

## Debdas Ray

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Department of Chemistry  
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### Research Interests

- Organic and Organometallic Synthesis
- Studies and Modulation of Excited State Properties of Light-emitters
- Development of Purely Organic Thermo-phosphors, and their applications
- White-light Emission (via harvesting of both singlet and triplet excitons) from Single Molecule
- Modulation of Intermolecular Charge Transfer (ICT) for Advanced Optical Materials.
- Applications of Light-emitters
- Molecular Switches (Conformational and/or Configurational)

### Current Projects

- Purely Organic Room-temperature Phosphorescence (RTP) Materials
- Thermal-enhancement (above RT) of Phosphorescence in Purely Organic Materials
- Light Emission via Fluorescence and Room-temperature Phosphorescence (RTP), and/or Thermally Activated Delayed Fluorescence (TADF) and Phosphorescence in Organic Donor-Acceptor Conjugates
- Ultra-long room-temperature (URTP) phosphorescence materials
- Conformational switches
- Application of RTP and URTP materials

### Future Projects

- High-efficient Organic Light-emitting Diodes (OLEDs)
- Responsive Phosphorescence Materials
- Ultralong Phosphorescence Materials
- Solid state phosphorescence lasers
- Photosensitizer
- Mechano-and Photoswitches

### Current Position

2019-present Associate Professor, Department of Chemistry, Shiv Nadar University (SNU), NH-91, Tehsil Dadri, District Gautam Buddha Nagar, Uttar Pradesh, 201 314, India.

2013 - 2018      Assistant Professor, Department of Chemistry, Shiv Nadar University (SNU), NH-91, Tehsil Dadri, District Gautam Buddha Nagar, Uttar Pradesh, 201 314, India.

### **Education**

2009              Ph.D., Department of Chemistry, Indian Institute of Technology Kanpur, Uttar Pradesh, 208 016, India.

2002              M.Sc. in Analytical Chemistry, The University of Kolkata, Science College, West Bengal, India.

2000              B.Sc. in Chemistry (Hons.), Thakurpukur Vivekananda College, The University of Kolkata, West Bengal, India.

### **Professional Experience**

2019–present    Associate Professor of Chemistry, Department of Chemistry, Shiv Nadar University, NH-91, Tehsil Dadri, Gautam Buddha Nagar, UP-201 314, India

2013–2018      Assistant Professor of Chemistry, Department of Chemistry, Shiv Nadar University, NH-91, Tehsil Dadri, Gautam Buddha Nagar, UP-201 314, India

2012–2013      Postdoctoral research in the laboratories of Takashi Nakanishi, Organic Materials Group, National Institute for Materials Science (NIMS), Tsukuba, Japan

2011-2012      Postdoctoral Research in the laboratories of Ivan Aprahamian, Department of Chemistry, Dartmouth College, Hanover, New Hampshire, USA

2009-2011      Postdoctoral Research in the laboratories of Dario M. Bassani, University of Bordeaux 1, France

2005-2007      Teaching assistant at The Indian Institute of Technology Kanpur, Kanpur, India

### **Awards and Honors**

2019              Academic Promotion

2002              Qualified National Eligibility Test in Chemical Sciences (CSIR-NET) Qualified Graduate Aptitude Test in Engineering (GATE)

### **Funding**

2018-2020      Board of Research in Nuclear Sciences (BRNS)-Department of Atomic Energy (DAE) (as Principal Investigator)

2016-2019      Empotement and Equity Opportunities in excellence in Science

(EMEQ) (DST- SERB) (as Principal Investigator)

2015 - 2017 Young Scientist (DST-SERB) (as Principal Investigator)  
(completed)

2014 - Present Shiv Nadar University (SNU)

### **Student Project/ Thesis Supervision**

- Thesis Supervision (on-going): 4 postgraduate students
- Thesis Supervision (completed): 1
- JRF Project Guidance: 4
- OUR Project Guidance: 2
- BS-Research Project Guidance: 2

### **Courses Taught**

#### Shiv Nadar University (SNU)

Undergraduate: Applied Chemistry (CHY-101)

Undergraduate: Structure and Bonding (CHY112)

Undergraduate: Chemical Analysis Lab (CHY213)

Undergraduate: Physical Methods in Chemistry (CHY213)

Undergraduate: Coordination Chemistry (CHY242)

Undergraduate: Molecular Spectroscopy (CHY313)

Undergraduate: Electrochemistry (CHY316)

Postgraduate : Nano and Supramolecular Chemistry (CHY542)

Postgraduate : Bioinorganic and Coordination Chemistry (CHY553)

Postgraduate : Advanced Molecular Spectroscopy (CHY512)

Postgraduate : Research Methodology (CHY600)

### **List of Publications** (h-index 10, i10-index 10)

(<https://scholar.google.com/citations?user=5awrC0IAAAAJ>)

### **Independent Research (Manuscript under preparation/submitted)**

[23] N. Acharya, **D. Ray**, [Structural change Revealing Secretes of Phosphorescence Enhancement above Room-Temperature](#). (Manuscript under preparation)

