PROGNA BANERJEE, PhD

Postdoctoral Fellow, McKetta Department of Chemical Engineering, The University of Texas at Austin,
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EDUCATION

Ph.D.	**University of Illinois at Urbana-Champaign, Urbana, IL, USA**	Dec 2018
	Discovery of novel phases in semiconducting nanocrystals	
M.S.	Physics	May 2014
M.Tech	**Indian Institute of Technology, Kharagpur, India**	2012
	Solid State Technology	
M.Sc	**Indian Institute of Technology, Kharagpur, India**	2010
	Physics (emphasis on condensed matter)	

RESEARCH EXPERIENCE

- **Postdoctoral Fellow,** The University of Texas at Austin, J. J. McKetta Department of Chemical Engineering, Austin, Texas, USA 04/2020-current

Studies of plasmonic semiconductor nanocrystals and optical properties of biological, bio-derived, and bio-inspired photonic structures (PI-Prof. Delia Milliron).

- **Postdoctoral Researcher**, Energy Storage Group, Energy Storage & Distributed R Division, Lawrence Berkeley National Laboratory, Berkeley, California, USA 03/2019-03/2020

Studying the Lithium ion (Li+) intercalation in transition metal oxides in a thin-film solid electrochemical cell setup. The electrodes and electrolyte for these cells were fabricated using a pulsed laser deposition setup. Efforts are being made toward insitu studies of lithiation in these solid cells using synchrotron based XPS (xray photoelectron spectroscopy) at the ALS (Advanced Light Source)

- **Graduate Research Assistant**, Jain Research Group, School of Chemical Sciences, 11/2014-11/2018
  University of Illinois at Urbana-Champaign, USA

Thesis: Exploring Condensed Phases in Engineered Semiconducting Nanocrystals

Engineering new class of unconventional materials through a template-based topotactic method called cation exchange to produce semiconductor nanocrystals (NCs) in novel morphologies and phases

Many firsts include the first evidence of a superionicity at room-temperature in disordered cationic sub-lattice in ultrasmall NCs; first synthesis of Hg(Cd)Se NCs in a stable non-natural polymorph form for applications as 3D topological insulators, first successful lithiation of Cu_2Se NCs for application as superionic electrolyte.

Investigation of the atomistic mechanism of anion exchange in NCs, for gaining physical insight into the phase transition characteristics. nanoDDSCAT+ tool development and outreach liaison member from Jain Group with the NSF-funded nanoBIONODE initiative https://nanohub.org/groups/uiucnanobio

- **Graduate Student Researcher**, Budakian Group, Physics 2013-14
  University of Illinois at Urbana-Champaign, USA

Utilizing nanoscale resonance technique to investigate coupling in vortices

- **S.I.P.I.S. Visiting Scholar**, NUSNNI, National University of Singapore, Singapore 2011

Involvement and training on several instruments such as PLD-MBE, SQUID-VSM, XRD, AFM etc. for investigation of transport properties of 2-d electron gas at the LAO/STO interface.

- **M.Tech Student Researcher,** with Prof. Tapan K. Nath 2011-12
  Indian Institute if Technology, Kharagpur, India

Thesis: An Investigation of the Junction Magneto-Resistance and Electrical Properties of Ferrites/n-Si Hetero-Structures for Spintronics Applications/

Designed hetero-structures to maximize spin-transport through an intermediate MgO layer to demonstrate a) electrical spin extraction and b) origin of giant positive junction magnetoresistance (JMR). Used standard spin injection/extraction and spin accumulation theory to explain results

- **Indian Academy of Sciences Summer Fellow**, with Prof. Jayanta K. Bhattacharjee 2010
  S.N. Bose National Institute of Basic Sciences, Kolkata

Extended involvement in understanding the impact of dimensional and particle interaction on the specific heat in Bose-Einstein Condensates (BEC)

- **M.Sc Student Researcher**, with Prof. Veeturi Srinivas 2009-10
  Indian Institute if Technology, Kharagpur, India

Thesis: *Synthesis and characterization of nanoparticles through devitrification of amorphous particles*

Demonstrated a) significant alteration in advanceproperty and b) underlying mechanism by reduction of particle interaction; which is important from fundamental Physics view-point.

