

CURRICULUM VITAE

Name: Tapati Dutta

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Date of superannuation: 25.4.2024

Designation: Associate Professor; Dean of Science; Ph.D. Coordinator

Official Address: Physics Department, St. Xavier's College(Autonomous), 30. Mother Teresa Sarani,; Kolkata 700016, India.

Membership in scientific bodies:

1. Condensed Matter Physics Research Centre , Jadavpur University
2. Indian Society of Non-linear Analysis, Registration Number : S/98686 of 2000-2001.

Academic Record:

Class	Year	Institution	Subject
UG	1985	Bethune College, Calcutta University	Physics (Major)
PG	1988	Calcutta University	Physics
Ph.D	1995	Jadavpur University	Physics

- Have been doing research since 1990

Field of Specialization: Condensed Matter Physics

Publications:

Refereed Journals:71

Books:2

(see annexure for list)

Ph.D Guidance of students:

Completed:7

Continuing Ph.D research:5

Current Areas of Interest:

1. Pattern Formation: Crack patterns in desiccating clay, Viscous fingering, Pattern formation in drying droplets with salt admixtures
2. Porous media; sedimentary rocks and their transport properties
3. Computational Fluid flow
4. Biofilms: viscoelastic properties, transport

5. **Significant Research accomplishments:**

- Study of porous media e.g. sedimentary rocks- developed a simulated model (Relaxed Bidisperse Ballistic Deposition Model) for sedimentary rocks; studied microstructure quantization and its link with transport property – namely, electrical conductivity, permeability.
- Developed a model for reactive flow through sedimentary rocks and its effect on dynamic evolution of the pore and transport properties of rocks.
- Studied pattern formation in the desiccation of colloidal solution, namely aqueous solution of Laponite, through experiments and modelling.
- Studied effect of composites, namely polymer-clay, in the development of desiccation cracks with a view on crack prevention, effect on manner of crack development in the form of a complete peel-off from the substrate or crack through body of material. The study was done through experiments and modelling.
- Controlling desiccation crack pattern in colloidal solutions by the application of electric field- both direct current (DC) and alternating current (AC) fields. Both experimental and simulation studies using spring network models have been done.
- Studying evaporating droplets of complex fluids in salt admixtures on different horizontal surfaces through experiments and modelling. The focus is to understand the underlying mass transfer processes that result in interesting patterns on desiccation. Depending on the complex liquid-substrate combination, the droplets may develop crack patterns too.
- Using fractals and multifractal tools to study mass distribution of particles in a complex system in any dimension.

Projects: (As PI or co-PI)

National: 2 (1 UGC, 1 DST)

International: 2 (1 CEFIPRA, 1 INDO-JAPAN)

Annexure

List of Publications:

1. Phenomenological model for the unified studies of different physical properties of polymers, Tapati Dutta, Prabir Kumar Biswas, *Angewandte Makromolekulare Chemie* 207(1) · April 1993, DOI:10.1002/apmc.1993.052070102.
2. Bounds on the effective thermal-expansion coefficient of a polycrystalline aggregate, Asis Kumar Ghorai, Tapati Dutta, *Journal of Applied Physics* 78(4):2349-2354 · August 1995, Impact Factor: 2.18 · DOI: 10.1063/1.360154
3. Effective medium theory for ionic conductivity of insulator dispersed composite electrolytes. A.J. Bhattacharyya, T. Dutta, S. Roy, S.Tarafdar and T.R. Middy, *Mater. Sci. forum*, 223{224, 279}, 1996.
4. Green function calculation of effective elastic constants of textured polycrystalline materials, Tapati Dutta, Tapas Kumar Ballabh, T R Middy, *Journal of Physics D Applied Physics*, 26(4):667, Impact Factor: 2.72 · DOI: 10.1088/0022-3727/26/4/020, December 1998 ·
5. Self-organized critical dynamics of a directed bond percolation model, Subhankar Ray, , Tapati Dutta, Jaya Shamanna, *Physics Letters A*, Volume 243, Issues 1–2, 15 June 1998, Pages 20-24

