Ashwin Joy

Associate Professor
Indian Institute of Technology Madras, Chennai - 600036, Tamil Nadu, India.
Phone (Office): +91-44-2257-4892
Email: ashwin@physics.iitm.ac.in
Web: https://physics.iitm.ac.in/ ashwin/

Personal

Born on April 30, 1981 in Bhopal, Madhya Pradesh

Nationality: Indian

Professional Experience

11/2022 - present: Associate Professor, Indian Institute of Technology Madras, Chennai

11/2015 - 10/2022: Assistant Professor, Indian Institute of Technology Madras, Chennai

11/2013 - 10/2015: DST-INSPIRE Faculty, Institute for Plasma Research, Gandhinagar

11/2011 - 10/2013: Post Doctoral Fellow with Itamar Procaccia, Weizmann Institute of Science, Israel

08/2011 - 10/2011: Post Doctoral Fellow with R. Ganesh, Institute for Plasma Research, Gandhinagar

Professional Grants as Principal Investigator

2020: Exploratory Research Proposal Grant, IIT Madras - Rs. 8,50,000

2020: Core Research Grant, Science & Engineering Board, DST - Rs. 26,51,000

2018: New Faculty Seed Grant, IIT Madras - Rs. 28,00,000

2015: New Faculty Initiation Grant, IIT Madras - Rs. 5,00,000

2014: INSPIRE Faculty Research Grant, DST, India - Rs. 35,00,000

Professional Awards/Honors/Grants

2019: **Young Faculty Recognition Award, IIT Madras**

"Carries a contigency grant of 50,000 Indian Rupees and awarded during Teachers day"

2015: **Parvez Guzdar Young Scientist medal** in the field of strongly coupled plasmas

"Carries a cash prize of 50,000 Indian Rupees and awarded during annual meeting of PSSI"

2014: **Indo-British Frontiers of Science Symposium** invite, Khandala, Oct 9-12

Organizers: DST, India and Royal Society of UK

2014: **Junior Associate** of the Abdus Salam International Center for Theoretical Physics, Trieste, Italy

2013: **INSPIRE faculty award**, Department of Science & Technology (DST), Government of India

"Carries a research grant of Rs. 35,00,000 for a block of five years"

2012: **VATAT Fellowship** by the Government of Israel to Outstanding Post-docs from China and India

2012: **Dean of Faculty Fellowship** by the Weizmann Institute of Science, Rehovot, Israel

2002: **National Graduate Physics Examination**, Top 1% in the state of Gujarat, India

Education

2006-2011: Ph.D. Physics, Institute for Plasma Research, Gandhinagar

2002-2004: M.Sc. Physics, Dept. of Physics, Gujarat University, Ahmedabad

1999-2002: B.Sc. Physics, St. Xavier's College, Gujarat University, Ahmedabad

Ph.D. Thesis

"Molecular Dynamics Simulations of Coherent Structures in Strongly Coupled Yukawa Liquids"
Advisor: R. Ganesh

Research Interests

Active matter flows

Physics of glass transition

Hydrodynamic instabilities and turbulence

Plasma physics

Journal Publications

1. Sachin CN and Ashwin Joy, "Configurational Entropy of Self Propelled Glass Formers",
Physica A: : Statistical Mechanics and its Applications (626), 129041 (2023) [arXiv: 2212.04190]

2. Sanjay CP and Ashwin Joy, "Effective Temperature and Einstein Relation for Particles in Active Matter Flows",
Physical Review E 105, 065114 (2022) [arXiv:1912.01286]

3. Sanjay CP and Ashwin Joy, "Transport Phenomena in Active Turbulence",
Pramana - Journal of Physics 96:60 (2022)

4. Sachin CN and Ashwin Joy, "Entropy Scaling Laws in Self Propelled Glass Formers",
Physica A: : Statistical Mechanics and its Applications (588), 126578 (2022) [arXiv: 1912.01286]

5. Dipanwita Ghoshal and Ashwin Joy, "Connecting Relaxation Time to a Dynamical Length Scale in Athermal Active Glass Formers",
Physical Review E 102, 062605 (2020) [arXiv:2008.04614]

6. Sanjay CP and Ashwin Joy, "Friction scaling laws for transport in bacterial turbulence", Physical Review F 5, 024302 (2020) [arXiv:1905.11124]
Editor's Suggestion

7. Akanksha Gupta, Rajaraman Ganesh and Ashwin Joy, "Compressible Kolmogorov flow in strongly coupled dusty plasma using Molecular dynamics and Computational fluid dynamics: A comparative study - Part II", Physics of Plasmas 25, 013706 (2018)

