

## Dr. Amit Kumar Bhattacharjee

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### CONTACT INFORMATION

Department of Physics,  
Asutosh College,  
92 S.P.Mukherjee Road,  
Kolkata 700 026, India.

*Tel:* +91 (033) 2455-4504  
*Fax:* +91 (033) 248-3006  
*E-mail:* a.k.bhattacharjee@gmail.com  
*Home:* <https://amitbny.github.io/akb.github.io>

### EDUCATION

- Ph.D. (Theoretical Physics), **Institute of Mathematical Sciences**, Chennai, India ('04-'10)  
[Registered: 01/09/06, Submitted: 28/02/10, Defended: 05/12/11, Awarded: 15/02/13].
- M.Sc. (Physics), **Indian Institute of Technology**, Kharagpur, India ('02-'04).
- B.Sc. (Physics Honours), **B.B. College**, University of Burdwan, India ('99-'02).
- $X^{th}$  &  $XII^{th}$ , DVC HS School, **W.B.B.S.E.** & **W.B.C.H.S.E.**, India ('97,'99).

### PROFESSIONAL EXPERIENCE

- Assistant Professor, **Asutosh College**, Kolkata, India ('17 onwards).
- DST-INSPIRE Faculty, **Asutosh College**, Kolkata ('17-'20) & **Indian Institute of Science**, Bangalore, India ('15-'17).
- Visiting Researcher, **Institute of Mathematical Sciences**, Chennai, India ('15, 3 months).
- Assistant Researcher in **Applied Mathematics**, **Courant Institute**, New York, USA ('13-'15).
- Helmholtz-University Young Investigator, **University of Konstanz**, Germany ('12-'13).
- DLR-DAAD Post Doctoral Fellow, **German Aerospace Center** Köln, Germany ('10-'12).

### HONOURS AND AWARDS

- Ranked 6<sup>th</sup> in **College Service Examination**, West Bengal State ('17).
- Work featured in **Science Letter**: “**Researchers from IISc report findings in Science**” ('17),
- Awarded **DST-INSPIRE Faculty** from **INSA-DST**, Govt. of India ('15-'20).
- Work selected for “**Francois Naftali Frenkiel Award**” by *Physics of Fluids* ('15) & featured in *Phys.org* highlighting “**Mathematicians model fluids at the mesoscale**”.
- **Research Scientist**, Courant Institute of Math. Sciences, New York University, USA ('13).
- Work selected for “**Special Topics in Glass Transition**” issue by *J. Chem. Phys.* ('13).
- **Helmholtz-University Young Investigator** at University of Konstanz, Germany ('12).
- **DLR-DAAD** award from German Aerospace Centre Köln, Germany ('10).
- All India rank 128<sup>th</sup> in **Joint Entrance Screening Test [JEST]** ('04).
- All India rank 117<sup>th</sup> (95.79%) in **Graduate Aptitude Test in Engineering [GATE]** ('04).
- Awarded CSIR-JRF & LS in **Joint CSIR-UGC JRF (NET) & LS**, Govt. of India ('04).
- **DST-Summer Research** fellow at SN Bose National Centre for Basic Science, India ('03).
- **National Scholarship** from **Department of Education**, Govt. of India ('03).
- All India rank 6<sup>th</sup> in **M.Sc. Entrance Test**, IIT Kharagpur ('02).
- “**University Silver Medal**”, B.Sc. 2<sup>nd</sup> rank in **University of Burdwan**, India ('02).
- DVC 1<sup>st</sup> prize for performance in  $XII^{th}$  Board Examination, **WBCHSE**, India ('99).
- DVC 2<sup>nd</sup> prize for **outstanding** performance in  $X^{th}$  Board Examination, **WBBSE**, India ('97).

### RESEARCH EXPERTISE

**Soft Condensed Matter Theory & Computation:** (a) **Field theoretic methods** ( $\mu\text{m-m}, \mu\text{s-hr}$ ): (i) Fluctuating hydrodynamics with Projection methods, (ii) hybrid Lattice-Boltzmann method, (iii) Landau-de Gennes energy landscape method, (b) **Particle based methods** (pm-nm, ps-ns): (iv) Molecular dynamics simulation, (v) Kinetic monte carlo methods, (c) **Multiscale methods**: (vi) Dissipative particle dynamics simulations, (vii) High performance computation (HPC).

