

Jyotirmoy Mandal

Assistant Professor

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Appointments

Assistant Professor Department of Civil & Environmental Engineering, Princeton University	Jan 2023-Present
Associated Faculty Princeton Institute of Materials	Jan 2023-Present
Schmidt Science Fellow and Postdoctoral Researcher Aaswath Raman Group, Department of Materials Science, University of California, Los Angeles	Sep 2019-June 2022

Specializations

Macro- to nano-scale optics, disordered and plasmonic metamaterials, atmospheric optics, radiative heat transfer, materials for building envelopes.

Research Interests

- Light-matter interactions at macro- to nano-scales in natural and engineered environments.
- Thermal radiation control using disordered metamaterials, metasurfaces and photonic structures.
- Passive radiative cooling and heating applications in built environments.
- Optical design for imaging and sensing systems.
- Scalable and sustainable designs for use in resource-poor settings.
- Biomimetics.

Education

Ph.D. in Applied Physics, Columbia University Thesis: Spectrally Selective Surfaces Across the Ultraviolet to Infrared Wavelengths for Optical and Thermal Management (Link). Advisor: Prof. Yuan Yang	2019
B.A. in Physics and Mathematics (MSE Minor), Vanderbilt University Summa Cum Laude (2014).	2014

Honors, Awards, Fellowships and Scholarships

- Schmidt Science [Fellow](#) (2019) awarded for a postdoctoral pivot.
- [Simon Prize](#) for the most outstanding doctoral dissertation in the department (Columbia University, 2020).
- [Featured](#) as one of the [outstanding graduates](#) of the class of 2019 (Columbia University, 2019).
- Elsevier Green and Sustainable Chemistry Challenge – [finalist](#) (3rd Elsevier G&SC Conference, Berlin, 2018).
- 3-Minute Thesis Competition – Audience Choice Award for [presentation](#) (Columbia University 2018).
- Nickolaus Fellowship (Columbia University, 2017).

Publications

Published in peer-reviewed journals

- [J. Mandal](#), Y. Fu, A. Overvig, M. Jia, N. Shi, K. Sun, H. Zhou, X. Xiang, N. Yu, Y. Yang. *Hierarchically Porous Polymer Coatings for Highly Efficient Passive Daytime Radiative Cooling*. **Science**, 2018, 362, 315–319. ([Link](#))

