

Dr. Mangilal Choudhary
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Working as an Assistant Professor, Physics(AP-1) at Institute of Advanced Research (IAR), The University for Innovation, Gandhinagar, Gujarat. Holding expertise in the area of experimental low temperature plasma and dusty plasma physics. My research is focused on the experimental studies of the basic phenomena in plasma (dusty plasma) and plasma applications for environment (Plasma-Catalysis) and agriculture (Plasma-Agriculture and Organic Fertilizer). I have been awarded PhD degree in the year of 2017 at Institute for Plasma Research, Gandhinagar.

Personal Details

Date of Birth: 01/07/1987
Place of Birth: Barod, Pali, Rajasthan
Nationality: Indian
Gender: Male
Category: OBC
Marriage status: Married
Languages: English and Hindi

Post Ph.D experience

March 2020–present: Assistant Professor–I, *Institute of Advanced Research, The university for Innovation, Gandhinagar, Gujarat, India*,
Research Interest: Non-thermal plasma and its applications, Plasma-catalysis for nitrogen fixation.

Feb 2018–Jan 2020: Post Doctoral Fellow, *Justus Liebig University Giessen, Giessen, Germany*,
PI: Prof. Markus H. Thoma.
Specialization: Dusty Plasma Physics

May 2017–Feb 2018: Post Doctoral Fellow, *Institute for Plasma Research, Gandhinagar, India*,
PI: Prof. S. Mukherjee.
Specialization: Basic and applied plasma physics

Education

2001–2003: **Secondary school, SPSS Schhol, Varkana, Pali, Rajasthan, India.**
Subjects: RBSE subject, percentage = 83.5%

2003–2005: **High secondary school, SPSS School, Varkana, Pali, Rajasthan, India.**
Subjects: Physics, Chemistry, Mathematicst, percentage = 78.3%

- 2005–2008 **Bachelor of Science**, *Lachoo memorial college of science and technology, J.N.V.U.*, Jodhpur, Rajasthan India.
Majors: Physics, Chemistry, Mathematics, percentage = 66.02%
- 2008–2010 **Master of Science**, *University of Rajasthan*, Jaipur, Rajasthan, India.
Majors: Physics, percentage = 69.17%
- 2011–2017 **PhD scholar**, *Institute for Plasma Research*, Gandhinagar, India.
Majors: Experimental Plasma and Dusty Plasma

Teaching experience

- March 2020–present Assistant professor (AP–I) at Institute for Advanced Research, The University for Innovation, Gandhinagar, Gujarat, India
- July 2010–April 2011 I taught high school physics and chemistry for 1 year at Jaideep Public High secondary school, Lalpura, Jaipur, Rajasthan (India).

Courses Taught at UG and PG level

- Under Graduate courses Waves and Optics (partial), Electric circuit and Network skill, Thermal Physics and Statistical Mechanics, Thermal Physics Lab, Mechanics Lab
- Post-Graduate courses Quantum Mechanics, Advanced Quantum Mechanics, Nuclear and particle Physics, General Physics Lab

Doctoral Research

- Title: *Experimental studies on collective phenomena in dusty plasmas*
- Supervisor: Prof. Subroto Mukherjee, Ex-head FCIPT (IPR), Head LIGO IPR
- Description: My doctoral thesis work focuses on the study of collective phenomena in a large volume dusty plasma medium, which is important for the understanding of astrophysical plasma phenomena, complex fluid flow, transport and trapping of particles in processing plasmas etc. I had specifically concentrated on the collective dynamics of dusty plasma and its characteristics with an external potential perturbation, transport and trapping of dust particles in the inductively coupled diffused plasma, and evolution of certain instabilities such as dissipative, ion-streaming, and dust acoustic etc in the large volume dusty plasma, which give rise to waves and co-rotating vortices. Meanwhile, the excitation of collective modes (solitary electron hole) and relaxation dynamics of low temperature plasma were also topics of focus during the PhD period. For studying the mentioned topics, different gas discharge (filament discharge, dc discharge, and inductively coupled discharge) and data analysis techniques were used.

