Dr. Sharad Kumar Yadav

(UGC-Dr. D. S. Kothari Postdoctoral Fellow)

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Date of Birth|July 1, 1982; Gender|M; Nationality|India

Career Objective

Seeking a faculty position at the level of Assistant Professor. Currently I am working as a Kothari Fellow in the Department of Physics at Indian Institute of Science (IISc.), Bangalore. This is a full time research position. My research is to develop a direct numerical simulation to solve the three dimensional (3D) MHD and Hall-MHD equations for the study of the turbulence at high Reynolds number relevant to solar winds.

Education

09/2011 **Ph.D.**, *Institute for Plasma Research (IPR)*, Gandhinagar, India.
Majors: Plasma Physics

07/2004 **M.Sc.**, *University of Allahabad*, Allahabad, India.
Majors: Physics

07/2002 **B.Sc.**, *University of Allahabad*, Allahabad, India.
Majors: Physics, Mathematics, Chemistry

Awards

- **"UGC-Dr. D.S. Kothari Postdoctoral Fellowship (Higher Fellowship)"**

  Awarded by University Grants Commission(UGC), New Delhi, in the year 2019 to work at the Department of Physics, Indian Institute of Science (IISc.), Bangalore, Karnataka.

- **"Buti Young Scientist Award"**

  Awarded by Buti Foundation at 24^{th} National Symposium on Plasma Science and Technology, held at National Institute of Technology (NIT), Hamirpur in the year of 2009, for the best thesis work presentation. This is a prestigious award in India to be awarded to Ph.D. student in plasma physics.

- **"UGC-Dr. D.S. Kothari Postdoctoral Fellowship (Higher Fellowship)"**

  Awarded by University Grants Commission(UGC), New Delhi, in the year 2017 to work at Department of Physics, Indian Institute of Science (IISc.), Bangalore. (Not availed due to enrollment in Columbia University, New York, USA as an associate research scientist)

Research Experience (including postdoctoral research)

- **Indian Institute of Science (IISc.), Bangalore, Karnataka**

  06/2019 - Contiuned; Dr. D. S. Kothari Postdoctoral Fellow, Department of Physics (Advisor: Professor Rahul Pandit)

- **Institute for Plasma Research (IPR), Gandhinagar**

  02/2019 - 05/2019; Research Associate, Theory and Simulation (Advisor: Professor Abhijit Sen)

- **Physical Research Laboratory (PRL), Ahmedabad, India**

For a short period (July 20, 2017-August 3,2017) I have worked at PRL, Ahmedabad as a postdoctoral fellow in the group of theoretical physics division with Professor Jitesh R. Bhatt. There I delivered lectures on "LCPFCT (Laboratory of Computational Physics - Flux Corrected Transport)" to Ph.D students. LCPFCT is a computational tools to solve the generalized form of continuity equation that is used to model the neutral and conducting fluid systems.

- ⋆ **University of Iowa, Iowa, USA**

  05/2012 - 03/2014; Postdoctoral Research Scholar, Department of Chemistry (Advisor: Professor Claudio J. Margulis)

- ⋆ **Institute for Plasma Research (IPR), Gandhinagar, India**

  03/2011 - 05/2012; Postdoctoral Fellow, Theoretical Division (Advisor: Professor Amita Das)

  09/2007 - 03/2011; Senior Research Fellow (SRF), Theoretical Division (Advisors: Professor Amita Das)

  09/2005 - 08/2007; Junior Research Fellow (JRF), Theoretical Division (Advisor: Professor Amita Das)

Job Experience

- ⋆ **Columbia University, In the City of New York, USA**

  08/2017 - 08/2018; Associate Research Scientist, Plasma Physics Laboratory, Department of Applied Physics and Applied Mathematics

- ⋆ **Institute for Plasma Research (IPR), Gandhinagar, India**

  07/2014 - 01/2017; Research Scientist, Theory and Simulation Group (Advisor: Professor Predhiman K. Kaw)

Teaching Experience

I have taught in the Advanced B.Sc. (Physics) Summer Programme held at St. Xavier's College, Ahmedabad in June, 2015.

Research Interests

- ⋆ Direct Numerical Simulation (DNS) of the magnetohydrodynamics (MHD) (at high reynolds numbers) to understand the turbulence and multiscaling present in the solar winds.
- ⋆ Computational modeling of ion sources to understand the ion dynamics and its extraction mechanism from conventional and non-conventional ion sources.
- ⋆ Particle-In-Cell (PIC) based computer simulation for studying the phenomena observed in inertial confinement fusion devices, laser plasma interaction phenomena.
- ⋆ In general I am interested in studying the following instabilities; weibel instability, hydrodynamic instabilities - Kelvin-Helmholtz (KH) and Rayleigh-Taylor (RT) instability, two stream instability, filamentation etc. occurring in the plasma.
- ⋆ Data analysis of the shots captured in the experiment to understand the underlying physics.
- ⋆ Molecular dynamics (MD) simulation of neat ionic liquids and binary mixtures.

