Curriculum Vitae

Contact Details

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Debasish Chaudhuri
Associate Professor - G
IOP Bhubaneswar, India

(Associate,
ICTS-TIFR, Bangalore)

Personal Details

Nationality: Indian
Date of Birth: 5th November, 1974

Current position

Associate Professor - G, Institute of Physics, Bhubaneswar

Employments held

Associate Professor G Institute of Physics, Bhubaneswar	**July, 2020 onwards**
Reader F Institute of Physics, Bhubaneswar	**February, 2016 to June, 2020**
Assistant Professor Indian Institute of Technology Hyderabad, India	**December, 2011 to January, 2016**
Post doctoral fellow Theory of Biomolecular Matter, FOM Institute AMOLF, Amsterdam, The Netherlands	**July, 2009 to November, 2011**
Guest Scientist Departments of Biological Physics Max Planck Institute for the Physics of Complex Systems (MPI-PKS), Dresden, Germany	**June, 2006 to June, 2009**

Externally funded projects as PI

Topic: "Stochastic thermodynamics of active particles and fields", SERB MATRICS project no. MTR/2019/000750	**February, 2020 to January 2023** (ongoing)
Topic: "Entropic and active forces on confined polymers: Organization and dynamics of bacterial chromomes" SERB Extramural Research grant no. EMR/2016/001454	**March 2017 to February 2021** (completed)
Topic: "Collective dynamics of active polymers : implications for cytoskeletal structure and dynamics" SERB Extramural Research grant no. EMR/2014/000791	**October, 2015 to September, 2018** (completed)

Distinctions

Our work on ant traffic aired by the National Public Radio (**npr**), USA as a part of a special series "Joe's Big Idea", and available on their website www.npr.org under the title "*Why ants handle traffic better than you do*"; also appeared in The Independent, UK and Frontline magazine, India as a news article "*No ant traffic jams*".	**2015**

Our work on semiflexible polymers became a part of the **textbook** "Path integrals in quantum mechanics, statistics, polymer physics, and financial market" by Hagen Kleinert, 5th edition, World Scientific, New Jersey.	**2009**
CSIR, Junior and Senior Research Fellowhip	**2001 - 2006**
Siddhartha Sengupta memorial award from Kalyani University *for securing first rank in M. Sc.-Physics*	**1999**

Education

Ph. D. (Physics) S. N. Bose National Center For Basic Sciences (SNBNCBS), Kolkata (*degree awarded by Jadabpur University, Kolkata*) Thesis title:'Equilibrium and Transport Properties of Constrained Systems' **Ph. D. Supervisor**: *Prof. Surajit Sengupta*	**Thesis submitted in June, 2006. Degree awarded in April, 2007**
M.Sc. in Physics *University of Kalyani, Kalyani*	**1999**

Ongoing Collaborations:

1. Active matter: In an ongoing collaboration with Prof. Fernando Peruani (LPTM, Paris), we are working on several aspects of active matter physics including fundamental questions such as fluctuation-dissipation and more application oriented projects involving active engines. We are currently preparing two manuscripts on (a) "Stop and go motion: Dispersion depends on the details of switching", (b) "Characterzing active particle bath: anomalous activity dependence of passive probe particles".

2. Chromosome organization: In an ongoing collaboration with Prof. Bela M Mulder (AMOLF, Amsterdam) we are preparing a manuscript on the "Role of crowder molecules in chromosome size and shape: impact of crowder size dependence"

3. Kinesin-3 motors in C. elegans axon: In an ongoing collaboration with the experimental biology group of Prof. Sandhya Kaushika of TIFR-Mumbai, we are working on the impact of ubiquitination in the vesicle transport. We are currently preparing a manuscript on "Ubiquitination of UNC-104 regulates anterograde movement of its cargo".

