

RANGANATHAN GOPALAKRISHNAN

Associate Professor & Graduate Coordinator, Dept. of Mechanical Engineering
312B Engineering Science Building, The University of Memphis, Memphis, TN 38152

Office Phone: +1-901-678-2580; Email: rgplkrsh@memphis.edu

Faculty page: <http://www.memphis.edu/me/faculty/gopalakrishnan.php>

Google Scholar: <https://scholar.google.com/citations?user=tOrZ9j4AAAAAJ&hl=en&oi=ao>

Teaching videos: <https://www.youtube.com/channel/UCDVmZHHXN5U5JJGMzWmgEsQ>

LinkedIn profile: <https://www.linkedin.com/in/ranganathan-gopalakrishnan-b47027b5/>

A. PROFESSIONAL PREPARATION

National Institute of Technology, Tiruchirappalli	Tiruchirappalli, India	Mechanical Engineering	Bachelor of Technology (2004 – 2008).
University of Minnesota – Twin Cities <i>Co-advisors:</i> Prof. Christopher Hogan and Prof. Peter McMurry	Minneapolis, MN	Mechanical Engineering	Ph. D. (September 2008 – August 2013)
California Institute of Technology <i>Supervisor:</i> Prof. Richard Flagan	Pasadena, CA	Chemical Engineering	Postdoctoral training (Sep. 2013–Sep. 2014)
University of California – Berkeley <i>Supervisor:</i> Prof. David Graves	Berkeley, CA	Chemical Engineering	Postdoctoral training (Oct. 2014 – July 2015)

B. PROFESSIONAL APPOINTMENTS

August 15, 2022 – present	Associate Professor	Mechanical Engineering	The University of Memphis
August 15, 2016 – August 12, 2022	Assistant Professor	Mechanical Engineering	The University of Memphis
July 1 – 20, 2018	Visiting Academic Fellow/Professor with Salary	Laboratoire des Sciences des Procédés et des Matériaux	University Paris XIII
August 2015 – July 2016	Lecturer	Mechanical Engineering	The University of Iowa

C. HONORS

1. **2021 and 2023:** Featured in top 20 finalists for The University of Memphis Distinguished Alumni Teaching Award; outcome will be known in April 2023.
2. **2022:** Herff College of Engineering Faculty Research Award, University of Memphis
3. **Sep 2021 – August 2023:** R. Eugene Smith Professorship, University of Memphis
4. **Sep 2020 – Aug 2022:** UMRF Ventures Assistant Professorship, University of Memphis
5. **2020:** Early Career Award, US Dept of Energy <https://science.osti.gov/early-career>
6. **2014:** Honorable mention in the Best Dissertation Competition, University of Minnesota
7. **Fall 2012 and Spring 2013:** Doctoral Dissertation Fellowship, University of Minnesota

D. RESEARCH SUPPORT

Summary of awarded support

Federal agencies (research)	\$1,834,854
Federal agencies (service)	\$50,000
Other sources (consulting)	\$10,264
Total	\$1,895,118

Ongoing funded projects

1. US Army Research Office - Sciences of Extreme Materials Branch (**Ongoing**)
 - Award #W911NF-23-2-0013
 - Theoretical and experimental investigation of grain charging, coagulation, and heating in dense non-thermal dusty plasmas for large scale materials synthesis
 - **\$725,689**, December 15, 2022 – December 14, 2025
 - **Role:** PI (co-PI: Prof. Truell Hyde, Baylor University)
 - **Share:** \$362,799 (50% of total project cost)
 - **Publicly released project abstract:** soon
2. Department of Energy Office of Science – Fusion Energy Sciences (**Ongoing**)
 - Award #DE-SC0021146
 - Thermodynamics and Transport Models of Strongly Coupled Dusty Plasma Matter (**FY 2020 EARLY CAREER award**)
 - **\$750,695**, September 1, 2020 – August 31, 2025
 - **Role:** PI (no co-PIs)
 - **Publicly released project abstract:**
<https://pamspublic.science.energy.gov/WebPAMSEExternal/Interface/Common/ViewPublicAbstract.aspx?rv=81050aaf-d943-419a-b14d-e911370cf527&rtc=24>
3. Department of Energy Office of Science – Fusion Energy Sciences (**Ongoing**)
 - Award #DE-SC0023416
 - Experiments to validate thermodynamic and transport models of strongly coupled dusty plasma matter at Magnetized Plasma Research Laboratory, Auburn University
 - **\$107,528**, September 1, 2022 – August 31, 2024
 - **Role:** PI (no co-PIs)
 - **Publicly released project abstract:**
<https://pamspublic.science.energy.gov/webPAMSEExternal/Interface/Common/ViewPublicAbstract.aspx?rv=fa7e0a58-acf2-45f5-87de-8dd47eccc18&rtc=24>
4. Department of Energy Office of Science – Basic Energy Sciences (**Ongoing**)
 - Award #DE-SC0021206
 - Langevin Dynamics modeling of gas-phase ion-ion recombination
 - **\$363,782**, September 1, 2020 – August 31, 2024
 - **Role:** PI (no co-PIs)