6. A perturbation calculation for the elastic constants of anisotropic drawn polymers, Tapati Dutta, Tapas Kumar Ballabh, T R Middy, Journal of Physics D Applied Physics 28(7):1521 · January 1999
Impact Factor: 2.72 · DOI: 10.1088/0022-3727/28/7/034
7. A Percolation Model of Diagenesis S S Manna, T Datta, R Karmakar and S Tarafdar, Int. J. Mod. Phys. C, 13, (2002), 319
8. Condensation and evaporation on a randomly occupied square lattice, T Dutta, N I Lebovka and S Tarafdar, Phys Rev. E, (2002) 046104.
9. Simulation of Hierarchical Viscous Fingering Pattern in Lifting Hele-Shaw Cell, Tapati Dutta, S Kabiraj, Sujata Tarafdar, arxiv.org/abs/cond-mat/0212544v1, 21 December, 2002.
10. A geometrical model of diagenesis using percolation theory, Ritanjali Karmakar, Subhrangshu Sekhar Manna, Tapati Dutta, Physica A: Statistical Mechanics and its Applications, 318:113, February 2003, Impact Factor: 1.73 · DOI: 10.1016/S0378-4371(02)01413-9
11. Fractal pore structure of sedimentary rocks: simulation by ballistic Deposition, T Dutta and S Tarafdar, J. Geophys. Res.108, 2062 (2003)
12. Radially interrupted viscous fingers in a lifting Hele-Shaw Cell, S Sinha, S K Kabiraj, T Dutta, S Tarafdar Eur. Phys. J B 36, 297 (2003)
13. Three-dimensional viscous fingering patterns in a lifting Hele-Shaw cell: A simulation study, Tapati Dutta, S K Kabiraj and S Tarafdar, Indian J. Phys. 78, 455 (2004)
14. Condensation and evaporation of mutually repelling particles: steady states and limit cycles, T Dutta, N Lebovka, S Tarafdar Phys. Rev. E 70 061609 (2004)
15. Effect of surface roughness on the bulk properties of simulated porous media R Karmakar, T Dutta, N I Lebovka, S Tarafdar Physica A, 348, 236 (2005)
16. Simulation of sedimentary rocks by ballistic deposition, T Dutta and S Tarafdar Proc. 9th World Multiconference on Systemics, cybernetics and informatics, July 10-13, 2005, at Orlando, Florida, pg 151
17. Condensation and evaporation on a randomly occupied square lattice: attracting and repelling particles, S Tarafdar, N I Lebovka and T Dutta Proc. 9th World Multi-conference on Systemics, cybernetics and informatics, July 10-13, 2005, at Orlando, Florida, pg 161
18. The coastline and lake shores on a fractal island, P Blaudeck, S Seeger, C Schulzsky, K H Hoffmann, T Dutta and S Tarafdar J. Phys A: Math. Gen. 39, 1609 (2006)
19. Fractal crack patterns in laponite films and their scaling behaviour, D Mal, S Sinha, T Dutta, S Mitra and S Tarafdar Fractals 14 (2006) 283-288.
20. Simulation of diagenesis and permeability variation in two-dimensional rock structure, S Sadhukhan, T Dutta, S Tarafdar Geophys. J. Int. 169 (2007) 1366
21. Desiccation cracks on different substrates: simulation by a spring network model S Sadhukhan, S Roy Majumder, D Mal, T Dutta, S Tarafdar J. Phys. Cond. Mat. 19 (2007) 356206
22. Pore structure and conductivity modelled by bidisperse ballistic deposition with relaxation, S Sadhukhan, T Dutta, S Tarafdar, Modelling Simul. Mater. Sci. Eng. 15 (2007) 773
23. Formation of Crack Patterns in Clay Films: Desiccation and Relaxation, Dibyendu Mal, Suparna Dutta Sinha, Tapati Dutta, and Sujata Tarafdar, Journal of the Physical Society of Japan, 76(1) · January 2007, Impact Factor: 1.59 · DOI: 10.1143/JPSJ.76.014801
24. Adhesion and fingering in the lifting Hele-Shaw cell: Role of the substrate, Suparna Sinha, Tapati Dutta and Sujata Tarafdar, Eur. Phys. J, E 25 (2008) 267
25. Chaotic behaviour of population on a square lattice, Tapati Dutta, Sujata Tarafdar, Ind. J. Phys.82 (2008) 201
26. Permeability variation with fracture dissolution: Role of diffusion vs. drift, Supti Sadhukhana, Dibendyu Mal, Tapati Dutta, S. Tarafdar, Physica A 387 (2008) 4541

