Rishi Raj, Ph.D.

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

1. **Major scientific fields of interest:** Energy, Boiling, Condensation, Bubble Acoustics, Colloids and Interface Science, Machine Learning, Microgravity Science

2. **Research Philosophy:** Our research at the Thermal and Fluid Transport Laboratory (TFTL) focuses on thermal and fluid transport during phase change for energy, water, and thermal management applications in both terrestrial and space systems. We integrate state-of-the-art experimentation, micro-/nano-fabrication, advanced characterization, and physics-/data-driven modeling to optimize heat and mass transfer processes. I am committed to mentoring students through hands-on experimentation, interdisciplinary collaboration, and cutting-edge research, fostering critical thinking and innovation. Our work addresses societal challenges in energy efficiency and water sustainability, aligning with country's technological and environmental goals, while preparing students for impactful careers in academia and industry.

3. Education

Degree	University / Institution	Year	Specialization
Ph.D.*	University of Maryland, College Park, MD, USA	2010	Mechanical, Thermal
M.S.	University of Maryland, College Park, MD, USA	2009	Mechanical, Thermal
B.Tech.	Indian Institute of Technology Guwahati	2006	Mechanical

*Doctoral Dissertation Title: Development of a Boiling Regime Map and Gravity Scaling Parameter for Pool Boiling Heat Transfer (**Best Dissertation Award**)

4. Experience

Duration	Institution	Position
December 2019 – present	Indian Institute of Technology Patna	Associate Professor, Department of Mechanical Engineering
July 2021 – July 2022	Indian Institute of Technology Patna	Associate Dean, Resources
August 2013 – December 2019	Indian Institute of Technology Patna	Assistant Professor, Department of Mechanical Engineering
August 2011 – July 2013	Massachusetts Institute of Technology (MIT), Cambridge, MA, USA	Post-doctoral Associate, Department of Mechanical Engineering
May 2010 – July 2011	University of Maryland, College Park, MD, USA	Post-doctoral Research Associate, Department of Mechanical Engineering
January 2009 – May 2010	University of Maryland, College Park, MD, USA	Future Faculty Fellow
August 2006 – May 2010	University of Maryland, College Park, MD, USA	Research Assistant

5. Fellowship/Editorship/Associateship/Membership

i. Member, Technical Programme Committee (TPC) for Advanced Research Grant (ARG) Mechanical, Manufacturing, Aerospace Engineering and Robotics Program of Anusandhan National Research Foundation (ANRF).
ii. Editor, International Communications in Heat and Mass Transfer, Elsevier (2022 – till date)
iii. Associate Editor, Sadhana, Springer Nature (2025 – till date)
iv. Member, Editorial Board, Interfacial Phenomena and Heat Transfer (2023 – till date)
v. Swarnajayanti Fellowship 2021, Department of Science and Technology, GoI
vi. Young Associate, Indian National Science Academy (INSA 2019)
vii. Young Associate, Indian National Academy of Engineering (INAE 2018)
viii. Associate, Indian Academy of Sciences (IASc 2018)
ix. Member, Assembly of World Conferences on Experimental Heat Transfer, Fluid Mechanics and Thermodynamics (2024 - till date)
x. Member, Publication Committee, Indian National Academy of Engineering (INAE, 2022 – till date)

Rishi Raj, Ph.D.

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

xi. Member, Executive Committee, Indian Society for Heat and Mass Transfer (ISHMT, 2021 – till date)
xii. Member, International Scientific Committee of the International Conference on Boiling and Condensation Heat Transfer (2018 – till date)
xiii. Life Member, Indian Society for Heat and Mass Transfer (ISHMT, 2015 – till date)
xiv. Life Member, National Society of Fluid Mechanics and Fluid Power (NSFMFP, 2023 – till date)

6. Awards and Recognition

Fellowship	Details	Year	Type
Swarnajayanati (*Engineering Sciences*)	Awarded by ***Department of Science and Technology, Government of India***	2021	National
Awards from Academies/Societies	**Details**	**Year**	**Type**
Prof. K. N. Seetharamu Medal and Prize	Awarded by the ***Indian Society for Heat and Mass Transfer (ISHMT)*** to Researchers in Heat and Mass Transfer	2021	National
Medal for Young Scientists	Awarded by the ***Indian National Science Academy (INSA)***	2019	National
Young Engineer	Awarded by the ***Indian National Academy of Engineering (INAE)***	2018	National
Associateship	Awarded by the ***Indian Academy of Science (IASc)***	2018	National
Keynote/Invited Lectures	**Details**	**Year**	**Type**
Invited Speaker	Delivered an **Invited Lecture** during the ***Micro and Nanoscale Phase Change Phenomena: Gordon Research Conference-2025,*** Sheraton Fairplex Hotel & Conference Center, Pomona, California, United States, January 12-17, 2025.	2025	International
Invited Speaker	Delivered an **Invited Lecture** during the ***National Conference on Advances in Reactor Thermal-Hydraulics (ARTH 2025)*** organized by Bhabha Atomic Research Centre-BARC, Mumbai, India, January 9-11, 2025.	2025	National
Keynote Speaker	Delivered a **Keynote Address** during the ***Micro Flow and Interfacial Phenomena - μFIP 2024 Conference*** organized by Hong Kong Polytechnic University, Hong Kong, June 20-24, 2024.	2024	International
Keynote Speaker	Delivered a **Keynote Address** at the ***Workshop on Interfacial Engineering at Multiple Spatio-Temporal Scales,*** Indian Institute of Science, Bangalore, India, January 29-31, 2024.	2024	National
Keynote Speaker	Delivered a **Keynote Address** during the ***1st International Conference in Fluid, Thermal, and Energy Systems*** organized by NIT Calicut, India, June 9, 2022.	2022	International

Rishi Raj, Ph.D.

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

	Keynote Speaker	Delivered a **Keynote Address** during the ***48th National Conference on Fluid Mechanics and Fluid Power (FMFP 2021)*** organized by Birla Institute of Science and Technology Pilani, Rajasthan, India, 28th December, 2021.	2021	National
	Keynote Speaker	Delivered a **Keynote Address** during the ***One-Day Online International Symposium on Fluid and Thermal Engineering (FLUTE 2021)*** organized by Amity University, India, 22nd July, 2021.	2021	International
	Keynote Speaker	Delivered a **Keynote Address** during the ***25th National and 3rd International ISHMT-ASTFE Heat and Mass Transfer Conference*** organized at IIT Roorkee, India, December 28-31, 2019.	2019	International
	Keynote Speaker	Delivered a **Keynote Address** during the ***ASME 2017 International Conference on Nanochannels, Microchannels and Minichannels***, Hyatt Regency, Cambridge, MA, USA, August 27-30, 2017.	2017	International
	Best Paper/ Presentation/Poster	**Details**	**Year**	**Type**
	ISHMT Best Paper Award.	Best Paper Award for the paper titled "Eco-friendly Dip-Coating Approach for Resilient and Sustainable Superhydrophobic Aluminium Surfaces" during the *28th National and 6th International ISHMT-ASTFE Heat and Mass Transfer Conference*, December 9-12, IIT Jodhpur, India.	2025	International
	Best Presentation Award	Avinash Upadhyay (student) received the Best Presentation Award for the paper entitled "Acoustic Signature of Isolated Vapor Bubble Nucleating from a Single cavity" at the 2nd International Conference on Multiphase Flow and Heat Transfer (ICOM 2025), IIT Guwahati, India.	2025	International
	Best Presentation Award	2nd Place to Tonmoy Sharma (student) for the paper titled "Utility of Lubricant Induced Surfaces for Enhancing Droplet Removal in Microgravity Applications", ***14th Asian Microgravity Symposium***, IIT Madras, Tamil Nadu, India, December 1-6, 2024.	2024	International
	Best Presentation Award	1st Place to Avinash Upadhyay (student) for the Visual Microgravity Contest titled "Sound of Bubble Departure in Adverse Gravity Conditions", ***14th Asian Microgravity Symposium***, IIT Madras, Tamil Nadu, India, December 1-6, 2024.	2024	International
	Best Poster Award	1st place to Rahul Sinha (student) for the paper titled Biomass Gasification-Based Dryers for Neem Leaves, ***27th National and 5th International ISHMT-ASTFE Heat and Mass Transfer Conference***, IIT Patna, Patna-801103, India, December 14-17, 2023.	2023	International

Rishi Raj, Ph.D.

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

	Best Presentation Award	1st Place to Avinash Upadhyay (student) for the paper titled Understanding the Role of Counterions of Imidazolium-based Ionic Liquids on Boiling Heat Transfer, ***International Chemical Engineering Conference 2022***, Indian Institute of Technology Patna, India, November 12 – 13, 2022.	2022	International
	Best Poster Award	1st Place to Madhu Ranjan Gunjan (student) for the paper titled "Constant Mean Curvature Based Framework for Modeling Droplet Evaporation on Lubricant-Infused Surfaces," ***10th International Colloids Conference***, ~~Mallorca, Spain~~ (Conducted Online), December 6-9, 2020."	2020	International
	Prof. P. K. Sarma Best Paper Award	1st place for the paper titled "Acoustic feedback-controlled pool boiling of aqueous surfactant solutions" during the ***25th National and 3rd International ISHMT-ASTFE Heat and Mass Transfer Conference (IHMTC)*** organized at IIT Roorkee between 28-31 December, 2019.	2019	International
	Best Poster Award	1st place for the paper titled "Pool boiling with aqueous ionic liquid solutions" during the ***10th International Conference on Boiling and Condensation Heat Transfer***, 12-15 March 2018, Nagasaki, Japan	2018	International
	Best Paper Award	For the paper titled "Experimental characterization and modeling of capillary-pumped thin-film evaporation from micropillar wicks" during the ***ASME THE/FE/ICNMM Conference***, Washington DC, July 10-14, 2016.	2016	International
	Best Poster Award	For the paper titled "Hotspot Thermal Management via Thin-Film Evaporation" during **The Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronic Systems (iTherm)**, Las Vegas, May 31 – June 3, 2016.	2016	International
	Best Paper Award	For the paper titled "Nanoporous evaporative device for advanced electronics thermal management" during ***The Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronic Systems (iTherm)***, Lake Buena Vista, Orlando, FL, USA, May 27-30, 2014.	2014	International
	Best Poster Award	For the paper titled "Characterization of Pool Boiling over a Range of Gravity Levels and Heater Sizes" during the ***5th International Topical Team Workshop on Two-Phase Systems for Ground and Space Applications,*** Kyoto, Japan, Sept. 26-29, 2010.	2010	International

Rishi Raj, Ph.D.

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

Best Poster Award	For the paper titled "Gravity Scaling Parameter for Pool Boiling Heat Transfer," during the ***ASME International Mechanical Engineering Congress and Exposition (IMECE),*** Orlando, Florida, November 13-19, 2009.	2009	International
Teaching	**Details**	**Year**	**Type**
Best Teacher Award	Awarded by the ***Indian Institute of Technology Patna***	2018	Institutional
Other Fellowships	**Details**	**Year**	**Type**
Postdoctoral Fellowship	Recipient of the 2011/12 Battelle/MIT Postdoctoral Fellowship by the ***Department of Mechanical Engineering, Massachusetts Institute of Technology***	2011	International
Future Faculty Fellowship	Awarded by ***A. James Clark School of Engineering, University of Maryland, College Park, MD, USA***	2009	International
Others	**Details**	**Year**	**Type**
Travel Award	Department of Science and Technology Travel Award for attending the ***15th International Heat Transfer Conference, August 10-15, 2014, Kyoto.***	2014	National
Best Doctoral Dissertation Award	Best Doctoral Dissertation Award 2010 by the ***Department of Mechanical Engineering University of Maryland, College Park, USA***	2010	International
Best Presentation Award	Graduate Research Interaction Day (GRID) 2010, ***University of Maryland, College Park, USA***	2010	Institutional

7. Externally Funded Projects: Completed: 13 | Ongoing: 4| Sanctioned: 1

Title of Sponsored Projects	Agency/Amount	Type	Status/Duration
Experimental Investigation of Condensation Heat Transfer and Pressure Drop in Circular Tubes (*with co-PI Dr. Aswani Assam, IIT Patna*)	RESPOND, ISRO ***Amount: 44 Lakhs***	Sponsored	2024-2027 **Sanctioned**
Development of Thermally Controlled Modules of Optronic Payloads for Stratospheric Operation (*with co-PI Dr. Aswani Assam, IIT Patna*)	IRDE, DRDO ***Amount: 154 Lakhs***	Sponsored	2024-2027 **Ongoing**
Investigation of low global warming potential alternative chemicals to substances controlled under the Montreal Protocol (*with co-PI Dr. A. D. Thakur, IIT Patna*)	Project Management Unit, Ozone Cell, Ministry of Environment, Forest and Climate Change ***Amount: 50 Lakhs***	Sponsored	2023-2028 **Ongoing**

Rishi Raj, Ph.D.