PEER REVIEWED  
PUBLICATIONS  
[h-index: 7,  
i10-index: 6,  
Citations: 148,  
Scopus ID:  
56556042400,  
ORCID ID: 0000-  
0002-1475-743X,  
Web of Science  
ResearcherID:  
AAB-1030-2020]

### LIQUID CRYSTALS :

- **A.K. Bhattacharjee.** Controlling motile disclinations in a thick nematogenic material with an electric field, *Scientific Reports*, **8**, 2517 (2018), [citation:**0**, pages:18, ISSN:2045-2322, IF:4.259].
- **A.K. Bhattacharjee.** Stochastic kinetics reveal imperative role of anisotropic interfacial tension to determine morphology and evolution of nucleated droplets in nematogenic films, *Scientific Reports*, **7**, 40059 (2017), (Highlighted in “**Review Article**” and featured in “**Science Letter**”), [citation:**5**, pages:17, ISSN:2045-2322, IF:4.259].
- **A.K. Bhattacharjee.** Inhomogeneous Phenomena in Nematic Liquid Crystals, *Homi Bhabha National Institute* (2013), [citation:**3**, pages:124, PhD Thesis].
- **A.K. Bhattacharjee**, Gautam I. Menon and R. Adhikari. Fluctuating dynamics of nematic liquid crystals using the stochastic method of lines, *J. Chem. Phys.* **133**, 044112 (2010), [citation:**23**, pages:7, ISSN:1089-7690, IF:2.965].
- S.M. Kamil, **A.K. Bhattacharjee**, R. Adhikari and Gautam I. Menon. The isotropic-nematic interface with an oblique anchoring condition, *J. Chem. Phys.* **131**, 174701 (2009), [citation:**8**, pages:10, ISSN:1089-7690, IF:2.965].
- S.M. Kamil, **A.K. Bhattacharjee**, R. Adhikari and Gautam I. Menon. Biaxiality at the isotropic - nematic interface with planar anchoring, *Phys. Rev. E* **80**, 041705 (2009), [citation:**11**, pages:5, ISSN:2470-0053, IF:2.366].
- **A.K. Bhattacharjee**, Gautam I. Menon and R. Adhikari. Numerical method of lines for the relaxational dynamics of nematic liquid crystals, *Phys. Rev. E* **78**, 026707 (2008), [citation:**26**, pages:10, ISSN:2470-0053, IF:2.366].

### DENSE COLLOIDS :

- **A.K. Bhattacharjee.** Stress-structure relation in dense colloidal melt under forward and instantaneous reversal of shear. *Soft Matter (Royal Society of Chemistry)*, **11**, 5697 (2015), [citation:**1**, pages:8, ISSN:1744-6848, IF:3.889].
- F. Frahsa, **A.K. Bhattacharjee**, J. Horbach, M. Fuchs and Th. Voigtmann. On the Bauschinger effect in supercooled melts under shear: results from MCT and molecular dynamics simulation, *J. Chem. Phys.* **138**, 12A513 (2013), (Appeared in “**Special Topics in Glass Transition**”), [citation:**20**, pages:14, ISSN:1089-7690, IF:2.965].

### MULTISPECIES LIQUIDS & REACTIVE GASES :

- **A.K. Bhattacharjee**, K. Balakrishnan, A. L. Garcia, J.B. Bell and A. Donev. Fluctuating hydrodynamics of multispecies reactive mixtures. *J. Chem. Phys.*, **142**, 224107 (2015), [citation:**30**, pages:22, ISSN:1089-7690, IF:2.965].
- A. Donev, A.J. Nonaka, **A. K. Bhattacharjee**, A. L. Garcia and J. B. Bell. Low Mach Number Fluctuating Hydrodynamics of Multispecies Liquid Mixtures. *Physics of Fluids* **27**, 037103 (2015), (Selected for “**Francois Naftali Frenkiel Award**” and featured in “**Phys.org**”), [citation:**22**, pages:34, ISSN:1089-7666, IF:2.232].

INVITED REVIEWER

- Journal reviewer: **Soft Matter (RSC)**, **Physical Review**, **Reviews of Modern Physics**.
- Proposal reviewer of **Netherlands Organisation for Scientific Research (NWO)**.
- Editor of **Centurion Teachers Council Journal**, Asutosh College, Kolkata, India.
- Biographical interview by **Deutsche Welle** at DLR, Germany.

(a) Asutosh College, Kolkata:

2020

- **Special Relativity & Mathematical Physics III** (in Python) for  $IV^{th}$  Sem U.G. (Honours) (Spring).
- **Physical Optics (Diffraction)** for  $II^{nd}$  Sem U.G. (Honours) (Spring).