Supervising Research

(a) ***PhD Theses completed under my supervision:***

Name	Thesis title	year	Current position
Subhadip Ghosh (IOP Bhubaneswar)	Active maintenance of structure and transport: impact of molecular motors	November, 2018	Postdoctoral fellow, Department of Physics, University of Zagreb, Croatia
Pinakinarayan AP Swain (IIT-Hyderabad)	Molecular simulations of bio-polymers: application to bacterial chromosome and biomaterials	February, 2020	Postdoctoral fellow, Quantitative life sciences, McGill Universisty, Montreal, Canada
Amit Kumar (IOP Bhubaneswar)	Polymeric models for chromosome organization: Impact of cross-linkers, crowders and confinement	November, 2020	Postdoctoral fellow in the group of Samuel Safran at Weizmann Institute

Amir Shee (IOP Bhubaneswar)	Studies on active systems	October, 2021	Postdoctoral fellow in the group of Christian Huepe at Northwestern University

(b) ***Supervising PhD Theses*** **:**

1. ***Arpan Sinha*** joined my group in August, 2019. He is working on collective behavior of active particles, particularly studying active apolar particles with nematic alignment.

2. ***Chitrak Karan*** joined my group in August, 2019. He is working on active polymers, particularly focussing on filaments driven by motor proteins, active loop extrusion in chromosomes, loop formation by Ftsz.

3. ***Manish Patel*** joined my group in January, 2022. He is working on dynamics of inertial active particles in arbitrary dimensions.

(c) ***Supervising postdocs :*** ***Dr. Biplab Bhattacharjee***, worked on active colloids in our group at IOP up to September, 2020, before moving to RIKEN-Japan for his next postdoc. ***Dr. Subhendu Khali*** started as a postdoc at the end of January, 2021.

(f) Teaching

- "Advanced Statistical Mechanics" to PhD students at IOP-Bhubaneswar, 2017, 2018, 2021, 2022.
- "Soft and active matter" to PhD students at IOP-Bhubaneswar, 2019.
- "Thermodynamics" to Engineering Physics B.Tech students in spring 2016.
- "Statistical Physics" and "Analytical Dynamics" to M.Sc. Physics students at IIT-H in *spring semester 2015*.
- "*Statistical Mechanics*" to M.Sc. Physics students at IIT-H in *spring semesters* 2013, 2014.
- "*Classical Mechanics*" to M.Sc. Physics students at IIT-H in *fall semesters* 2012, 2013.
- "Numerical methods" to M.Sc. Physics students at IIT-H in f*all semester* 2013, and s*pring semester* 2014.
- "*Classical Electrodynamics*" to a combined batch of 160 1st year B.Tech. students of IIT-Hyderabad, in the *spring-semester* 2012.

Publications

Citation metrics: (http://scholar.google.co.in/)

• Over 671 citations. • h-index = 16 • i10-index = 23 Journals:

1. "Extension and dynamical phases in random walkers depositing and following chemical trails" S S Khutia, A. Chaudhuri, **DC,** arXiv:2202.00366
2. "Active Brownian motion with speed fluctuations in arbitrary dimensions: exact calculation of moments and dynamical crossovers", A. Shee, **DC**, *J. Stat. Mech. Theory Exp.* **2022**, 013201 (2022).
3. "Self-propulsion with speed and orientation fluctuation: exact computation of moments and dynamical bistabilities in displacement", A. Shee, **DC**, arXiv:2112.13415; accepted for publication in *Phys. Rev. E* (2021).
4. "Pattern formation, pulsation and traveling wave on active spherical membranes", S Ghosh, S Gutti, **DC,** *Soft Matter* **17,** 10614 (2021).
5. "Filament-motor protein system under loading: instability and limit cycle oscillations", A Shee, S Ghosh, **DC,** *Soft Materials* **19**, 323 (2021).
6. "Two step melting of the Weeks-Chandler-Anderson system in two dimensions", S S Khali, D

Chakraborty, **DC,** *Soft Matter* **17**, 3473 (2021).