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

Title of Sponsored Projects	Agency/Amount	Type	Status/Duration
Decoding the science of boiling via bubble acoustics: Towards preemptive control of vapor explosion in industrial applications	Swarnajayanti Fellowship Scheme, SERB and DST ***Amount: 334 Lakhs***	Sponsored	2022-2027 **Ongoing**
Passive Two-Phase Heat Spreader for Hotspot Mitigation in Microgravity of Space	*Human Spaceflight Centre (HSFC) ISRO* ***Amount: 37 Lakhs***	Sponsored	2020-2026 **Ongoing**
Strengthening Interfacial Characterization Facilities: Funds for Improvement of S&T Infrastructure (one among six co-PIs with HoD as the PI)	*DST FIST* ***Amount: 290 Lakhs***	Sponsored	2019-2024 **(Completed)**
Permanent Dropwise Condensation via Amphiphilic Additives in Vapor Phase (*with co-PI Dr. S. Daschakraborty, IIT Patna*)	*Indo*-Korea, *DST* ***Amount: 30 Lakhs***	Sponsored	2021-2024 **(Completed)**
Psychrometry Driven Design and Fabrication of An All-Season Optimal Atmospheric Water Harvester (*with co-PI Dr. A. D. Thakur, IIT Patna*)	*Water Technology Initiative, DST* ***Amount: 32 Lakhs***	Sponsored	2020-2023 **(Completed)**
Assessment of the Use of Modern Robotic and Machine Learning Tools for Addressing Operational Challenges at 3×660 MW Capacity Coal Fired Supercritical Power Plant (*as Co-PI with Dr. Atul Thakur, IIT Patna, as PI*)	Prayagraj Power Generation Company Ltd. ***Amount: 10 Lakhs***	Sponsored	2022-2023 **(Completed)**
Development of an Ionic Liquid-based Ultra-High Heat Dissipation Module for Energy Efficient Boiling Systems	*Core Research Grant, SERB* ***Amount: 47 Lakhs***	Sponsored	February 2020-August 2023 **(Completed)**
Development of an agricultural waste based off-the-grid climate control unit for storage and processing of agricultural produce (*with co-PI Dr. A. D. Thakur, IIT Patna*) *Industry Partner: New Leaf Dynamics*	*SERB under IMRPINT-2 scheme* ***Amount: 108 Lakhs***	Sponsored	March 2019 – January 2023 **(Completed)**
Surface Active Additives for Enhanced Flow Boiling in Microchannels	*DST-RFBR Joint Call* ***Amount: 16 Lakhs***	Sponsored	December 2019 – December 2021 **(Completed)**
Acoustic Detection of Leidenfrost Dynamics on Scalable Micro-/Nanostructured Surfaces	*DST Nanomission* ***Amount: 27 Lakhs***	Sponsored	July 2016 – July 2019 **(Completed)**
Design and Development of an Agricultural Waste Based Gasifier Heating System for GreenCHILL™ (*with co-PI Dr. A. D. Thakur, IIT Patna*) *Industry Partner: New Leaf Dynamics*	*MHRD and DST under UAY* ***Amount: 95 Lakhs***	Sponsored	August 2016 – August 2018 **(Completed)**
Enhancement of Boiling Heat Transfer via the Suppression of Coalescence in Microgravity	*RESPOND ISRO* ***Amount: 27 Lakhs***	Sponsored	April 2015 – April 2018 **(Completed)**
Flow Boiling Heat Transfer in Scalable Nanostructured Microchannels for High Heat Flux Applications (*with co-PI Dr. S. K. Saha, IIT Bombay*)	*DST SERB* ***Amount: 50 Lakhs***	Sponsored	August 2014 – August 2018 **(Completed)**

Rishi Raj, Ph.D.

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

Title of Sponsored Projects	Agency/Amount	Type	Status/Duration
CFD Simulation in a Co-Current Pressure Nozzle-Spray Dryer	*Haryana Leather Chemicals Ltd.*	Consultancy	December 2016 – February 2017 **(Completed)**
Performance Analysis and Improvement of a Tonne, 7 kW Ammonia based Adsorption Refrigerator (*with co-PI Dr. A. D. Thakur, IIT Patna*)	*New Leaf Dynamic Technologies (P) Ltd.*	Consultancy	December 2014 – February 2015 **(Completed)**

8. Patents: **Granted: 7 | Filed/Published: 3**

S.N.	Patent Title	Name of Inventors(s)	Patent No.	Award/ Appl. Date	Agency/ Country	Status
1.	Submerged Nozzle and Silencer Therefor	Alam, Md. Q., Upadhyay, A., Assam, A. and Raj, R	Application number 202531106299	03/11/2025	Indian Patent Office	Application filled and published online
2.	Method for Developing Tunable Wettability Surfaces	Shukla, A., Upadhyay, A., Thakur, A. D. and Raj, R	Application number 202531005502	23/01/2025	Indian Patent Office	Application filled and published online
3.	Optical System and Method for Capturing Acoustic Emissions in Harsh Environment	Jha, R., Maurya, A. K., and Raj, R.	Application Number 202431039103	18/05/2024	Indian Patent Office	Application filed and published online
4.	An Apparatus and Method for Off-The-Grid Climate Control	Sunil, Sinha, R., Raj, R., Thakur, A. D., Shukla, A., and Agarwal, A.	Indian Patent Number 519459	05/03/2024	Indian Patent Office	**Granted**
5.	An Improved Heat Sink System for Suppressing Two-Phase Thermal and Flow Instabilities and a Method Thereof	Sharma, D., Kumar, A., Ghosh, D. P., Raj, R., and Saha, S. K.	Indian Patent Number 510610	14/02/2024	Indian Patent Office	**Granted**
6.	System and Method for Extracting Atmospheric Moisture	Shukla, A., Sunil, Raj, R., and Thakur, A. D.	Indian Patent Number 496332	9/01/2024	Indian Patent Office	**Granted**
7.	A System and Method for Controlling the Buoyancy of an Underwater Submersible	Raj, R., Thakur, A., Banerjee, S., and Pandey, U.	Indian Patent Number 453932	22/09/2023	Indian Patent Office	**Granted**
8.	System and Method for Heat Recovery in Gasification Process	Sunil, Raj, R., Thakur, A. D., Rajan, B. K., Chaitanya, B., Sinha, R., Agarwal, A., and Agarwal, A.	Indian Patent Number 390902	01/03/2022	Indian Patent Office	**Granted**

Rishi Raj, Ph.D.

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

S.N.	Patent Title	Name of Inventors(s)	Patent No.	Award/ Appl. Date	Agency/ Country	Status
9.	Surfactant Based Boiling System for Zero Gravity	Raza, M. Q., and Raj, R.	Indian Patent Number 314531	24/06/2019	Indian Patent Office	**Granted**
10.	Enhanced Evaporative Heat Transfer Device Using Porous Membranes	Xiao, R., Raj, R., Narayanan, S., Wang, E. N., Enright, R., and Maroo, S. C.	U.S. Patent No. 9,835,363	05/12/2017	U.S. Patent Office	**Granted**

9. Memoranda of Understanding (MoU) / Agreements (MoA): Ongoing: 2 | Completed: 2

S. N.	Title	Institute/ Organization	MoU No.	Date Signed	Purpose	Duration
1	Research and Development of Low GWP Chemicals Including Blends to be used as Alternatives to HCFCs/HFCs	Project Management Unit, Ozone Cell, Ministry of Environment, Forest and Climate Change, Government of India	42/1/2018/PMU-OC	05/04/2023	Engagement of research scholars	5 Years
2	Development of Science Payload for Unmanned Mission of Indian Human Space Programme	Human Space Flight Centre (HSFC), Indian Space Research Organization (ISRO)	HSFC/GGYN/SS/MOU/IITP/01	08/04/2018	Developing a passive two-phase heat spreader	5 + 3 Years (extension)
3	Research Collaboration	New Leaf Dynamic Technologies (P) Ltd.	IMPRINT IIA/IITP	26/04/2019	Jointly work on projects in topics of mutual interest	5 Years
4	Research Collaboration	New Leaf Dynamic Technologies (P) Ltd.	UAY/IITP	26/09/2016	Jointly work on projects in topics of mutual interest	3 Years

10. Scholarly Publications: Journals: 74 | Conferences: 131 | Book Chapters: 3 | Technical Reports: 2

Journal Publications

[1] Suriyaprasaad, B., Upadhyay, A., Thakur, A., & Raj, R. (2025). A roadmap for decoding the sound of boiling. *Thermal Science & Engineering – Nature Portfolio* (**accepted**).

[2] Maurya, A. K., Alam, M. Q., Upadhyay, A., Hazra, S. K., Raj, R., & Jha, R. (2025). Decoding bubble acoustic emissions in multiphase flows using reconfigurable optical hydrophone. *APL Engineering Physics* (**accepted**).

[3] Suriyaprasaad, B., Upadhyay, A., Thakur, A., & Raj, R. (2025). Explainable boiling acoustics analysis using Grad-CAM and YAMNet for robust pool boiling regime classification. *Applied Thermal Engineering*. 278 Part B, 127220: 1-11. https://doi.org/10.1016/j.applthermaleng.2025.127220

[4] Alam, M. Q., Upadhyay, A., Assam, A., & Raj, R. (2025). On the origin and nature of acoustic emissions from bubbles departing an underwater nozzle. *Physics of Fluids*, 37(4). https://doi.org/10.1063/5.0263935

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

[5] Azad, R., Sharma, T., Martin, D., Daschakraborty, S., & Raj, R. (2024). Unravelling the surface activity of ethanol-water mixtures through experiments and molecular dynamics simulations. *Langmuir, 40*(33), 17577-17589. https://doi.org/10.1021/acs.langmuir.4c01825

[6] Sinha, R., Thakur, A. D., & Raj, R. (2024). Investigating drying behaviour and quality of neem leaves using a novel biomass gasification powered climate control unit with built-in humidity control. *International Communications in Heat and Mass Transfer, 158*, 107888: 1-14. https://doi.org/10.1016/j.icheatmasstransfer.2024.107888

[7] Upadhyay, A., Kumar, B., & Raj, R. (2024). Ionic liquid as a cosurfactant for critical heat flux enhancement during boiling with aqueous surfactant solutions. *Applied Thermal Engineering, 246*, 122962: 1-13. https://doi.org/10.1016/j.applthermaleng.2024.122962

[8] Sinha, R., Sunil, Agarwal, A., Thakur, A. D., & Raj, R. (2024). Design, fabrication, and performance assessment of a novel biomass gasification-powered all-season climate control unit for perishables. *Biomass and Bioenergy, 183*, 107161: 1-14. https://doi.org/10.1016/j.biombioe.2024.107161

[9] Shukla, A., Sunil, Thakur, A. D., & Raj, R. (2024). Experiment and modeling of an improvised atmospheric water harvester for arid and semi-arid conditions. *Applied Thermal Engineering, 242*, 122486: 1-14. https://doi.org/10.1016/j.applthermaleng.2024.122486

[10] Sunil, Agarwal, A., Thakur, A. D., & Raj, R. (2024). Demonstration of long-term cyclic sorption of ammonia in modified expanded graphite-calcium chloride composites for practical applications. *International Communications in Heat and Mass Transfer, 150*, 107206: 1-14. https://doi.org/10.1016/j.icheatmasstransfer.2023.107206

[11] Sinha, K. N. R., Kumar, V., Kumar, N., Thakur, A., & Raj, R. (2024). Dataset for boiling acoustic emissions: A tool for data-driven boiling regime prediction. *Data in Brief, 52*, 109793: 1-8. https://doi.org/10.1016/j.dib.2023.109793

[12] Sharma, T., Erimban, S., Azad, R., Nam, Y., Raj, R., & Daschakraborty, S. (2023). Investigating the vapor-phase adsorption of aroma molecules on water-vapor interface using molecular dynamics simulations. *Langmuir, 39*(49), 17889-17902. https://doi.org/10.1021/acs.langmuir.3c02531

[13] Upadhyay, A., Hazra, S. K., Assam, A., & Raj, R. (2023). Review of the current status and the potential of machine learning tools in boiling heat transfer. *Numerical Heat Transfer, Part B- Fundamentals,* 1–44. https://doi.org/10.1080/10407790.2023.2266770

[14] Upadhyay, A., Kumar, B., Kumar, N., & Raj, R. (2023). Simultaneous enhancement of critical heat flux and heat transfer coefficient via in-situ deposition of ionic liquids during pool boiling. *International Journal of Heat and Mass Transfer, 208,* 124066: 1–11. https://doi.org/10.1016/j.ijheatmasstransfer.2023.124066

[15] Hedau, G., Qadeer, Md., Gulhane, N. P., Raj, R., & Saha, S. K. (2023). On the importance of fluidic manifold design and orientation on flow boiling instability in microchannel heat sinks. *International Journal of Heat and Mass Transfer, 209,* 124120: 1–19. https://doi.org/10.1016/j.ijheatmasstransfer.2023.124120

[16] Chaitanya, B., Gunjan, M. R., Sanargi, R. N., Raj, R., & Thakur, A. D. (2022). Per-fluorinated chemical-free robust superhydrophobic copper surface using a scalable technique. *Materials Chemistry and Physics, 278,* 125667: 1–10. https://doi.org/10.1016/j.matchemphys.2021.125667

[17] Hedau, G., Raj, R., & Saha, S. K. (2022). Complete suppression of flow boiling instability in microchannel heat sinks using a combination of inlet restrictor and flexible dampener. *International Journal of Heat and Mass Transfer, 182,* 121937: 1–18. https://doi.org/10.1016/j.ijheatmasstransfer.2021.121937

[18] Sinha, K. N. R., Kumar, V., Kumar, N., Thakur, A., & Raj, R. (2021). Deep learning the sound of boiling for advance prediction of boiling crisis. *Cell Reports Physical Science, 2(3),* 100382: 1–14. https://doi.org/10.1016/j.xcrp.2021.100382

[19] Gunjan, M. R., Kumar, A., & Raj, R. (2021). Cloaked droplets on lubricant-infused surfaces: Union of constant mean curvature interfaces dictated by thin-film tension. *Langmuir, 37*(22), 6601–6612. https://doi.org/10.1021/acs.langmuir.0c03560

[20] Verma, A., Kumar, N., & Raj, R. (2021). Direct prediction of foamability of aqueous surfactant solutions using property values. *Journal of Molecular Liquids, 323,* 114635: 1–10. https://doi.org/10.1016/j.molliq.2020.114635

[21] Hedau, G., Raj, R., & Saha, S. K. (2021). Effect of outlet plenum design on flow boiling heat transfer in microchannel heat sinks. *Thermal Science and Engineering Progress, 23,* 100868: 1–19. https://doi.org/10.1016/j.tsep.2021.100868

[22] Kumar, A., Gunjan, M. R., & Raj, R. (2020). On the validity of force balance models for predicting gravity-induced detachment of pendant drops and bubbles. *Physics of Fluids, 32*(10), 101703: 1–5. https://doi.org/10.1063/5.0025488

[23] Kumar, V., Sinha, K. N. R., & Raj, R. (2020). Leidenfrost phenomenon during quenching in aqueous solutions: Effect of evaporation-induced concentration gradients. *Soft Matter, 16,* 6145–6154. https://doi.org/10.1039/D0SM00622J

[24] Gunjan, M. R., Kumar, A., & Raj, R. (2020). Droplets on lubricant-infused surfaces: Combination of constant mean curvature interfaces with Neumann triangle boundary conditions. *Langmuir, 31*(11), 2974–2983. https://doi.org/10.1021/acs.langmuir.9b03927

[25] Sarode, A., Raj, R., & Bhargav, A. (2020). On the role of confinement plate wettability on pool boiling heat transfer. *International Journal of Heat and Mass Transfer, 156,* 119723: 1–12. https://doi.org/10.1016/j.ijheatmasstransfer.2020.119723