2019

- **Solid State Physics & Computer Laboratory** (in C) for  $III^{rd}$  year U.G. (Honours) (Fall).
- **Thermal Physics & Mathematical Physics II** (in Python) for  $III^{rd}$  Sem U.G. (Honours) (Fall).
- **Mechanics (Fluid Motion, Non-Inertial Systems)** for  $I^{st}$  Sem U.G. (Honours) (Fall).
- **Mechanics (Oscillations)** for  $I^{st}$  Sem U.G. (General) (Fall).
- **Physical Optics (Diffraction & Holography)** for  $II^{nd}$  Sem U.G. (Honours) (Spring).
- **Electrodynamics (Induction & Maxwell Equation)** for  $II^{nd}$  Sem U.G. (General) (Spring).

2018

- **Mechanics (Fluid Motion, Non-Inertial Systems) & Mathematical Physics I** (in Python) for  $I^{st}$  Sem U.G. (Honours), (Fall).
- **Mechanics (Oscillations & Elasticity)** for  $I^{st}$  Sem U.G. (General) (Fall).
- **Thermal Physics II** for  $II^{nd}$  year U.G. (Honours), (Fall).
- **Solid State Physics & Computer Laboratory** (in C) for  $III^{rd}$  year U.G. (Honours), (Fall).
- **Computer Laboratory** (in C) & **Communication Theory** for  $III^{rd}$  year U.G. (General) (Spring).
- **Environment and Energy** for  $II^{nd}$  Sem **(P.G. ENVS)** (Spring).
- Mentored Ph.D. student S.Anand (IISER Bhopal) in a project “Electrically Driven Droplets” (Fall).

2017

- **Thermal Physics I** for  $I^{st}$  year U.G. (Honours), (Fall).
- **Thermal Physics II** for  $II^{nd}$  year U.G. (Honours), (Fall).
- **Solid State Physics & Computer Laboratory** (in C) for  $III^{rd}$  year U.G. (Honours) (Fall).
- **Waves and Oscillations** for  $I^{st}$  year U.G. (General) (Fall).
- **Computer Laboratory** (in C) & **Communication Theory** for  $III^{rd}$  year U.G. (General) (Fall).

(b) Indian Institute of Science, Bangalore:

2016

- Mentored a Ph.D. student (Name: Pranab J. Bhuiyan) in a project “Emergent structures in colloidal membranes” (Fall).
- Mentored a Summer student (Name: Anuj Shetty, Engineering Physics, IIT Bombay) in a project “Nematic rheochaos in two spatial dimensions” (Summer).

(c) Universität Konstanz, Konstanz:

2012

- Mentored M.Sc. student Martin Evers towards “**Ausarbeitung**” in the course **Materie und Ordnung** (Spring).
- Bilingual Teaching Assistant/Grader (German & English) in the course **Classical Field Theory** (Fall).

University of Calcutta: Examiner & Scrutinier (Theory)

2020

- B.Sc. Honours Sem-III; Paper-CC6 (Thermal Physics) [E=44, S=47].

2019

- B.Sc. Honours Sem-I; Paper-1 (Math.Methods, Geom.Optics & Electronics) [E=20, S=20].
- B.Sc. General Sem-I; Paper-GE/CC-1 (Mechanics) [E=37, S=49].
- B.Sc. General Sem-II; Paper-GE/CC-2 (EM Theory) [E=11, S=16].

2018

- B.Sc. Honours  $III^{rd}$ -year; Paper-VI (Nuclear & Solid State Physics) [**E**=33, **S**=37].
- B.Sc. General  $II^{nd}$ -year; Paper-*IIIA* (Optics, Electronics, Modern Physics) [**E**=44, **S**=49].
- B.Sc. General  $III^{rd}$ -year; Paper-*IVA* (Thermodynamics, Electronics) [**E**=55, **S**=53].
- M.Sc. Environmental Science Sem-*II*; ENVC-24 (Energy & Environment) [**E**=**P**=25].

#### 2017

- B.Sc. General  $I^{st}$ -year; Paper-*I* (Mechanics, GPM, Oscillations, Optics) [**E**=67, **S**=76].
- B.Sc. General  $II^{nd}$ -year; Paper-*IIIA* (Optics, Electronics, Modern Physics) [**E**=50, **S**=71].
- B.Sc. General  $III^{rd}$ -year; Paper-*IVA* (Thermodynamics, Electronics) [**E**=31, **S**=50].

