<p style="text-align:center">Curriculum vitae</p>

Ratan Kumar Bera

Postdoctoral Research Assistant III   **Email:** rataniitb@gmail.com
Center for Space Plasma and Aeronomic Research (CSPAR)   **Email**: rkb0019@uah.edu
University of Alabama in Huntsville (UAH)   **Phone:** (256)-961-7115
Address : 320 Sparkman Dr NW, Huntsville, AL 35805, USA   **ORCID:** https://orcid.org/0000-0002-4207-3633

Web: https://www.uah.edu/cspar/people/faculty-and-staff/ratan-kumar-bera
Google scholar: https://scholar.google.co.in/citations?user=ebMsSGYAAAAJ&hl=en

Education

Institute for Plasma Research	Gandhinagar, India
Granted by Homi Bhabha National Institute	Mumbai, India
PhD in Physics	2012 — 2018

Thesis title: Fluid simulation of electron beam driven wakefield in a cold plasma
Advisor(s): Prof. Amita Das and Prof. Sudip Sengupta

Indian Institute of Technology Bombay	Mumbai, India
Master of Science in Physics	2010 — 2012

Project title: Study of coriolis mixing and decoupling constant in Nielson's model for odd-even nuclei
Advisor: Prof. Pragya Das

University of Calcutta	Kolkata, India
Ramakrishna Mission Vivekananda Centenary College	Rahara, Kolkata, India
Bachelor of Science in Physics	2007 — 2010

Employment history

University of Alabama in Huntsville	Huntsville, AL, USA
Center for Space Plasma and Aeronomic Research (CSPAR)	March 2021 — Present
Postdoctoral Research Assistant III	

Developing and performing a fully 3-D, parallel, plasma simulation code, "Multi-Scale Fluid Kinetic Simulation Suite" (MS-FLUKSS), developed at CSPAR, UAH, to study the interaction of solar wind (SW) with the partially ionized local interstellar medium (LISM).

Virginia Polytechnic Institute and State University	Blacksburg, VA, USA
Postdoctoral Research Associate	September 2019 — March 2021

Developed and performed 2-D, parallel, fluid description based plasma modeling tool "PHORCE" (Package of High Order Simulation of Convection-diffusion Equations), developed at Virginia Tech, USA, to study the Rayleigh-Taylor instabilities (RTI) in high-energy density plasmas (HEDP).

Developed and performed simulations using fully kinetic, particle-based Particle-In-Cell (PIC) simulation code "VPIC" (vector particle-in-cell) to study the mega-electron-volt (MeV) range of ion acceleration process in inertial confinement fusion (ICF) target.

Delivered couple of guest lectures to undergraduate students on "Computational Plasma Physics for Laboratory/Space Plasmas"

Institute for Plasma Research	Gandhinagar, India
Postdoctoral Fellow	February 2018 — July 2019

Developed and performed a 2-D, fully explicit, relativistic, electromagnetic, multi-fluid depiction based fluid code to study the electron - and proton-beam driven plasma wakefield acceleration scheme. Also performed fully kinetic, particle-based Particle-In-Cell (PIC) simulation code, "OSIRIS", for studying various nonlinear processes associated with laser/beam-plasma interaction system.

Simulation and modeling skills

Fluid simulation:

Developing and performing a 3-D, fully explicit, parallel, plasma simulation tool, "MS-FLUKSS" (Multi-Scale FLUid Kinetic Simulation Suite), developed at the Center for Space Plasma and Aeronomic Research (CSPAR), University of Alabama in Huntsville (UAH). MS-FLUKSS, one of the sophisticated code, is capable of modeling the partially ionized space plasmas. The code uses adaptive mesh refinement (AMR) technique in cartesian or spherical grids, implemented using "Chombo" package. The flow of plasmas is described by the ideal magnetohydrodynamics (MHD) equations, and neutral particles are treated as either hydrodynamically by solving the Euler equations or kinetically by solving the time dependent Boltzmann transport equation (BTE) using Monte Carlo method.

