

Anirban Sain

Address: Department of Physics, IIT Bombay, Powai, Mumbai 400076, India.

Phone: +91 22 25767553, Cell: +91 9820368553, Email: asain@phy.iitb.ac.in.

Web: <http://www.phy.iitb.ac.in/en/employee-profile/anirban-sain>

Research areas (Theoretical Soft Matter and Biophysics)

Bio-physics: Dynamic processes in the Cell (cell division, endo/exo-cytosis).

Soft Matter Physics: Bio-polymers, Bio-membranes, liquid-crystals and fluids.

Grain dynamics in soft-polycrystals: MD and Phase field simulations.

Professional Experience

Professor, Indian Institute of Technology (IIT)-Bombay, India; since Oct, 2014.

Guest Scientist, Max Planck Inst. for physics of complex systems, Dresden; June, 2010-June, 2011.

Associate professor, Indian Institute of Technology (IIT)-Bombay, India; 2009-2014.

Assistant professor, Indian Institute of Technology (IIT)-Bombay, India; 2004-08.

Postdoctoral Fellow, McGill University, Canada; 2003, with Prof. Martin Grant.

Postdoc., University of Waterloo, Canada, 2002, with Prof. Jeff Z.Y. Chen.

Industrial Research scientist, Hindustan Lever Research Center, Mumbai, India, 2001.

Postdoc., Simon Fraser University, Canada; 1999-2000, with Prof. Michael Wortis.

Education

Integrated M.Sc.- Physics, Indian Institute of Technology (IIT)-Kanpur, India, 1988-93.

PhD- IISc Bangalore, 1999, *Thesis*: Multiscaling in Fluid turbulence. *Guide*: Prof. Rahul Pandit.

Publication in chronological order.

1. *Chiral flows in the separating wall during cell division*, V. Ganguly, M Chatterjee, [A. Sain](#), (bioRxiv, 2023.03. 03.531016, under review)
2. *Directing the Formation of Tunable Superlattice Crystalline Phases from Anisotropic Nanoparticles*, S. Khawas, S. Bhattacharjee, S. Mukherjee, [A. Sain](#) and S. Srivastava, (accepted in *Colloids and Surfaces A*, 2024).
3. *A human curvature sensitive septin octamer complex drives membrane deformation with a specific mesh-like organization*, K. Nakazawa, G. Kumar, B. Chauvin, Aurelie Di Cicco, L. Pellegrino, M. Trichet, B. Hajj, J. Cabral, [A. Sain](#), S. Mangenot and A. Bertin, *J. Cell Sci* **136**, jcs260813, (2023).
4. *Temperature-dependent self-assembly of biofilaments during red blood cell sickling*, A. Behera, O. Sharma, D. Paul, and [A. Sain](#), *J. Chem. Phys.* **157**, 014105 (2022).
5. *Dynamic surface patterns on cells*, M. Chatterjee and [A. Sain](#), *J. Chem. Phys.* **156**, 084117 (2022).
6. *Dynamics and stability of the contractile actomyosin ring in the cell*, M. Chatterjee, A. Chatterjee, A. Nandi, and [A. Sain](#), *Phys. Rev. Lett.* **128**, 068102 (2022).
7. *Cytoplasmic streaming in C. elegans: forces that drive oogenesis*, V.V. Menon, M.M. Inamdar and [A. Sain](#), *Euro. Phys. Lett.* **135**, 24003 (2021).
8. *Deformation of membrane vesicles due to chiral surface proteins*, A. Behera, G. Kumar, Sk A. Akram and [A. Sain](#), *Soft Matter*, **17**, 7953 (2021).
9. *Chiral molecules on curved colloidal membranes*, Sk A. Akram, A. Behera, P. Sharma and [A. Sain](#), *Soft Matter*, **16**, 10310 (2020).
10. *Poiseuille Flow of Soft Polycrystals in 2D Rough Channels*, T. Sarkar, P. Chaudhuri, and [A. Sain](#), *Phys. Rev. Lett.* **124**, 158003 (2020).
11. *Non-Gaussian subdiffusion of single-molecule tracers in a hydrated polymer network*, R.K. Singh, J. Mahato, A. Chowdhury, [A. Sain](#), and A. Nandi, *J. Chem. Phys.* **152**, 024903 (2020).
12. *Confined filaments in soft vesicles - case of sickle red blood cells*, A. Behera, G. Kumar and [A. Sain](#), *Soft Matter*, **16**, 421 (2020).
13. *Tubulation pattern of membrane vesicles coated with bio-filaments*, Gaurav Kumar, N. Ramakrishnan, and [A. Sain](#), *Phys. Rev. E* **99**, 022414 (2019).