27. Desiccation of a clay film: cracking versus peeling, S Sadhukhan, J Prehl, P Blaudeck, K H Hoffmann, T Dutta, S Tarafdar, *Eur. Phys. J. E*, 27 (2008) 391
28. Scaling laws for spreading of a liquid under pressure Nag, S., Dutta, S., Tarafdar, S. 2009 *Applied Surface Science* 256 (2), pp. 353-355
29. Computer simulation of viscous fingering in a lifting Hele-Shaw cell with grooved plates Tarafdar, S., Nag, S., Dutta, T., Sinha, S. 2009 *Pramana - Journal of Physics* 73 (4), pp. 743-754
30. Fingering and pressure distribution in lifting Hele-Shaw cells with grooves: A computer simulation study Tarafdar, S., Sinha, S., Nag, S., Dutta, T. 2009 *Physical Review E - Statistical, Nonlinear, and Soft Matter Physics* 80 (2), art. no. 026315
31. Crack patterns in desiccating clay-polymer mixtures with varying composition Nag, S., Sinha, S., Sadhukhan, S., Dutta, T., Tarafdar, S. 2010 *Journal of Physics Condensed Matter* 22 (1), art. no. 015402
32. Crack formation in composites through a spring model Supti Sadhukhan, Tapati Dutta, Sujata Tarafdar, *Physica A* 390 (2011) 731-740
33. Spreading of fluids on solids under pressure: Slip and stick effects, Soma Nag, Tapati Dutta, Sujata Tarafdar, *J. Coll. Interface sci.* 35(2011) 293-297
34. Spreading of Non-Newtonian and Newtonian Fluids on a Solid Substrate Under Pressure, M. Dutta Choudhury, S. Chandra, S. Nag, S. Das, S. Tarafdar, *J. Phys. Conf. Series* 319 (2011) 012006
35. Electric-field-induced crack patterns: Experiments and simulation, Tajkera Khatun, Moutushi Dutta Choudhury, Tapati Dutta, Sujata Tarafdar, *Phys. Rev. E* 86 (2012), 016114
36. Fractal pore structure of sedimentary rocks: Simulation in 2-d using a Relaxed Bidisperse Ballistic Deposition Model A Giri, S Tarafdar, P Gouze, T Dutta - *Journal of Applied Geophysics*, 87 (2012) 40-45
37. Sadhukhan S., Gouze P., Dutta T. Porosity and permeability changes in sedimentary rocks induced by injection of reactive fluid: A simulation model // *Journal of Hydrology*. 2012. Vol. 450-451. P. 134–139
38. Multifractal Growth of Crystalline NaCl Aggregates in a Gelatin Medium, Abhra Giri, Moutushi Dutta Choudhury Tapati Dutta and Sujata Tarafdar, *Cryst. Growth Des.*, 13, pp 341-345 (2013)
39. Fractal geometry of sedimentary rocks: Simulation in 3D using a Relaxed Bidisperse Ballistic Deposition Model, A Giri, S Tarafdar, P Gouze, T Dutta, *Geophysical Journal International* (doi: 10.1093/gji/ggs084,2012)
40. Experiment and simulation of multifractal growth of crystalline NaCl aggregates in aqueous gelatin medium, T Dutta, A Giri, M Dutta Choudhury, S Tarafdar, *Colloids and Surfaces A: Physico chem. Eng. Aspects* 432 (2013) 127131
41. Pattern formation in droplets of starch gels containing NaCl dried on different surfaces, M Dutta Choudhury, T Dutta, S Tarafdar, *Colloids and Surfaces A: Physico chem. Eng. Aspects* 432 (2013) 110118
42. Crack formation in Laponite gel under AC fields, Tajkera Khatun, Tapati Dutta, Sujata Tarafdar, *Applied Clay Science* 86 (2013) 125128
43. Crack Formation under an Electric Field in Droplets of Laponite Gel: Memory Effect and Scaling Relations, Tajkera Khatun, Tapati Dutta, Sujata Tarafdar, *Langmuir*, 29, 15535-15542 dx.doi.org/10.1021/la404297k (2013)
44. Competition between cracking and peeling in composites: a simulation in 2-d, Tapati Dutta, Sujata Tarafdar, *J Mater Sci* DOI 10.1007/s10853-014-8456-0 (2014)
45. Crack Formation on a Drying Droplet in the Presence of Static Electric Field, T. Khatun, T. Dutta and S. Tarafdar, *J. Surface Sci. Technol.*, Vol 30, No. 1-2, pp. 17-33, (2014)
46. . Sadhukhan S., Gouze P., Dutta T. A simulation study of reactive flow in 2-D involving dissolution and precipitation in sedimentary rocks // *Journal of Hydrology*. 2014. Vol. 519, no. PB. P. 2101–2110

