters, **110**, 064501 (2013).

12. *Turbulence in Noninteger Dimensions by Fractal Fourier Decimation*,
U. Frisch, A. Pomyalov, I. Procaccia, and **Samriddhi Sankar Ray**,
Physical Review Letters, **108**, 074501 (2012).

11. *Nelkin scaling for the Burgers equation and the role of high-precision calculations*,
S. Chakraborty, U. Frisch, W. Pauls, and **Samriddhi Sankar Ray**,
Physical Review E (Rapid), **85**, 015301(R) (2012).

10. *Dynamic Multiscaling in Two-dimensional Turbulence*,
Samriddhi Sankar Ray, D. Mitra, P. Perlekar, and R. Pandit,
Physical Review Letters, **107**, 184503 (2011).

9. *Universality of scaling and multiscaling in turbulent symmetric binary fluids*,
Samriddhi Sankar Ray and A. Basu,
Physical Review E, **84**, 036316 (2011).

8. *Resonance phenomenon for the Galerkin-truncated Burgers and Euler equations*,
Samriddhi Sankar Ray, U. Frisch, S. Nazarenko, and T. Matsumoto,
Physical Review E, **84**, 016301 (2011).

7. *The Persistence Problem in Two-Dimensional Fluid Turbulence*,
   P. Perlekar, **Samriddhi Sankar Ray**, D. Mitra, and R. Pandit,
   Physical Review Letters, **106**, 054501 (2011).

6. *Extended Self Similarity works for the Burgers equation and why*,
   S. Chakraborty, U. Frisch, and **Samriddhi Sankar Ray**,
   Journal of Fluid Mechanics, **649**, 275 (2010).

5. *Statistical Properties of Turbulence: An Overview*,
   R. Pandit, P. Perlekar, and **Samriddhi Sankar Ray**,
   Pramana - Journal of Physics, **73**, 157 (2009).

4. *Entire solutions of hydrodynamical equations with exponential dissipation*,
   C. Bardos, U. Frisch, W. Pauls, **Samriddhi Sankar Ray**, and E. S. Titi,
   Communications in Mathematical Physics, **293**, 2, 519 (2009).

3. *Hyperviscosity, Galerkin truncation and bottlenecks in turbulence*,
   U. Frisch, S. Kurien, R. Pandit, W. Pauls, **Samriddhi Sankar Ray**, A. Wirth, and J-Z Zhu,
   Physical Review Letters, **101**, 144501 (2008).

2. *The Universality of Dynamic Multiscaling in Homogeneous, Isotropic Navier-Stokes and Passive-Scalar Turbulence*,
   Samriddhi Sankar Ray, D. Mitra, and R.Pandit,
   New Journal of Physics, **10**, 033003 (2008).

1. *Dynamic Multiscaling in Turbulence*,
   R. Pandit, **Samriddhi Sankar Ray**, and D. Mitra,
   European Physics Journal B 64, 463 (2008).

Group Members

Post-doctoral Fellows

1. Dr Divya Venkataraman, PhD (University of Genoa), 2014-2016.
   Now: Assistant Professor, Department of Mathematics, Institute of Chemical Technology, Mumbai, India.

Masters' Students (MS thesis)

1. Amal Roy (Indian Institute of Science, Bangalore), 2016-2017.
2. Martin James (Indian Institute of Science, Bangalore), 2015-2016.
   Now: Graduate Student, Max Planck Institute for Dynamics and Self-Organization, Göttingen, Germany.
3. Akhil Sivakumar (Indian Institute of Science, Bangalore), 2015-2016.
   Now: Graduate Student, International Centre for Theoretical Sciences, Bangalore, India.

Batchelors' Students (BS thesis)

1. Ritwik Tom (Indian Institute of Science, Bangalore), 2016-2017.

Visiting Students

1. Deeksha Adil (At present: BS, Department of Mathematics, IISER, Pune)
2. Purba Chatterjee (At present: Graduate School, Department of Physics, University of Illinois at Urbana–Champaign)
3. Ashok Choudhary (At present: Graduate School, Department of Physics & Astronomy, West Virginia University)

4. Siddhartha Saha (At present: BS, Indian Institute of Science, Bangalore)
5. Ankur Sharma (Graduate Student, Department of Statistics, Yale University)
6. Himani Singhal (At present: Shell Corporation, Bangalore)
7. Ritwik Tom (At present: BS, Indian Institute of Science, Bangalore)