Post-doctoral work experience

Supervisor: Prof. Markus H. Thoma, JLU, Giessen, Germany

Description: The post-doctoral project at JLU, Giessen, Germany was on the magnetized dusty plasma. I assembled, operated and worked on the superconducting electromagnet ($B_{max} = 4 \text{ T}$) to study the dusty plasma medium at strong magnetic field. For performing experiment in magnetized plasma, dusty plasma was created in the capacitive coupled discharge. In the first experiments, the surface potential of magnetic and non-magnetic spherical probes (or large dust grains) were estimated and compared at various strengths of magnetic fields. The role of magnetic field on the propagation characteristics of dust acoustic waves in rf discharge was studied in another experiment. The studies of 3-dimensional dusty plasmas and 2D annular dusty plasmas were carried out in the presence of strong magnetic field ($B > 1 \text{ T}$). We observed a single rotating dust torus and a pair of the counter-rotating dust torus in the 3-dimensional dusty plasma while a rigid rotational motion in 2D annulus dusty at various strengths of magnetic field. We used various electrode configurations to get the homogeneous and stable dusty plasma at strong magnetic field. During the experiments, we also came to know the challenges in working with strongly magnetized plasma (equipment challenges) and challenges to diagnose the strongly magnetized plasma.

Principal Abilities

- ★ Have expertise in designing and operating the various plasma sources (dc glow discharge, filament discharge, and rf discharge).
- ★ Experienced in experimental technique to characterize the plasma and dusty plasma by using the various diagnostics.
- ★ Basic knowledge in MATLAB for numerical programming, data plotting with origin and Matlab, PIV and PTV analysis for flow measurements, ImageJ software for image analysis, animation etc.
- ★ Understanding of different analytical and experimental methods applicable to complex/ambient plasma.
- ★ Have a ability to write research projects and working on basic as well as applied plasma physics projects.
- ★ Have a ability to guide the bachelor thesis, Master thesis and PhD thesis in the field of applied plasma as well as dusty plasma physics.
- ★ Have a ability to teach U.G. and P.G. physics courses and guide the experimental courses at U.G. and P.G. level
- ★ Have a ability to develop the physics laboratory at university

Teaching Statement

As an assistant professor, I am sharing the knowledge that I have learned to inspire young and fresh minds. I would be happy to teach UG and PG Physics courses at University if I get an opportunity. I am handling the Physics Laboratory (Lab Incharge and instructor) and have ability to handle the existing experiments and develop some simple new experiments.

As a Teacher, I have some idea to increase the learning capability of physics students

- ★ Self-assignment by students (Students can choose the problems and prepare a report on the given advanced physics topic)
- ★ At least one presentation by the student on the textbook (course) or research topic.

- ★ A Small project or demo on physical phenomena among few students
- ★ Understanding based class assignments and exams.
- ★ Group discussion on some topics among students during semester time
- ★ Viva for the individual students in presence of all the students.
- ★ Think and Bring Idea projects

As a Physics Faculty at university

- ★ I will Offer the elective papers or special course papers related to plasma physics: (a) Basic Plasma Physics (b) Experimental Plasma Physics (c) Applied low-temperature plasma physics.
- ★ I will do my best to develop physics department as a research department in line with academic activities
- ★ I will share the new ideas and try to implement them on time to shape the physics department (curriculum and laboratories, projects, etc.)
- ★ I will do my best to establish MoU or collaboration with other higher educational institute/research institutes
- ★ Organising conferences or workshops will also be priorities at university

Computational Expertise

Programming basic Fortran 90

Languages:

Operating Windows

Systems:

Office Kile (LaTeX), MS Office

Software:

Computational MATLAB, Origin, PIV and PTV, ImageJ

Software:

Affiliation

1. Member of Plasma Science Society of India (PSSI) (LM-1078)
2. Member of Division of Plasma Physics Association of Asia Pacific Physical Societies (AAPPS-DPP).

Scholarships and Recognition

- ★ GATE -2010), AIR Rank-912
- ★ GATE-2011, AIR Rank-360
- ★ National Eligibility Test (NET-2010), AIR Rank-152
- ★ UGC-CSIR JRF (2010), AIR Rank-152
- ★ Awarded with the Junior and Senior Research Fellowship (DAE-Scholarship) for my doctoral research at the Institute for Plasma Research, Gandhinagar, India.
- ★ Received a Travel Grant from 'Homi Bhabha National Institute' to attend the 18th ICPP at Kaohsiung, Taiwan, June 27 - July 1 2016.
- ★ Received a Travel Grant from 'Department of Science and Technology (DST), India' to attend the 1st AAPPS-DPP 2017 at Chengdu, China, September 18 - 23, 2017.