- ⋆ Theoretical (based on statistical mechanics) and computational (using molecular dynamics simulation) study of soft condensed matters.

Publications

1. *Sharad K. Yadav* and R. K. Singh, "Numerical study of the effect of atomic mass of the ambient gas on the expansion and the lateral interactions of LBO plumes", *Journal of Physics D: Applied Physics*, **54**, 075201, 2021.
2. *Sharad K. Yadav*, R. K. Bera, D. Verma, A. Das and P. Kaw, "Propagation of low frequency electromagnetic disturbances in plasma", Accepted in *Contributions to Plasma Physics*, **August 2020** (DOI: 10.1002/ctpp.202000101).
3. *Sharad K. Yadav*, B. G. Patel, R. K. Singh, A. Das, P. K. Kaw and A. Kumar, "Numerical study of the lateral interaction of two plasma plumes", *Journal of Physics D: Applied Physics* **50**, 355201, 2017.
4. C. A. Rumble, A. Kaintz, *Sharad K. Yadav*, B. Conway, J. C. Araque, G. Baker, Claudio J. Margulis, and M. Maroncelli, "Rotational dynamics in ionic liquids from NMR relaxation experiments and simulations: benzene and 1-ethyl-3-methylimidazolium", *J. Phys. Chem. B* **120(35)**, pp 9450-9467, 2016.
5. J. C. Araque, *Sharad K. Yadav*, M. Shadeck, M. Maroncelli and Claudio J. Margulis, "How is diffusion of neutral and charged tracers to the structure and dynamics of a room temperature ionic liquids ? large deviations from stokes-einstein behavior explained", *J. Phys. Chem. B* **119(23)**, pp 7015-7029, 2015 (for June issue this paper was selected for cover page).
6. *Sharad K. Yadav*, P. K. Kaw, A. Das, S. K. Pathak, S. Joisa, D. Raju and SST-1 Team, "Determination of Plasma Temperature in Steady State Tokamak (SST-1)",**IPR/TR-359/2015**, October, 2015.
7. A. Das, *Sharad K. Yadav*, P. K. Kaw and S. Sengupta, "Collisionless stopping of electron current in an inhomogeneous EMHD plasma", *Pramana - Journal of Physics* **77**, 949, 2011.
8. *Sharad K. Yadav*, and A. Das, "Nonlinear studies of fast electron current pulse propagation in a two dimensional inhomogeneous plasma", *Phys. Plasmas* **17**, 052306, 2010.
9. G. Gaur, S. Sundar, *Sharad K. Yadav*, A. Das, P. K. Kaw, and S. Sharma, "Role of natural length and time scales on shear driven 2D electron magnetohydrodynamic instability", *Phys. Plasmas* **16**, 072310, 2009.
10. *Sharad K. Yadav*, A. Das, P. K. Kaw, and S. Sengupta, "Anomalous energy dissipation of electron current pulses propagating through an inhomogeneous collisionless plasma medium", *Phys. Plasmas* **16**, 040701, 2009.
11. *Sharad K. Yadav*, A. Das, and P. K. Kaw, "Propagation of electron magnetohydrodynamic strcutures in a 2D inhomogeneous plasma", *Phys. Plasmas* **15**, 062308, 2008.
12. S. Kahaly, *Sharad K. Yadav*, W. M. Wang, S. Sengupta, Z. M. Sheng, A. Das, P. K. Kaw and G. Ravindra Kumar, "Near complete absorption of intense, ultrashort laser light by sub-lambda gratings", *Phys. Rev. Lett.* **101**, 145001, 2008.
13. S. Kahaly, G. R. Kumar, *Sharad K. Yadav*, S. Sengupta, A. Das, and P. K. Kaw, "Hot electron generation by highly efficient absorption of high intensity femtosecond laser light in plasma generated on sub-lambda gratings", *Journal of Physics: Conference Series* **112**, 022102, 2008.

Full paper published in national conferences

14. *Sharad K. Yadav*, A. Das, P. Kaw and S. Sengupta, "Electron current pulse propagation and its anomalous dissipation through inhomogeneous plasma", 24^{th} *National Symposium on Plasma Science & Technology (PLASMA-2009)*, 8-11 December, 2009, National Institute of Technology(NIT), Hamirpur (HP).