47. Topology of desiccation crack patterns in clay and invariance of crack interface area with thickness, Tajkera Khatun, Tapati Dutta, and Sujata Tarafdar, *Eur. Phys. J. E* (2015) 38, 83
48. Growth kinetics of NaCl crystals in a drying drop of gelatin: transition from faceted to dendritic growth, Moutushi Dutta Choudhury, Tapati Dutta and Sujata Tarafdar, *Soft Matter*, (2015), 11, 6938 – 6947
49. Multi-scale patterns formed by sodium sulphate in a drying droplet of gelatin, Biswajit Roy, Moutushi Dutta Choudhuri, Tapati Dutta, Sujata Tarafdar, *Applied Surface Science* 357 (2015) 10001006
50. Multifractal analysis of the pore space of real and simulated sedimentary rocks, Abhra Giri, Sujata Tarafdar, Philippe Gouze and Tapati Dutta, *Geophys. J. Int.* (2015) **200**, 1108–1117
51. Alternating Field Induced Crack Patterns in Desiccating Colloidal Solutions: Experiment and Simulation, Sudeshna Sarkar, Tajkera Khatun, Tapati Dutta and Sujata Tarafdar, *Indian J Phys* DOI 10.1007/s12648-016-0886-x 2016.
52. Unstable crack propagation in Laponite gels: selection of a sinusoidal mode in an electric field, Sudeshna Sarkar, Tajkera Khatun, Tapati Dutta and Sujata Tarafdar, Somasri Hazra, Sudeshna Sircar, Tajkera Khatun, Moutushi Dutta Choudhury, Abhra Giri, Sanat Karmakar, Tapati Dutta, Shantanu Das and Sujata Tarafdar, *RSC Adv.*, 2016, 6, 64297
53. Pattern formation in desiccated sessile colloidal droplets with salt admixture: Short Review, Yuri.Y.Tarasevich, Sujata Tarafdar, Tapati Dutta, arXiv:1611.00882 [cond-mat.soft]
54. Identifying 'Island-Mainland' phase transition using the Euler number, Tajkera Khatun, Tapati Dutta, Sujata Tarafdar, arXiv:1612.04522 [cond-mat.stat-mech]
55. Unstable crack propagation in Laponite gels: Selection of a sinusoidal mode in an electric field; Electronic Supplementary material for *RCS Advances*, The Royal Society of Chemistry, 2016
56. Cover page of *EPJE*, *Soft Matter* and *Biological Physics*, volume 38, number 8, august, 2015
57. A Study of the Rheological Properties of Visco-elastic Materials Using Fractional Calculus, Simantini Majumdar, Somasri Hazra, Moutushi Dutta Choudhurya, Suparna Dutta Sinha, Shantanu Das, Tapas Ranjan Middy, Sujata Tarafdar, Tapati Dutta, *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, Accepted manuscript (unedited version) available online: 16-DEC-2016, DOI information: 10.1016/j.colsurfa.2016.12.019
58. Memory of Electric Field in Laponite and How It Affects Crack Formation: Modeling through Generalized Calculus(Article) Hazra, S., Dutta, T., Das, S., Tarafdar, S, *Langmuir*, Volume 33, Issue 34, 29 August 2017, Pages 8468-8475
59. 'Islands in Sea' and 'Lakes in Mainland' phases and related transitions simulated on a square lattice, Tajkera Khatun, Tapati Dutta, S. Tarafdar, *Eur. Phys. J. B* (2017) 90: 213 DOI: 10.1140/epjb/e2017-80365-3
60. Droplet Drying Patterns on Solid Substrates: From Hydrophilic to Superhydrophobic Contact to Levitating Drops, Sujata Tarafdar • Yuri Yu Tarasevich • Moutushi Dutta Choudhury • Tapati Dutta • Duyang Zang, *Advances in Condensed Matter Physics*, Published on 01 Jan 2018, doi: 10.1155/2018/5214924
61. Multi-scale patterns formed by sodium sulphate in a drying droplet of gelatin: experiment and simulation in 2-dimensions; Tapati Dutta, Sujata Tarafdar and Tajkera Khatun; 2018 *J. Phys. Commun.* <https://doi.org/10.1088/2399-6528/aac341>
62. Existence of convective threshold and its role on temperature inreactive flow through fractured rocks: a simulation study in 2D, S Sadhukhan and T Dutta, *J. Phys. Commun.* 2 (2018) 045033, doi.org/10.1088/2399-6528/aab5a8
63. An insight into Newton's cooling law using fractional calculus, Adreja Mondol, Rivu Gupta, Shantanu Das, and Tapati Dutta, *Journal of Applied Physics* 123, 064901 (2018);, doi.org/10.1063/1.4998236
64. Crack formation in desiccating Laponite® films under AC field: Effect of varying frequency, Sudeshna Sircara, Sujata Tarafdar, Tapati Dutta, *Applied Clay Science* 156 (2018) 69–76