[26] Kumar, N., Sinha, K. N. R., Raza, M. Q., Verma, A., Seth, D., Jasvanth, V. S., & Raj, R. (2020). Design, fabrication, and performance evaluation of a novel orientation-independent and wickless heat spreader. *International Journal of Heat and Mass Transfer, 153,* 119572: 1–12. https://doi.org/10.1016/j.ijheatmasstransfer.2020.119572

[27] Hedau, G., Dey, P., Raj, R., & Saha, S. K. (2020). Experimental and numerical investigation of the effect of number of parallel microchannels on flow boiling heat transfer. *International Journal of Heat and Mass Transfer, 158,* 119973: 1–18. https://doi.org/10.1016/j.ijheatmasstransfer.2020.119973

[28] Ghosh, D. P., Sharma, D., Kumar, A., Saha, S. K., & Raj, R. (2020). An ingenious fluidic capacitor for complete suppression of thermal fluctuations in two-phase microchannel heat sinks. *International Communications in Heat and Mass Transfer, 110,* 104347: 1–8. https://doi.org/10.1016/j.icheatmasstransfer.2019.104347

[29] Kumar, A., Gunjan, M. R., Jakhar, K., Thakur, A., & Raj, R. (2020). Unified framework for mapping shape and stability of pendant drops including the effect of contact angle hysteresis. *Colloids and Surfaces A: Physicochemical and Engineering Aspects, 597,* 124619: 1–10. https://doi.org/10.1016/j.colsurfa.2020.124619

[30] Sinha, K. N. R., Ranjan, D., Kumar, N., Raza, M. Q., & Raj, R. (2020). Simultaneous audio-visual-thermal characterization of transition boiling regime. *Experimental Thermal and Fluid Science, 118,* 110162: 1–12. https://doi.org/10.1016/j.expthermflusci.2020.110162

[31] Rahman, O. S. A., Mukherjee, B., Priyadershini, S., Gunjan, M. R., Raj, R., Aruna, S. T., & Kehsri, A. K. (2020). Investigating the wetting phenomena and fabrication of sticky, para-hydrophobic cerium oxide coating. *Journal of the European Ceramic Society, 40(15),* 5749–5757. https://doi.org/10.1016/j.jeurceramsoc.2020.06.028

[32] Hedau, G., Dey, P., Raj, R., & Saha, S. K. (2020). Combined effect of inlet restrictor and nanostructure on two-phase flow performance of parallel microchannel heat sinks. *International Journal of Thermal Sciences, 153,* 106339: 1–16. https://doi.org/10.1016/j.ijthermalsci.2020.106339

[33] Sarode, A., Raj, R., & Bhargav, A. (2020). Scalable macroscale wettability patterns for pool boiling heat transfer enhancement. *Heat and Mass Transfer, 56,* 989–1000. https://link.springer.com/article/10.1007/s00231-019-02783-y

[34] Sachi, S., Zaitsev, D. V., & Raj, R. (2020). Effect of ionic liquid additives on temperature and pressure fluctuations during water flow boiling in microchannels. *Journal of Physics: Conference Series, 1677,* 012093. https://doi.org/10.1088/1742-6596/1677/1/012093

[35] Sarode, A., Raj, R., & Bhargav, A. (2020). Effect of confinement and heater surface inclination on pool boiling performance of patterned wettability surfaces. *Journal of Enhanced Heat Transfer, 27*(8), 711–727. https://doi.org/10.1615/JEnhHeatTransf.2020033852

[36] Kumar, N., Raza, M. Q., Sinha, K. N. R., Seth, D., & Raj, R. (2020). Amphiphilic additives to enhance pool boiling heat transfer in confined spaces. *Journal of Enhanced Heat Transfer, 27*(6), 545–560. https://doi.org/10.1615/JEnhHeatTransf.2020034432

[37] Sunil, Sinha, R., Chaitanya, B., Rajan, B. K., Agarwal, A., Thakur, A. D., & Raj, R. (2019). Design, fabrication, and performance evaluation of a novel biomass-gasification-based hot water generation system. *Energy, 185,* 148–157. https://doi.org/10.1016/j.energy.2019.06.186

[38] Raza, M. Q., Kumar, N., & Raj, R. (2019). Effect of foamability on pool boiling critical heat flux with nanofluids. *Soft Matter, 15,* 5308–5318. https://doi.org/10.1039/C8SM02565G

Rishi Raj, Ph.D.

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

[39] Sinha, K. N. R., Ranjan, D., Raza, M. Q., Kumar, N., Kaner, S., Thakur, A., & Raj, R. (2019). In-situ acoustic detection of critical heat flux for controlling thermal runaway in boiling systems. *International Journal of Heat and Mass Transfer, 138,* 135–143. https://doi.org/10.1016/j.ijheatmasstransfer.2019.04.029

[40] Sharma, D., Ghosh, D. P., Saha, S. K., & Raj, R. (2019). Thermohydraulic characterization of flow boiling in nanostructured microchannel heat sink with vapor venting manifold. *International Journal of Heat and Mass Transfer, 130,* 1249–1259. https://doi.org/10.1016/j.ijheatmasstransfer.2018.11.005

[41] Kumar, N., Raza, M. Q., Seth, D., & Raj, R. (2019). Surface-active ionic liquids as potential additive for pool boiling-based energy systems. *Journal of Molecular Liquids, 287,* 110953: 1–12. https://doi.org/10.1016/j.molliq.2019.110953

[42] Raza, M. Q., Kumar, N., & Raj, R. (2019). Experimental characterization and modeling of critical heat flux with subcooled foaming solution. *International Journal of Thermal Sciences, 141,* 199–210. https://doi.org/10.1016/j.ijthermalsci.2019.03.007

[43] Ghosh, D. P., Sharma, D., Mohanty, D., Saha, S. K., & Raj, R. (2019). Facile fabrication of nanostructured microchannels for flow boiling heat transfer enhancement. *Heat Transfer Engineering, 40*(7), 537–548. https://doi.org/10.1080/01457632.2018.1436399

[44] Chaitanya, B., Bahadur, V., Thakur, A. D., & Raj, R. (2018). Biomass-gasification-based atmospheric water harvesting in India. *Energy, 165(B),* 610–621. https://doi.org/10.1016/j.energy.2018.09.183

[45] Raza, M. Q., Kumar, N., & Raj, R. (2018). Wettability-independent critical heat flux during boiling crisis in foaming solutions. *International Journal of Heat and Mass Transfer, 126*(A), 567–579. https://doi.org/10.1016/j.ijheatmasstransfer.2018.05.062

[46] Kumar, N., Raza, M. Q., & Raj, R. (2018). Aqueous ionic liquid solutions for boiling heat transfer enhancement in the absence of buoyancy-induced bubble departure. *International Journal of Heat and Mass Transfer, 122,* 354–363. https://doi.org/10.1016/j.ijheatmasstransfer.2018.01.101

[47] Kumar, N., Raza, M. Q., & Raj, R. (2018). Surfactant-aided bubble departure during pool boiling. *International Journal of Thermal Sciences, 131,* 105–113. https://doi.org/10.1016/j.ijthermalsci.2018.05.025

[48] Adera, S., Antao, D. S., Raj, R., & Wang, E. N. (2018). Hotspot thermal management via thin-film evaporation - Part II: Modeling. *IEEE Transactions on Components, Packaging and Manufacturing Technology, 8*(1), 99–112. https://doi.org/10.1109/TCPMT.2017.2757461

[49] Adera, S., Antao, D. S., Raj, R., & Wang, E. N. (2018). Hotspot thermal management via thin-film evaporation - Part I: Experimental characterization. *IEEE Transactions on Components, Packaging and Manufacturing Technology, 8*(1), 88–98. https://doi.org/10.1109/TCPMT.2017.2757463

[50] Gunjan, M. R., & Raj, R. (2017). Dynamic roughness ratio-based framework for modeling mixed mode of droplet evaporation. *Langmuir, 33*(28), 7191–7201. https://doi.org/10.1021/acs.langmuir.7b01653

[51] Jakhar, K., Chattopadhyay, A., Thakur, A., & Raj, R. (2017). Spline-based shape prediction and analysis of uniformly rotating sessile and pendant droplets. *Langmuir, 33*(22), 5603–5612. https://doi.org/10.1021/acs.langmuir.7b00811

[52] Kumar, A., & Raj, R. (2017). Droplets on microdecorated surfaces: Evolution of the polygonal contact line. *Langmuir, 33*(19), 4854–4862. https://doi.org/10.1021/acs.langmuir.7b00559

[53] Raza, M. Q., Kumar, N., & Raj, R. (2016). Surfactants for bubble removal against buoyancy. *Scientific Reports, 6,* 19113. https://doi.org/10.1038/srep19113

[54] Adera, S., Antao, D. S., Raj, R., & Wang, E. N. (2016). Design of micropillar wicks for thin-film evaporation. *International Journal of Heat and Mass Transfer, 101,* 280–294. https://doi.org/10.1016/j.ijheatmasstransfer.2016.04.107

[55] Antao, D. S., Adera, S., Zhu, Y., Farias, E., Raj, R., & Wang, E. N. (2016). Dynamic evolution of the evaporating liquid-vapor interface in micropillar arrays. *Langmuir, 32*(2), 519–526. https://doi.org/10.1021/acs.langmuir.5b03916

[56] Antao, D. S., Adera, S., Zhu, Y., Farias, E., Raj, R., & Wang, E. N. (2016). Visualization of evaporating liquid-vapor interface in micropillar arrays. *Journal of Heat Transfer – Transactions of ASME, 138*(2), 020910. https://doi.org/10.1115/1.4032254

[57] Raj, R., Adera, S., Enright, R., & Wang, E. N. (2014). High-resolution liquid patterns via three-dimensional droplet shape control. *Nature Communications, 5,* 4975. https://doi.org/10.1038/ncomms5975

[58] Humplik, T., Raj, R., Maroo, S. C., Laoui, T., & Wang, E. N. (2014). Effect of hydrophilic defects on water transport in MFI zeolites. *Langmuir, 30*(22), 6446–6453. https://doi.org/10.1021/la500939t

[59] Humplik, T., Raj, R., Maroo, S. C., Laoui, T., & Wang, E. N. (2014). Framework water capacity and infiltration pressure of MFI zeolites. *Microporous and Mesoporous Materials, 190,* 84–91. https://doi.org/10.1016/j.micromeso.2014.01.026

[60] Raj, R., Adera, S., Enright, R., & Wang, E. N. (2014). Polygonal droplets on microdecorated surfaces. *Journal of Heat Transfer – Transactions of ASME, 136*(8), 080906. https://doi.org/10.1115/1.4027521

[61] Adera, S., Raj, R., Enright, R., & Wang, E. N. (2013). Non-wetting droplets on hot superhydrophilic surfaces. *Nature Communications, 4,* 2518. https://doi.org/10.1038/ncomms3518

[62] Raj, R., Maroo, S. C., & Wang, E. N. (2013). Wettability of graphene. *Nano Letters, 13*(4), 1509–1515. https://doi.org/10.1021/nl304647t

[63] Raj, R., Enright, R., Zhu, Y., Adera, S., & Wang, E. N. (2012). Unified model for contact angle hysteresis on heterogeneous and superhydrophobic surfaces. *Langmuir, 28*(45), 15777–15788. https://doi.org/10.1021/la303070s

[64] Raj, R., Kim, J., & McQuillen, J. (2012). Pool boiling heat transfer on the International Space Station: Experimental results and model verification. *Journal of Heat Transfer – Transactions of ASME, 134*(10), 101504-1–101504-14. https://doi.org/10.1115/1.4006846

[65] Kim, J., Raj, R., & McQuillen, J. (2012). Gravity scaling of pool boiling heat transfer. *Journal of the Japan Society of Microgravity Application, 29*(2), 92–98. Link

[66] Raj, R., Kunkelmann, C., Stephan, P., Plawsky, P., & Kim, J. (2012). Contact line behavior for highly wetting fluid under superheated conditions. *International Journal of Heat and Mass Transfer, 55*(9–10), 2664–2675. https://doi.org/10.1016/j.ijheatmasstransfer.2011.12.026

[67] Raj, R., Kim, J., & McQuillen, J. (2012). On the scaling of pool boiling heat flux with gravity and heater size. *Journal of Heat Transfer – Transactions of ASME, 134*(1), 011502: 1-13. https://doi.org/10.1115/1.4004370

[68] Di Marco, P., Raj, R., & Kim, J. (2011). Boiling in variable gravity under the action of electric field: Results of parabolic flight experiments. *Journal of Physics: Conference Series, 327,* 012039. https://doi.org/10.1088/1742-6596/327/1/012039

[69] Raj, R., Kim, J., & McQuillen, J. (2010). Gravity scaling parameter for pool boiling heat transfer. *Journal of Heat Transfer – Transactions of ASME, 132*(9), 091502-1–091502-9. https://doi.org/10.1115/1.4001632

[70] Raj, R., & Kim, J. (2010). Heater size and gravity-based pool boiling regime map: Transition criteria between buoyancy and surface tension dominated boiling. *Journal of Heat Transfer – Transactions of ASME, 132*(9), 091503: 1-10. https://doi.org/10.1115/1.4001635

[71] Raj, R., Kim, J., & McQuillen, J. (2009). Subcooled pool boiling in variable gravity environments. *Journal of Heat Transfer – Transactions of ASME, 131(9),* 091502: 1-10. https://doi.org/10.1115/1.3122782

[72] Raj, R., & Kim, J. (2008). Thermocapillary convection during subcooled boiling in reduced gravity environments. *Annals of the New York Academy of Sciences, 1161,* 173–181. https://doi.org/10.1111/j.1749-6632.2008.04327x

[73] Parida, P. R., Raj, R., Prasad, A., & Mishra, S. C. (2007). Solidification of a semitransparent planar layer subjected to radiative and convective cooling. *Journal of Quantitative Spectroscopy and Radiative Transfer, 107(2),* 226–235. https://doi.org/10.1016/j.jqsrt.2007.02.004

[74] Raj, R., Prasad, A., Parida, P. R., & Mishra, S. C. (2006). Analysis of solidification of a semitransparent planar layer using the lattice Boltzmann method and the discrete transfer method. *Numerical Heat Transfer Part A: Applications, 49,* 1–21. https://doi.org/10.1080/10407780500359828

Book Chapters

[1] **Chaitanya, B., Thakur, A. D., and Raj, R.** (2020). Biomass gasifier-powered adsorption chiller for atmospheric water harvesting: Prospects in developing world. In *Advances in Energy Research, Vol. 1* (pp. 451–460). Springer. ISBN 978-981-15-2666-4.