Publications (Under Preparation)

15. *Sharad K. Yadav*, Hideaki Miura and Rahul Pandit, "Statistical Properties in the decaying three-dimensional (3D) Hall Magnetohydrodynamics (HMHD) Turbulence".
16. *Sharad K. Yadav et. al.*, "Collisional modeling of particle transport, confinement and losses from a toroidal ECRIS".
17. *Sharad K. Yadav* and Abhijit Sen, "Excitation of electromagnetic (EM) solitons by a moving object in ionosphere plasma".

Principal Abilities/Accomplishments/Computer Skills

- ⋆ Experienced in developing and optimizing FORTRAN codes for numerical simulations.
- ⋆ Developed a 2D fluid simulation code to solve the electron magnetohydrodynamics(EMHD) model equations using LCPFCT (Library of Computational Physics - Flux Corrected Transport, a package of fortran subroutines). LCPFCT is a solver and used to solve the generalized form of continuity equation. Such kind of simulation techniques/skills are quite useful for the study of the many phenomena occuring in plasma and neutral fluid systems, where the problem can be modelled using the fluid equations: continuity equation, Navier-Stokes equation and energy equations.
- ⋆ Write a code for particle tracing in the different geometry of magnetic field (linear, toroidal and stellarator) by solving the guiding center equation of motion of particle (deduced from the Lagrangian), using 4th order Runge-Kutta method.
- ⋆ Adept in using molecular dynamics simulation based packages: GROMACS (GROningen Machine for Chemical Simulation) and LAMMPS (Large-scale Atomic/Molecular Massively Parallel Simulator).
- ⋆ Also developed a monte carlo simulation to study the experimental results obtained in SMARTEX-C (Small Aspect Ratio Toroidal Experiment) device installed at Institute for Plasma Research, for studying the transport properties of non-neutral plasma. Monte carlo simulation rely on the use of random numbers to generate a trajectory through the phase space based on conserved quantities.
- ⋆ Softwares used: GAUSSIAN, VMD, OPENBABEL, XMGRACE, MATLAB, MATHEMATICA, GNUPLOT
- ⋆ Numerical libraries used:IMSL, NAG, LCPFCT, Numerical Recipes.
- ⋆ Operating systems Used: Windows, Linux, Unix.
- ⋆ Machines used: Clusters for the purpose of high performance computing, Cray XIE, SUN-Blade, pentium.
- ⋆ Document preparation: Latex, MS-Word, Open-office, preparation of talk presentation using Powerpoint and Latex.

Grants/Fellowships

- ⋆ Awarded full grant by Strong Field Science (SFS), a national funding agency instituted by Department of Atomic Energy institutes, to attend and present my research work in the 18^{th} International Congress on Plasma Physics (ICPP) held at Kaohisung, Taiwan during June 27- July 1, 2016.
- ⋆ Awarded half travel grant by the Abdus Salam International Center for Theoretical Physics (ICTP), Trieste, Italy for attending the "Summer College on Plasma Physics" held during August 10-28, 2009.
- ⋆ Junior Research Fellowship (9/2005–8/2007) and Senior Research Fellowship (9/2007–8/2011) awarded by Department of Atomic Energy, India for pusuding Ph.D. at Institute for Plasma Research (IPR), Gandhinagar, India.
- ⋆ Qualified Joint Entrance Test (JEST) in year 2005 for pursuing Ph.D. in physics within country.

Training/Professional Courses

- ⋆ **Completed one Year pre- Ph.D. Course Work**

  9/2005–8/2006, Institute for Plasma Research (IPR), Gandhinagar, India.

  Covered Courses: *Numerical methods, mathematical physics, basic and advanced plasma physics, tokamak physics, experimental tools and techniques relevant to plasma physics, statistical mechanics, laser plasma interaction, lasers, electrodynamics, classical mechanics.*
- ⋆ **Completed pre- Ph.D. project work titled as "Monte carlo simulation of toroidal electron plasmas and comparison with a meanfield theory"**

  5/2006–8/2006, Institute for Plasma Research (IPR), Gandhinagar, India.
- ⋆ **Attended workshop on tool of theoretical physics and the problem of turbulence**

  Feb. 16-21, 2009, SNBNCS, Kolkata, India.