- **Publicly released project abstract:**
<https://pamspublic.science.energy.gov/WebPAMSEExternal/Interface/Common/ViewPublicAbstract.aspx?rv=412be1ad-8af3-4d68-ab51-53fc44ee8975&rtc=24>
5. Department of Energy Office of Science – Biological and Environmental Sciences **(Ongoing)**
- Award #DE-SC0023267
 - Building partnerships for development of sustainable energy systems with atmospheric measurements
 - **\$149,892**, September 1, 2022 – February 29, 2024
 - **Role:** co-PI (PI: Prof. Daniel Foti, University of Memphis)
 - **Share:** \$49,964 (33% of total project cost)
 - **Publicly released project abstract:**
<https://pamspublic.science.energy.gov/WebPAMSEExternal/Interface/Common/ViewPublicAbstract.aspx?rv=97113085-5acf-45c1-a5c1-0fb4a71a1d6d&rtc=24&PRoleId=10>

Completed projects

1. National Science Foundation Division of Physics **(Completed)**
 - Award #1903432
 - An effective potential approach to the modeling of concentrated dusty plasmas
 - **\$199,673**, July 1, 2019 – June 30, 2023
 - **Role:** PI (no co-PIs)
 - **Publicly released project abstract:**
https://nsf.gov/awardsearch/showAward?AWD_ID=1903432
2. Jet Propulsion Laboratory – California Institute of Technology **(Completed)**
 - PK-4 data organization for NASA Physical Sciences Informatics
 - **\$50,000**, March 1, 2022 – December 31, 2022
 - **Role:** PI (no co-PIs)
3. University of Minnesota Board of Regents **(Completed)**
 - Fabrication of ultrasonic aerosol generators
 - **\$8,054**, May 1, 2019 – August 31, 2019
 - **Role:** PI (no co-PIs)
4. Consulting for All World Project Management Inc. **(Completed)**
 - Provided consultation on indoor air quality monitoring
 - **\$2,210**, August 1, 2021 – August 31, 2021
 - **Role:** PI (no co-PIs)

E. TEACHING (F: Fall, S: Spring, Su: Summer, F08 = Fall 2008)

The University of Memphis (Assistant Professor, F16 – S22; Associate Professor, F22 onwards)

Undergraduate courses

- MECH 2311 Thermodynamics I (F19, S20)
- MECH 3331 Fluid Mechanics (F18, S20, F20)
- MECH 3335 Fluid Mechanics Lab (S20, F20, S21, F21, S22, F22)
- MECH 3341 Numerical and Statistical Methods (F18, F19, F23)
- MECH 4309/6309 Gas Dynamics (F16)
- MECH 4991/6991 Special Topics: Aerosol Engineering (S17, S21)

Graduate courses

- MECH 7302/8302: Theory of Continuous Media (S22, S24)
- MECH 7341/8341 Engineering Analysis I (F17, F22)
- MECH 7342/8342 Engineering Analysis II (S18, S23)
- MECH 7378/8378 Introduction to Computational Fluid Dynamics (S18)

The University of Iowa (as Lecturer, F15 & S16)