[2] **Ghosh, D. P., Raj, R., Mohanty, D., Saha, S. K.** (2016). Onset of nucleate boiling, void fraction, and liquid film thickness. In *Microchannel Phase Change Transport Phenomena* (pp. 5–90). Elsevier. ISBN 978-0128-04-356-1.

[3] **Chattopadhyay, A., Thakur, A., and Raj, R.** (2016). Spline based modeling of two-dimensional droplets on rough and heterogeneous surfaces. In *Fluid Mechanics and Fluid Power - Contemporary Research*. Springer. ISBN 978-81-322-2741-0.

Rishi Raj, Ph.D.

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

Archival Technical Reports

[1] Jakhar, K., Chattopadhyay, A., Thakur, A., and Raj, R., 2019, "Spline-based Interface Modeling and Optimization (SIMO) for Surface Tension and Contact Angle Measurements," ***arXiv***, 1909.05943.

[2] Kim, J., Raj, R., McQuillen, J., 2014, "Gravity and Heater Size Effects on Pool Boiling Heat Transfer," ***NASA Contractor Report # NASA/CR-2014-216672, E-18879, GRC-E-DAA-TN13259.***

Peer Reviewed Conference Proceedings

[1] Shukla, A., Upadhyay, A., Qadeer, M., & Raj, R. (2025, December 9–12). Eco-friendly Dip-Coating Approach for Resilient and Sustainable Superhydrophobic Aluminium Surfaces. *Proceedings of the 28th National and 6th International ISHMT-ASTFE Heat and Mass Transfer Conference*, IIT Jodhpur, India. – ISHMT Best Paper Award.

[2] Upadhyay, A., Ghosh, P., Kumar, K., Charan, S., Alam, M. Q., Assam, A., & Raj, R. (2025, December 9–12). On the Absence of Measurable Acoustic Emissions During Gas Bubble Coalescence in a Liquid Pool. *Proceedings of the 28th National and 6th International ISHMT-ASTFE Heat and Mass Transfer Conference*, IIT Jodhpur, India.

[3] Qadeer, M., Shukla, A., Thakur, A. D., & Raj, R. (2025, December 9–12). Propane-Centric Binary Refrigerant Blends for Domestic Use: A Low-GWP Pathway to Replace R134a. *Proceedings of the 28th National and 6th International ISHMT-ASTFE Heat and Mass Transfer Conference*, IIT Jodhpur, India.

[4] Upadhyay, A.*, Hazra, S. K., Alam, M. Q., & Raj, R. (2025, December 9–12). Acoustic Signatures of Vapor Bubble During Boiling: Experiments and Insights from a Spring–Mass–Damper Model. *Proceedings of the 28th National and 6th International ISHMT-ASTFE Heat and Mass Transfer Conference*, IIT Jodhpur, India.

[5] Suriyaprasaad, B., Upadhyay, A., Thakur, A., & Raj, R. (2025, December 9–12). A Semi-Supervised Framework for Robust Boiling Regime Classification via Acoustic Emissions. *Proceedings of the 28th National and 6th International ISHMT-ASTFE Heat and Mass Transfer Conference*, IIT Jodhpur, India.

[6] Suriyaprasaad, B. Upadhyay, A., Thakur, A., & Raj, R. (2025, October 10-12). Interpretable and Robust Acoustic-Based Classification of Boiling Regime via Transfer Learning, *1st International Conference on Thermofluids Engineering*, IIT(ISM) Dhanbad, Jharkhand, India.

[7] Sinha, R., Sunil, Shukla, A., Thakur, A. D., & Raj, R. (2023, December 14–17). Experimental investigation of biomass gasification-based dryers for neem leaves. *Proceedings of the 27th National and 5th International ISHMT-ASTFE Heat and Mass Transfer Conference*, IIT Patna, Patna, India. Best Poster Award - 1st Place

[8] Sunil, Agarwal, A., Thakur, A. D., & Raj, R. (2023, December 14–17). High cycle sorption performance of calcium chloride composites with ammonia. *Proceedings of the 27th National and 5th International ISHMT-ASTFE Heat and Mass Transfer Conference*, IIT Patna, India.

[9] Shukla, A., Thakur, A. D., & Raj, R. (2023, December 14–17). Experiment and modeling of a modified atmospheric water harvester for arid and semi-arid climates. *Proceedings of the 27th National and 5th International ISHMT-ASTFE Heat and Mass Transfer Conference*, IIT Patna, Patna, India.

[10] Suriyaprasaad, B., Upadhyay, A., & Raj, R. (2023, December 14–17). Boiling regime classification via principal component analysis on bubble images and acoustics. *Proceedings of the 27th National and 5th International ISHMT-ASTFE Heat and Mass Transfer Conference*, IIT Patna, Patna, India.

[11] Alam, M. Q., Upadhyay, A., Assam, A., & Raj, R. (2023, December 14–17). Improving acoustic emission modeling of underwater bubble detachment by accounting for compressibility effects. *Proceedings of the 27th National and 5th International ISHMT-ASTFE Heat and Mass Transfer Conference*, IIT Patna, Patna, India.

[12] Raj, A., Alam, M. Q., Assam, A., & Raj, R. (2023, December 14–17). Numerical validation of acoustic emissions from a train of bubbles departing from an underwater nozzle. *Proceedings of the 27th National and 5th International ISHMT-ASTFE Heat and Mass Transfer Conference*, IIT Patna, Patna, India.

[13] Kumar, A., Sunil, Sinha, R., Maity, I., Raj, R., & Thakur, A. D. (2023, December 14–17). Biomass gasification residue as a rich source of carbon nanomaterials. *Proceedings of the 27th National and 5th International ISHMT-ASTFE Heat and Mass Transfer Conference*, IIT Patna, Patna, India.

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

[14] Sharma, T., Erimban, S., Azad, R., Nam, Y., Daschakraborty, S., & Raj, R. (2022, December 14–16). Decoding the vapor-phase adsorption of aroma compounds on the vapor-liquid interface by molecular dynamic simulations. *9th International and 49th National Conference on Fluid Mechanics and Fluid Power (FMFP)*, IIT Roorkee, Uttarakhand, India.

[15] Sinha, R., Sunil, Thakur, A. D., & Raj, R. (2021, December 17–20). Development of an all-season off-the-grid climate control unit for agricultural produce. *Proceedings of the 26th National and 4th International ISHMT-ASTFE Heat and Mass Transfer Conference,* IIT Madras, Chennai, India.

[16] Prakash, C. G. J., Gunjan, M. R., & Raj, R. (2021, December 17–20). Bio-inspired honeycomb pores as lubricant reservoirs for scalable and durable slippery surfaces. *Proceedings of the 26th National and 4th International ISHMT-ASTFE Heat and Mass Transfer Conference,* IIT Madras, Chennai, India.

[17] Sharma, T., Kumar, V., Sinha, K. N. R., & Raj, R. (2021, December 17–20). Deep learning time-frequency representations of boiling acoustics for accurate prediction of transition between heat transfer regimes. *Proceedings of the 26th National and 4th International ISHMT-ASTFE Heat and Mass Transfer Conference,* IIT Madras, Chennai, India.

[18] Sharma, T., Kumar, V., Sinha, K. N. R., & Raj, R. (2021, December 17–20). Physics-informed deep learning for acoustic detection of departure from nucleate boiling. *Proceedings of the 26th National and 4th International ISHMT-ASTFE Heat and Mass Transfer Conference,* IIT Madras, Chennai, India.

[19] Kumar, V., Sinha, K. N. R., Sharma, T., & Raj, R. (2021, December 17–20). Acoustic detection of departure from nucleate boiling as a precursor to the critical heat flux. *Proceedings of the 26th National and 4th International ISHMT-ASTFE Heat and Mass Transfer Conference,* IIT Madras, Chennai, India.

[20] Upadhyay, A., Kumar, N., Pathak, M., & Raj, R. (2021, December 17–20). Numerical simulation of bubble behavior during pool boiling with foaming solutions. *Proceedings of the 26th National and 4th International ISHMT-ASTFE Heat and Mass Transfer Conference,* IIT Madras, Chennai, India.

[21] Hedau, G., Raj, R., & Saha, S. K. (2020, October). Effect of outlet plenum volume during flow boiling inside plain parallel microchannel. *Proceedings of the 5th World Congress on Momentum, Heat and Mass Transfer (MHMT'20),* Lisbon, Portugal Virtual Congress.

[22] Kumar, N., Sinha, K. N. R., Raza, M. Q., Seth, D., & Raj, R. (2019, December 4–6). Aqueous ionic liquid solution-based two-phase thermal management for adverse gravity applications. *21st Electronics Packaging Technology Conference (EPTC),* IEEE RS/EPS/EDS Singapore Chapter, Singapore.

[23] Kumar, N., Raza, M. Q., Sinha, K. N. R., Seth, D., & Raj, R. (2019, December 23–31). Heat transfer enhancement using surface-active additive during pool boiling in a confined chamber. *Proceedings of the 25th National and 3rd International ISHMT-ASTFE Heat and Mass Transfer Conference,* IIT Roorkee, Roorkee, India.

[24] Sarode, A., Raj, R., & Bhargav, A. (2019, December 23–31). A simple, scalable and cost-effective technique for pool boiling heat transfer enhancement. *Proceedings of the 25th National and 3rd International ISHMT-ASTFE Heat and Mass Transfer Conference,* IIT Roorkee, Roorkee, India.

[25] Sinha, K. N. R., Ranjan, D., Kumar, N., & Raj, R. (2019, December 23–31). Acoustic detection of microbubble emission boiling (MEB). *Proceedings of the 25th National and 3rd International ISHMT-ASTFE Heat and Mass Transfer Conference,* IIT Roorkee, Roorkee, India.

[26] Ranjan, D., Sinha, K. N. R., Raza, M. Q., Kumar, N., & Raj, R. (2019, December 23–31). Acoustic feedback-controlled pool boiling of aqueous surfactant solutions. *Proceedings of the 25th National and 3rd International ISHMT-ASTFE Heat and Mass Transfer Conference,* IIT Roorkee, Roorkee, India. Prof. P. K. Sarma Best Paper Award by ISHMT.

[27] Raza, M. Q., Kumar, N., & Raj, R. (2018, December 27–30). Critical heat flux enhancement during subcooled pool boiling with foaming solution. *CHEMCON 2018: 71st Annual Session of Indian Institute of Chemical Engineers,* NIT Jalandhar, India.

[28] Kumar, N., Raza, M. Q., Seth, D., & Raj, R. (2018, December 27–30). Bubble dynamics during boiling with foaming ionic liquid solution. *CHEMCON 2018: 71st Annual Session of Indian Institute of Chemical Engineers,* NIT Jalandhar, India.

[29] Gunjan, M. R., Kumar, A., & Raj, R. (2018, December 10–12). Wettability of lubricant-infused surfaces (LIS). *7th International and 45th National Conference on Fluid Mechanics and Fluid Power,* IIT Bombay, Mumbai, India.

[30] Kumar, A., Gunjan, M. R., Jakhar, K., & Raj, R. (2018, December 10–12). Interface shape evolution during buoyancy-induced droplet detachment. *7th International and 45th National Conference on Fluid Mechanics and Fluid Power,* IIT Bombay, Mumbai, India.

[31] Behera, D., Mohanty, D., Ghosh, D. P., Saha, S. K., & Raj, R. (2018, August 16–18). Experimental investigation of single-phase heat transfer on scalable nanostructured microchannels. *4th World Congress on Mechanical, Chemical, and Material Engineering,* Madrid, Spain.

[32] Kumar, N., Raza, M. Q., Seth, D., & Raj, R. (2018, March 12–15). Pool boiling with aqueous ionic liquid solution. *10th International Conference on Boiling and Condensation Heat Transfer,* Nagasaki, Japan. Best Poster Award- 1st Place

[33] Raza, M. Q., Kumar, N., & Raj, R. (2018, March 12–15). Critical heat flux mechanisms during pool boiling with nanofluids. *10th International Conference on Boiling and Condensation Heat Transfer,* Nagasaki, Japan.

[34] Kumar, N., Raza, M. Q., Seth, D., & Raj, R. (2017, December 27–30). Pool boiling with aqueous ionic liquid solutions for zero gravity applications. *24th National and 2nd International ISHMT-ASTFE Heat and Mass Transfer Conference,* Hyderabad, India.

[35] Raza, M. Q., Kumar, N., & Raj, R. (2017, December 27–30). Critical heat flux mechanism during pool boiling with surfactants. *24th National and 2nd International ISHMT-ASTFE Heat and Mass Transfer Conference,* Hyderabad, India.

[36] Sinha, N. R., & Raj, R. (2017, December 27–30). Acoustic detection of Leidenfrost dynamics on plain and nanostructured surfaces. *24th National and 2nd International ISHMT-ASTFE Heat and Mass Transfer Conference,* Hyderabad, India.

[37] Ghosh, D. P., Sharma, D., Saha, S. K., Raj, R. (2017, December 27–30). Flow boiling enhancement using scalable nanostructures inside rectangular microchannels. *24th National and 2nd International ISHMT-ASTFE Heat and Mass Transfer Conference,* Hyderabad, India.

[38] Sharma, D., Ghosh, D. P., Saha, S. K., & Raj, R. (2017, December 27–30). Optimization of inlet and outlet manifolds for flow boiling heat transfer enhancement in microchannels. *Proceedings of the 24th National and 2nd International ISHMT-ASTFE Heat and Mass Transfer Conference,* Hyderabad, India.

[39] Hedau, G., Ghosh, D. P., Sharma, D., Vaeghese, A., Raj, R., & Saha, S. K. (2017, December 27–30). Effect of nanostructure microchannels on flow boiling instability. *Proceedings of the 24th National and 2nd International ISHMT-ASTFE Heat and Mass Transfer Conference,* Hyderabad, India.

[40] Jakhar, K., & Raj, R. (2016, December 14–16). Spline-based interface modeling and optimization (SIMO) for tensiometry and goniometry applications. *44th National Conference on Fluid Mechanics and Fluid Power,* Amrita University, Amritapuri Campus, Kollam, Kerala, India.

[41] Gunjan, M. R., & Raj, R. (2017, December 14–16). Modelling of inner coffee ring deposits during evaporation of nanoparticle-laden droplets. *44th National Conference on Fluid Mechanics and Fluid Power,* Amrita University, Amritapuri Campus, Kollam, Kerala, India.