Developed and used 2-D, fully explicit, parallel, fluid description (Magnetohydrodynamics (MHD) and two-fluid) based plasma modeling tool, "PHORCE" (Package of High Order Simulation of Convection-diffusion Equations), based on multi-dimensional unstructured Discontinuous Galerkin-Finite Element method (DG-FEM), developed at Virginia Tech, USA. An affine reconstructed discontinuous Galerkin (aRDG) algorithm is developed and used to solve diffusion terms (viscosity, resistivity, and thermal conduction).

Developed and used a 2-D, fully explicit, relativistic, electromagnetic, multi-fluid description based fluid code, based on "Flux-Corrected-Transport (FCT)" scheme iteratively coupled with "Finite-Difference-Time-Domain (FDTD)" method. This code can solve the coupled set of fluid-Maxwell equations in 2-D cartesian geometry.

Developed and used "Test-Particle Simulation (TPS)", based on "Buneman-Boris" method, to calculate various kinetic and statistical properties of the fluid systems by evaluating the trajectories of the passive tracer particles distributed under the fluid background.

Particle-In-Cell (PIC) simulation:

Developed and used fully parallel, relativistic, electromagnetic PIC code "VPIC (vector particle-in-cell)", developed at Los Alamos National Laboratory (LANL), USA, to study the ion acceleration process in Inertial Confinement Fusion (ICF) target.

Used fully parallel, relativistic, electromagnetic PIC code "OSIRIS", developed and maintained by the Osiris Consortium, consisting of IST, Portugal and UCLA Plasma Simulation Group, USA, to study the laser/beam-plasma interaction system.

Molecular Dynamic (MD) simulation:

Performed simulation using Molecular Dynamics (MD) simulator, "LAMMPS'", to study the basics of strongly couple plasmas.

Computer skills

Programming languages: Fortran, C, C++, MATLAB, Python
Operating systems: Linux, Mac, Windows
Office software: LaTeX, Microsoft Office, Open-office, Microsoft Power Point
Computation and visualization software: MATLAB, ParaView, Python, VisIt, Tecplot, Gmsh, Mathematica, Microsoft Excel, Scilab, Origin, gnuplot, VMD-Visual Illustrator

Code management: GitHub

High-Performance-Computing (HPC): Performed simulations on Linux based large scale HPC systems (e.g. NASA-HECC, San Diego Super Computer Center (SDSC), Advance Research Computing (ARC) at Virginia Tech, UDBHAV at Institute for Plasma Research)

IDE: Visual studio code, Eclipse

Drawing tools: Inkscape, MS-paint

List of publications

Published journal articles

8. **Ratan Kumar Bera**, Arghya Mukherjee, Sudip Sengupta, and Amita Das, "Effect of Ion Motion on Breaking of Longitudinal Relativistically Strong Plasma Waves: Khachatryan mode revisited'", *Physics of Plasmas* **28**, 092102 (2021). https://doi.org/10.1063/5.0051094

7. Amita Das, Atul Kumar, Chandrasekhar Shukla, **Ratan Kumar Bera**, Deepa Verma, Devshree Mandal, Ayushi Vashishta, Bhavesh Patel, Y. Hayashi, K. A. Tanaka, G. Chatterjee, Amit D. Lad, G. Ravindra Kumar, and Predhiman Kaw, "Boundary driven unconventional mechanism of macroscopic magnetic field generation in beam-plasma interaction", *Phys. Rev. Research* **2**, 033405 (2020). https://link.aps.org/doi/10.1103/PhysRevResearch.2.033405

6. SK Yadav, **Ratan Kumar Bera**, D Verma, P Kaw, and A Das , "Nonlinear propagation of low−frequency electromagnetic disturbances in plasmas", *Contributions to Plasma Physics*, (2021). DOI: 10.1002/ctpp.202000101

5. **Ratan Kumar Bera**, Devshree Mandal, Amita Das, and Sudip Sengupta, "Effect of transverse beam size on the wakefields and driver beam dynamics in plasma wakefield acceleration schemes", *AIP Advances* **10**, 025203 (2020). https://doi.org/10.1063/1.5126210

4. Deepa Verma, **Ratan Kumar Bera**, Atul Kumar, Bhavesh Patel, and Amita Das, "Observation of 1-D time dependent non-propagating laser plasma structures using fluid and PIC codes", *Physics of Plasmas* **24**, 123111 (2017). https://doi.org/10.1063/1.5000442