SELECTED HONORS AND AWARDS (degrees indicated to the left)

Ph.D	2018	Scott Anderson Outstanding Graduate Assistant Award, Physics Department, UIUC
	2017	University fellowship including travel grant, Graduate College, UIUC
	2017	AVS Prairie Chapter Symposium Registration Waiver for the 64th AVS Conference
	2017	First prize for poster presentation, Monsanto Research Symposium, Urbana, IL
	2016	Academic Leadership for Women in Engineering, SWE-ALWE Program, Philadelphia
	2016	ASSIST Travel Grant, SWE Annual National Conference, Philadelphia, USA
M.Tech	2010-12	Govt. of India MRHM Institute Fellowship, Indian Institute of Technology, Kharagpur
	2011	S.I.P.I.S. Summer Fellowship (10 awards granted annually), NUS, Singapore
M.Sc	2010	Indian Academy of Sciences Summer Research Fellowship
	2009	Institute Summer Fellowship, S. N. Bose Centre for Basic Sciences, Kolkata
	2010	Top 1 percentile, rank 43 in GATE Entrance (out of 8000+ applicants), all-India level
B.Sc	2008	Top 1 percentile among JAM applicants (Joint Admission to M.Sc) at all-India level
	2005–08	First Rank in Department, highest GPA among all STEM field students in College
	2008	Hiron Bala Memorial Gold Medal (Highest GPA in the College), University of Kolkata

TEACHING EXPERIENCE

University of Illinois at Urbana-Champaign

Graduate Teacher Certificate from the Center for Innovation in Teaching & Learning

Laboratory, Phys 402, Light	Fa 2018
Laboratory, Phys 101, College Physics: Mechanics & Heat	Su 2018
Laboratory, Phys 102, College Physics: Electricity and Magnetism, and Modern Physics	Sp 2018
Discussion, Phys 211 Classical Mechanics, 70+ students	Su 2015
Discussion, Phys 213/214 Thermodynamics/Quantum Mechanics, 70+ students	Sp 2015
Laboratory, Phys 212, Electricity & Magnetism, 70+ students	Sp, Su 2014
Discussion, Phys 212 Electricity & Magnetism, 70+ students	Fa 2012

Indian Institute of Technology, Kharagpur

Laboratory, Introductory Physics, 60+ students	Fa, Sp 2009-10

MENTORING EXPERIENCE:

- Research Mentor:

Graduate: **Rajesh Mondal** (thesis mentor), Masters (M.Sc.) in Physics 2011-2012. Presently Ph.D. candidate in Physics at IIT-Kgp

Undergraduates at University of Illinois at Urbana-Champaign: **Bara Saadah** (BioE, research mentor: Summer 2016-Present). Currently Junior in Bioengineering at UIUC. **Johan Yapo** (CHEM, research mentor: Spring 2016). Currently B.S. in Chemistry Program at UIUC. **Priya Patel** (CHEM, research mentor: Spring 2016). Currently Lab Technician at Zoetis in Chicago Heights. **Ryan Sanders** (ChBE, research mentor: 2015- 2016). Currently John Deere in the Engineering Development.

- Non-research mentoring:

Kavinda Nissanka (PHYS, GPS mentee: 2016- 2017). Currently Junior. **Sidney Lower** (PHYS, GPS mentee: 2015-2016). Currently Senior. **Dewen Zhong** (PHYS, GPS mentee: 2016-2017). Currently Doctoral Student.

WORKSHOP ORGANIZING:

[3] Light/Matter Interactions at the Nano-Bio Interface Workshop, Nov 2016, Urbana, IL

- Responsible for structuring tutorial on the open-source nanoDDSCAT+ tool and conduct hands-on workshop for 30+ attendees.

[2] Transition from Undergrad to Doctoral/Graduate Programs Workshop, Nov 2016, Urbana, IL

- Director and Speakers' Coordinator

[1] Transition from Undergrad to Doctoral/Graduate Programs Workshop, March 2016, Urbana, IL

- Director and Speakers' Coordinator
- Launched a new Subcommittee in the Dean's EGSAC and imitated this event, involved in fundraising through donations from the Engineering Departments on Campus

PROFESSIONAL AFFLIATIONS:

- APS (American Physical Society), *Early Career member*, 2014-present
- ACS (American Chemical Society)
- MRS (Materials Research Society)
- SWE
- UIUC Engineering Dean's Graduate Advisory Committee (EGSAC) Elected Membership, 2015-2017.