8. Ashwin Joy, "Universal Scaling of Pair-Excess Entropy and Diffusion in Yukawa Liquids", Physics of Plasmas (Letter) 24, 010702 (2017)

9. Akanksha Gupta, R. Ganesh, Ashwin Joy., "Molecular shear heating and vortex dynamics in thermostatted two dimensional Yukawa liquids", Physics of Plasmas 23, 073706 (2016)

10. Akanksha Gupta, R. Ganesh, Ashwin Joy., "Kolmogorov flow in two dimensional strongly coupled Yukawa liquid : A Molecular Dynamics study", Physics of Plasmas 22, 103706 (2015)

11. Vijayakumar Chikkadi, Oleg Gendelman, Valery Ilyin, Ashwin Joy., Itamar Procaccia and Carmel A. B. Z. Shor, "Spreading plastic failure as a mechanism for the shear modulus reduction in amorphous solids", European Physics Letters 110, 48001 (2015)

12. Ashwin Joy. and Abhijit Sen, "Microscopic Origin of Shear Relaxation in Strongly Coupled Yukawa Liquids", Physical Review Letters 114, 055002 (2015)

13. Harish Charan, Rajaraman Ganesh, Ashwin Joy., "Molecular dynamics of Yukawa liquids in gravitation: Equilibrium, Instability and Transport" Journal of Plasma Physics 80, 895-917 (2014)

14. Akanksha Gupta, R. Ganesh and Ashwin Joy., "Kolmogorov flow in two dimensional strongly coupled dusty plasma", Physics of Plasmas 21, 073707 (2014)

15. Harish Charan, R. Ganesh and Ashwin Joy., "Properties of gravitationally equilibrated Yukawa systems - A Molecular dynamics study", Physics of Plasmas 21, 043702 (2014)

16. Oleg Gendelman, Ashwin Joy, Pankaj Mishra and Itamar Procaccia, "On the Effect of Micro-alloying on the Mechanical Properties of Metallic Glasses", Acta Materialia 63, 209 (2013) [arXiv:1309.4998]

17. Ashwin Joy., Oleg Gendelman, Itamar Procaccia and Carmel Shor, "The Yield-Strain and Shear-Band Direction in Amorphous Solids Under Two-Dimensional Uniaxial Loading", Physical Review E 88, 022310 (2013)

18. Ajai Kumar, V. Sivakumaran, Ashwin Joy. and R. Ganesh, "Dense Strongly Coupled Plasma in Double Laser Pulse Ablation of Lithium: Experiment and Simulation", Physics of Plasmas 20, 082708 (2013)

19. Ashwin Joy., Eran Bouchbinder and Itamar Procaccia, "The Cooling Rate Dependence of the Mechanical Properties of Amorphous Solids", Physical Review E 87, 042310 (2013)

20. Ratul Dasgupta, Ashwin Joy., H.G.E. Hentschel and Itamar Procaccia, "Derivation of the Johnson-Samwer $T^{2/3}$ Temperature Dependence of the Yield Strain in Metallic Glasses",
Physical Review B Rapid Communications 87, 020101 (2013)
Also selected for Kaleidoscope images: http://prb.aps.org/kaleidoscope/prb/87/2/020101

21. Ashwin Joy. and R. Ganesh, "A Molecular Dynamics Study of Dipolar Vortices in Strongly Coupled Yukawa Liquid",
Physics of Fluids 24, 092002 (2012)

22. Ashwin Joy. and R. Ganesh, "Coevolution of Inverse Cascade and Non Linear Heat Front in Shear Flows of Strongly Coupled Yukawa Liquids",
Physics of Plasmas 18, 083704 (2011)

23. Ashwin Joy. and R. Ganesh, "Coherent Vortices in Strongly Coupled Liquids",
Physical Review Letters 106, 135001 (2011)

24. Ashwin Joy. and R. Ganesh, "Parallel Shear Flow Instabilities in Strongly Coupled Yukawa Liquids - A comparison of Generalized Hydrodynamic Model and Molecular Dynamics Results",
Physics of Plasmas 17, 103706 (2010)

25. Ashwin Joy. and R. Ganesh, "Kelvin-Helmholtz Instability in Strongly Coupled Yukawa Liquids",
Physical Review Letters 104, 215003 (2010)