Major Invited Talks

- *Droplets in Turbulent Flows: Lessons for the Microphysics of Clouds*
  Summer Research Program on Dynamics of Complex Systems
  Bangalore, India, July 2016
- *Intermittency in Turbulent Flows: Time to Look in Fourier Space?*
  Indian Statistical Physics Community Meeting 2016
  Bangalore, India, February 2016
- *Settling, collisions, coalescences of inertial particles in turbulent flows*
  CSAS - 2016
  Chennai, February 2016
- *Abrupt Growth of Large Aggregates by Correlated Coalescences in a Turbulent Flow: Short Time Results*
  CompFlu - 2016
  Pune, January 2016
- *Abrupt growth of large aggregates by correlated coalescences in turbulent flow*
  Growing Length Scale Phenomena in Condensed Matter Physics
  Bangalore, India, October 2015.
- *Enhanced Settling and Droplet Growth in Inertial Particles in a Turbulent Flow*
  Colloquium
  Theoretical Sciences Unit, **Jawaharlal Nehru Centre for Advanced Scientific Research**, **Bangalore**, India, September 2015.
- *Bottlenecks in Turbulence: Signatures in Physical Space*
  European Turbulence Conference 15
  Delft, The Netherlands, August 2015
- *Settling and Coalescences of Inertial Particles in Turbulence*
  Seminar
  Department of Physics, **Indian Institute of Technology Bombay**, **Mumbai**, India, August 2015
- *Inertial Particles: Implication for Clouds*
  Colloquium
  Interdisciplinary Programme (IDP) in Climate Studies, **Indian Institute of Technology Bombay**, **Mumbai**, India, August 2015.
- *Settling, Collisions, and Coalescences: Droplets in a Turbulent Flow*
  Seminar
  University of Rome, Tor Vergatta, **Rome**, Italy, May 2015
- *Gravitational Settling of Heavy Particles*
  Indian Statistical Physics Community Meeting 2015
  Bangalore, India, February 2015
- *The dynamics of finite-sized particles in turbulent airflows*
  Colloquium
  International Center for Theoretical Sciences (ICTS-TIFR), **Bangalore**, India, February

2015

- *Extreme fluctuations of the relative velocities between droplets in turbulent airflow*
  CompFlu - 2014
  Bangalore, December 2014
- *Inertial particles in turbulent flows*
  Colloquium
  TIFR Center for Inter-disciplinary Sciences, **Hyderabad**, India, August 2014
- *Gravity-driven enhancement of heavy particle clustering in turbulent flow*
  Dynamic Days Asia Pacific 08
  Chennai, India, July 2014.
- *T*he dynamics of finite-sized particles in turbulent flows
  Seminar
  Jawaharlal Nehru Centre for Advanced Scientific Research,**Bangalore**, India, July 2014
- *Gravity-driven enhancement of heavy particle clustering in turbulent flow*
  Dynamics of Particles in Flows
  Stockholm, Sweden, June 2014
- *Are thermalised solutions meaningful in the equations of hydrodynamics?*
  Seminar
  Indian Association for the Cultivation of Science Kolkata, India, April 2014
- *Turbulence: The Grand Challenge*
  Seminar
  Department of Physics,**Indian Institute of Technology**, **Kanpur**, India, March 2014.
- *Turbulence in Fractal Dimensions: The Critical Dimension*
  Indian Statistical Physics Community Meeting 2014
  Bangalore, India, February 2014
- *Sticky Elastic Collisions*
  Soft-matter: Young Investigators Meet
  Pondicherry, India, January 2014
- *Are thermalised solutions meaningful in the equations of hydrodynamics?*
  Colloquium
  Tata Institute of Fundamental Research – Centre for Applicable Mathematics, **Bangalore**, India, October 2013
- *Sticky Elastic Collisions*
  Monthly StatPhys Meeting
  International Centre for Theoretical Sciences — Tata Institute of Fundamental Research, **Bangalore**, India, September 2013
- *Can Truncated Systems Help Us Understand Turbulence?*
  Perspectives in Nonlinear Dynamics
  Hyderabad, July 2013
- *Sticky elastic collisions and the effect of hydrodynamic interactions*
  Seminar
  International Centre for Theoretical Sciences — Tata Institute of Fundamental Research, **Bangalore**, India, June 2012
- *Statistical Mechanics and Turbulence*
  Colloquium
  International Centre for Theoretical Sciences — Tata Institute of Fundamental Research,