UNIVERSITY, DEPARTMENTAL & LABORATORY SERVICE:

MRSEC Outreach Committee, UT MRSEC (Centre for Dynamics and Control of Materials) 2020-present
Reviewer, *Chemistry of Materials, Advanced Functional Materials, Advanced Science* 2019, 2020
TechWomen **Professional Mentor** 2019
Panel on science outreach for Oakland high schoolers 2019
Undergraduate Research Symposium (Office of Undergraduate Research, UIUC), ***Judge*** 2017
SWE- Introduce a Girl to Engineering Day (IGED), ***Judge*** 2017
Incoming visiting graduate students in Physics, ***Recruiting****, lab tours* 2017
nanoHUB webpage on the nanoDDSCAT+ tool, **troubleshooting**, **interacting** with users from different institutes 2016-present
Jain Lab **Safety Officer** 2016-17
Chemistry Department Joint Safety Team (JST), ***Member*** 2017
Engineering Dean's Graduate Advisory Committee (EGSAC): Mentoring Subcommittee-***Team Leader*** 2015-17

PROFESSIONAL TRAINING:

Active participation in Semester-long course Chem-590 F *Preparing Future Faculty* Spring 2016
SWE- Academic Leadership Program 2016

MEDIA:

- Beckman Graduate Student Researcher of the Week, Featured 2017
- Research on superionic solids (co-first author) featured on several science and general news outlets including Smithsonian magazine, R&D Magazine, AzoNanao, CEMag, Phys.Org, EurekAlert, UIUC News Bureau etc.

STEM OUTREACH:

- Actively involved in providing detailed tutorials at the Workshops directed at introducing the nanoDDSCAT+ tool to wider scientific audience (including students, post-docs and faculty from domestic and international Academic Institutions).
- Volunteer at the nanoSTRuCT Outreach Organization, for introducing 3rd graders to nanoscience and nanotechnology.

SKILLS:

- ***Languages:*** Fluent in English, Bengali, Hindi, beginner in Sanskrit.
- ***Computing:*** ANSI C/C++, HTML, Adobe Illustrator, Word, Excel, PowerPoint, Python (beginner)
- ***Technical Skills***: Data Analysis and instrumental design involving Origin Pro, LabVIEW, nanoDDSCAT+ (open-source DDA simulations and structural modeling involving Blender), MATLAB, Solidwork, Powdercell for structure factor simulations, LaTex, ParaView, CrystalMaker for modeling nanocrystals and simulation of diffraction patterns, MDI-JADE for powder diffraction data analysis, Rietveld Refinement of pXRD and Synchrotron Beamline data.
- ***Laboratory***: Cleanroom Operation, HR-TEM (Transmission Electron Microscope), STEM-EDS, SEM, XRD (pXRD and single crystal), Laue, Glovebox Operation and maintenance, Optical Characterization including UV-VIS, PL, DLS, XRF, Schlenk Line Nanoparticle Synthesis, PLD-MBE, AFM, Ultrahigh vacuum involving He, MPMS, SQUID-VSM, DSC, Machining, Soldering, electrochemical characterization on liquid and solid cells

REFERENCES:

Available upon request

LIST OF PUBLICATIONS: (‡ denotes equal contribution)

ORCID ID: orcid.org/0000-0003-3257-7317
RESEARCHGATE PROFILE: https://www.researchgate.net/profile/Progna_Banerjee
Scholar: https://scholar.google.com/citations?user=3OCCLyMAAAAJ&hl=en#

Submitted:

11) **P. Banerjee**, Gabriel R. Burks, Sarah B. Bialik, Mostafa Nassr, Elizabeth Bello, Marianne Alleyne, Benny D. Freeman, Jeffrey E. Barrick, Charles M. Schroeder, and Delia J. Milliron, **Structure derived anti-reflectivity at the nanoscale in leafhopper brochosomes**, *submitted*.

Published in peer-reviewed journal articles:

10) N. Borodinov**, P. Banerjee**, S. H. Cho, D. J. Milliron, O. S. Ovchinnikova, R. K. Vasudevan, J. A. Hachtel, **Enhancing Hyperspectral EELS Analysis of Complex Plasmonic Nanostructures with Pan-Sharpening**, *Journal of Chemical Physics,* 154, 014202, 2021. **DOI**: https://doi.org/10.1063/5.0031324
FEATURED ARTICLE link

9) J. Heo**,** D. D. Torres, **P. Banerjee,** P. K. Jain, **In-situ electron microscopy mapping of an order-disorder transition in a superionic conductor**, *Nature Communications*, 10, 1505, 2019. **DOI:** https://doi.org/10.1038/s41467-019-09502-5 link

8) **P. Banerjee**, P. K. Jain, **Mechanism of sulfidation of small zinc oxide nanoparticles**, *RSC Advances,* 8, 34476-34482, 2018. **DOI**: 10.1039/C8RA06949B. link