14. *Grain size distribution in sheared polycrystals*, T. Sarkar, S. Biswas, P. Chaudhuri and A. Sain, Phys. Rev. M. **1**, 070601 (**Rapid Comm.**) (2017).
15. *Asymmetric flows in the intercellular membrane during cytokinesis*, V.V. Menon, S.S. Soumya, A. Agarwal, S.R. Naganathan, M.M. Inamdar and A. Sain, Biophys. J. **113**, 2787 (2017).
16. *Curvature Instability of Chiral Colloidal Membranes on Crystallization*, L. Saikia, T. Sarkar, M. Thomas, V. A. Raghunathan, A. Sain, and P. Sharma. **Nat. Commun.** **8**, 1160 (2017).
17. *Shape transitions during clathrin-induced endocytosis*, G. Kumar and A. Sain , Phys. Rev. E. **94**, 062404 (2016) .
18. *Dynamic force balances and cell shape changes during cytokinesis*, A. Sain, M.M. Inamdar and F. Jülicher **Phys. Rev. Lett.** **114**, 048102 (2015).
19. *How helix-coil transition influences translocation of a single stranded DNA and kinetics of its fluctuation inside the channel*, Kulveer Singh and Anirban Sain, **Euro. Phys. Lett.** **104**, 18007 (2013) (**Editors Choice**).
20. *Micromechanics of emergent patterns in plastic flows*, Santidan Biswas, Martin Grant, Indradev Samajdar, Arunanshu Haldar and Anirban Sain, **Sci. Rep.** **3**, 2728 (2013). (An **NPG** JI.)
21. *Plasticization of Poly(vinylpyrrolidone) Thin Films under Ambient Humidity: Insight from Single-Molecule Tracer Diffusion Dynamics*, S. Bhattacharya, D.K. Sharma, S. Saurabh, S. De, A. Sain, A. Nandi and A. Chowdhury, J. Phys. Chem. B **117**, 7771 (2013).
22. *Stretching force dependent transitions in single stranded DNA*, Kulveer Singh, Surya Kanta Ghosh, Sanjay Kumar and Anirban Sain, **Euro. Phys. Lett.**, **100**, 68004 (2012).
23. *From chemosensing in bacteria to practical biosensors*, Surya K. Ghosh, Tapanendu Kundu and Anirban Sain, Phys. Rev. E., **86**, 051910 (2012).
24. *Stuttering Min oscillations within Escherichia coli bacteria: a stochastic polymerization model*, S. Sengupta, J. Derr, A. Sain and A.D. Rutenberg, Phys. Biol., **9**, (2012) 056003, (2012).
25. *High electron mobility through the edge states in random networks of c-axis oriented wedge-shaped GaN nanowalls grown by molecular beam epitaxy*, H. P. Bhasker, S. Dhar, A. Sain, M. Kesaria, and S. M. Shivaprasad, **Appl. Phys. Lett.** **101**, 132109 (2012).
26. *Force generation in bacteria without nucleotide-dependent bending of cytoskeletal filaments*, Biplab Ghosh and Anirban Sain, Phys. Rev. E., **83**, 051924 (2011).
27. *Coarsening in polycrystalline material using Quaternions*, Santidan Biswas, Indradev Samajdar, Arunansu Haldar and Anirban Sain, J. Phys.: Condens. Matter, **23**, 072202 (2011) (Fast track comm.) (included in **IOP select**).
28. *Effect of hydrodynamic interaction on polymeric tethers*, Suman G. Das, Dimitri Pescia, Mithun Biswas and Anirban Sain, Phys. Rev. E. **82**, 041910 (2010). Highlighted by **Nature-India**.
29. *Effect of Intrinsic Curvature on Semiflexible Polymers*, Surya K. Ghosh, Kulveer Singh and Anirban Sain, Phys. Rev. E. **80**, 051904 (2009).
30. *Predicting the coherence resonance curve using a semianalytic treatment*, Santidan Biswas, Dibyendu Das, Punit Parmananda and Anirban Sain, Phys. Rev. E **80**, 046220 (2009).
31. *Self-organization of the MinE ring in subcellular Min oscillations*, Julien Derr, Jason T. Hopper, Anirban Sain and Andrew D. Rutenberg, Phys. Rev. E **80**, 011922 (2009).
32. *Origin of contractile force during cell division of bacteria*, Biplab Ghosh and Anirban Sain, **Phys. Rev. Lett.**, **101**, 178101, (2008). Highlighted by **Nature-India**.
<http://www.nature.com/nindia/2008/081111/full/nindia.2008.317.html>.
33. *Effect of hydrodynamic interaction on partially stretched polymers*, Anirban Sain, Phys. Rev. E, **77**, 061919 (2008).
34. *Microscopic strain distribution profile in a 1-D chain during rupture - a many body Kramers calculation*, Anirban Sain, Cristiano Dias, and Martin Grant, Phys. Rev. E, **74**, 046111 (2006).
35. *Review of "Resistance to Hydriding in Zirconium - An Emerging Possibility"*, K.V. Mani Krishna, A. Sain, I. Samajdar, G.K. Dey, D. Srivastava, S. Neogi, R. Tiwari and S. Banerjee, Acta Materialia, **54**, 4665 (2006).
36. *Effect of base stacking interaction in heterogeneous single stranded DNA*, Anirban Sain, Bae-Yeun Ha, and Jeff.Z.Y. Chen, Physica-A, **369**, 679, (2006).
37. *Phase ordering kinetics of a binary fluid mixture : the inertia dominated regime*, Anirban Sain, and Martin Grant **Phys. Rev. Lett.**, **95**, 255702, (2005).