- S16: ME 3052 Mechanical Systems
- S16: ME 4080 Experimental Engineering
- S16: ME 4086 Mechanical Engineering Design Project
- F15: ME 3351 Engineering Instrumentation
- F15: ME 4080 Experimental Engineering

University of Minnesota – Twin Cities (as Graduate Teaching Assistant, F09 – S12)

- ME 4031W: Basic Mechanical Measurements Laboratory
Instructor: Prof. Peter H. McMurry, Terms: F09, F10, S11, F11, S12
- ME 3332: Thermal Sciences II
Instructor: Prof. Christopher J. Hogan Jr., Term: S10

F. STUDENT MENTORING (F: Fall, S: Spring, Su: Summer, F08 = Fall 2008)

PhD graduates

1. Spring 2020: Rayhan Ahmed
2. Spring 2021: Li Li
3. Summer 2022: Vikram Suresh

MS graduates

1. Spring 2018: Ewe Jiun Chng
2. Spring 2018: Lekhnath Pokharel
3. Spring 2019: Harjindar Singh Chahl
4. Spring 2019: Prashant Parajuli
5. Fall 2021: Andrei Fendley
6. Summer 2023: Zhibo Liu

Current PhD Advisees

Mrittika Roy (F21 – present)
Ravi Kumar (F21 – present)
Sai Kiran Madugula (F21 – present)
Dinil Jose (F23 - present)
Vedant Singh (F23 - present)
Alhasan Hadidi (F23 - present)

Undergraduate Research Assistants

Joshua Redmond Go Felipe (F19)
Zhibo Liu (S20 – S21)
Zach Perry (F20 – Su22)
Davis Ballard (F22 – S22)
Camille Robinson (F22 – present)
Karston Salsbury (F23 – present)

High School students in research

Logan Wymore (S23 – Su23)

G. SCHOLARLY PRODUCTS

i. Peer reviewed journal articles (* - advisees of Dr. Gopalakrishnan)

Journal	2021 Impact Factor	# Publications
Journal of Aerosol Science	4.586	9
Aerosol Science and Technology	4.809	5
Journal of Chemical Physics	4.304	3
Physical Review E	2.707	2
Journal of Physics D: Applied Physics	3.207	2
Thin Solid Films	2.183	1
Powder Technology	5.530	1
Career total (as of October 3, 2023)		23
Google Scholar® Citation total (as of October 3, 2023)		849
Publications as PI (excluding collaborations)		11

- Liu*, Z., Roy*, M., DeYonker, N. J., and **Gopalakrishnan, R.**, Neutral gas pressure dependence of ion–ion mutual neutralization rate constants using Landau–Zener theory coupled with trajectory simulations. Accepted for publication in *Journal of Chemical Physics* 159 (2023) 114111.
<https://doi.org/10.1063/5.0168609>
- Suresh*, V., Liu*, Z., Perry*, Z. and **Gopalakrishnan, R.**, Modeling Particle-Particle Binary Coagulation Rate Constants for Spherical Aerosol Particles at High Volume Fractions Using Langevin Dynamics Simulations. *Journal of Aerosol Science* 164: 106001.
<https://doi.org/10.1016/j.jaerosci.2022.106001>
Selected by the Editor-in-Chief of J. Aerosol Sci. to feature in the cover page of the Volume 164 August 2022 issue.
- Suresh*[#], V., Li*[#], L., Redmond Go Felipe*, J. and **Gopalakrishnan, R.**, Modeling nanoparticle charge distribution in the afterglow of non-thermal plasmas and comparison with measurements *Journal of Physics D: Applied Physics* 54, 275205 (2021).
<https://doi.org/10.1088/1361-6463/abf70c>
- Li*, L. and **Gopalakrishnan, R.** (2021), An experimentally validated model of diffusion charging of arbitrary shaped aerosol particles. *Journal of Aerosol Science* 151: 105678.
<https://doi.org/10.1016/j.jaerosci.2020.105678>
- Suresh*, V. and **Gopalakrishnan, R.** (**invited article**), Tutorial: Langevin Dynamics methods for aerosol particle trajectory simulations and collision rate constant modeling. *Journal of Aerosol Science* 155: 105476.
<https://doi.org/10.1016/j.jaerosci.2021.105746>
- Li*, L., Chahl*, H. S. and **Gopalakrishnan, R.** (2020), Comparison of the predictions of Langevin Dynamics-based diffusion charging collision kernel models with canonical experiments, *J. Aerosol. Sci.* 140, 105481.
<https://doi.org/10.1016/j.jaerosci.2019.105481>
- Ahmed*, R., Suresh*, V., Li*. L. and **Gopalakrishnan, R.** (2020), Scalable generation of high concentration aerosol in the size range of 0.1–10 μm from commercial powders using ultrasonic dispersion, *Powder Technology* 376, 52.
<https://doi.org/10.1016/j.powtec.2020.08.009>