[42] Kumar, A., Gunjan, M. R., Jakhar, K., & Raj, R. (2017, December 14–16). Buoyancy induced detachment of pendant droplets from surfaces with contact angle hysteresis. *44th National Conference on Fluid Mechanics and Fluid Power,* Amrita University, Amritapuri Campus, Kollam, Kerala, India.

[43] Chaitanya, B., Thakur, A. D., & Raj, R. (2017, December 12–14). Biomass gasifier powered adsorption chiller for atmospheric water harvesting: Prospects in developing world. *6th International Conference on Advances in Energy Research,* Indian Institute of Technology Bombay, India.

[44] Adera, S., Antao, D. S., Raj, R., & Wang, E. N. (2017, May 30–June 2). Thin-film evaporation from micropillar wicks in ambient environment. *The Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronic Systems (ITHERM),* Orlando, FL, USA.

[45] Ghosh, D. P., Sharma, D., Raj, R., & Saha, S. K. (2016, December 15–17). Enhancement of flow boiling heat transfer via suppression of pressure drop fluctuations in nanostructured microchannels. *6th International and 43rd National Conference on Fluid Mechanics and Fluid Power,* MNNITA, Allahabad, U.P., India.

[46] Sharma, D., Ghosh, D. P., Raj, R., & Saha, S. K. (2016, December 15–17). Flow boiling in microchannels: Experimental study of heat transfer and pressure drop fluctuations. *6th International and 43rd National Conference on Fluid Mechanics and Fluid Power,* MNNITA, Allahabad, U.P., India.

[47] Gunjan, M. R., & Raj, R. (2016, December 15–17). Modelling and characterization of mixed mode of droplet evaporation. *6th International and 43rd National Conference on Fluid Mechanics and Fluid Power,* MNNITA, Allahabad, U.P., India.

[48] Kumar, A., & Raj, R. (2016, December 15–17). Evolution of droplets with polygonal contact line on microstructured surfaces. *6th International and 43rd National Conference on Fluid Mechanics and Fluid Power,* MNNITA, Allahabad, U.P., India.

[49] Kumar, N., Raza, M. Q., & Raj, R. (2016, December 15–17). Effect of orientation on pool boiling heat transfer with aqueous surfactant solution. *6th International and 43rd National Conference on Fluid Mechanics and Fluid Power,* MNNITA, Allahabad, U.P., India.

[50] Raza, M. Q., Kumar, N., & Raj, R. (2016, December 15–17). Surfactant enhanced pool boiling heat transfer in confined spaces. *6th International and 43rd National Conference on Fluid Mechanics and Fluid Power,* MNNITA, Allahabad, U.P., India.

[51] Shukla, V., Raza, M. Q., Kumar, N., & Raj, R. (2016, December 15–17). Effect of sidewall containment on pool boiling with aqueous surfactant solution on an inverted heater. *6th International and 43rd National Conference on Fluid Mechanics and Fluid Power,* MNNITA, Allahabad, U.P., India.

[52] Raj, R., & Thakur, A. (2016, December 15–17). Buoyancy induced detachment of pendant droplets. *6th International and 43rd National Conference on Fluid Mechanics and Fluid Power,* MNNITA, Allahabad, U.P., India.

[53] Adera, S., Antao, D. S., Raj, R., & Wang, E. N. (2016, July 10–14). Experimental characterization and modeling of capillary-pumped evaporation from micropillar wicks. *Heat Transfer, Fluids Engineering, & Nanochannels, Microchannels, and Minichannels Conferences,* Washington DC, USA. Best Paper Award

[54] Adera, S., Antao, D. S., Raj, R., & Wang, E. N. (2016, June 5–9). Extreme hotspot heat flux thermal management via thin-film evaporation from microstructured surfaces. *Hilton Head 2016 Workshop, A Solid-State Sensors, Actuators and Microsystems Workshop,* Sonesta Resort, SC 29928, USA.

[55] Adera, S., Antao, D. S., Raj, R., & Wang, E. N. (2016, May 31–June 3). Hotspot thermal management via thin-film evaporation. *The Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronic Systems,* Cosmopolitan Hotel, Las Vegas, NV, USA. Best Poster Award

[56] Kumar, N., Raza, M. Q., & Raj, R. (2015, December 27–30). Comparison of bubble behavior and heat transfer during pool boiling with aqueous surfactant solution on upward and downward facing heater. *CHEMCON 2015, 68th Annual Session of Indian Institute of Chemical Engineers,* Guwahati, India.

[57] Ghosh, D. P., Mohanty, D., Saha, S. K., & Raj, R. (2015, December 17–20). Fabrication of nanostructured microchannels for enhancement of single and multiphase heat transfer. *23rd National Heat and 1st International ISHMT-ASTFE Heat and Mass Transfer Conference,* Thiruvananthapuram, India.

[58] Raza, M. Q., & Raj, R. (2015, December 17–20). Pool boiling critical heat flux enhancement for reduced gravity application. *23rd National Heat and 1st International ISHMT-ASTFE Heat and Mass Transfer Conference,* Thiruvananthapuram, India.

[59] Chattopadhyay, A., Thakur, A., & Raj, R. (2015, December 14–16). Spline-based modeling of static and sliding droplets with contact angle hysteresis. *42nd National Conference on Fluid Mechanics and Fluid Power,* National Institute of Technology, Surathkal, India.

[60] Wei, M., Somasundaram, S., He, B., Liang, Q., Raj, R., Tan, C. S., & Wang, E. N. (2015, November 13–19). Optimization of biporous micropillar array for enhanced heat transfer performance. *ASME International Mechanical Engineering Congress and Exposition,* Houston, Texas, USA.

[61] Raza, M. Q., & Raj, R. (2015, April 26–30). Surfactant-enhanced pool boiling heat transfer during surface tension dominated boiling regime. *9th International Conference on Boiling and Condensation Heat Transfer,* Boulder, Colorado, USA.

[62] Chattopadhyay, A., Thakur, A., & Raj, R. (2014, December 12–14). Spline-based two-dimensional modeling of droplets on rough and heterogeneous surfaces. *5th International and 41st National Conference on Fluid Mechanics and Fluid Power,* Kanpur, India.

[63] Raza, M. Q., & Raj, R. (2014, December 8–11). Pool boiling heat transfer with aqueous surfactant solutions: Importance of time scales. *IUTAM Symposium on Multiphase Flows with Phase Change: Challenges and Opportunities,* Hyderabad, India.

[64] Raj, R., & Wang, E. N. (2014, August 10–15). Influence of dynamic wettability on evaporation kinetics of microscopic sessile droplets. *The 15th International Heat Transfer Conference,* Kyoto, Japan.

[65] Lu, Z., Narayanan, S., Hanks, D. F., Raj, R., Xiao, R., Antao, D. S., & Wang, E. N. (2014, August 10–15). Modeling of nanoporous membranes for high flux thin film evaporation. *The 15th International Heat Transfer Conference,* Kyoto, Japan.

[66] Hanks, D. F., Lu, Z., Bagnall, K. R., Narayanan, S., Raj, R., Xiao, R., & Wang, E. N. (2014, May 27–30). Nanoporous evaporative device for advanced electronics thermal management. *The Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronic Systems (ITHERM),* Orlando, FL, USA. Best Paper Award

[67] Humplik, T., Raj, R., Maroo, S. C., Laoui, T., & Wang, E. N. (2014, June 8–12). Selective water transport across uniform sub-nanometer pores in microfabricated membranes. *Hilton Head 2014 Workshop, A Solid-State Sensors, Actuators and Microsystems Workshop,* Sonesta Resort, SC 29928, USA.

[68] Liang, Q., Raj, R., Adera, S., Somasundaram, S., Tan, C. S., & Wang, E. N. (2013, December 11–13). Experiment and modeling of microstructured capillary wicks for thermal management of electronics. *15th Electronic Packaging Technology Conference,* Singapore.

[69] Adera, S., Raj, R., & Wang, E. N. (2013, December 11–14). Capillary limited thin-film evaporation on microstructured surfaces. *ASME 2013 4th Micro/Nanoscale Heat and Mass Transfer International Conference,* Hong Kong, China.

[70] Adera, S., Raj, R., Enright, R., & Wang, E. N. (2012, July 8–12). Evaporation-induced Cassie droplets on superhydrophilic microstructured surfaces. *ASME 2012 10th International Conference on Nanochannels, Microchannels and Minichannels,* Puerto Rico.

[71] Raj, R., *Kim*, J., & McQuillen, J. (2011, March 13–17). On the scaling of pool boiling heat flux with gravity and heater size. *ASME/JSME 8th Thermal Engineering Joint Conference,* Honolulu, Hawaii.

[72] Raj, R., *Kim*, J., McQuillen, J., Sheredy, W., Booth, W., Charpie, J., Eggers, J., Funk, G., Funk, J., & Valentine, R. (2010, August 8–13). Heater size and orientation effect on pool boiling of FC-72. *ASME International Heat Transfer Conference IHTC-14,* Washington D.C.

[73] Raj, R., *Kim*, J., & McQuillen, J. (2009, November 13–19). Gravity scaling parameter for pool boiling heat transfer. *ASME International Mechanical Engineering Congress and Exposition,* Lake Buena Vista, Florida. Best Poster Award

[74] *Raj, R.*, & Kim, J. (2009, May 3–7). Heater size effect on subcooled boiling of FC-72. *7th ECI Conference on Boiling,* Florianopolis-SC, Brazil.

[75] *Raj, R.*, & Kim, J. (2007, October 14–19). Thermocapillary convection during subcooled boiling in reduced gravity environments. *Interdisciplinary Transport Phenomena V: Fluid, Thermal, Biological, Material and Space Sciences,* Bansko, Bulgaria.

[76] Raj, R., *Prasad*, A., Parida, P. R., & Mishra, S. C. (2006, January 4–6). Analysis of phase change of a semitransparent media using the lattice Boltzmann method and the discrete transfer method. *18th National and 7th International ISHMT-ASME Heat and Mass Transfer Conference,* Indian Institute of Technology Guwahati, India.

[77] Mishra, S. C., Parida, P. R., Raj, R., & Prasad, A. (2005, December 14–16). Application of the lattice Boltzmann method and the discrete ordinate method for the analysis of solidification of a semitransparent planar layer subjected to radiative and convective cooling. *International Conference on Advanced Material Design and Development,* Goa, India.

Conference Presentations

[78] Alam, M. Q., Upadhyay, A., Kumar, K., Assam, A., and Raj, R. (2025, December 13 – 17*). On the acoustic contrast between bubble coalescence and departure*. Annual International Meeting on Complex Fluids and Soft Matter (CompFlu 2025), Indian Institute of Science (IISc), Bengaluru, India.

[79] Upadhyay, A., Hazra, S. K., Alam, M. Q., and Raj, R. (2025, October 31 – November 2). *Acoustic Signature of Isolated Vapor Bubble Nucleating from a Single Cavity*. 2nd International Conference on Multiphase Flow and Heat Transfer (ICOM 2025), IIT Guwahati, India. - Best Presentation Award- 1st Place

[80] Azad, R., Sharma, T., Upadhyay, A., Daschakraborty, S., and Raj, R. (2025, October 31 – November 2). *Surface Activity of Ethanol in Water: A Combined Molecular and Experimental Study*. 2nd International Conference on Multiphase Flow and Heat Transfer (ICOM 2025), IIT Guwahati, India.

Rishi Raj, Ph.D.

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

[81] Shukla, A., Upadhyay, A., Qadeer, M., Thakur, A. D., and Raj, R. (2025, October 31 – November 2). *Robust Superhydrophobic Aluminium via Immersion Coating: Scalable Solutions for Complex Geometries*. 2nd International Conference on Multiphase Flow and Heat Transfer (ICOM 2025), IIT Guwahati, India.

[82] Sharma, T., Raj, R., and Daschakraborty, S. (2025, October 11 – 14). *In-Silico Exploration of Wettability Tuning via Volatile Amphiphiles from the Vapour Phase*. Society of Physical Chemistry Symposium, IIT Patna, Patna, India. - Best Poster Award

[83] Azad, R., Sharma, T., Daschakraborty, S., and Raj, R. (2025, October 11 – 14). *Molecular Dynamics Investigation of the Surface Activity of Ethanol, n-Propanol, Isopropanol, and Tert-Butanol in Aqueous Solutions*. Society of Physical Chemistry Symposium, IIT Patna, Patna, India.

[84] Suriyaprasaad, B., Upadhyay, A., Thakur, A., and Raj, R. (2025, October 10 – 12). *Interpretable and Robust Acoustic-Based Classification of Boiling Regime via Transfer Learning*. Proceedings of the 1st International Conference on Thermofluids Engineering, IIT (ISM) Dhanbad, Dhanbad, India.

[85] Sharma, T., Azad, R., Daschakraborty, S., & Raj, R. (2024, December 1-6). Utility of Lubricant Induced Surfaces for Enhancing Droplet Removal in Microgravity Applications, *14th Asian Microgravity Symposium*, IIT Madras, Tamil Nadu, India. - Best Presentation Award- 2nd Place

[86] Upadhyay, A., Raza, M. Q., Kumar, N., and Raj, R. (2024, December 1-6). Sound of Bubble Departure in Adverse Gravity Conditions. *14th Asian Microgravity Symposium*, IIT Madras, Tamil Nadu, India. - Best Presentation Award, Visual Microgravity Contest- 1st Place

[87] Upadhyay, A., Raza, M. Q., Kumar, N., and Raj, R. (2024, December 1 – 6). Enhancing Boiling Performance in Adverse Gravity Conditions with Mixtures of Surfactants and Ionic Liquids. *14th Asian Microgravity Symposium*, IIT Madras, Tamil Nadu, India.

[88] Sharma, T., Raj, R., and Daschakraborty, S. (2024, October 22 – 25). *Scented Slippery Surfaces: Designing Aroma-Infused Lubricants through Experiments and Simulations*. Physical Chemistry Symposium, IIT Bombay, Mumbai, India.

[89] Alam, Md. Q., Upadhyay, A., Assam, A., & Raj, R. (2024, August 11–13). Investigation of bubble acoustics via experimental, analytical, and computational fluid dynamics approaches. *Annual AeSI CFD Symposium, AeSI CFD 2024*, Birla Institute of Technology, Mesra, Ranchi.

[90] Shukla, A., Upadhyay, A., Qadeer, M., Thakur, A. D., and Raj, R. (2024, July 18 – 21). Advancing Two-Phase Energy Systems with Ionic Liquid-Based Coating Technologies. *1st International Conference on Advancement in Thermal-Spray (ICOAT) 2024*, Indian Institute of Technology Patna.