Awards

- ★ Young Scientist Award by VDGGOOD Professional Association, Chennai, India (2020)
- ★ Poster award (Second Prize) at NCRAS-2020, Assam Science and Technology University, Guwahati, India. August 17-19, 2020

Master Project Guided

- ★ Mr. Ritabrata B, A Literature Survey on Various Plasma Potential Measurement techniques (2020-2021)
- ★ Mr. Dinesh T, Application of Python in analysing Dusty Plasma Data (2020-2021)
- ★ Ms. Tanvira Malek, Plasma Agriculture: Demand for a better future (2021-2022)
- ★ Mr. Jay Pandya, Plasma Catalyst: A Demand for Environment Safety (2021-2022)
- ★ Mr. Chintan Vyas, Dusty Plasma Image Analysis Using Python (2021-2022)

Professional Services

Reviewer of journal articles:

- ★ Physics of Plasmas, Physica Scripta, Journal of Plasma Physics, Journal of Applied Physics:Physics D.

Journal Published papers

- 1) Long-time evolution of Low Pressure Laboratory Plasma After Application of Transient High Voltage Positive Pulses.
[Mangilal Choudhary](#), S. Kar and S. Mukherjee.
Contrib. Plasma Phys. 56, 878 (2016)
- 2) Transport and trapping of dust particles in a potential well created by inductively coupled diffused plasma.
[Mangilal Choudhary](#), S. Mukherjee, and P. Bandyopadhyay.
Rev. Sci. Instrum. 85, 053505 (2016).
- 3) Propagation characteristics of dust-acoustic waves in presence of a floating cylindrical object in the DC discharge plasma.
[Mangilal Choudhary](#), S. Mukherjee, and P. Bandyopadhyay.
Phys. Plasmas 23, 083705 (2016)
- 4) Experimental observations of self-excited co-rotating multiple dust vortices in dust cloud confined in the non-uniform inductively coupled diffused plasma.
[Mangilal Choudhary](#), S. Mukherjee, and P. Bandyopadhyay.
Phys. Plasmas 24, 033703 (2017)
- 5) Collective dynamics of large aspect ratio dusty plasma in an inhomogeneous plasma background: Formation of the co-rotating vortex series
[Mangilal Choudhary](#), S. Mukherjee, and P. Bandyopadhyay.
Phys. Plasmas 25, 023704 (2018)
- 6) Comment on "Potential profile near the virtual cathode in presence of charged dust, [Contribution to Plasma Physics, doi.org/10.1002/ctpp.201900007"].
[Mangilal Choudhary](#)
Contributions to Plasma Physics. 2020; 60:e201900137

- 7) Influence of external magnetic field on dust–acoustic waves in a capacitive RF discharge.
[Mangilal Choudhary](#), Roman Bergert, Slobodan Mitic, and Markus H Thoma.
Contributions to Plasma Physics. 2020; 60:e201900115
- 8) Three-dimensional dusty plasma in a strong magnetic field: Observation of rotating dust tori
[Mangilal Choudhary](#), Roman Bergert, Slobodan Mitic, and Markus H. Thoma.
Physics of Plasmas 27, 063701 (2020)
- 9) Rotational properties of annulus dusty plasma in a strong magnetic field.
[Mangilal Choudhary](#), Roman Bergert, Sandra Moritz, Slobodan Mitic, and Markus H. Thoma.
Contributions to Plasma Physics. 2020;e202000110
- 10) comparative study of the surface potential of magnetic and non-magnetic spherical objects in a magnetized radio-frequency discharge
[Mangilal Choudhary](#), Roman Bergert, Slobodan Mitic, and Markus H. Thoma.
Journal of Plasma Physics, 86 9058605 (2020)
- 11) Perspective: The dusty plasma experiments a learning tool for physics graduate students.
[Mangilal Choudhary](#).
European Journal of Physics, 42 053001 (2021), <https://doi.org/10.1088/1361-6404/abfdff>
- 12) Response of the low-pressure hot-filament discharge plasma to a positively biased auxiliary disk electrode.
[Mangilal Choudhary](#), P. K. Sreejith.
Plasma Sci. Technol. 24 015401 (2022)

Cover Pictures

- 1) Title = Cover Picture: Contrib. Plasma Phys. 2/2020.
[Mangilal Choudhary](#), Roman Bergert, Slobodan Mitic, and Markus H Thoma.
Contributions to Plasma Physics. 2020; 60:e201990025; doi.org/10.1002/ctpp.201990025
- 2) Title = Cover Picture: Contrib. Plasma Phys. 1/2021.
[Mangilal Choudhary](#), Roman Bergert, Slobodan Mitic, and Markus H Thoma.
Contributions to Plasma Physics. 2020; 61:e202190002; doi.org/10.1002/ctpp.202190002