8. Ahmed*, R., & **Gopalakrishnan, R.** (2019), Computational study of electrostatic focusing of aerosol nanoparticles using an Einzel lens, *Journal of Aerosol Science*, 105443 (2019).
<https://doi.org/10.1016/j.jaerosci.2019.105443>
9. Chng*, E. J., Watson, A. B., Suresh*, V., Fujiwara, T., Bumgardner, J. D., & **Gopalakrishnan, R.** (2019), Adhesion of electrosprayed chitosan coatings using silane surface chemistry, *Thin Solid Films*, 137454.
<https://doi.org/10.1016/j.tsf.2019.137454>
10. Chahl*, H. S. and **Gopalakrishnan, R.**, (2019) High potential, near free molecular regime Coulombic collisions in aerosols and dusty plasmas, *Aerosol Science and Technology*, 53(8): 933-957.
<https://doi.org/10.1080/02786826.2019.1614522>
11. Pokharel*, L., Parajuli*, P., Li*, L., Chng*, E. J., and **Gopalakrishnan, R.**, (2019) An ultrasonic feeding mechanism for continuous aerosol generation from cohesive powders. *Aerosol Science and Technology*, 53(3): 321-331.
<https://doi.org/10.1080/02786826.2018.1559920>
12. Wong, C.-S., **Gopalakrishnan, R.**, and Goree, J. A., (2019) Fluctuation-theorem method of measuring a particle's mass without knowing its shape or density, *Journal of Aerosol Science*, 129: 116-123.
<https://doi.org/10.1016/j.jaerosci.2018.12.009>
13. Wong, C.-S., Goree, J. A., & **Gopalakrishnan, R.**, (2018) Experimental demonstration that a free-falling aerosol particle obeys a fluctuation theorem, *Physical Review E (Rapid Communication)*, 97: 050601(R).
<https://doi.org/10.1103/PhysRevE.97.050601>
14. **Gopalakrishnan, R.**, Kawamura, E., Lichtenberg, A. J., Lieberman, M. A., & Graves, D. B., (2016) Solvated electrons at the atmospheric pressure plasma-water anodic interface *J. Phys. D: Appl. Phys.*, 49: 295205.
<https://doi.org/10.1088/0022-3727/49/29/295205>
Selected by the Editorial Board of *J. Phys. D: Appl. Phys.* to feature in Highlights of 2016.
15. **Gopalakrishnan, R.**, McMurry, P. H., & Hogan, C. J., (2015). The Bipolar Diffusion Charging of Nanoparticles: A Review and Development of Approaches for Non-Spherical Particles. *Aerosol Science and Technology*, 49(12): 1181-1194.
<https://doi.org/10.1080/02786826.2015.1109053>
16. **Gopalakrishnan, R.**, McMurry, P. H., & Hogan, C. J. (2015), The electrical mobilities and scalar friction factors of modest-to-high aspect ratio particles in the transition regime. *Journal of Aerosol Science*, 82: 24-39.
<https://doi.org/10.1016/j.jaerosci.2015.01.001>
17. **Gopalakrishnan, R.**, Thajudeen, T., Ouyang, H. & Hogan, C. J. (2013), The unipolar diffusion charging of arbitrary shaped aerosol particles. *Journal of Aerosol Science*, 64: 60-80.
<https://doi.org/10.1016/j.jaerosci.2013.06.002>
18. **Gopalakrishnan, R.**, Meredith, M. J., Larriba, C. & Hogan, C. J. (2013), Brownian dynamics determination of the bipolar steady charge distribution on sphere and non-spheres in the transition regime. *Journal of Aerosol Science*, 63: 126-145.
<https://doi.org/10.1016/j.jaerosci.2013.04.007>