26. Ashwin Joy. and R. Ganesh, "Effect of External Drive on Strongly coupled Yukawa systems : A Non-Equilibrium Molecular Dynamics Study",
Physical Review E 80, 056408 (2009)

Conference Proceedings/Book Chapters

1. Ashwin Joy., Oleg Gendelman, Itamar Procaccia and Carmel Shor, "Atomistic Theory of Shear Band Direction in Amorphous Solids",
Book chapter in *"Symposium on Fragility Special Volume"*, January 5-8, 2014 Organized by TIFR Hyderabad & JNCASR Bangalore. [arXiv:1304.4009]

2. Ratul Dasgupta, H. George E. Hentschel, Ashwin Joy, and Itamar Procaccia, "Shear banding instabilities in amorphous solids: Predicting the yield strain", 4th International Symposium on Slow Dynamics in Complex Systems, December 2-7, 2012, Sendai, Japan.
American Institute of Physics Conference Proceedings 1518, 162 (2012)

3. R. Ganesh and Ashwin Joy., "Shear Flows in Two Dimensional Strongly Coupled Yukawa Liquids : A Large Scale Molecular Dynamics Study": The 6^{th} International Conference on the Physics of Dusty Plasmas, May 16-20, 2011, Garmisch-Partenkirchen, Germany
American Institute of Physics Conference Proceedings 1397, 78 (2011)

Ph.D. Projects Supervision

2017: **D. Ghoshal**, joined Jan 2017

2017: **Sanjay C.P.**, joined Jan 2017

2017: **Sachin C.N.**, joined Jan 2017

2017: **A. Manoharan**, joined Aug 2019

Under Graduate Projects Supervision

2022: *Configurational Entropy of a Disordered System* -**Neelkanth Rawat**, IInd year M.Sc. (PH)

2018: *Real Space Re-normalization and Applications* -**K. Vishwanathan**, IVth year B.Tech. (EP)

2017: *Critical Exponents in Ising Model Using Re-normalization Group* -**A. Misra**, IInd year M.Sc. (PH)

2016: *Transport & Dynamics in Simple Liquids* -**Mr. Sukrut Mondkar**, IInd year M.Sc. (PH)

2016: *Diffusion in Glass Forming Systems* -**Mr. Saparshi Dasgupta**, IInd year M.Sc. (PH)

Teaching Experience at IIT Madras

Coordinated PH 1020	Physics II	Core	B. Tech	2022
Coordinated NPTEL	Statistical Physics	Online	Introductory Course	2019
PH 5020	Electromagnetic Theory	Core	M.Sc. and B.S/M.S. in Physics	2020
PH 5080	Statistical Physics	Core	M.Sc. and B.S/M.S. in Physics	2017, 2018, 2019
EP 2110	Mathematical Physics	Core	B.Tech and B.S./M.S. in Physics	2017, 2018
PH 1010	Physics I	Core	B.Tech	2016, 2019, 2021
EP 3290	Physics Lab III	Lab	B.Tech	2016

Talks & Seminars

1. "Effective Temperature for Particles in Active Matter Flows", Oral presentation at StatPhys28 —the 28th International Conference on Statistical Physics, Tokyo, Japan, August 7-11, 2023.
2. "Statistical Mechanics of Living Turbulence", Invited Talk at the discussion meeting on "Statistical Physics and Complex Systems" at IIT Kharagpur, July 18-20, 2022.
3. "Transport Scaling Laws in Living Turbulence", Invited Talk at the Soft Matter Young Investigators Meet (SMYIM 2020), Dec 3-5, 2020, IISc Bangalore
4. "Transport Scaling Laws in Living Turbulence", Invited Talk at 4th Asia-Pacific Conference on Plasma Physics, Oct 26-31, 2020, AAPPS-DPP
5. "Friction Scaling Laws in Bacterial Turbulence", Aditi Simha Memorial Symposium on Dec 10, 2019 at the Department of Physics, IIT Madras, Chennai - 600036.
6. "Microscopic origin of shear relaxation in Yukawa liquids" in the joint conference of the 12th Asia Pacific Plasma Theory Conference (APPTC) and the 10th West Lake International Symposium will be held May 9-12, 2016, at Zhejiang University, Hangzhou, China.
7. 30th National Symposium on Plasma Science & Technology on Dec 3, 2015 at SINP, Kolkata. Organizers: Plasma Science Society of India (PSSI)
8. Soft Matter Young Investigators Meet (YIM) 2015 on Dec 17, 2015 at Pondicherry, India
9. "Microscopic Origin of Shear Relaxation in a Model Visco-elastic Liquid" on Feb 24, 2015 at The Institute of Mathematical Sciences (IMSc), Chennai
10. "Microscopic Origin of Shear Relaxation in a Model Visco-elastic Liquid" on Feb 25, 2015 at The Indian Institute of Technology (IIT), Chennai