38. *The Influence of tether dynamics on forced Kramers escape from a kinetic trap*, Anirban Sain and Michael Wortis, Phys. Rev. E, **70**, 031102, (2004).
39. *Chain persistency in single stranded DNA*, Anirban Sain, Bae-Yeun Ha, Heng-Kwong Tsao and Jeff.Z.Y. Chen, Phys. Rev. E, **69**, 061913, (2004).
40. *Langevin equation for the motion of a Brownian particle in an ideal gas environment*, Rangan Lahiri(late), Arvind and Anirban Sain, Pramana: J. Phys., **62**, 1015 (2004).
41. *Counterion distribution and charge-fluctuation-interactions between like-charged fluid membranes*, Anirban Sain and Bae-Yeun Ha, Physica A **320**, 67 (2003).
42. *Multiscaling in the Randomly Forced and Conventional Navier-Stokes Equations*, Anirban Sain and Rahul Pandit, Physica A **270**, 190 (1999)
43. *Large momentum expansions in fluid turbulence*, J. K. Bhattacharjee and Anirban Sain, Physica A **270**, 165 (1999)
44. *Extended self-similarity and dissipation range dynamics of three-dimensional turbulence*, Anirban Sain and J. K. Bhattacharjee, Phys. Rev. E **60**, 571 (1999).
45. *Multiscaling in randomly stirred fluid model for turbulence*, Anirban Sain, Manu and Rahul Pandit, **Phys. Rev. Lett.** **81**, 4377 (1998).
46. *Multiscaling in models of Magnetohydrodynamic turbulence*, Abhik Basu, Anirban Sain, Sujan K.Dhar and Rahul Pandit, **Phys. Rev. Lett.** **81**, 2687 (1998).
47. *Inertial and dissipation range asymptotics in fluid turbulence*, Sujan Dhar, Anirban Sain and Rahul Pandit, **Phys. Rev. Lett.** **78**, 2964 (1997).
48. *Some recent advances in the theory of homogeneous and isotropic fluid turbulence*, Sujan K. Dhar, Anirban Sain, Ashwin Pande, and Rahul Pandit, *Pramana: J. Phys. (Special issue on Nonlinearity and Chaos in Physical Sciences)*, **48**, 325 (1997).
49. *Scaling of resistance in the 2-dimensional Anderson Tight Binding model of disordered systems-2*, Anirban Sain and Abhijit Mookerjee, **Mod. Phys. Lett. B** **8** 195(1994).

Teaching Experience

Soft Matter Physics (Adv. elective for undergrad and Masters): Fall 2018-20.
 Classical Mechanics (2nd yr undergrad): Spring 2015-17.
 Advanced Statistical Physics (Adv. elective for undergrad and Masters) : Fall 2011-13.
 Electricity and Magnetism (1st yr, undergrad, class size 150): Spring 2008-09.
 Classical mechanics (1st yr, undergrad, class size 375): Spring 2023.
 Nonlinear Dynamics (Senior undergrad and Masters): Spring 2006,2007.
 Statistical Physics (senior undergrad and Masters: Spring 2004-06,2009,2015-17.
 Continuum Mechanics (3rd yr, undergrad): Fall 2004-05,2007; Spring 2010,2012-13.
 Classical Mechanics (Honors, 4th yr undergrad): Spring 2003,McGill University, Canada.

Research Students: PhD students graduated 10, supervising at present 3.

Awards

BUTI foundation award (2008), given by Indian Physics Association.
 IRCC (IIT Bombay) Research paper award (2013).

References:

Prof. Martin Grant

Dean of Science, Dawson Hall, McGill University,
 853 Sherbrooke St W, Montreal QC H3A 2T6 Canada,
 Email: martin.grant@mcgill.ca; Phone: (514) 398-4211, Fax: (514) 398-8102.

Prof. Jeff Z.Y. Chen

Dept. of Physics, University of Waterloo, Waterloo, ON, Canada N2L 3G1.
 Email: jeffchen@onsager.uwaterloo.ca; Phone: (519) 888 5361, Fax:(519) 746-8115.

Prof. Rahul Pandit

Dept. of Physics, Indian Institute of Science, Bangalore-560 012, India.
 Email: rahul@physics.iisc.ernet.in, Phone:+91(80)309 2581, Fax:+91(80)346 1602.

Prof. Dr. Frank Julicher

Director, Max-Planck-Institute for the Physics of Complex Systems.

Nothnitzer Strasse 38, 01187 Dresden, Germany.

Email: julicher@pks.mpg.de; Phone: +49 351 871-1202, Fax: +49 351 871-1299.