19. Thajudeen, T., **Gopalakrishnan, R.** & Hogan, C. J. (2012), The collision rate of non-spherical particles and aggregates for all diffusive Knudsen numbers. *Aerosol Science and Technology*, 46(11): 1174-1186.
<https://doi.org/10.1080/02786826.2012.701353>
20. Ouyang, H., **Gopalakrishnan, R.** & Hogan, C. J. (2012), Nanoparticle collisions and growth in the gas phase in the presence of singular attractive potentials. *Journal of Chemical Physics*, 137: 064316.
<https://doi.org/10.1063/1.4742064>
21. **Gopalakrishnan, R.**, & Hogan, C. J. (2012), Coulomb-influenced collisions in aerosols and dusty plasmas. *Phys. Rev. E*, 85: 026410.
<https://doi.org/10.1103/PhysRevE.85.026410>
22. **Gopalakrishnan, R.**, Thajudeen, T. & Hogan, C. J. (2011), Collision limited reaction rates for arbitrarily shaped particles across the entire diffusive Knudsen number range. *Journal of Chemical Physics*, 135: 054302.
<https://doi.org/10.1063/1.3617251>
23. **Gopalakrishnan, R.**, & Hogan, C. J. (2011), Determination of the transition regime collision kernel from mean first passage times. *Aerosol Science and Technology*, 45: 1499-1509.
<https://doi.org/10.1080/02786826.2011.601775>

ii. **Patents**

1. **Ranganathan Gopalakrishnan**, Lekhnath Pokharel, Rayhan Ahmed, Ewe Jiun Chng, Jason Scott Presley, "SYSTEMS AND METHODS FOR DISPERSION OF DRY POWDERS", US Patent Number 11,358,112
<https://patents.google.com/patent/US11358112B2/en>

iii. **Invited Presentations by Dr. Gopalakrishnan**

(F: Fall, S: Spring, Su: Summer, F08 = Fall 2008)

1. Chahl, H. S., & **Gopalakrishnan, R.**, Langevin dynamics modeling of gas-phase ion-ion recombination rates, 1st Symposium on Nonequilibrium Multiphase Systems, Saint Louis, MO USA December 7-8, 2018, Hosted at Washington University in Saint Louis by the Center for Aerosol Science and Engineering.
2. Vikram Suresh, Ewe Jiun Chng, Joel Bumgardner & **Ranganathan Gopalakrishnan**, invited presentation titled “Evaluation of the Adhesion of Electrosprayed and Solution-Cast Chitosan Coatings on Titanium Surfaces”, Session D2-TuA2, Abstract #292 at the International Conference on Metallurgical Coatings and Thin Films 2019, May 19 – 24, 2019, San Diego, CA, USA.
3. Vikram Suresh, Li Li, & **Ranganathan Gopalakrishnan**, Abstract 3I-A-04: Modeling nanoparticle charge distribution in the afterglow of non-thermal plasmas and comparison with measurements, 48th International Conference on Plasma Science, September 12 – 16, 2021, Virtual Conference.
4. **Ranganathan Gopalakrishnan**, Modeling grain level and grain phase level transport processes in dusty plasmas, International Online Seminar on Dusty Plasmas, February 23, 2022.
5. **Ranganathan Gopalakrishnan**, Zhibo Liu, Vikram Suresh, Zachary Perry, Abstract 8CO.1: Modeling Coagulation, Aggregation and Gelation in High Volume Fraction Aerosols using Langevin Dynamics Simulations, American Association for Aerosol Research Conference, October 2 – 7, Raleigh, NC.
6. **Ranganathan Gopalakrishnan**, TS4: Tutorial on Langevin Dynamics trajectory simulations, American Association for Aerosol Research Conference, October 2 – 7, Raleigh, NC.