- [J. Mandal](#), D. Wang, A. Overvig, N. Shi, D. Paley, A. Zangiabadi, Q. Cheng, K. Barmak, N. Yu, Y. Yang. *Scalable, “Dip-and-Dry” Fabrication of a Wide-Angle Plasmonic Selective Absorber for High-Efficiency Solar–Thermal Energy Conversion*. **Advanced Materials**, 2017, 29 (41), 201702156. **Featured on the inside back cover**. ([Link](#))
- [J. Mandal](#),* N. Yu, Y. Yang, A. Raman.* *Paints as an effective radiative cooling technology for buildings*. **Joule**, 2020, 4(1–7). ([Link](#))
- [J. Mandal](#), M. Jia, A. Overvig, Y. Fu, E. Che, N. Yu, Y. Yang. *Porous polymers with switchable optical transmittance for optical and thermal regulation*. **Joule**, 2019, 3(1–12). ([Link](#))
- [J. Mandal](#), S. Du, M. Dontigny, K. Zaghbi, N. Yu, Y. Yang. *Li₄Ti₅O₁₂: A Visible-to-Infrared Broadband and Fast Electrochromic Material for Thermal and Optical Management*. **Advanced Functional Materials**, 2018, 28 (36), 201802180. ([Link](#))
- Y. Chen†, [J. Mandal](#)†, C. Tsai, S. Shrestha, N. Yu, Y. Yang. *Paintable Bilayer Colored Radiative Cooling Coatings with High Solar Infrared Reflectance*. **Science Advances**, 2020, 6 (eaaz5413). ([Link](#)) † co-first author.
- [J. Mandal](#),* X. Huang, A. Raman.* *Accurately Calculating Clear-Sky Radiative Cooling Potentials: A Temperature-correction of the Transmittance-based Model*. *Atmosphere*, 2021, 12(9), 1195 (**Invited**). ([Link](#))
- W. Huang, † Y. Chen, † Y. Luo, † [J. Mandal](#), † W. Li, M. Chen, C.C. Tsai, T. Jin, Y. Zhang, P. Wang, Z. Shan, N. Yu, Y. Yang. *Scalable Aqueous Processing-based Radiative Cooling Coatings*. **Advanced Functional Materials**, 2021. ([Link](#)) † co-first author.
- X. Huang, [J. Mandal](#),* A. Raman.* *A Do-it-Yourself Radiative Cooler as a Radiative Cooling Standard and Cooling Component for Device Design*. **Journal of Photonics for Energy**. 2021. 12(012112). ([Link](#))
- J. Xu, [J. Mandal](#), A. Raman.* *Broadband directional control of thermal emission*. **Science**, 2021, 372, 393–397. ([Link](#))
- M. Chen, [J. Mandal](#), Q. Ye, A. Li, B. Xie, Q. Cheng, Y. He, Y. Yang. *A Scalable Dealloying Technique to Create Thermally Stable Plasmonic Nickel Selective Solar Absorbers*. **ACS Applied Energy Materials**. 2019, 2, 9, 6551–6557. ([Link](#))
- X. Huang, [J. Mandal](#), J. Brewer, J. Xu, A. Raman.* *Passive Freezing Desalination driven by Radiative Cooling*. **Joule**, 2022, 6(1–12). ([Link](#))
- E. Simsek, [J. Mandal](#), A. Raman,* L. Pilon.* *Dropwise Condensation Enhances Emittance and Reduces Selectivity of Radiative Cooling Surfaces*. **International Journal of Heat and Mass Transfer**. 2022. 198(123399). ([Link](#))
- M. Chen, D. Pang, [J. Mandal](#), X. Chen, H. Yan, Y. He, N. Yu, and Y. Yang. *Designing Mesoporous Photonic Structures for High-Performance Passive Daytime Radiative Cooling*. **Nano Letters**. 2021, 21(3) ([Link](#))
- N. Shi, C. Tsai, M. Carter, [J. Mandal](#), A. Overvig, M. Sfeir, M. Lu, C. Craig, G. Bernard, Y. Yang, N. Yu. *Nanostructured fibers as a versatile photonic platform: radiative cooling and waveguiding through transverse Anderson localization*. **Light: Science and Applications**. 2018, 7, 36. ([Link](#))
- H. Zhai, P. Xu, M. Ning, Q. Cheng, [J. Mandal](#), Y. Yang. *A Flexible Solid Composite Electrolyte with Vertically Aligned and Connected Ion-Conducting Nanoparticles for Lithium Batteries*. **Nano Letters** 2017, 17, 3182–3187. ([Link](#))
- Z. Cao, P. Xu, H. Zhai, S. Du, [J. Mandal](#), M. Dontigny, K. Zaghbi, Y. Yang. *Ambient-Air Stable Lithiated Anode for Rechargeable Li-Ion Batteries with High Energy Density*. **Nano Letters** 2016, 16, 7235–7240. ([Link](#))
- G. Shcherbatyuk, P. Talbot, [J. Mandal](#), A. J. Krejci, J. H. Dickerson, and S. Ghosh. *Increased photo-stability of quantum dots in segregated bilayer films*. **Journal of Applied Physics** 114, 084305, 2013. ([Link](#))
- A. Krejci, C. Thomas, [J. Mandal](#), I. Gonzalo-Juan, W. He, R. Stillwell, J. Park, D. Prasai, V. Volkov, K. Bolotin, and J. Dickerson. *Using Voronoi Tessellations to Assess Nanoparticle-Nanoparticle Interactions and Ordering in Monolayer Films Formed through Electrophoretic Deposition*. **Journal of Physical Chemistry B** 117, 1664, 2013. ([Link](#))
- A. Krejci, [J. Mandal](#); J.H. Dickerson. *Patterned substrates to facilitate long-range ordering in the formation of nanoparticle monolayers by electrophoretic deposition*. **Applied Physics Letters** 101 (2012) 043117-4. ([Link](#))

Preprints and Submitted Manuscripts

- [J. Mandal](#),* J. Brewer, A. Raman.* *Nanostructured Plasmonic Metal Surfaces as Optical Components for Infrared Imaging and Sensing*. Submitted. ArXiv ([Link](#)).
- [J. Mandal](#),* S. Mandal, A. Ramachandran, J. Brewer, A. Raman.* *Radiative Cooling and Thermoregulation in the Earth’s Glow*. Submitted. ArXiv ([Link](#)).
- [J. Mandal](#),* *A Survey of Radiative Coolers in the Literature*. engrXiv ([Link](#)).
- [J. Mandal](#),* *How much heat do radiative coolers really lose to the sky?* Submitted.