65. Multi-scale patterns formed by sodium sulphate in a drying droplet of gelatin: experiment and simulation in 2-dimensions, Tapati Dutta, Sujata Tarafdar and Tajkera Khatun, 2018 *J. Phys. Commun.* in press <https://doi.org/10.1088/2399-6528/aac341>
66. Crack patterns in drying Laponite®- NaCl suspension : Role of the substrate and a static electric field" Author(s): Sircar, Sudeshna; Dutta Choudhury, Moutushi; Karmakar, Sanat; Tarafdar, Sujata; Dutta, Tapati,, Langmuir, MANUSCRIPT NUMBER: la-2018-00501q.R1, Accepted on 11.5.2018
67. Formation of desiccation crack patterns in electric fields: a review, Sujata Tarafdar, Tapati Dutta, Phil. Trans. R. Soc. A 2019 377 20170398; DOI: 10.1098/rsta.2017.0398. Published 26 November 2018,
68. **Tree-like Crack Patterns in Clay Dried in a Uniform DC Electric Field" by Ghosh, Ankita; Sircar, Sudeshna; KHATUN, TAJKERA; Dutta, Tapati; Tarafdar, Sujata, Materials Research Express, <https://dx.doi.org/10.1088/2053-1591/aaed0b>**
69. A spring network simulation in 3 dimensions for designing optimal crack pattern template to fabricate transparent conducting electrodes. by Supti sadhukhan, Ankush Kumar, Giridhar Kulkarni, Sujata Tarafdar and Tapati Dutta, accepted for publication in Bulletin of Materials Science, 12th December, 2018.
70. Droplet Drying Patterns on Solid Substrates: From Hydrophilic to Superhydrophobic Contact to Levitating Drops: Sujata Tarafdar , Yuri Yu. Tarasevich, Moutushi Dutta Choudhury, Tapati Dutta, and Duyang Zang, Hindawi, Advances in Condensed Matter Physics, Volume 2018, Article ID 5214924, 24 pages, <https://doi.org/10.1155/2018/5214924>
71. Evaporation of a Droplet: From physics to applications Duyang Zang , Sujata Tarafdar , Yuri Yu. Tarasevich , Moutushi Dutta Choudhury, Tapati Dutta , Physics Reports (2019), <https://doi.org/10.1016/j.physrep.2019.01.008>.