[91] Upadhyay, A., Kumar, B., and Raj, R. (2024, June 20 – 24). Potential of Soluble Molecular Additives in Boiling-Based Thermal Management Systems. *4th Conference on Micro Flow and Interfacial Phenomena (μFIP)*, The Hong Kong Polytechnic University, Hong Kong.

[92] Sinha, R., Sunil, Thakur, A. D., and Raj, R., (2023, October 9-12), Design, fabrication, and experimental investigations of a heat recovery system from biomass gasifier exhaust for regeneration of desiccant, 4th *International Conference on Recent Advances in Bio-Energy Research*, SSS-NIBE, Kapurthala, Punjab, India.

[93] Alam, Md. Q., Upadhyay, A., Sinha, K. N. R., Kumar, V., Assam, A., Thakur, T., & Raj, R. (2023, May 15–17). Acoustic characterization of bubbles for in-situ prediction and control of boiling heat transfer regimes. *11th International Conference on Boiling and Condensation Heat Transfer,* ICBCHT-2023, University of Edinburgh.

[94] Upadhyay, A., Kumar, B., & Raj, R. (2022, December 27–30). Simultaneous enhancement in pool boiling CHF and HTC with the aqueous solutions of mixture of SDS and [C2mim][Cl]. *Indian Chemical Engineering Congress & 75th Annual Session of Indian Institute of Chemical Engineers CHEMCON - 2022,* Harcourt Butler Technical University, Kanpur.

[95] Kumar, B., Upadhyay, A., & Raj, R. (2022, December 27–30). Synergistic effect of ionic liquid on the foamability of aqueous surfactant solutions. *Indian Chemical Engineering Congress & 75th Annual Session of Indian Institute of Chemical Engineers CHEMCON - 2022,* Harcourt Butler Technical University, Kanpur.

[96] Alam, M. Q., Upadhyay, A., Assam, A., & Raj, R. (2022, December 27–30). Numerical investigation of passive acoustic emissions during bubble departure from an underwater nozzle. *Indian Chemical Engineering Congress & 75th Annual Session of Indian Institute of Chemical Engineers CHEMCON - 2022,* Harcourt Butler Technical University, Kanpur.

Rishi Raj, Ph.D.

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

[97] Azad, R., Sharma, T., Nam, Y., Daschakraborty, S., & Raj, R. (2022, December 27–30). On-demand rupture of condensate film via interfacial adsorption of aroma compounds. *Indian Chemical Engineering Congress & 75th Annual Session of Indian Institute of Chemical Engineers CHEMCON-2022,* Harcourt Butler Technical University, Kanpur.

[98] Sunil, Sinha, R., Agarwal, A., Thakur, A. D., & Raj, R. (2022, November 17–19). Biomass gasification-based low-temperature drying of farm perishables. *International Virtual Conference on H2 and CO2 2022 (ICH2CO2'22),* Indian Institute of Science Education and Research Pune, India.

[99] Upadhyay, A., Kumar, B., & *Raj, R.* (2022, November 12–13). Understanding the role of counterions of imidazolium-based ionic liquids on boiling heat transfer. *International Chemical Engineering Conference 2022,* Indian Institute of Technology Patna. Best Presentation Award- 1st Place

[100] Sharma, T., Erimban, S., Azad, R., Nam, Y., Daschakraborty, S., & Raj, R. (2022, November 12–13). Molecular dynamic simulations of aroma compounds adsorbed on vapor-liquid interface. *International Chemical Engineering Conference 2022,* Indian Institute of Technology Patna.

[101] *Sunil*, Agarwal, A., Thakur, A. D., & Raj, R. (2022, November 12–13). Comparison of high cycle performance of calcium chloride composites. *International Chemical Engineering Conference 2022,* Indian Institute of Technology Patna.

[102] Sinha, K. N. R., Kumar, V., Thakur, A., & Raj, R. (2022, June 9). Decoding the sound of boiling for advance prediction of boiling crisis. *1st International Conference in Fluid, Thermal, and Energy Systems (ICFTE22),* NIT Calicut. Keynote Address

[103] Raza, M. Q., Kumar, N., Verma, A., & Raj, R. (2021, July 22). Boiling-based thermal management strategies for Earth and reduced gravity applications. *Online International Symposium on Fluid and Thermal Engineering (FLUTE 2021),* Amity University. Keynote Address

[104] Gunjan, M. R., Kumar, A., & Raj, R. (2020, December 6–9). Constant mean curvature based framework for modeling droplet evaporation on lubricant-infused surfaces. *10th International Colloids Conference,* Mallorca, Spain (Conducted Online). Best Poster Award- 1st Place

[105] Kumar, A., Gunjan, M. R., & Raj, R. (2020, December 6–9). Unified tool for mapping the evolution of sessile drop under the influence of gravity. *10th International Colloids Conference,* Mallorca, Spain (Conducted Online).

[106] Chaitanya, B., Gunjan, M. R., Thakur, A. D., & *Raj, R.* (2020, December 6–9). Fabrication of robust and PFC free superhydrophobic copper surfaces. *10th International Colloids Conference,* Mallorca, Spain (Conducted Online).

[107] Kumar, N., Raza, M. Q., & Raj, R. (2019, December 28–31). Boiling with foaming solutions for Earth and microgravity applications. *25th National and 3rd International ISHMT-ASTFE Heat and Mass Transfer Conference (IHMTC),* IIT Roorkee, India. Keynote Address

[108] Raza, M. Q., Kumar, N., & Raj, R. (2019, February 3–8). Critical heat flux mechanisms during pool boiling with nanofluids. *2019 Micro and Nanoscale Phase Change Heat Transfer,* GRC, Renaissance Tuscany Il Ciocco in Lucca (Barga), Italy.

[109] Sinha, K. N. R., Ranjan, D., & Raj, R. (2018, December 22–23). Acoustic detection of CHF during pool boiling. *Proceedings of the National Conference on Critical Heat Flux and Multiphase Flow,* Indian Institute of Technology, BHU.

[110] Kumar, N., Raza, M. Q., & Raj, R. (2018, December 22–23). Pool boiling critical heat flux enhancement in the absence of buoyancy induced bubble departure. *Proceedings of the National Conference on Critical Heat Flux and Multiphase Flow,* Indian Institute of Technology, BHU.

[111] Raza, M. Q., Kumar, N., & Raj, R. (2018, December 22–23). Critical heat flux with foaming solutions: Mechanism and modeling. *Proceedings of the National Conference on Critical Heat Flux and Multiphase Flow,* Indian Institute of Technology, BHU.

[112] Raza, M. Q., Kumar, N., & Raj, R. (2017, August 27–30). Vapor crowding-based limit to pool boiling critical heat flux. *ASME 2017 International Conference on Nanochannels, Microchannels and Minichannels,* Hyatt Regency, Cambridge, MA. Keynote Address

[113] Adera, S., Antao, D. S., Raj, R., & Wang, E. N. (2016, January). Hotspot cooling via thin-film evaporation. *MARC 2016,* Bretton Woods, NH.

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

[114] Hanks, D. F., Lu, Z., Sircar, J., Raj, R., Antao, D. S., Narayanan, S., Barabadi, B., Enright, R., Salamon, T., Simon, E., & Wang, E. N. (2015, May 23–26). Microfabricated nanoporous membrane-based evaporation for high heat flux thermal management. *GOMACTech,* St. Louis, MO.

[115] Raj, R., Adera, S., Enright, R., & Wang, E. N. (2015, January 10–16). Wettability on micro and nanoscale surfaces for improved understanding of phase change heat transfer. *Gordon Research Conference on Micro and Nanoscale Phase Change Heat Transfer,* Galveston, TX.

[116] Antao, D. S., Adera, S., Raj, R., & Wang, E. N. (2015, January 10–16). Probing the liquid-vapor interface during phase change heat transfer. *Gordon Research Conference on Micro and Nanoscale Phase Change Heat Transfer,* Galveston, TX.

[117] Adera, S., Antao, D. S., Raj, R., & Wang, E. N. (2015, January). Experimental study of thin-film evaporation from microstructured surfaces. *MARC 2015,* Bretton Woods, NH.

[118] Humplik, T., Raj, R., Maroo, S. C., Laoui, T., & Wang, E. N. (2014, January). Optimized zeolite-based membranes for water desalination. *MARC 2014,* Bretton Woods, NH.

[119] Raj, R., Adera, S., Enright, R., & Wang, E. N. (2013, July 14–19). Polygonal droplets on microstructured surfaces. *Visualization of Heat Transfer, ASME 2013 Summer Heat Transfer Conference,* Minneapolis, MN.

[120] Raj, R., Enright, R., Zhu, Y., Adera, S., & Wang, E. N. (2013, July 14–19). Thermodynamic model for contact angle hysteresis on heterogeneous and superhydrophobic surfaces. *ASME 2013 Summer Heat Transfer Conference,* Minneapolis, MN.

[121] Raj, R., Xiao, R., & Wang, E. N. (2013, July 14–19). Experiments, modeling, and optimization of thin film evaporation in microstructured capillary wicks. *ASME 2013 Summer Heat Transfer Conference,* Minneapolis, MN.

[122] Raj, R., Maroo, S. C., & Wang, E. N. (2013, April 1–5). Substrate effect on the wettability of graphene. *2013 Material Research Society Spring Exhibit and Meeting,* San Francisco, CA.

[123] Humplik, T., Raj, R., Laoui, T., & Wang, E. N. (2013, April 1–5). Determining the optimal zeolite properties for increasing water permeability. *2013 Material Research Society Spring Exhibit and Meeting,* San Francisco, CA.

[124] Raj, R., Enright, R., Adera, S., & Wang, E. N. (2013). Thermodynamic model for contact angle hysteresis on rough surfaces. *Bulletin of the American Physical Society, APS March Meeting,* 58(1).

[125] Adera, S., Raj, R., Enright, R., & Wang, E. N. (2012, November 9–15). Evaporation-induced Cassie droplets on superhydrophilic microstructured surfaces. *ASME International Mechanical Engineering Congress and Exposition,* Houston, Texas.

[126] Di Marco, P., Raj, R., & Kim, J. (2010, September 17–21). Boiling in variable gravity under the action of electric field: Preliminary results of two parabolic flight experiments. *Seventh International Topical Team Workshop on Two-Phase Systems for Ground and Space Applications,* Beijing, China.

[127] Kim, J., Raj, R., & McQuillen, J. (2012, June 26–27). Pool boiling heat transfer in microgravity: Results from the Microheater Array Boiling Experiment (BXF-MABE) on the ISS. *1st Annual ISS Research and Development Conference,* Colorado, Denver, USA.

[128] Raj, R., & Kim, J. (2010, September 26–29). Characterization of pool boiling over a range of gravity levels and heater sizes. *Fifth International Topical Team Workshop on Two-Phase Systems for Ground and Space Applications,* Kyoto, Japan. Best Poster Award

[129] Raj, R., Kim, J., & McQuillen, J. (2010, September 26–29). Gravity scaling parameter for pool boiling heat transfer. *Fifth International Topical Team Workshop on Two-Phase Systems for Ground and Space Applications,* Kyoto, Japan.

[130] Di Marco, P., Raj, R., & Kim, J. (2010, September 26–29). Boiling in variable gravity under the action of electric field: Preliminary results from the parabolic flight experiments. *Fifth International Topical Team Workshop on Two-Phase Systems for Ground and Space Applications,* Kyoto, Japan.

[131] Raj, R., Kim, J., & McQuillen, J. (2008, September 10–12). Subcooled pool boiling in variable gravity environments. *Third International Topical Team Workshop on Two-Phase Systems for Ground and Space Applications,* Brussels, Belgium.

Rishi Raj, Ph.D.

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

11. Invited Talks

[1] **Bubble Acoustics and Two-Phase Cooling for Thermal Management in Extreme Environments: From Space Systems to Next-Generation 5G and Power Electronics**
E&ICT-Sponsored FDP on Thermal Challenges in 5G and High-Power Electronics Devices
NIT Jamshedpur, September 22, 2025.

[2] **AI in Academia: Balancing Innovation, Integrity, and Efficiency**
Refresher Course Spark Edge: Cutting Edge Engineering for the Future, MMTTC
K.K. University Campus, Bihar Sharif, Nalanda, Bihar, September 18, 2025.

[3] **Suppression of Two-phase Instabilities in Microchannel Heat Sinks**
DST-ANRF FUNDED FIVE DAYS ONLINE WORKSHOP on Frontiers in Flow Boiling: Exploring Multiscale Transport, Industrial Applications, and Future Pathways
NIT Surathkal, August 22, 2025.

[4] **Engineering Biomass Gasification Systems for Off-Grid Thermal Applications**
Invited Lecture DIBER (A cell of DIPAS), Haldwani, India, July 15, 2025.

[5] **Decoding the Sound of Bubbles in Multiphase Flow and Heat Transfer Applications**
Two days short-term course on two-phase liquid immersion cooling: Theory and Applications
Department of Mechanical Engineering, MNNIT Allahabad, March 5, 2025.

[6] **Bubble Acoustics: From Fundamentals to Multiphase Heat Transfer Heat Transfer Applications**
Taming Turbulence: Advancement in Flow and Acoustic Control
Department of Mechanical Engineering, NIT Jamshedpur, January 21, 2025.

[7] **Unraveling the Physics of Sound Generation in Multiphase Flow and Heat Transfer Applications**
Two-Day Workshop on Multiphase Flows and Applications to Heat Transfer
Department of Mechanical Engineering, IIT Madras, January 7, 2025.

[8] **Optimizing Boiling-Based Thermal Management with Soluble Molecular Additives: Applications on Earth and in Reduced Gravity**
DST-SERB Sponsored One Week Short Term Training Program on Thermal Management Techniques
Department of Mechanical Engineering, Sardar Vallabhbhai National Institute of Technology, Surat, November 18-22, 2024.

[9] **From Concept to Patent: Navigating the Path from Research Papers to Patents**
National Seminar on Innovation & Intellectual Property Rights
Amity University Jharkhand, Ranchi, March 21, 2024. *Keynote Address.*

[10] **Acoustic Bubbles: A Deep Dive into Sound Generation and Propagation in Multiphase Flows**
Workshop on Interfacial Engineering at Multiple Spatio-Temporal Scales
Indian Institute of Science, Bangalore, January 29-31, 2024. *Keynote Address.*

[11] **Engineering Fluidic Interfaces for Thermal Management Applications**
Two-Day Workshop on Thermal Management Techniques: Innovations and Insights
IIT Madras, January 11, 2024.