3. Deepa Verma, **Ratan Kumar Bera**, Amita Das, and Predhiman Kaw, "The stability of 1-D soliton in transverse direction", *Physics of Plasmas* **23**, 123102 (2016). https://doi.org/10.1063/1.4968843

2. **Ratan Kumar Bera**, Arghya Mukherjee, Sudip Sengupta, and Amita Das, "Relativistic electron beam driven longitudinal wake-wave breaking in a cold plasma", *Physics of Plasmas* **23**, 083113 (2016). https://doi.org/10.1063/1.4960832

1. **Ratan Kumar Bera**, Sudip Sengupta, and Amita Das, "Fluid simulation of relativistic electron beam driven wakefield in a cold plasma", *Physics of Plasmas* **22**, 073109 (2015). https://doi.org/10.1063/1.4926816

Manuscripts under review

2. **Ratan Kumar Bera**, Yang Song, and Bhuvana Srinivasan "The effect of viscosity and resistivity on Rayleigh-Taylor instability induced mixing in magnetized high energy density plasmas", submitted in *Journal of Plasma Physics* , arXiv:2106.10391 [physics.plasm-ph] (2021)

1. Deepa Verma, **Ratan Kumar Bera**, Bhavesh Patel, and Amita Das, "Evolution of radiation burst from a multi-peak soliton in the laser-plasma system", submitted in *Laser and Particle Beams* (2021)

Manuscripts under preparation

2. **Ratan Kumar Bera**, Yang Song, and Bhuvana Srinivasan, "Rayleigh-Taylor instability induced turbulence in magnetized high-eenergy-density-plasmas" (2021).

1. **Ratan Kumar Bera**, Grigory Kagan, and Bhuvana Srinivasan, "Particle-In-Cell (PIC) simulation of mega-electron volt range ion acceleration process in Inertial Confinement Fusion (ICF) target" (2021).

Mentoring experiences

Project title: Fluid Simulation of ultra-intense laser-driven wakefield excitation in a cold plasma   2018
Student: Mr. Vraj Patel, Dept. of Physics, IIT(ISM) Dhanbad, Jharkhand, India
A three months project for the partial fulfillment of 3rd year in Bachelor of Technology (B. Tech.) course work
Supervised jointly with Prof. Amita Das at Institute for Plasma Research, Gandhinagar, India

Project title: Quantum mechanical effects in plasmas   2018
Student: Mr. Kamalendu Paul, Dept. of Physics, National Institute of Science Education and Research, Odisha, India
A three months project for the partial fulfillment of 2nd year in Master of Science (M.Sc.) course work
Supervised jointly with Prof. Amita Das at Institute for Plasma Research, Gandhinagar, India

Project title: Study of acoustic and Langmuir waves using fluid simulations   2016
Student: Mr. M. Vardharajan, Department of Physics, St. Joseph's College, Bangalore, India
A three months project for the partial fulfillment of 3rd year in Bachelor of Science (B.Sc.) course work
Supervised jointly with Prof. Sudip Sengupta at Institute for Plasma Research, Gandhinagar, India

Project title: Role of the external magnetic field on the relativistic electron beam driven wakefield   2015
          in a cold plasma
Student: Mr. Anup Borade, Department of Physics, Indian Institute of Technology Madras, India
A three months project for the partial fulfillment of 3rd year in Bachelor of Technology (B. Tech.) course work
Supervised jointly with Prof. Amita Das at Institute for Plasma Research, Gandhinagar, India

Professional services

Reviewed more than ten articles in the following journals:
   Physics of Plasmas
   Plasma Physics and Controlled Fusion
    Pramana -Journal of Physics
   New Journal of Physics
   Journal of Plasma Physics

Participated outreach program organized by Institute for Plasma Research, India, on National Science Day and helped intermediate school and undergraduate students to learn the basics of nuclear fusion and tokamak physics.