7) **P. Banerjee,** P. K. Jain, **Lithiation of copper selenide nanocrystals**, *Angewandte Chemie Int. Ed.*, 57 (30), 9315-9319, 2018. **DOI:**10.1002/anie.201803358 link
FEATURED IN HOT TOPIC: BATTERIES AND SUPERCAPACITORS

6) H. Nguyen‡, **P. Banerjee‡ (co-first),** D. Nguyen, J. W. Lyding, M. G. Gruebele, P. K. Jain, **STM imaging of localized surface plasmons on individual gold nanoislands**, *Journal of Physical Chemistry Letters,* 9 (8), 1970-1976, 2018. **DOI:** 10.1021/acs.jpclett.8b00502. link

5) D. D. Torres, **P. Banerjee**, S. Pamidighantam, P. K. Jain, **A non-natural wurtzite polymorph of HgSe: A potential 3D topological Insulator**, *Chemistry of Materials*, 29 (15), 6356-6366, 2017. **DOI:** 10.1021/acs.chemmater.7b01674.link

4) S.L. White‡, **P. Banerjee‡ (co-first)**, P.K. Jain, **Liquid-Like Cationic Sub-Lattice in Copper Selenide Clusters**, *Nature Communications*, 8, 14514, 2017. **DOI:**10.1038/ncomms14514. link
UIUC NEWS BUREAU PRESS RELEASE: TINY NANOCLUSTERS COULD SOLVE BIG PROBLEMS FOR LITHIUM ION BATTERIES link
SMITHSONIAN MAGAZINE STORY: CHARGING AHEAD: THE FUTURE OF BATTERIES link
R&D MAGAZINE HIGHLLIGHT: NANOCLUSTERS HELP IMPROVE LITHIUM ION BATTERIES link
AZONANO STORY: NANOCLUSTERS AND THE FUTURE OF LITHIUM BATTERIES link
HIGHLIGHTED ON CEMAG LAYERED GRAPHENE, IMAGING NEMATODES, PREVENTING BATTERY EXPLOSIONS link
ALSO FEATURED ON PHYSORG, EUREKALERT, AND OTHER SCIENCE MEDIA OUTLETS

3) S.L. White, **P. Banerjee**, I. Chakraborty, and P. K. Jain, **Ion Exchange Transformation of Magic-sized Clusters**, *Chemistry of Materials*. 28 (22), 8391-9398, 2016. **DOI:** 10.1021/acs.chemmater.6b03882. link
ACS AUTHOR CHOICE ARTICLE

2) K-K. Liu, S. Tadepalli, G. Kumari, **P. Banerjee**, L. Tian, P.K. Jain, S. Singamaneni, **Polarization-Dependent Surface-Enhanced Raman Scattering Activity of Anisotropic Plasmonic Nanorattles**, *Journal of Physical Chemistry C*, 120 (30), 16899-16906, 2016. **DOI:** 10.1021/acs.jpcc.6b00955. link

1) J.Panda, **P. Banerjee**, T.K. Nath, **Electrical Spin Extraction and giant positive junction magneto-resistance in Fe_3O_4/MgO/n-Si diode-like hetero-structure**, *Journal of Physics D: Applied Physics*,

47 (41), 415103, 2014. link

TALKS & PRESENTATIONS:

TUTORIAL PRESENTATIONS:

[2] Tutorial on nanoDDSCAT+, Light/Matter Interactions at the Nano-Bio Interface Workshop, Urbana, IL, 2016.

[1] Modules on Plasmonics Design Lab, Light/Matter Interactions at the Nano-Bio Interface Workshop, IL, 2016.

RESEARCH PRESENTATIONS AT SELECTED CONFERENCES/RETREATS:

[10] Structure derived anti-reflectivity at the nanoscale in leafhopper-derived brochosomes, American Physical Society (APS) virtual March Meeting 2021, Session X03: Optics and Photonics in Polymers and Soft Matter II: Photonics, (Sponsoring Units: DPOLY DSOFT DBIO DAMOP), Abstract: X03.00009.

[9] Mapping the opto-electronic, thermal and chemical behavior in natural and inspired artificial brochosomes using electrodynamic modelling, and single-particle/ensemble experiments, Army Research Office-Multi University Research Initiative (MURI) meeting, Nov 2020.

[8] Exploring condensed phases in engineered semiconducting nanocrystals. Symposium 3 (Quantum dots for the Infrared), iCQD, nanoge internet conference on quantum dots, July 2020.

[7] Unique Superionicity achieved on the nanoscale with applications in next-generation Lithium ion batteries, Departmental Seminar, Indian Association for the Cultivation of Sciences, Kolkata, India, Dec 2018.