[12] **Analysis of Bubble Acoustics for Real-Time Prediction and Control of Boiling Heat Transfer Regimes**
Mechanical & Aerospace Engineering (online)
The University of Texas at Arlington, USA, September 15, 2023.

[13] **Acoustic Characterization of Bubbles for In-situ Prediction and Control of Boiling Heat Transfer Regimes**
Department of Mechanical Engineering, IIT Gandhinagar, January 6, 2023.

[14] **Decoding the Sound of Boiling for Advance Prediction of Boiling Crisis**
1st International Conference in Fluid, Thermal, and Energy Systems (ICFTE22)
NIT Calicut, June 9, 2022. *Keynote Address.*

[15] **Acoustic Prediction and Control of Boiling Heat Transfer Regimes**
Thermal Transport Café, May 19, 2022.

[16] **Decoding the Sound of Boiling for Advance Prediction of Boiling Crisis**
Department of Mechanical Engineering (online) IIT Ropar, February 3, 2022.

[17] **Droplet on Lubricant Infused Surfaces: Union of Constant Mean Curvature Surfaces**
48th National Conference on Fluid Mechanics and Fluid Power (FMFP 2021)
Birla Institute of Science and Technology Pilani, Rajasthan, December 27-29, 2021. *Keynote Address.*

[18] **Boiling-Based Thermal Management Strategies for Earth and Reduced Gravity Applications**
FLUTE – 2021, International Symposium on Fluids and Thermal Engineering
Amity University, July 22, 2021. *Keynote Address.*

Rishi Raj, Ph.D.

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

[19] **Boiling Heat Transfer with Foaming Solutions for Terrestrial and Microgravity Applications**
Faculty Development Programme on Advanced Engineered Surfaces for Phase Change Heat Transfer Application
Department of Chemical Engineering, NIT Calicut, July 13, 2021.

[20] **Bubble Dynamics during Boiling with Foaming Solutions: Implications on Earth and Microgravity Heat Transfer**
Department of Mechanical and Materials Engineering (online)
University of Cincinnati, USA, January 22, 2021.

[21] **Enhancement of Boiling Heat Transfer via the Suppression of Coalescence in Microgravity**
ISRO Academia Day 2021, January 7, 2021.

[22] **Novel Insights on Fluidic Interfaces in Thermal Applications**
ScienceConnect: Langmuir, The ACS Journal of Fundamental Interface Science
October 10-12, 2020.

[23] **Boiling Heat Transfer in Earth and Space**
TEQIP-3 Webinar
Bhagalpur College of Engineering, Bihar, September 25, 2020.

[24] **Boiling Heat Transfer in Earth and Space**
TEQIP-3 Webinar
Gaya College of Engineering, Bihar, August 4, 2020.

[25] **Bubble Dynamics during Boiling with Foaming Solutions**
Two-Day International Workshop on Interfacial Flow and Heat Transfer in Droplets and Liquid Films for Advanced Thermal Management
IIT Bombay, March 6-7, 2020.

[26] **Boiling with Foaming Solutions for Earth and Microgravity Applications**
25th National and 3rd International ISHMT-ASTFE Heat and Mass Transfer Conference
IIT Roorkee, December 28-31, 2019. *Keynote Address.*

[27] **Passive Heat Spreader for Hotspot Mitigation**
Structured Training Programme (STP) on GenNext Spacecraft Systems & Technologies
URSC, ISRO, December 16-20, 2019.

[28] **Workshop on Research Projects and Publications**
Amity University, Ranchi, Jharkhand, July 2019. *Keynote Address.*

[29] **Energizing the Waste: Biomass-Based Gasifier Heating System for Energy and Environmental Applications**
TEQIP-III Sponsored Faculty Development Programme
Bhagalpur College of Engineering, Bihar, May 2019.

[30] **Development of Two-Phase Heat Sinks for Earth and Microgravity Thermal Management Applications**
Department of Mechanical Engineering
Indian Institute of Science, Bangalore, April 5, 2019.

[31] **Agricultural Waste-Based Gasifier Heating System for Various Energy and Environmental Applications**
TEQIP-III
National Institute of Technology Patna, December 19, 2018.

[32] **Two-Phase Heat Spreader for Hotspot Mitigation in Reduced Gravity Applications**
INAE Annual Convention
RCI Hyderabad, December 13-15, 2018.

[33] **Pool Boiling Critical Heat Flux Enhancement Strategies on Earth and in Reduced Gravity of Space**
Indian Institute of Technology Gandhinagar, September 8, 2017.

[34] **Vapor Crowding-Based Limit to Pool Boiling Critical Heat Flux**
ASME 2017 International Conference on Nanochannels, Microchannels, and Minichannels
Hyatt Regency, Cambridge, MA, August 27-30, 2017. *Keynote Address.*

[35] **Vapor Crowding-Based Hydrodynamic Limit to Critical Heat Flux during Pool Boiling with Nanofluids and Aqueous Surfactant Solutions**
Department of Mechanical Engineering
University of Maryland, College Park, MD, USA, August 25, 2017.

[36] **Critical Heat Flux Mechanism during Boiling with Surfactants**
6th International and 43rd National Conference on Fluid Mechanics and Fluid Power
MNNITA, Allahabad, December 2016.

[37] **Boiling Heat Transfer: Introduction to Applications**
Workshop on Boiling Heat Transfer
BCE Bhagalpur, Bihar, December 2016.

[38] **Nanotechnology for Two-Phase Flow and Heat Transfer Enhancement**
TEQIP-II Sponsored National Workshop on Advances in Two-Phase Flow and Heat Transfer
NIT Agartala, Tripura, March 2016.

[39] **Nanotechnology for Energy-Efficient Thermal Management**
TEQIP-II Sponsored Faculty Development Programme
College of Engineering, Adoor, Kerala, December 2015.

[40] **Surfactants for Bubble Removal against Buoyancy**
ISRO Satellite Centre, Bangalore, December 2015.

[41] **SEISMECH 2015, The Annual Technical Symposium**
Department of Mechanical Engineering
IIT Guwahati, March 2015.

[42] **Role of Wettability on Micro- and Nano-Structured Surfaces for Enhanced Phase Change Heat Transfer**
International Workshop on Thermal Design and Management in Electronics
Bangalore, December 2013.

[43] **Microheater Array Boiling Experiment (MABE) on the International Space Station**
ISRO Satellite Centre, Bangalore, December 2013.

[44] **Thermo-Fluidic Transport Processes Near the Three-Phase Contact Line**
Recent Advances in Micro/Nanoscale Heat Transfer and Applications in Clean Energy Technologies
IIT Ropar, December 2013.

[45] **Thermo-Fluidic Transport Processes Near the Microscopic Contact Line**
International Symposium on Micro/Nanoscale Heat Transfer & its Applications
PESIT, Bangalore, December 2013.

[46] **Surface Heterogeneity Effects on the Wettability of Graphene**
Department of Mechanical Engineering
Syracuse University, March 2013.

[47] **Multiscale Transport Phenomena for Space and Energy Applications**
Department of Mechanical Engineering
Indian Institute of Technology Bombay, September 2012.

12. Popular Science Lectures

- Weight, Less Weight, and Weightlessness, *Moon Landing Day, Shrikrishna Science Centre, Patna, July 20, 2022*.
- Finding your Thrill, TEDx Talk, *IIT Patna,* September 10, 2021.

13. Student/Post-Doc Guidance

Postdoctoral Researchers/Research Associates: **Completed: 3 | Ongoing: 2**

Ongoing

- **Mr. Nikhil Chitnavis (Ph.D.- Thesis Submitted: IIT Madras)**
  Theme: Thermal Management of Stratospheric Payloads
  Duration: October 2025 – Present
- **Dr. Shivji Prasad Yadav (Ph.D.: IIT Bombay)**
  Theme: CFD Simulation of Bubble Acoustics
  Duration: May 2025 – Present

Completed

- **Dr. Abhinav Rajan (Ph.D.: IIT Madras)**
  Theme: CFD Simulation of Stratospheric Payloads
  Other Guide: Dr. Ashwani Assam (Mechanical)
  Duration: August 2024 – August 2025
- **Dr. Soumya Kanti Hazra (Ph.D.: IIT Kharagpur)**
  Theme: Boiling Acoustics and Surface Science
  Duration: August 2022 – April 2025
- **Dr. Jothi Prakash C. G. (Ph.D.: Pondicherry University)**
  Theme: Surface Fabrication and Characterization
  Duration: December 2020 – 2022

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

Doctor of Philosophy (Ph.D.): **Awarded: 9 | Ongoing: 9**

Ongoing

- **Suriyaprasaad B.**
  Theme: Machine Learning in Heat Transfer
  Co-Guide: Dr. Atul Thakur (Mechanical)
  Duration: 2024 – Present
- **Mohammed Qadeer Mohammed Taheer**
  Theme: Low GWP Refrigerants
  Co-Guide: Dr. Ajay D. Thakur (Physics)
  Duration: 2023 – Present
- **Prashant Kumar**
  Theme: Numerical Simulation of Boiling
  Co-Guide: Dr. Ashwani Assam (Mechanical)
  Duration: 2023 – Present
- **Surendra Prasad Yadav**
  Theme: Boiling Heat Transfer
  Duration: 2023 – Present
- **Rajnish Azad**
  Theme: Condensation Heat Transfer
  Co-Guide: Dr. Snehashis Daschakraborty (Chemistry)
  Duration: 2022 – Present
- **Md. Quamar Alam**
  Theme: Bubble Acoustics
  Co-Guide: Dr. Ashwani Assam (Mechanical)
  Duration: 2022 – Present
- **Tonmoy Sharma** *(Prime Minister's Research Fellowship)*
  Theme: Condensation Heat Transfer
  Co-Guide: Dr. Snehashis Daschakraborty (Chemistry)
  Duration: 2021 – Present
- **Avinash Upadhyay**
  Theme: Boiling Heat Transfer
  Duration: 2021 – Present
- **Abhash Shukla**
  Theme: Renewable Energy
  Co-Guide: Dr. Ajay D. Thakur (Physics)
  Duration: 2021 – Present

Awarded

- **Rahul Sinha**
  Theme: Development of an Off-the-Grid Climate Control Unit with Built-in Humidity Control for Storage and Processing of Perishables
  Co-Guide: Dr. Ajay D. Thakur (Physics)
  Duration: 2019 – 2025
- **Sunil**
  Theme: Design and Development of a Biomass Gasification-Based Off-the-Grid Storage and Processing Unit for Perishables
  Co-Guide: Dr. Ajay D. Thakur (Physics)
  Duration: 2019 – 2025
- **Kumar Nishant Ranjan Sinha**
  Thesis Title: Acoustic Characterization of Bubble Behavior for In-Situ Prediction and Control of Boiling Heat Transfer Regimes
  Duration: 2016 – 2022
- **Madhu Ranjan Gunjan**
  Thesis Title: Modeling the Effect of Contaminants and Lubricant Film on the Modes of Droplet Evaporation
  Duration: 2016 – 2022

- **Alok Kumar**
  Thesis Title: Modeling and Simulation of Fluid-Fluid Interface and Three-Phase Contact Line of Drops and Bubbles on Solid Surfaces
  Duration: 2015 – 2022
- **Bathina Chaitanya**
  Thesis Title: Fabricating Eco-Friendly Superhydrophobic Coating and Exploiting Biomass Energy Potential for Sustainable Atmospheric Water Harvesting
  Co-Guide: Dr. Ajay D. Thakur (Physics)
  Duration: 2015 – 2022
- **Nirbhay Kumar**
  Thesis Title: Design and Development of an Orientation Independent and Wickless Two-Phase Heat Spreader
  Duration: 2016 – 2021
- **Durga Prasad Ghosh**
  Thesis Title: Suppression of Two-Phase Instabilities in Microchannel Heat Sinks via Adaptive Vapor Venting
  Duration: 2015 – 2019
- **Md. Qaisar Raza**
  Thesis Title: Pool Boiling of Foaming Solutions for Earth and Reduced Gravity Heat Transfer Applications
  Duration: 2014 – 2019

Master of Technology (M.Tech.): **Awarded: 19 | Ongoing: 1**

- **Bhola Kumar Yadav**
  Theme: Thermo-Mechanical Design of Optronic Payload
  Other Guides: Dr. Ashwani Assam (Mechanical)
  Duration: 2024 – 2026
- **Ravindra Kumar**
  Theme: Numerical Study on Droplet Dynamics Through Multiconstriction Microchannel
  Other Guides: Dr. Abhishek Raj, Dr. Ashwani Assam (Mechanical)
  Duration: 2022 – 2024
- **Kundan Saha**
  Theme: Design and Development of a Portable Augmented Reality Enabled Smart Digital Stethoscope
  Other Guide: Dr. Atul Thakur (Mechanical)
  Duration: 2022 – 2024
- **Ravikant Kumar**
  Theme: Heat Treatment of AA6061-O in Different Quench Media
  Other Guide: Dr. Anirban Bhattacharya (Mechanical)
  Duration: 2022 – 2024
- **Brijesh Kumar**
  Theme: Boiling Heat Transfer Using Ionic Liquid as a Co-Surfactant in an Aqueous Surfactant Solution: Interplay Between Foamability and Wettability
  Duration: 2021 – 2023
- **Monisha Daimari**
  Theme: Bubble Acoustics Using Computational Fluid Dynamics Simulations
  Other Guide: Dr. Ashwani Assam (Mechanical)
  Duration: 2020 – 2022
- **Ninad Pradeep Kuware**
  Theme: Prognosis and Control of Boiling Crisis by Leveraging Acoustic Emissions and Deep Learning
  Other Guide: Dr. Atul Thakur (Mechanical)
  Duration: 2020 – 2022
- **Tonmoy Sharma**
  Theme: Deep Learning Time-Frequency Representations of Boiling Acoustics for Accurate Prediction of Transition Between Heat Transfer Regimes
  Duration: 2019 – 2021