Awards and achievements

Awarded by **DPP Student Travel Grant** from American Physical Society -Division of Plasma Physics (APS-DPP) to attend the 59th APS-DPP Annual Meeting in Milwaukee, Wisconsin, USA, (October 23-27, 2017)

Awarded by **PSSI Poster Presentation Award** in 30th National Symposium on Plasma Science and Technology, organized by Saha Institute For Nuclear Physics (SINP), Kolkata, India, (1-4 December, 2015).

Received T**ravel Grant** from the "Strong Field Science, India" to attend The International School on Ultra-IntenseLasers (ISUIL), Moscow, Russia, (October 4- 9, 2015).

Awarded by **PSSI Poster Presentation Award** in 29th National Symposium on Plasma Science and Technology, organized by Mahatma Gandhi University, Kottayam, India, (8-11 December, 2014).

Received T**ravel Grant** from "Strong Field Science, India" to attend CERN Accelerator School, CERN, Geneva, Switzerland, (November 23-29, 2014).

Secured AIR-174 in Joint Entrance Screening Test (JEST)-2013.

Secured AIR (All India Rank)-104 under Eligibility for Lectureship (NET-2012), awarded by University Grants Commission National Eligibility Test (UGC-NET).

Secured AIR-242 in Graduate Aptitude Test in Engineering (GATE)-2012.

Recipient of Merit-cum Scholarships, IIT Bombay, India, (2010-2012)

Recipient of West Bengal Govt. Merit-cum Scholarships awarded by Ministry of Higher Education, Govt. of West Bengal, India (2007-2010).

Conference and school presentations

Invited talk

1. 4th Asia Pacific Conference on Plasma Physics (AAPPS-DPP) as e-conference, (26-31 October, 2020).

2. ASian core program for High energy density science Using intense LAser photons (ASHULA), Lonavala, Maharashtra, India, (20-21 January, 2015).

Oral presentation

1. 62nd Annual Meeting of American Physical Society-Division of Plasma Physics (APS-DPP) virtual meeting, (9-13 November, 2020).

2. 32nd National Symposium on Plasma Science and Technology, Institute for Plasma Research, Gandhinagar (Gujarat), Gandhinagar, Gujarat, India, (7-10 November 2017).

3. 4th PSSI-Plasma Scholars' Colloquium, Jadavpur University, Kolkata, India, (6-17 August, 2015).

Poster presentation

1. 59th Annual Meeting of American Physical Society-Division of Plasma Physics (APS-DPP), Milwaukee, USA, (23-28 October 2017).

2. 10th Asia Plasma and Fusion Association Conference. Institute for Plasma Research, Gandhinagar, India, (14-18 December 2015).

3. International School on Ultra-Intense Lasers (ISUIL), 4-9 October 2015, Russia, (4-9 October 2015).
4. 30th National Symposium on Plasma Science and Technology (PSSI - 2015). Saha Institute For Nuclear Physics (SINP), Kolkata, India, (1-4 December, 2015).

5. 29th National Symposium on Plasma Science and Technology (PSSI - 2014). Mahatma Gandhi University, Kottayam, India, (8-11 December, 2014).

Professional memberships

Life member, Plasma Science Society of India (PSSI), India, since 2014
Student member, American Physical Society (APS), USA, since 2018
Regular member, American Geophysical Union (AGU), USA, since 2021

References

Prof. Amita Das
Professor
Dept. of Physics
Indian Institute of Technology Delhi
Hauz Khas, New Delhi - 110 016, India
Email: amita@iitd.ac.in
Email: amitadas3@yahoo.com

Prof. Sudip Sengupta
Professor
Institute for Plasma Research
Gandhinagar, Gujarat-382 428, India
Email: sudip@ipr.res.in
Phone: +91-79-23962170

Dr. Bhuvana Srinivasan
Associate Professor
Dept. of Aerospace and Ocean Engineering
Virginia Polytechnic Institute and State University
Blacksburg, VA 24061, USA
Email: srinbhu@vt.edu
Phone: +1-540-231-6795

Prof. Rahul Pandit
Professor
Department of Physics and Chairman Division of Physical and Mathematical Sciences
Indian Institute of Science
Bangalore 560 012, India
Email: rahul@iisc.ac.in
Phone: +91-80-2293-2863