[6] Unique Superionicity achieved on the nanoscale with applications in next-generation Lithium ion batteries, Departmental Seminar, S. N. Bose National Centre for Basic Sciences, Kolkata, India, Nov 2018.

[5] Nanoscience in next-gen Li-ion batteries, Research Live!, Graduate College, Urbana, IL, 2018.

[4] Unique Superionicity achieved on the nanoscale with applications in next-generation Lithium ion batteries, 64th National AVS Conference & Symposium, Tampa, Florida, 2017.

[3] Engineering novel nanocrystals with unconventional properties employing cation exchange, Materials Research Laboratory Fall Competition, Urbana, IL, 2017.

[2] Engineering new materials to explore Physics at the nanoscale, Research Live!, Graduate College, 2016.

[1] Some Special Attributes of Ultrasmall Cu2Se Clusters, Research Live!, Graduate College, 2015.

SELECTED SCIENCE OUTREACH/MENTORING TALKS:

[5] Panelist for Science Outreach for Oakland High school students, Berkeley Lab, 2019.

[4] Panelist for “Preparing for Graduate School” seminar, hosted by Engineering Career Services, UIUC, 2017.

[3] Panelist for sessions on “Choosing a Grad Advisor”, “UG Research” and “Choosing the Right Grad School” Transition from Undergrad to Doctoral Programs Workshop, IL, 2016.

[2] Panelist, Graduate PhD student Panel, University of Illinois Engineering GradFest, 2016.

[1] Panelist for multiple sessions in Transition from Undergrad to Doctoral Programs Workshop, IL, 2016.

SELECTED POSTER PRESENTATIONS:

[12] Structure-derived optical properties in metal oxide nanocrystal linker gels, NSF Centre for Dynamics & Control of Materials (NSF-MRSEC): Annual Retreat 2021.

[11] Elucidating structure-optical property relationship in metal oxide nanocrystal superlattices, NSF Centre for Dynamics & Control of Materials (NSF-MRSEC): Annual Retreat 2021.

[10] Nanocrystal-electrolytes for lithium-ion batteries, Molecular Foundry user meeting, Berkeley, CA, 2019.

[9] Design of superionic electrolytes for next-generation battery applications, Monsanto Research Symposium, UIUC, 2017.

[8] Cation exchange transformation in QDs, SWE Introduce a Girl to Engineering Day (IGED), Urbana, IL,2017.

[7] nanoDDSCAT+, ECS Career Fair, Micro & Nanotechnology Laboratory, Urbana, IL, 2016.

[6] Design of Plasmon Rulers for Study of RNA Splicing, Biomedical Engineering Society (BMES) Annual Meeting, 2016 in Minneapolis.

[5] Tracking defects in the cation exchange transformation of QDs, Mentee Ryan Sanders’s poster for the UG Research Symposium, Urbana, IL, 2016.

[4] nanoDDSCAT+: The perspective of a new trainee, nanoBIONODE site visit, Beckman Institute, Urbana, IL, 2016.

[3] Specific Heat for the BEC in a trapped gas”, International Conference on Theoretical and Applied Physics, ICTAP, I.I.T. Kharagpur, 2011.

[2] Structural Properties of Nickel Rich Amorphous Boride Nanoparticles, AIP Conf. Proc. Series, American Institute of Physics, New York. International Conference on Materials ICMM, Saha Institute of Nuclear Physics, Kolkata, 2010.

[1] Synthesis and Characterization of Nanoparticles through Devitrification of Amorphous Particles,

Proceedings of annual DAE Solid State Physics Symposium, Paper C-34. DAE-SSPS 2009, M.S. University, Vadodara, India, 2009.

RESEARCH PROPOSALS:

Spokesperson & Principal Investigator.

General-User Proposals (GUP) at the Argonne National Laboratory, APS

Accepted as rapid-access proposal and allotted Beamtime at the 11-BM facility:

[4] GUP-49646, 'Investigation of structural phase transitions in novel room-temperature superionic nanostructures', Run Cycle-2 *on-site*.

[3] GUP-49642, 'Determination of structural phase transition point in novel room-temperature superionic nanoscale solid structures', Run Cycle-3, *mail-in*.

[2] GUP-47736, 'Novel Nanoscale Structures that support Room-Temperature Superionicity in Solids', Run Cycle-2, *mail-in*. *In Review* for conducting pair-distribution function analysis 11-ID-B facility*:*

[1] GUP-51246, Structural elucidation of the non-superionic to superionic phase transition in nanocrystals (NCs), Run Cycle 2017-1.