11. Invited talk on the "Shear Softening in Amorphous Solids",
    Ist Discussion Meeting on Glass Formers and Glasses [August 8-9, 2014, JNCASR, Bangalore]

12. "Shear Localization in Glass-Forming Yukawa Systems",
    7th International Conference on the Physics of Dusty Plasmas (ICPDP), [March 3-7, 2014, New Delhi, India]

13. "Atomistic theory of the shear band direction in amorphous solids",
    Symposium on Fragility, January 5-8, 2014, JNCASR Bangalore

14. "Shear band direction in amorphous solids - an atomistic theory",
    Indian Institute of Technology, Gandhinagar, June 2013

15. "Shear band direction in amorphous solids - an atomistic theory",
    Host: Professor Chandan Dasgupta
    Department of Physics, Indian Institute of Science, Bangalore, June 2013

16. "Shear flows in strongly coupled Yukawa liquids",
    Host : Professor Edward Thomas Jr.
    Department of Physics, Auburn University, Alabama, USA, September 2011

17. "Large scale molecular simulations of hydrodynamic instabilities in strongly coupled Yukawa liquids"
    Ist Annual Student Research Symposium (ASRC), Institute for Plasma Research, Gandhinagar, April 2011

Poster Presentations

1. Ashwin Joy. and Abhijit Sen, "Microscopic Origin of Shear Relaxation in Strongly Coupled Yukawa Liquids": Indo-British Frontiers of Science Symposium held, Khandala (Maharashtra), October 9-12, 2014

2. Ashwin Joy., Harish Charan, Akanksha Gupta, Swati Baruah and Rajaraman Ganesh, "Study of nonlinear structures in strongly coupled Yukawa liquids": 27th National Symposium on Plasma science & technology, Dec 2012, Pondicherry, India

3. Ashwin Joy. and R. Ganesh, "Kolmogorov Flows in Strongly Coupled Plasmas - A Molecular Dynamics Study": The 22nd International Conference on Numerical Simulation of Plasmas, Sep 7-9, 2011, Princeton Plasma Physics Laboratory, Princeton, NJ, USA

4. Ashwin Joy., R. Ganesh and M. Warrier, "Calculation of transport coefficients using non-equilibrium molecular dynamics (NEMD)", 22nd National Symposium on Plasma Science & Technology, Nov 2007, Ahmedabad, India

Computational Projects

Developed during my Postdoctoral work:

Added modules to implement SLLOD algorithm in my parallel MD codes to perform thermostatted shear flows in liquids and shear deformation in solids

Added modules to perform athermal quasi-static deformation using conjugate gradient energy minimizer

Added modules to perform fast diagonalization of large matrices using highly optimized LAPACK library

Developed during my Ph.D.:

A parallel MPI-based molecular dynamics code written in C for simulating Yukawa, Lennard-Jones and Carbon systems (using Tersoff-Brenner potentials)

MD-PyUtils *"Molecular Dynamics - Python Utilities"*A collection of python scripts for numerical post-processing of MD output data

movieGL An openGL-based C code to visualize the particle trajectories in real time

PPSTS-2D *"Parallel Pseudo-Spectral Turbulence Solver - 2D"* Screened generalized hydrodynamic code, a massively parallel MPI based pseudo-spectral code designed to model turbulence in a screened generalized hydrodynamic model. The code is written in C and parallel Fourier transforms are implemented using FFTW library to achieve performance.

Schools & Workshops Attended

1. "US-India Advanced Studies Institute on Thermalization: From Glasses to Black Holes", June 10-21, 2013, Indian Institute of Science, Bangalore
2. Italian-Israeli bilateral meeting on the "Statistical Physics of Amorphous Solids", March 3-4 2013, The Weizmann Institute of Science, Israel
3. The 9^{th} Minerva Winter School on Statistical and Nonlinear Physics of Amorphous Solids, February 19-26, 2012, The Weizmann Institute of Science, Israel
4. Advanced School in High Performance and GRID computing at The Abdus Salam International Center for Theoretical Physics, Trieste, Italy from November 3-14, 2008
5. EUIndia Grid Workshop on Material, Earth and Atmospheric Sciences at C-DAC, Pune, India from September 24-28, 2007

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