Oral Presentations

1. "Numerical Simulation of three dimensional Hall magnetohydrodynamic (HMHD) for the study of statistical properties" at 7^{th} Indian Statistical Physics Conference Meeting (ISPCM-2020), February 19 - February 21, 2020, International Centre for Theoretical Physics (ICTS), Bangalore, India (Talk)
2. "Hydrodynamics simulation of plasma plume for the study of the lateral interaction of two plasma plumes" at Institute for Plasma Research (IPR), Gandhinagar, India, February 07, 2019 (Invited talk)
3. "Rotational Dynamics of Cation in Neat Ionic Liquids and Mixture of Ionic liquids with Neutral Solvent" at Department of Physics, Indian Institute of Science (IISc.), Bangalore, Karnataka, India, February 02, 2017 (Invited talk)
4. "Modeling and simulation of laser generated plasma plume" at Dhirubhai Ambani Institute of Information and Communication Technolgy (DAIICT), Gandhinagar, India, November 10, 2016 (talk)
5. "Study of the lateral interactions of two LBO plasma plumes in close proximity via hydrodynamic simulation" at Indian Institute of Technology (IIT)- Bombay, Mumbai, India, October 20, 2016 (Invited talk)

6. "Numerical modeling of laser-blow-off plume: lateral interactions of two plumes in presence of background pressure" at 18^{th} International Congress on Plasma Physics (ICPP), June 27- July 1, 2016, Kaohsiung, Taiwan (talk)
7. "Study of the rotational dynamics of cation in pure ionic liquids and in its mixture with neutral solvent via MD simulation" at Conference on Research Progress in Physical Sciences, September 7-8, 2016, University and Institute of Advanced Research (UIAR), Gandhinagar, India (oral)
8. "Collisionless mechanism of energy dissipation, collimating and guiding behavior of electron pulses in over dense plasma", at Indian Institute of Technology (IIT) Patna, India, November 9, 2015 (talk)
9. "Rotational dynamics of cation in ionic liquids and ionic liquids mixture" at Institute for Plasma Research (IPR), Gandhinagar, India, May 19, 2014 (Invited talk)
10. "Electron current pulse propagation and its anomalous dissipation through inhomogeneous plasma", 24^{th} National Symposium on plasma Science and Technology, December 11-13, 2009, NIT, Hamirpur, India (talk awarded by "Buti Young Scientist Award")

Paper Presented in International/National Conferences

1. *Sharad K. Yadav*, Nadia B. Padhan and Rahul Pandit, "Statistical Properties in three-dimensional (3D) Hall Magnetohydrodynamics (HMHD) Turbulence", Conference on Plasma Simulation (CPS) - 2020, Institute for Plasma Research (IPR), Gandhinagar, India, January 23-24, 2020.
2. A. Sen, *Sharad K. Yadav*, G. Ganguli and C. Crabtree, "Stimulated Fore-wake excitations from Moving Charged Objects in the ionosphere", ICEAA-IEEE APWC 2019, Granada, Spain, 9-13 September 2019.
3. *Sharad K. Yadav*, Nadia B. Padhan and Rahul Pandit, "Direct Numerical Simulations of three-dimensional (3D) Hall Magnetohydrodynamics (HMHD) Turbulence", In-house Symposium held in the Department of Physics, Indian Institute of Science (IISc.), Bangalore, India, November 22-23, 2019.
4. *Sharad K. Yadav*, R. K. Singh, B. G. Patel, A. Das, P. K. Kaw, and A. Kumar, "Numerical modeling of laser-blow-off plume: lateral interactions of two plumes in presence of background pressure", 18^{th} International Congress on Plasma Physics (ICPP 2016), Kaohsiung, Taiwan, June 27– July 1, 2016.
5. J. C. Araque, *Sharad K. Yadav*, M. Shadeck, M. Maroncelli, and C. J. Margulis,"Soft jumps and stiff cagesL link between the structural lanscape of room temperature ionic liquids and the dynamics of neutral and charged tracers", 24^{th} edition of the Midwest thermodynamics and statistical mechanics conference at Iowa State University, May 28–29, 2015, Ames, IA, USA.
6. J. C. Araque, *Sharad K. Yadav*, M. Maroncelli and C. J. Margulis, "Disparity in the diffusion mechanism of neutral vs. charged solutes in ionic liquids", The First Gordan Research Conference on Ionic Liquids, August 17 –22, 2014, Newry, ME, USA.
7. J. Kohanoff, C. Xu, A. Durumeric, H. K. Kashyap, *Sharad K. Yadav*, A. Kaintz, C. Rumble, M. Maroncelli, C. J. Margulis,"Dynamics of excess electrons and other solutes in room temperature ionic liquids", Thirty-fifth DOE Solar Research Meeting, June 2–5, 2013, Maryland, USA.