7. "Active Brownian particle in harmonic trap: exact computation of moments, and re-entrant transition", **DC**, A Dhar, *J. Stat. Mech.: Theor Expt* ***2021***, 13207 (2021).
8. "Semiflexible polymer in a gliding assay: reentrant transition, role of turnover and activity", A Shee,N Gupta, A Chaudhuri, **DC,** *Soft Matter* **17**, 2120 (2020).
9. "Active Brownian particles: mapping to equilibrium polymers and exact computation of moments", A Shee, A Dhar, **DC**, *Soft Matter* **16,** 4776 (2020).
10. "Impact of crowders on the morphology of bacterial chromosome", A Kumar, P Swain, B M Mulder, **DC** *EuroPhysics Letters* **128,** 68003 (2020).
11. "Structure-dynamics relationship in ratcheted colloids: Resonance melting, dislocations, and defect clusters", S S Khali, D Chakraborty, **DC,** *Soft Matter* **16**, 2552 (2020).
12. "Re-entrant motility induced phase separation in nematically aligning active polar particles", B Bhattacherjee, **DC,** *Soft Matter* ***15,*** 8483 (2019).
13. "Cell Boundary Confinement Sets the Size and Position of the E. coli Chromosome", F Wu, P Swain,L Kuijpers, X Zheng, K Felter, M Guurink, J Solari, S Jun,T S Shimizu, **DC**, B M Mulder, C Dekker, *Current Biology* ***29***, 2131 (2019).
14. "Cross-linker mediated compaction and local morphologies in a model chromosome", A Kumar, **DC,** *Journal of Physics: Condensed Matter* **31,** 354001 (2019).
15. "Morphological and dynamical properties of semiflexible filaments driven by molecular motors", N Gupta, A Chaudhuri, **DC,** *Phys. Rev. E* ***99,*** 42405 (2019).
16. "Confinement and crowding control the morphology and dynamics of a model bacterial chromosome", P Swain, B M Mulder, **DC,** *Soft Matter* ***15,*** 2677 (2019).
17. "Bidirectional motion of filaments: Role of motor proteins and passive cross linkers", S Ghosh, VNS Pradeep, S Muhuri, I Pagonabarraga, **DC,** *Soft Matter* ***13,*** 7129 (2017).
18. "Rotational Brownian motion: Trajectory, reversibility and stochastic entropy", S Bandopadhyay, A M Jayannavar, **DC,** *J.Stat.Phys* **168,** 549 (2017*)*.
19. "Entropy production by active particles: Coupling of odd and even functions of velocity", **DC,** *Phys. Rev. E* **94,** 32603 (2016).
20. "Forced desorption of semiflexible polymers, adsorbed and driven by molecular motors", A Chaudhuri, **DC,** *Soft Matter* ***12,*** 2157 (2015).
21. "Macrospin in external magnetic field: Entropy production and fluctuation theorems", S Bandopadhyay, **DC**, A M Jayannavar, *J. Stat. Mech.: Thoer. Expt* ***2015,*** P11002 (2015).
22. "Stochastic thermodynamics of macrospins with fluctuating amplitude and direction", S Bandopadhyay, **DC**, A M Jayannavar, *Phys. Rev. E* ***92,*** 32143 (2015).

23. "Absence of jamming in ant trails: Feedback control of self propulsion and noise", **DC**, A Nagar, *Phys. Rev. E* ***91***, 12706 (2015).

24. "Pumpingsingle-filecolloids:Absenceofcurrentreversal", **DC,**ARaju,ADhar,*Phys.Rev.E- Rapid Comm* **91,** 050103 (R) (2015).

25. "Stochastic ratcheting of two dimensional colloids: Directed current and dynamical transitions", D Chakraborty, **DC,** *Phys. Rev. E - Rapid Comm*. **91,** 050301 (R) (2015).
26. "Active Brownian particles: Entropy production and fluctuation-response", **DC**, *Phys. Rev. E* ***90***, 22131 (2014).
27. "Stochastic thermodynamics of active Brownian particles", C Ganguly, **DC,** *Phys. Rev. E* ***88***, 32102 (2013).
28. "Spontaneous helicity of a polymer with side-loops confined to a cylinder", **DC,** B M Mulder, *Phys.*

Rev. Lett. ***108***, 268305 (2012).