Bangalore, India, June 2012

- *Resonance phenomenon for the Galerkin-truncated Burgers and Euler equations*
  Mathematics of particles and flows
  Vienna, Austria, May–June 2012
- *Sticky elastic collisions*
  Particles in Turbulence
  Leiden, Holland, May 2012
- *Statistical Mechanics and Turbulence*
  Seminar
  Department of Physics, **Indian Institute of Technology**, **Kanpur**, India, January 2012
- *Inertial Particles in Turbulent Flows and the Effect of Collisions*
  Seminar
  Department of Physics, **Indian Institute of Technology**, **Kanpur**, India, January 2012
- *Statistical Mechanics and Turbulence*
  Colloquium
  Satyandra Nath Bose National Center for Basic Sciences, **Kolkata**, India, January 2012
- *Statistical Mechanics and Turbulence*
  Seminar
  Saha Institute of Nuclear Physics, **Kolkata**, India, December 2011
- *Statistical Mechanics and Turbulence*
  Seminar
  Indian Institute of Technology, **Kharagpur**, India, December 2011
- *Resonant phenomenon for the Galerkin-truncated Burgers and Euler equations*
  ICTS–TIFR Discussion Meeting on High Precision Computing
  Bangalore, India, December 2011
- *Sticky elastic collisions*
  Rencontre Nicoise de Mecanique des Fluides
  Nice, France, November 2011
- *Gravitational settling of heavy particles*
  Seminar
  Max Planck Institute for Dynamics and Self-Organization, **Göttingen**, Germany, November 2011
- *Gravitational settling of heavy particles*
  Meeting of the ANR
  Nice, France, October 2011
- *The tyger phenomenon for the Galerkin truncated Burgers and Euler equations*
  The solar course, the chemic force, and the speeding change of water
  Stockholm, Sweden, October, 2011
- *The Persistence Problem in Turbulence*
  Fundamental Problems of Turbulence: 50 years after the Turbulence Colloquium Marseille 1961
  Marseille, France, September, 2011
- *Turbulence in Fractal Dimensions*
  Seminar
  Saha Institute of Nuclear Physics, **Kolkata**, India, July 2011
- *Time Scales in Turbulent Flows in Two Dimensions*
  Seminar

Max-Plank-Institute for Dynamics and Self-Organization, **Göttingen**, Germany, May, 2010

- *The Universality of Dynamic Multiscaling*
  Seminar
  Saha Institute of Nuclear Physics, **Kolkata**, India, July 2009
- *Thermalisation*
  Turbulence and Statistical Mechanics
  Les Houches, France, March 2009.
- *Bottlenecks, thermalization and surprises in the Galerkin-truncated Burgers Equation*,
  Seminar
  Satyendra Nath Bose National Centre for Basic Sciences, **Kolkata**, India, October, 2008
- *Surprises in the Galerkin-truncated Burgers Equation*
  Transport in Hydrodynamical Flows: Numerical and Analytical Approaches
  Moscow, Russia, September, 2008
- *Dynamic Multiscaling in Turbulence*
  Seminar
  Max-Plank-Institute for Dynamics and Self-Organization Göttingen, Germany, July, 2008
- *Galerkin-truncated Burgers Equation and Bottlenecks*
  Rencontres Nicoises de Mecanique des Fluides
  Nice, France, May 2008
- *Burgers Equation and Hyperviscosity*
  GdR Turbulence: Fundamental Aspects of Turbulence
  Lyon, France March - April 2008

Major Conferences (2013 —)