8. *Sharad K. Yadav*, A. Das, P. K. Kaw and S. Sengupta, "Theoretical description of electron current pulse transport and stopping through plasma and its implications to fast ignition (FI)", International Conference on Inertial Fusion Sciences and Application (IFSA 2009), Sept. 6–11, 2009, Sanfrancisco, USA.
9. *Sharad K. Yadav*, A. Das, and P. Kaw, "Propagation of 2D nonlinear EMHD coherent structures in the inhomogeneous plasma", Summer College on Plasma Physics held at the Abdus Salam International Center for Theoretical Physics (ICTP), Trieste, Italy.
10. *Sharad K. Yadav*, A. Das, and P. K. Kaw, "Propagation of electron magnetohydrodynamics structures in a two dimensional inhomogeneous plasma", 23^{rd} National Symposium on Plasma Science and Technology, December 10–13, 2008, BARC, Mumbai, India.
11. A. Kaintz, C. Rumble, *Sharad K. Yadav*, C. J. MArgulis and M. Maroncelli, "Rotational Dynamics in Ionic Liquids- NMR and MD studies", Thirty DOE Solar Research Meeting, June 2–5, 2013, Maryland, USA.
12. *Sharad K. Yadav*, A. Das, P. K. Kaw and S. Sengupta, "Electron Current pulse propagation and its anomalous dissipation through inhomogeneous plasma", 24^{th} National Symposium on Plasma Science and Technology, December 11–13, 2009, NIT, Hamirpur,HP,India.
13. S. Kahaly, G. R. Kumar, *Sharad K. Yadav*, S. Sengupta, A. Das and P. K. Kaw, "Sub-lambda gratings surface plasmons, hotter electrons and brighter X-ray sources: enhanced absorption of intense, uktrashort laser light by tiny surface modulations", 22^{nd} National Symposium on Plasma Sciences and Technology, December 6–10, 2007, IPR, Gandhinagar, India.
14. *Sharad K. Yadav et. al.*, "Monte carlo simulation of Toroidal electron plasmas and comparision with a meanfield theory", 21^{st} National Symposium on Plasma Sciences and Technology, December 19–22, 2006, MNIT, Jaipur, India.
15. G. Gaur, S. Sundar, A. Das, P. K. Kaw and *Sharad K. Yadav*, "Non-linear simulations of a 2D sheared electron flow in the presence of in-plane equilibrium magnetic field", 23^{rd} National Symposium on Plasma Science and Technology, December 10–13, 2008, BARC, Mumbai,India.

References

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Anomalous energy dissipation of electron current pulses propagating through an inhomogeneous collisionless plasma medium SK Yadav, A Das, P Kaw, S Sengupta Physics of Plasmas 16 (4), 040701	14	2009
Nonlinear studies of fast electron current pulse propagation in a two dimensional inhomogeneous plasma SK Yadav, A Das Physics of Plasmas 17 (5), 052306	11	2010
Role of natural length and time scales on shear driven two-dimensional electron magnetohydrodynamic instability G Gaur, S Sundar, SK Yadav, A Das, P Kaw, S Sharma Physics of Plasmas 16 (7), 072310	11	2009
Numerical study of the lateral interactions of two plasma plumes SK Yadav, BG Patel, RK Singh, A Das, PK Kaw, A Kumar Journal of Physics D: Applied Physics 50 (35), 355201	3	2017
Propagation of slow electromagnetic disturbances in plasma SK Yadav, RK Bera, D Verma, A Das, P Kaw arXiv preprint arXiv:2002.09778	1	2020

TITLE	CITED BY	YEAR
Numerical study of the effect of atomic mass of the ambient gas on the expansion and the lateral interactions of LBO plumes SK Yadav, RK Singh Journal of Physics D: Applied Physics (https://iopscience.iop.org/article/10 …		2020
Nonlinear propagation of low-frequency electromagnetic disturbances in plasmas SK Yadav, RK Bera, D Verma, P Kaw, A Das Contributions to Plasma Physics (https://onlinelibrary.wiley.com/doi/abs/10 …		2020
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Determination of Plasma Temperature in SST-1 SK Yadav, PK Kaw, A Das, SK Pathak, S Joisa, D Raju, SST Team Institute for plasma research(IPR)/359/2015,Oct.2015		2015
Collisionless stopping of electron current in an inhomogeneous electron magnetohydrodynamics plasma A Das, SK Yadav, P Kaw, S Sengupta Pramana 77 (5), 949-957		2011
Hot electron generation by highly efficient absorption of high intensity femtosecond laser light in plasma generated on sub-λ gratings S Kahaly, GR Kumar, S Yadav, S Sengupta, A Das, PK Kaw Journal of Physics: Conference Series 112 (2), 022102		2008