29. "Modified fluctuation-dissipation and Einstein relation at nonequilibrium steady states", **DC,** A Chaudhuri, *Phys. Rev. E* ***85,*** 21102 (2012).
30. "A model of fasciculation and sorting in mixed population of axons", **DC,** P Borowski, and M Zapotocky, *Phys. Rev. E* ***84,*** 21908 (2011).
31. "Stochastic pump of interacting particles", **DC** and A Dhar, *Europhys. Lett.* ***94,*** 30006 (2011).
32. "Bimodal response in periodically driven diffusive systems", U Basu, **DC**, P K Mohanty, *Phys. Rev. E* ***83,*** 31115 (2011).
33. "On the size and shape of excluded volume polymers confined between parallel plates", **DC,** B M Mulder, *Phys. Rev. E* ***83,*** 31803 (2011).
34. "A comparative study of two phenomenological models of dephasing in series and parallel resistors", S Bandopadhyay, **DC** and A M Jayannavar, *Phys. Lett. A* ***374,*** 813 (2010).
35. "Dynamics of path aggregation in the presence of turnover", **DC,** P Borowski, P K Mohanty and M Zapotocky, *Europhys. Lett.* ***87,*** 20003 (2009).
36. "Anomalous structural and mechanical properties of solids confined in quasi one dimensional strips", **DC**, S Sengupta, *J. Chem. Phys.****128,*** 194702 (2008).
37. "Fluctuations at a Constrained Liquid-Solid Interface", A Chaudhuri, **DC,** S Sengupta, *Phys. Rev. E* ***76,*** 21603 (2007*)*.
38. "Heat conduction through a trapped solid: Effect of structural changes on thermal conductance", **DC,** A Chaudhuri**,** S Sengupta, *J. Phys.: Condens. Matter* **19,** 152201 (2007*)*.
39. "Semiflexible polymers: Dependence on ensemble and boundary orientations", **DC,** *Phys. Rev. E* **75,** 21803 (2007).
40. "Heat conduction in confined solid strip: Response to external strain", **DC**, A Dhar, *Phys. Rev. E* **74,** 16114 (2006).
41. "Electrical transport in deformed nanostrips: Electrical signature of reversible mechanical failure", S Datta, **DC**, T Saha-Dasgupta, S Sengupta, *Europhys. Lett.* ***73,*** 765 (2006).
42. "Direct test of defect mediated laser induced melting theory for two dimensional solids", **DC,** S Sengupta, *Phys. Rev. E* **73,** 11507 (2006).
43. "Constrained Deformation of a Confined Solid: Anomalous Failure by Nucleation of Smectic Bands", **DC,** S Sengupta, *Phys. Rev. Lett.* **93,** 115702 (2004).
44. "A numerical renormalization group study of laser-induced freezing", **DC,** S Sengupta, *Europhys. Lett.***67,** 814 (2004); "Erratum: A numerical renormalization group study of laser- induced freezing", **DC,** S Sengupta, *Europhys. Lett.***68,** 160 (2004).
45. "Triple Minima in the Free Energy of Semiflexible Polymers", A Dhar, **DC,** *Phys. Rev. Lett.* **89,** 65502 (2004).

Conference proceedings:

1. "Stochastic models of classical particle pumps: Density dependence of directed current", **DC,** *J. Phys: Conference series* **638,** 12011 (2015).
2. "Induced interfaces at nano-scales: structure and dynamics", A Chaudhuri, **DC** and S Sengupta, *International Journal of Nanoscience* ***4,*** 995 (2005).

3. "Mechanical Failure of a Small and Confined Solid", **DC** and S Sengupta, *Indian Journal of Physics* **79,** 941 (2005).
4. "Elastic properties, structures and phase transitions in model colloids", P. Nielaba, K. Binder, **DC**, K. Franzrahe, P. Henseler, M. Lohrer, A. Ricci, S. Sengupta, and W.Strepp, *J. Phys.: Condens. Matter* **16,** S4115 (2004).

Book Chapters:

"Molecular dynamics simulations of a feather-boa model of a bacterial chromosome", in Springer Protocols on "Bacterial Chromatin", edited by Remus T. Dame., **D Chaudhuri** and B M Mulder, Springer (2018).