Manuscripts in preparation

- P. Ohno, J. Mandal, J. Anand, E. Aruffo.* *Could Radiative Coolers Aggravate Ozone Formation in Urban Environments? An analysis based on the FOAM-Box Model.*

Presentations

- J. Mandal. *Passive Radiative Cooling of Urban Environments: Science and Design Considerations*. American Meteorological Society 103rd Annual Meeting. 2023, Denver, USA.
- J. Mandal. *Radiative Cooling: Optical Design Considerations*. Gordon Research Conference – Plasmonics and Nanophotonics. 2022, Newry, USA.
- J. Mandal, J. Brewer, S. Mandal, A. Raman. *Solution Processed Plasmonic Surfaces as Optical Components for Infrared Thermography*. Conference on Lasers and Electro-Optics. 2021. San Jose, USA.
- J. Mandal, A. Raman. *Porous Ceramics as a near-ideal Radiative Cooling Design*. Materials Research Society, 2021 Fall Conference. Boston, USA.
- J. Mandal, A. Raman. *Plasmonic Surfaces as Optical Components for Infrared Sensing and Imaging*. Materials Research Society, 2020 Fall Conference. Boston, USA.
- J. Mandal, S. Mandal, J. Brewer, A. Ramachandran, A. Raman. *Radiative Cooling in the Earth's Glow Using Commonplace Materials*. Materials Research Society, 2020 Fall Conference. Boston, USA.- **Awarded best presentation of the symposium.**
- J. Mandal, A. Raman. *Radiative Cooling Under the Earth's Glow*. Advanced Science Research Center, Photonics Seminar, 2020-06-08, City University of New York. **Invited.**
- J. Mandal, A. Raman, A. Overvig, K. K. Mandal, Y. Yang, N. Yu. *Enhancing the most Versatile and Time-Tested Radiative Cooling Metamaterial – Challenges and Opportunities with Paints*. Materials Research Society, 2019 Fall Conference. Boston, USA.
- J. Mandal, N. Yu, Y. Yang. *Structured Polymers for High-Performance Passive Daytime Radiative Cooling*. Conference on Lasers and Electro-Optics. 2019. San Jose, USA. **Invited.**
- J. Mandal, Y. Yang. *Porous Polymer Coatings with Fluid-Mediated Optical Switching – A Diverse Platform for Optical and Thermal Regulation*. Materials Research Society, 2019 April Conference. Phoenix, USA.
- J. Mandal, N. Yu, Y. Yang. *Micro- and Nanoporous Polymer Coatings: A Diverse and Promising Platform for Optical and Thermal Regulation*. American Physical Society, 2019 March Meeting. Boston, USA.
- J. Mandal, N. Yu, Y. Yang. *Paint-Like Structured Polymer Coatings for High-Performance Passive Daytime Radiative Cooling*. Materials Research Society, 2018 Fall Conference. Boston, USA.
- J. Mandal, Y. Yang. *Solution-Derived Plasmonic Metal Surfaces for Optical and Thermal Applications*. Materials Research Society, 2018 Fall Conference. Boston, USA.
- J. Mandal, Y. Yang. *Scalable, 'Dip-and-Dry' Fabrication of a Plasmonic, Wide-Angle Selective Absorber for High-Efficiency Solar-Thermal Energy Conversion*. Materials Research Society, 2017 Fall Conference. Boston, USA.
- J. Mandal, Y. Yang. *A TiO_x-Based, Visible-to-Infrared Broadband Electrochromic Material for Thermal and Optical Management*. Materials Research Society, 2017 Fall Conference. Boston, USA.
- J. Mandal. *A Green Chemical Pathway for Making Selective Solar Absorbers*. Elsevier Green and Sustainable Chemistry 2018 Conference. Berlin, Germany.