Book

1. Effect of Chemical Kinetics on the Permeability of a Porous Rock: Scaling by Concentration of Active Fluid, **T. Dutta**, S. Sadhukhan and S. Tarafdar in *Dynamical Systems and Methods*, ed. A.C.J. Luo, J.A.T. Machado and D. Baleanu (Springer, New York, 2012) ISBN 978-1-4614-04538
2. Desiccation Cracks and their Patterns: Formation and Modelling in Science and Nature, Lucas Goehring, Akio Nakahara, Tapati Dutta, So Kitsunezaki, Sujata Tarafdar ISBN: 978-3-527-41213-6, Wiley-VCH(2015)

Conferences:

Invited Talks:

- i. Dimensions and Fractals, Invited Talk at Condensed Matter Research Centre, Jadavpur University, on 13th December, 2018.
- ii. Island-Mainland transition in simulation of patterns in a drying droplet, 23rd February, 2018, Invited lecture at Acharya Bhavan,, organised by Sir J C Bose trust and Calcutta University Press, Kolkata .
- iii. Multi-scale patterns formed by Sodium Sulphate in a drying droplet of Gelatin: Experiment and simulation , 17-19 February 2017, Indian Statistical Physics Community Meeting 2017, Bangalore, India
- iv. Multi-scale patterns formed by Sodium Sulphate in a Drying Drop of gelatin: Experiment

- and Simulation, MicroMAST2016, 1st International Conference on Multiscale Applications of Surface Tension, 4-8th September, 2016Brussels, Belgium
- v. Pattern Formation, 'Indian Statistical Physics Community Meeting' held in ICTS campus, Bangalore, India from February 17-19, 2017.
 - vi. A Simulation Study of reactive flow in 2-D involving dissolution and precipitation in Sedimentary Rocks, International Conference on Numerical and Mathematical Modeling of Flow and Transport in Porous Media (NM2PorousMedia-2014), Dubrovnik, Croatia, 29 September-3 October 2014.
 - vii. Cracking and peeling in composites: A simulation in 2-d , 7th International Conference on Fracture of Polymers, Composites and Adhesives, 14-18th September, 2014, Les Diablerets, Switzerland

Organised:

- i. Joint Convenor of National Summer School on Statistical Physics 2018, titled "Introducing Research Topics of Statistical Physics to Young Physicists", 4 - 15 June, 2018, organised jointly by Satyendra Nath Bose National Centre for Basic Sciences, Saha Institute of Nuclear Physics, Physics Department, Jadavpur University, Physics Department, St. Xavier's College, Kolkata,