- **Avinash Upadhyay** *(Institute Silver Medal)*
  Theme: Numerical Simulation of Bubble Behavior in Surfactant-Aided Pool Boiling
  Other Guide: Dr. Manabendra Pathak (Mechanical)
  Duration: 2019 – 2021
- **Vijay Kumar** *(Institute Silver Medal)*
  Theme: Leidenfrost Phenomenon During Quenching in Aqueous Solutions
  Duration: 2018 – 2020
- **Ashwani Verma**
  Theme: Direct Prediction of Foamability of Aqueous Surfactant Solution from Property Values
  Duration: 2018 – 2020
- **Sabya Sachi**
  Theme: Flow Boiling in Microchannels with Aqueous Ionic Liquid Solution
  Duration: 2018 – 2020
- **Rabindra Sarangi** *(Best M.Tech. Project Award)*
  Theme: Robust Superhydrophobic Surface with Self-Cleaning, Water Droplet Bouncing, and Dropwise Condensation Properties
  Other Guide: Dr. Ajay D. Thakur (Physics)
  Duration: 2017 – 2019
- **Dugesh Ranjan**
  Theme: Acoustic Feedback Control of Pool Boiling with Aqueous Surfactant Solutions
  Duration: 2017 – 2019
- **Anurag Kumar** *(Institute Silver Medal, Best M.Tech. Project Award)*
  Theme: Fluidic High-Pass Filter for Suppressing Two-Phase Instabilities in Microchannel Heat Sinks
  Duration: 2017 – 2019
- **Ajit Kumar Tanti**
  Theme: Performance Evaluation of Gasifier Hot Water Generation System with Pinewood Pellets
  Duration: 2017 – 2019
- **Sumit Banerjee**
  Theme: Development, Characterization and Control of a Boiling-Based Variable Buoyancy Robot
  Other Guide: Dr. Atul Thakur (Mechanical)
  Duration: 2015 – 2017
- **Deepak Sharma** *(Best M.Tech. Project Award)*
  Theme: Investigation of Liquid Supply Manifold Designs for Flow Boiling Heat Transfer Enhancement in Microchannel Heat Sinks
  Duration: 2015 – 2017
- **Nirbhay Kumar**
  Theme: Surfactant Aided Bubble Departure During Pool Boiling on Upward and Vertical Facing Heater Orientations
  Duration: 2014 – 2016
- **Guddi Kumari**
  Theme: Development of a Data Acquisition Unit for Temperature Monitor and Control During Pool Boiling Application
  Other Guide: Dr. Atul Thakur (Mechanical)
  Duration: 2013 – 2015

Bachelor of Technology (B.Tech.): **Awarded: 18**

Awarded

- **Pragati Bajpai** *(Graduation Year: 2025)*
- **Ansh Saxena** *(Graduation Year: 2024)*
- **Manav Agrawal** *(Graduation Year: 2024)*
- **Siddharth Merukar** *(Graduation Year: 2024)*
- **Priyanka Kumari** *(Graduation Year: 2024)*
- **Veer Bahaur Singh** *(Graduation Year: 2024)*
- **Kritadhi Maity** *(Graduation Year: 2023)*
- **Ayush Gupta** *(Graduation Year: 2023)*

- **Jnandeep Talukdar** *(Graduation Year: 2023)* Best B.Tech. Project Award
- **Harsh Shah** *(Graduation Year: 2022)*
- **Shreyas Taware** *(Graduation Year: 2021)*
- **A. M. K. Sarma** *(Graduation Year: 2019)*
- **Busireddy V. D. Reddy** *(Graduation Year: 2019)*
- **Harshit Agrawal** *(Graduation Year: 2018)*
- **Kartik Agrawal** *(Graduation Year: 2018)*
- **Karan Jakhar** *(Graduation Year: 2017)*
- **Sai Raviteja Bhamidipati** *(Graduation Year: 2015)*
- **Ashesh Chattopadhyay** *(Graduation Year: 2015)* Best B.Tech. Project Award

14. Teaching Experience

(a) Lecture Courses (Fall 2013 - Present)

Semester	Course No. & Title	No. of hours/week	No. of Students
Fall 2025	ME 1102 – Engineering Mechanics	6	387
Fall 2025	ME 3101 – Data Analytics and Machine Learning Tools for Engineers	1	92
Summer 2025	ME 1102/1202 – Engineering Mechanics	3	20
Spring 2025	ME 1202 – Engineering Mechanics	6	385
Fall 2024	ME 1102 – Engineering Mechanics	6	382
Summer 2024	ME 102 – Engineering Mechanics	3	34
Spring 2024	ME 102 – Engineering Mechanics	3	686
Fall 2023	MH 681 – Advanced Engineering Mathematics	3	57
Spring 2023	ME 546 – Multiphase Flow and Heat Transfer	3	5
Fall 2022	ME 315 – Heat and Mass Transfer	3	79
Spring 2022	ME 546 – Multiphase Flow and Heat Transfer	3	20
Fall 2021	ME 315 – Heat and Mass Transfer	3	63
Spring 2021	ME 102 – Engineering Mechanics	3	394
Fall 2020	ME 315 – Heat and Mass Transfer	3	59
Spring 2020	ME 102 – Engineering Mechanics	3	336
Fall 2019	ME 209 – Thermodynamics	3	59
Spring 2019	ME 546 – Multiphase Flow and Heat Transfer	3	9
Fall 2018	ME 209 – Thermodynamics	3	51
Spring 2018	ME 546 – Multiphase Flow and Heat Transfer	3	17
Fall 2017	ME 209 – Thermodynamics	3	47
Spring 2017	ME 102 – Engineering Mechanics	6	196
Fall 2016	ME 209 – Thermodynamics	3	49
Spring 2016	ME 102 – Engineering Mechanics	6	98
Fall 2015	ME 302 – Mechanical Measurement	3	44
Spring 2015	ME 101 – Engineering Mechanics	3	84
Spring 2015	ME 546 – Multiphase Flow and Heat Transfer	3	16

Rishi Raj, Ph.D.

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

Semester	Course No. & Title	No. of hours/week	No. of Students
Fall 2014	ME 302 – Mechanical Measurement	3	33
Summer 2014	ME 101 – Engineering Mechanics	3	5
Spring 2014	ME 546 – Multiphase Flow and Heat Transfer	3	5
Fall 2013	ME 302 – Mechanical Measurement	3	38

(b) Laboratory-A / Drawing-B / Tutorial-C Courses (Fall 2013 - Present)

Semester	Course No. & Title	No. of hours/week	No. of Students
Fall 2025	ME 3101 – Data Analytics and Machine Learning Tools for Engineers	1-A, 2-C	92
Summer 2025	ME 1102/1202 – Engineering Mechanics	1-C	20
Spring 2025	ME 1202 – Engineering Mechanics	1-C	32
Fall 2024	ME 1102 – Engineering Mechanics	1-C	33
Summer 2024	ME 102 – Engineering Mechanics	1-C	34
Spring 2024	ME 102 – Engineering Mechanics	1-C	37
Fall 2023	MH 681 – Advanced Engineering Mathematics	1-C	57
Spring 2023	MH 507 – Seminar	4-C	37
Fall 2022	ME 315 – Heat and Mass Transfer	3-A	79
Fall 2021	ME 315 – Heat and Mass Transfer	3-A	63
Spring 2021	ME 102 – Engineering Mechanics	1-C	198
Fall 2020	ME 315 – Heat and Mass Transfer	3-A	59
Spring 2020	ME 102 – Engineering Mechanics	1-C	154
Fall 2019	ME 209 – Thermodynamics	1-C	59
Spring 2019	ME 529 – Thermo-Fluid Lab I	3-A	9
Fall 2018	ME 209 – Thermodynamics	1-C	51
Spring 2018	ME 528 – Thermo-Fluid Lab II	3-A	7
Fall 2017	ME 529 – Thermo-Fluid Lab I	3-A	7
Fall 2016	ME 529 – Thermo-Fluid Lab I	6-A	9
Spring 2016	ME 528 – Thermo-Fluid Lab II	3-A	10
Fall 2015	ME 529 – Thermo-Fluid Lab I	6-A	10
Spring 2015	ME 101 – Engineering Mechanics	1-C	84
Fall 2014	ME 529 – Thermo-Fluid Lab I	6-A	10
Spring 2014	SE 508 – Seminar	4-C	16
Fall 2013	ME 111 – Engineering Drawing	3-B	40

Rishi Raj, Ph.D.

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

15. Conferences/Workshops Organized

[1] **27th National and 5th International ISHMT-ASTFE Heat and Mass Transfer Conference (IHMTC-2023)**

Date: December 14–17, 2023
Venue: IIT Patna
As the Organizing Secretary of IHMTC-2023, I oversaw one of the most prestigious events in the field of heat and mass transfer. The conference, jointly organized by the Indian Society for Heat and Mass Transfer (ISHMT) and the American Society of Thermal and Fluids Engineers (ASTFE), featured:

- **4 Plenary Lectures** by distinguished global experts.
- **13 Keynote Sessions** on emerging research topics.
- **4 Industry Sessions** with participation from leading organizations such as ISRO and DRDO.
- **48 Parallel Sessions** and **3 Poster Sessions** showcasing cutting-edge research.

The conference attracted nearly **400 participants** from over **10 countries**, reflecting its international significance. Of the **419 paper submissions**, more than **350 papers** were accepted after rigorous peer review, underscoring the conference's high academic standards. Selected papers were published in special issues of reputed journals, including **Elsevier ICHMT**. This event not only highlighted the latest advancements in heat and mass transfer but also facilitated collaboration between academia and industry, setting a benchmark for future conferences.

[2] **SERB Sponsored Workshop on Emerging Trends in Liquid-Vapor Phase Change Heat Transfer**

Date: July 17–19, 2023
Format: Online
The SERB-sponsored workshop, which focused on recent advancements in liquid-vapor phase change heat transfer. The workshop included 13 thought-provoking lectures from experts and attracted a diverse audience, including:

- 25 Faculty Members
- 5 Postdoctoral Researchers
- 35 Ph.D. and M.Tech. Students
- 30 Undergraduate Students
- Industry professionals from national and international institutions.

With over **100 registrations**, the workshop provided an interactive platform for participants to learn from experts, exchange ideas, and explore emerging trends in phase change heat transfer. The event's broad appeal and diverse participation highlighted its success in bridging gaps between academia, research, and industry.

16. Editorial and Reviewer Activities

Editor: International Communications in Heat and Mass Transfer, Elsevier (2022 – till date)

Associate Editor, Sadhana, Springer Nature (2025 – till date)

Member, Editorial Board, Interfacial Phenomena and Heat Transfer (2023 – till date)

Reviewer for Journals in the area of Energy and Thermal Management: International Journal of Heat & Mass Transfer (*Certificate of Outstanding Contribution in Reviewing 2017*), Applied Thermal Engineering, International Communications in Heat & Mass Transfer, Applied Energy, International Journal of Therm. Sciences, International Journal of Multiphase Flow, Experimental Thermal and Fluid Sciences, Journal of Heat Transfer – Transactions of ASME, Journal of Electronic Packaging – Transactions of ASME, Journal of Thermal Science and Engineering Applications – Transactions of ASME, Thermal Science and Engineering Progress, Numerical Heat Transfer: Part B, Interfacial Phenomena and Heat Transfer, Heat Transfer Research, Heat Transfer Engineering, Microgravity Science and Technology, Transport in Porous Media, Journal of Enhanced Heat Transfer

Associate Professor,
Department of Mechanical Engineering
and
Principal Investigator,
Thermal and Fluid Transport Laboratory (TFTL)
Indian Institute of Technology Patna

Address: Room 113, Block III
IIT Patna, Bihar 801103, India
www.iitp.ac.in/~rraj/ (TFTL)
rraj@iitp.ac.in, rraj.iitp@gmail.com
+91-611-5233166 (office), +91-829-2339322 (mob)

Reviewer for Journals in the area of Colloids and Interface Science: Langmuir, Soft Matter, Journal of Colloids and Interface Science, Colloids and Surfaces A: Physicochemical and Engineering Aspect, The Journal of Physical Chemistry, Applied Surface Science, Current Opinion in Colloids an Interfaces, ACS Omega

Reviewer for Multidisciplinary Journals: Advanced Materials Interfaces, Nature Materials, Nature Nanotechnology, Nature Microsystems and Nanoengineering, Scientific Reports, Nanoscale and Microscale Thermophysical Engineering

17. Other Professional Activities

[1] **International Scientific Committee Member** for the 12th International Conference on Boiling and Condensation Heat Transfer, Boston/Cambridge, USA (2026).
[2] **Advisory Committee Member** for the 28th National and 6th International ISHMT-ASTFE Heat and Mass Transfer Conference (IHMTC-2025), IIT Jodhpur, India.
[3] **Coordinator,** Local Scientific Committee, International Heat Transfer Conference, IHTC-18, Rio De Janeiro, Brazil, (2026).
[4] **Member** of the Assembly of World Conferences on Experimental Heat Transfer, Fluid Mechanics, and Thermodynamics (2024).
[5] **Organizing Secretary** of the 27th National and 5th International ISHMT-ASTFE Heat and Mass Transfer Conference (IHMTC-2025), IIT Patna, India.
[6] **International Scientific Committee Member** for the 11th International Conference on Boiling and Condensation Heat Transfer, Edinburgh, Scotland (2023).
[7] **National Advisory Committee Member** for the 1st International Conference in Fluid, Thermal, and Energy Systems (ICFTE22), NIT Calicut, June 9, 2022.
[8] **Session Chair** and **Technical Program Committee (TPC) Member** for the 26th National and 4th International ISHMT-ASTFE Heat and Mass Transfer Conference (IHMTC-2021), IIT Madras, India.
[9] **International Ambassador** for the Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronic Systems (iTherm) (2019–2020).
[10] **Session Chair** and **Technical Programme Committee Member** for the 25th National and 3rd International ISHMT-ASTFE Heat and Mass Transfer Conference (IHMTC-2019), IIT Roorkee, India.
[11] **International Scientific Committee Member** for the 10th International Conference on Boiling and Condensation Heat Transfer, Nagasaki, Japan (2018).
[12] **Session Chair** at the 24th National and 2nd International ISHMT-ASTFE Heat and Mass Transfer Conference (IHMTC-2017), BITS Pilani, Hyderabad, India.
[13] **Session Chair** at the 6th International & 43rd National Conference on Fluid Mechanics and Fluid Power (FMFP-2016).
[14] **Technical Program Committee Member** for the 6th International & 43rd National Conference on Fluid Mechanics and Fluid Power (FMFP-2016).
[15] **Session Chair** at the 9th International Conference on Boiling and Condensation Heat Transfer, Boulder, Colorado, USA (2015).
[16] **Topic Chair** at the ASME 2015 InterPACK/ICNMM Conference.

**********END**********