Patents (Granted and Under Evaluation)

- N. Yu, J. Mandal, N. Shi, A. Overvig. *Systems and Methods for Radiative Cooling and Heating*. [International application number: PCT/US2016/038190](#).
- J. Mandal, Y. Yang. *Scalable method of fabricating structured polymers for passive daytime radiative cooling*. [International application number: WO/2019/113581](#).
- J. Mandal, Y. Yang. *Scalable Method of Fabricating Structured Polymers For Passive Daytime Radiative Cooling and Other Applications*. [International application Number WO/2019/113596](#).
- J. Mandal, Y. Yang, Y. Chen. *A paintable bilayer design that simultaneously achieves color and reflects infrared solar radiation to stay cool*. Provisional patent [US 62/901,932](#) (September 2019).
- J. Mandal, A. Raman. *Spectrally Selective Thermal Radiators for Cooling of Vertical or Horizontal Surfaces with Limited View of the Sky*. [International Application Number WO/2021/087128](#) (October 2019).
- J. Mandal, A. Raman. *Methods and Systems for UV-Reflective Paints with High Overall Solar Reflectance for Passive Cooling of Buildings*. International Application Number PCT/US 21/19448 (March 2020).

- [J. Mandal](#), A. Raman. *Spectrally Selective Structured Materials and Designs for Thermal Optics*. Provisional patent US 63/104,216 (November 2020).

Other Writing

- J. Mandal. *The Importance of Personal Interdisciplinarity*. Schmidt Science Fellows, 2019-10-31. ([Link](#))

Professional Associations and Service

- Founder and Co-organizer: Conference on Climate Change – Impacts and Innovations (2021) – featuring wide-ranging talks by early career scientists, panel discussions, and 94 registrants, with an emphasis on interdisciplinarity, socio-economic aspects of climate change, and diversity of backgrounds.
- Journal Reviewer: Science, Nature Energy, Nature Reviews Physics, Joule, Science Advances, Nature Communications, ACS Nano Letters, ACS Photonics, Macromolecular Rapid Communications (Wiley), Global Challenges (Wiley), Optics Letters (Optical Society of America), Optics Express (Optical Society of America), JOSA B (Optical Society of America), Cell Reports Physical Science, Solar Energy (Elsevier), Journal of Advanced Research (Elsevier), Composites B (Elsevier), Journal of Cleaner Production (Elsevier).
- Creator of a public database of radiative coolers for use by researchers, journal editors and reviewers. Beta version [currently online](#).
- Member: Materials Research Society, American Physical Society, Optical Society of America.

Commercialization Activities and Community Service

- Former member, PowerBridgeNY Grant Cycle 3 Awardee Team** Sep 2015 – Mar 2016
 - Spearheaded the technical work and co-authored a commercialization grant application for the radiative cooling designs created with Prof. Nanfang Yu at Columbia University. Team awarded **seed grant** to form a startup, [MetaRE](#).
- Finalist, Elsevier Green Chemistry Challenge** May 2018
 - Led an initiative to implement the plasmonic solar heater I created, in resource-poor settings. Project was nominated as one of the top 5 among more than 500 proposals, and [presented](#) at the Elsevier Green & Sustainable Chemistry Conference.
- Scientist, Heat Resilient L.A. initiative** Jul 2021-Present
 - Scaling radiative cooling paints for deployment in [heat shelters](#) in resource-poor communities in Los Angeles.

Teaching Experience

- Dept. of Applied Physics, Columbia University, New York** Sep 2014 – May 2017
 - Teaching Assistant for graduate courses including Quantum Physics, Applied Electrodynamics, Linear Algebra, and Ceramics & Composites, with class sizes ranging from ~15 to ~70.
- Department of Physics, Vanderbilt University, Nashville, TN** Jan 2012 – Apr 2014
 - Teaching Assistant for introductory undergraduate Physics courses.

Other Interests and Skills

- **Photography** – featured in [National Geographic \(Feature\)](#), [Nature \(Feature\)](#), [Advanced Materials \(Cover\)](#), [Science website](#), and [multiple media outlets](#).
- **Blogger** and promoter of Bangla (Bengali) Literature and Language on the Web 2014 - Present
 - Contributor to online Bangla translation systems (> 3000 translations in Google Translate) and dictionaries.
- **Language:** Bangla (Speak, Read, Write), Hindi (Speak).