- H. SERVICE** (F: Fall, S: Spring, Su: Summer, F08 = Fall 2008)
- i.** Service to the Department of Mechanical Engineering, The University of Memphis
 - **Graduate Program Coordinator (Su21 – present).** Responsibilities include
 - Manage the graduate program that is ~40 strong as of August 2023
 - Review and issue decisions on applications for graduate studies
 - Advise graduate students on career development
 - Lead the Graduate Curriculum Process Team deliberations
 - Organize the PhD Qualifying Examination
 - *Chair*, Instructor Search Committee (S21)
 - *Member*, Undergraduate Curriculum Process Team (Aug 2016 – Nov 2018)
 - *Member*, Graduate Curriculum Process Team (Nov 2018 – present)
 - *Member*, Tenure-track Faculty Search Committees (F17, S18, S22)
 - *Member*, Instructor Search Committee (Su20)
 - *Member*, Tenured Faculty Search Committee (S22)
 - ii.** Service to the Herff College of Engineering, The University of Memphis
 - *Member*, Biomedical Engineering PhD Qualifying Exam Committee (S17 – S20)
 - *Member*, R1 Research Areas Task Force (F22, S23)
 - iii.** Service to The University of Memphis
 - *Member*, Herff College of Engineering Dean Search Committee (S22)
 - iv.** Reviewed >60 scientific manuscripts as of September 2022 for various journals.
 - v.** Served as co-guest editor for Frontiers in Physics Research Topic on “Particle Interaction With Afterglow Plasma and Non-Quasi-Neutral Plasma”:
<https://www.frontiersin.org/research-topics/30469/particle-interaction-with-afterglow-plasma-and-non-quasi-neutral-plasma>
 - vi.** Reviewed grant proposals for
 - US National Science Foundation
 - US Department of Energy Office of Science, MagNetUS Frontier Plasma Science
 - US Army Research Office
 - vii.** Service to the American Association for Aerosol Research (AAAR)
 - Session Chair of “Aerosol Physics” session at AAAR conferences 2015 (Minneapolis, MN) and 2020 (Virtual Conference).
 - Session Chair of “Aerosol Modeling” session at the International Aerosol Conference 2018 (St. Louis, MO).
 - Tutorial Speaker on “Langevin Dynamics trajectory simulations” at AAAR conference 2022 (Raleigh, NC).
 - viii.** Service to IEEE
 - Session Chair of “Computational Physics” session at the 48th International Conference on Plasma Science 2021 (Virtual Conference).
 - ix.** Industrial Consulting
 - AllWorld Project Management Inc., Memphis, TN (F21)

I. MENTIONS IN THE MEDIA

- ***UofM's Gopalakrishnan Receives \$750,000 U.S. DOE EARLY CAREER Award***, published on July 2, 2020. <https://www.memphis.edu/mediaroom/releases/2020/july/ranga.php>
- ***Movers & Shakers***, published on July 8, 2020 in the Daily Memphian. <https://dailyemphian.com/section/businessmovers-and-shakers/article/15298/movers-shakers>
- ***Research gains fuel U of M hopes for Carnegie R1 status***, published on August 31, 2020 in the Daily Memphian. <https://dailyemphian.com/section/metroeducation/article/16502/carnegie-r1-research-park-u-of-m>
- ***UofM's Gopalakrishnan receives \$363,782 DOE award for studying chemical recombination of gas-phase ions***, published on September 3, 2020 <https://www.memphis.edu/mediaroom/releases/2020/september/gopalakrishnandoeaward.php>
- ***U of M edges closer to R1 status, feels confident about chances in 2021***, published on September 10, 2020 in the Memphis Business Journal. <https://www.bizjournals.com/memphis/news/2020/09/10/university-of-memphis-r1-status.html>
- ***U of M professor part of international effort to harness clean, abundant energy source***, published on September 28, 2020 in the Memphis Business Journal. <https://www.bizjournals.com/memphis/news/2020/09/28/ranganathan-gopalakrishnan-university-of-memphis.html>
- ***MIT Fusion Startup Gears Up for Reactor Design and Construction***, published on October 9, 2020 in Engineering News-Record <https://www.enr.com/articles/50293-mit-fusion-startup-gears-up-for-reactor-design-and-construction>
- ***Fusion Test Produces More Power Than It Takes In***, published on September 8, 2021 in Engineering News Record <https://www.enr.com/articles/52374-fusion-test-produces-more-power-than-it-takes-in>