#### University of Calcutta: Internal Examiner & Scrutinier (Experiment)

- B.Sc. General Sem-*I*; Paper-GE/CC-1 (2020) [**E**=96].
- B.Sc. General  $II^{nd}$ -year; Paper-*IIA* (2019) [**E**=92].
- B.Sc. General  $III^{rd}$ -year; Paper-*IIA* (2018) [**E**=105].
- B.Sc. General  $III^{rd}$ -year; Paper-*IVA* (2017) [**E**=100].

#### University of Calcutta: External Examiner & Scrutinier (Computer)

- B.Sc. General  $III^{rd}$ -year; Paper-*IVB* (2020) [**E**=xx].
- B.Sc. Honours Sem-*I*; Paper-CC1 (Heritage College) (2020) [**E**=19].
- B.Sc. Honours Sem-*I*; Paper-CC1 (Heritage College) (2018) [**E**=19, **S**=120].

#### INVITED SPEAKER

- **Centre for Computational & Data Sciences**, IIT Kharagpur, India (December 2018).
- **Complex Fluids - CompFlu-2017**, IIT Madras, India (December 2017).
- **Complex Fluids - CompFlu-2016**, IIIT Hyderabad, India (December 2016).
- Institute Seminar, RRI Bangalore, India (September 2016).
- **Theoretical Science Unit, JNCASR Bangalore, India (March 2016)**.
- Thematic Unit of Excellence in Computational Material Science, SNBNCBS Kolkata, India (January 2016).
- Department of Physics, IIT Delhi, India (January 2016).
- **3<sup>rd</sup> Soft Matter Young Investigator Meet, Pondicherry, India (December 2015)**.
- Journal Club, The Institute of Mathematical Sciences, Chennai, India (July 2015).
- Department of Physics, IISER Mohali, India (April 2015).
- **School of Physical Sciences, JNU New Delhi, India (April 2015)**.
- Department of Physics, IISER Bhopal, India (April 2015).
- Workshop Bartholomäberg, Vorarlberg, Austria (August 2012).
- **Konstanzer Kolloidal Klub, Universität Konstanz, Konstanz, Germany (June 2012)**.
- Fachbereich Physik, Universität Konstanz, Konstanz, Germany (February 2012).
- Institut für Theoretische Physik, Heinrich-Heine-Universität Düsseldorf, Germany (October 2011).
- Institut für Materialphysik im Weltraum, DLR Köln, Germany (April 2011).
- **Journal Club, The Institute of Mathematical Sciences, Chennai, India (April 2009)**.
- Mahabaleswar Seminar on Modern Biology, TIFR, Mumbai, India (January 2008).

#### CONFERENCES ATTENDED / POSTERS PRESENTED

- Indian Statistical Physics Community Meeting, ICTS Bangalore, India (2016).
- Growing Length Scale Phenomena, JNCASR Bangalore, India (2015).
- **Kurt Binder honorary workshop, Johannes Gutenberg-Universität Mainz, Germany (2012)**.
- SimBioMa2011, Universität Konstanz, Konstanz, Germany (2011).
- School on Nonlinear Response to Vitrification, Universität Konstanz, Konstanz, Germany (2011).
- Glastag, Universität Marburg, Marburg, Germany (2011).
- **8<sup>th</sup> Liquid Matter Conference, Universität Wien, Vienna, Austria (2011)**.
- SERC School cum Symposium on Rheology of Complex Fluids, IIT Madras, India (2010).
- **Disorder, Complexity and Biology II, BHU Varanasi, India (2009)**.
- The Interface of Life, IIT Madras, India (2008).
- School on Understanding Molecular Simulation, JNCASR Bangalore, India (2007).

- Assembly Organization and Propulsion in Complex Systems, IIT Madras, India (2007).
- SERC School on Nonlinear Dynamics and Pattern Formation, IACS Kolkata, India (2006).
- Common Trends in Traffic: Physical and Computational Models in Transportation Engineering and Biological Sciences, IIT Kanpur, India (2006).
- Discussion Meeting on Statistical Physics, Vardanahalli, India (2005).

## COMPUTATIONAL SKILLS

**Languages :** C, Fortran (77,90/95), Python (Numpy, Scipy, Matplotlib), Unix shell-scripts.

**Libraries :**

- GSL, Numerical Recipes in C.
- **BoxLib**, **PETSc**, **LAPACK**, **HDF5** and **dXHDF5**.
- **Lammps** and **PyMol**.
- **Matlab** (including **DMSuite**, **IDL** and **Spectral Methods**), **Mathematica**.