- **CSAS - 2016**, **IIT**, **Chennai**, India, 1 – 5 February 2016.
- **CompFlu - 2016**, **IISER**, **Pune**, India, 2 – 4 January 2016.
- **Growing Length Scale Phenomena in Condensed Matter Physics**, **JNCASR**, **Bangalore**, India, 24 – 28 October 2015.
- **European Turbulence Conference 15 (ETC15)**, **Delft**, The Netherlands, 25-28 August 2015.
- **CompFlu - 2014**, **JNCASR**, **Bangalore**, India, 22-24 December 2014.
- **Soft-matter: Young Investigators Meet**, **Pondicherry**, India, 18-20 December 2014.
- **Dynamic Days Asia Pacific 08**, **IIT Chennai and IMSc**, **Chennai**, India, 21-24 July 2014.
- **Dynamics of Particles in Flows**, **NORDITA**, **Stockholm**, Sweden, 11-13 June, 2014.
- **Soft-matter: Young Investigators Meet**, **Pondicherry**, India, 5-7 January 2014.
- **STATPHYS 25**, *International Conference on Statistical Physics of the International Union for Pure and Applied Physics (IUPAP)*, **Seoul**, South Korea, 22 - 26 July 2013.
  Selected as *Young Scientist* for participation.
- **Perspectives in Nonlinear Dynamics 2013 (PNLD 2013)**, **University of Hyderabad**, **Hyderabad**, India, 15-18 July 2013.

Workshops, Conferences and Meetings Organised

1. *Indian Statistical Physics Community Meeting 2016* at the **International Centre for Theoretical Sciences — Tata Institute of Fundamental Research**, **Bangalore**, India, February 2017.
   Co-Organisers: R. Bandyopadhyay, A. Dhar, K. Jain, R. Pandit, S. Sabhapandit, and P. Sharma.
2. *Indian Statistical Physics Community Meeting 2016* at the **International Centre for Theoretical Sciences — Tata Institute of Fundamental Research**, **Bangalore**, India, February 2016.

Co-Organisers: A. Dhar, K. Jain, R. Pandit, and S. Sabhapandit

3. *Soft-matter: Young Investigators Meet* in **Pondicherry**, India, December 2015.
   Co-Organisers: P. Chaudhury and S. Roy.
4. *Geodynamo Research (GDR) 2015* at the **International Centre for Theoretical Sciences — Tata Institute of Fundamental Research**, **Bangalore**, India, June 2015.
   Co-Organisers: E. Dormy, S. Fauve, B. Sreenivasan, and M. Verma.
5. *The Nonlinear Physics of Complex Flows and Amorphous Solids* and the associated Chandrasekhar Lectures at the **International Centre for Theoretical Sciences — Tata Institute of Fundamental Research**, **Bangalore**, India, April 2015.
   Sole Organiser.
6. *Indian Statistical Physics Community Meeting 2015* at the **International Centre for Theoretical Sciences — Tata Institute of Fundamental Research**, **Bangalore**, India, February 2015.
   Co-Organisers: A. Dhar, K. Jain, R. Pandit, and S. Sabhapandit
7. *Indian Statistical Physics Community Meeting 2014* at the **International Centre for Theoretical Sciences — Tata Institute of Fundamental Research**, **Bangalore**, India, February 2014.
   Co-Organisers: A. Dhar, K. Jain, R. Pandit, and S. Sabhapandit
8. *Transport of Particles in Turbulent Flows: Experimental, Computational and Theoretical Investigations*, at the **International Centre for Theoretical Sciences — Tata Institute of Fundamental Research**, **Bangalore**, India, October 2013.
   Co-Organisers: J. Bec and R. Pandit.

Awards & Grants

- ECR/2015/000361 grant from DST, India (2016-2019).
- PI of Airbus Group Corporate Foundation Chair in Mathematics of Complex Systems.
- Co-PI and Member, Indo-French Centre for Applied Mathematics (IFCAM).
  Project : "Theoretical and Numerical Studies of Turbulence in Fluids".
- Funding from the European Research Council under the European Community's Seventh Framework Program (FP7/2007-2013 Grant Agreement No. 240579).
- Member, *European Cooperation in Science and Technology* (COST) on *Flowing Matter – Cost Action* (COST MP1305)
- Member, *European Cooperation in Science and Technology* (COST) on *Particles in Turbulence – Cost Action* (COST MP0806).
- Member, *Optimal transport : Theory and Applications to cosmological Reconstruction and Image processing* (ANR-OTARI).
- PRACE Project (2010-2011) : Awarded access to the PRACE (Partnership for Advanced Computing in Europe) Research Infrastructure for 50,000,000 core-hours on the JUGENE, IBM BlueGene/P, hosted by the Gauss-Centre for Supercomputing member site in Juelich, Germany.
- Young Fellow of the Indian Institute of Science, Bangalore (2000-2003), India.