Paper Under Review

- 1) Low-Temperature Plasma Technology: Impact on Indian Rural Life.
[Mangilal Choudhary](#).
Under review (IAR Research Bulletin), [arXiv:2006.16564v1](https://arxiv.org/abs/2006.16564v1)(2020)

Current research Interest

- ★ My current research focuses on understanding the basic physical and chemical mechanism (Literature review) of plasma-catalysis and methods to resolve the issues for a better use of technology
- ★ To learn the Python image analysis tools and techniques for analyzing the dusty plasma data.
- ★ To design and develop the plasma experimental setup to study the nitrogen and carbon dioxide fixation process using the plasma-catalysis techniques.
- ★ To use the nitrogen fixation techniques in agriculture sector (plasma-agriculture).

Conferences and schools

- 1) 1st PSSSI - Plasma Scholars Colloquium (PPSC - 2012).
Institute for Plasma Research, Gandhinagar, India, 3 - 4 July 2012.
- 2) 27th National Symposium on Plasma Science and Technology (PSSI - 2012).
Pondicherry University, Pondicherry, India, 10 - 13 December 2012.
- 3) International Conference on Complex Processes in Plasma and Nonlinear Dynamical Systems.
Institute for Plasma Research, Gandhinagar, India, 6 - 9 November 2012.
- 4) DST-SERB School-2013.
Institute for Plasma Research, Gandhinagar, India, 25 Feb.-15 March, 2013.
- 5) DST SERC school on tokamaks and magnetized plasma fusion,
Institute for Plasma Research, Gandhinagar, India, 25 February - 15 March 2013.
- 6) 7th International Conference on the Physics of Dusty Plasmas.
University of Delhi, New Delhi, India, 3-7 March 2014.
- 7) Hands-on-School on Nonlinear Dynamics (HSND-2015).
Institute for Plasma Research, Gandhinagar, India, Feb. 16-22, 2015.

Talks

- 1) Experimental observations of multiple co-rotating vortices in dusty plasma with inhomogeneous plasma background, ([Contributed Talk](#))
1st Asia Pacific International Conference on Plasma Physics (AAPPS-DPP 2017),
Chengdu, China, September 18-23, 2017.
- 2) Experiments on surface floating potential of spherical objects in the magnetized rf discharge plasma, ([Contributed Talk](#))
DPG-2019,
Munich, Germany, March 17-22, 2019.
- 3) Dusty Plasma in a Strong Magnetic Field, ([Invited talk](#))
International Online Seminar on Dusty Plasmas),
Christian-Albrechts-Universität zu Kiel, Germany, May- Aug. 2020.
- 4) Experimental study of dusty plasma in the various discharge configurations, ([Invited talk](#))
Physics Department Colloquium at Indian Institute of Technology (IIT), Jammu),
Jammu, August 27, 2020
- 5) Perspective: dusty plasma experiments—a learning tool for physics graduate students, ([Contributed Talk](#))
FAS-2021, SVNIT-Surat),
20-21 Oct, 2021

Poster presentations

- 1) Transient evolution of electron energy distributions function in low pressure plasma after formation of solitary electron hole.
28th National Symposium on Plasma Science and Technology-Plasma - 2013.
KIIT University, Bhubaneswar, India, 3 - 6 December 2013.

- 2) Propagation characteristics of dust–acoustic waves in presence of a floating cylindrical object in the DC discharge plasma (poster)
10th Asia Plasma and Fusion Association Conference.
Institute for Plasma Research, Gandhinagar, India, Dec. 14 - 18, 2015.
- 3) Characteristics of the Dust acoustics waves in an inductively coupled diffused plasma.
30th National Symposium on Plasma Science and Technology (PSSI - 2012..
Saha Institute For Nuclear Physics (SINP), Kolkata, India, 1 - 4 December 2015.
- 4) Transport and dynamical behavior of dust particles in a potential well created by inductively coupled diffused plasma
18th International Congress on Plasma Physics (ICPP–2016)
Kaohsiung, Taiwan, June 27 – July 1, 2016.
- 5) A Comparative study of surface potential of magnetic and non-magnetic spherical objects in magnetized rf discharge plasma.
Physics school on Physics of strongly coupled
Bad Honnef, Germany 31 March–4 April, 2019.
- 6) Rotational properties of annulus dusty plasma in a strong magnetic field.
3rd National Conference on Recent Advances in Science and Technology
Assam Science and Technology University, Guwahati, India August 17-19, 2020.

References

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