**Visualizations:** **Paraview**, **OpenDX**, **Ovito**, **VisIt**.

**Familiarity with Operating Systems:** Linux, Sun, Cray, Blue-Gene.

**Familiarity with version control:** **GIT** and **SVN**.

**High Performance Computation:** Computations with (i) 80 million degrees of freedom (DOF) on 1024 node clusters at IMSc Chennai, (ii) 7 million DOF on 64 node cluster at Courant Institute, New York and, (iii) 100 million DOF on CRAY system and smaller clusters (Rahman, Tyrone, Fermi etc.) at IISc Bangalore.

## DEVELOPED CODES

- *Stochastic Electrodynamics* solver in 3D for Maxwell-GLdG integrator (explicit) using PETSc.
- Hybrid Gay-Berne/Aasakura-Oosawa NEMD for nematic-polymer raft using LAMMPS.
- Kinetic Monte Carlo, GENERIC formalism (LME) and Chemical Langevin Equation (CLE) integrator for dimerization reaction, Schlögl reaction and Baras-Pearson-Mansour model.
- Compressible fluctuating hydrodynamics (CFHD) integrator with *Law of mass action* on 3D collocative grid using BOXLIB.
- **Low-Mach** (incompressible) fluctuating hydrodynamics (IFHD) integrator on 3D staggered grid using BOXLIB.
- Dissipative particle dynamics with Lees-Edwards boundaries for WCA/Yukawa forces in three dimensions.
- Stochastic Method of Lines nematic integrator using GSL and PETSc.
- Method of Lines nematic explicit/implicit integrator using GSL, **Numpy-Scipy** and Spectral Collocation Method.
- Data-parallel (cross platform) Allen-Cahn explicit/implicit solver using PETSc.
- ADI operator splitting integrator to study patterns in motor-microtubule mixtures.

## ACHIEVEMENTS

- Anonymous reviewer on the sole author manuscript “*Controlling motile disclinations ...*” stated: “*This is an extremely interesting outcome as it represents an easy and practical way to control defects motion, a long-standing open problem in liquid crystals. The manuscript is very well-written and the results discussed are robust. These are based on a well-established liquid crystal theory (namely the Beris-Edwards one) intelligently coupled with a stochastic method in order to capture fluctuating dynamics in dry (or with no momentum-conserving) systems. The connection with experiments is well documented and is also clearly supported by the mapping between simulation parameters and real units. The main article is clear and accessible. Therefore, I strongly support the publication of the manuscript in the actual form.*”
- Prof.N.M.Abukhdeir (University of Waterloo, Canada) wrote in TOPICAL REVIEW IN LIQUID CRYSTALS on the sole author manuscript “*Stochastic kinetics reveal ...*” highlighting, “*Recently, Bhattacharjee have applied the stochastic nematic dynamics model to study homogeneous nucleation of an isotropic nematic transition. This study provides significant insight into the deviation of anisotropic fluids from the predictions of classical nucleation theory for nucleation rate and critical droplet size resulting from the presence of nematic elasticity and anisotropic interfacial tension.*” Later, NewsRX, USA highlighted in SCIENCE LETTER, FEB.2017, “*Researchers from Indian Institute of Science Report Findings in Science*”.

- Anonymous Editor elected me as a reviewer of journal **Soft Matter (RSC)** after having very positive response from both reviewers on the sole author manuscript “*Stress-microstructure relation ...*”. I’m also invited as a faculty proposal reviewer of **Netherlands Organization for Scientific Research (NWO)** for this contribution.
- Manuscript entitled “*Low Mach Number ...*” is selected for the prestigious **Francois-Naftali-Frenkiel award** by the Editorial board of the journal **Physics of Fluids**. Later, J.Chao, USA highlighted in **PHYS.ORG**, “*Mathematicians model fluids at the mesoscale*”.

STUDENT  
OUTREACH  
ACTIVITY

- Judged and evaluated “**Chhatra Yuba Bigyan Mela**” at Beltala Girls High School, Kolkata (September '19).
- Conducted Heat and Annual Sports “**Krira**”, Asutosh College (December 2019, January 2019 & February 2018).
- **Seminar on “Computational Science**” at PG Department of Physics, B.B.College, Asansol (December 2009).
- Question-Answer session with students of  $X^{th}$  std. at DVC High School, Maithan (April 2015).

EXTRACURRICULAR  
ACTIVITY

- **Visharad (5<sup>th</sup> year)** on Hawaiian Guitar, Nikhil Bharat Sangeet Samiti, Kolkata, 1999.
- **Visharad (5<sup>th</sup> year)** in Art, Pracheen Kala Kendra, Chandigarh, 1999.
- **Nature Photography & Birding.**
- **Travelogue.**