[22] H. Bhatia, **D. Ray**, [White-light Emission with Afterglow Feature from Single-component Organic Donor\(D<sub>4</sub>\)-Acceptor\(A\) molecular systems, and Document Security Protection](#), *J. Am. Chem. Soc.* (Manuscript submitted)

[21] H. Bhatia, **D. Ray**, [Intrinsic Dual emission via TADF and RTP in assymmetric Donor\(D<sub>2</sub>D'<sub>2</sub>\)-Acceptor\(A\) systems](#), *Angew. Chem. Int. Ed.* (Manuscript under preparation)

- [20] S. Karmakar, I. Bhattacharjee, **D. Ray**, Fluorescence and Room-Temperature Phosphorescence in Pyridine-Fused Coumarin, (manuscript under review)

### **Independent Research (Published)**

- [20] H. Bhatia, **D. Ray**, Use of Dimeric Excited states of the Donors in D<sub>4</sub>-A systems for Accessing White-light emission, Afterglow and Invisible Security Ink, *J. Phys. Chem. C*, **2019**, *xx*, xxxx-xxxx. (Revised manuscript under publication)
- [19] I. Bhattacharjee, N. Acharya, **D. Ray**, Thermally activated delayed fluorescence and room-temperature phosphorescence in naphthyl appended carbazole-quinoline conjugates, and their mechanical regulation, *Chem. Commun.*, **2019**, *55*, 1899-1902.
- [18] I. Bhattacharjee, N. Acharya, S. Karmakar, **D. Ray**, Room-Temperature Orange-Red Phosphorescence by Way of Intermolecular Charge Transfer in Single-Component Phenoxazine-Quinoline Conjugates and Chemical Sensing, *J. Phys. Chem. C*, **2018**, *122*, 21589-21597.
- [17] H. Bhatia, I. Bhattacharjee, **D. Ray**, Bioluminescence via Fluorescence and Persistent Phosphorescence in Amorphous Organic Donor(D<sub>4</sub>)-Acceptor(A) Conjugates and Application in Data Security Protection, *J. Phys. Chem. Lett.*, **2018**, *9*, 3808-3813. (This phenomenal work is getting highlighted via ACS-live slide presentation (<https://pubs.acs.org/doi/suppl/10.1021/acs.jpcllett.8b01551>)).
- [16] I. Bhattacharjee, N. Acharya, H. Bhatia, **D. Ray**, Dual Emission through Thermally Activated Delayed Fluorescence and Room-Temperature Phosphorescence, and Their Thermal Enhancement via Solid-State Structural Change in a Carbazole-Quinoline Conjugate, *J. Phys. Chem. Lett.*, **2018**, *9*, 2733-2738. (This work is getting highlighted via ACS-live slide presentation (<https://pubs.acs.org/doi/suppl/10.1021/acs.jpcllett.8b00937>)).
- [15] I. Bhattacharjee, N. Ghosh, A. Raina, J. Dasgupta, **D. Ray**, Conformational switching via an intramolecular H-bond modulates the fluorescence lifetime in a novel coumarin-imidazole conjugate, *Phys. Chem. Chem. Phys.*, **2018**, *20*, 6060-6072. (Cover)

### **Post-doctoral Research**

- [14] J. T. Foy, **D. Ray**, I. Aprahamian, Regulating signal enhancement with coordination-coupled deprotonation of a hydrazone switch, *Chem. Sci.*, **2015**, *6*, 209-213.
- [13] **D. Ray**, J. T Foy, R. P. Hughes, I. Aprahamian, A Switching cascade of hydrazone-based rotary switches through coordination-coupled proton relays, *Nat. Chem.*, **2012**, *4*, 757-762. (nature news)
- [12] G. Raffy, **D. Ray**, C.-C. Chu, A. D. Guerzo, D. M. Bassani, Effect of Hydrogen-Bonding on the Excited-State Reactivity of Fullerene Derivatives and their Impact on the Control of the Emission Polarization from Single Crystals, *Phys. Chem. Chem. Phys.*, **2012**, *14*, 8859-8865.

- [11] G. Raffy, **D. Ray**, C.-C. Chu, A. D. Guerzo, D. M. Bassani, [Controlling the third property of light: Towards photopolic materials](#), *Angew. Chem. Int. Ed.* **2011**, *50*, 9584-9588. (**Hot Article**)
- [10] D. M. Bassani, **D. Ray**, C.-K. Liang, B. Fabre, F. Hui, P. Hapiot, [Anthracene- and anthracene:C<sub>60</sub> adduct- terminated monolayers covalently bound hydrogen terminated silicon surfaces](#), *J. Phys. Chem. C* **2011**, *115*, 14786-14796.
- [9] **D. Ray**, C. Liang, N. D. McClenaghan, D. M. Bassani, [Organic and Supramolecular Materials for LED and Photovoltaic Applications](#), *Current Physical Chemistry* **2011**, *1*, 169-180.
- [8] **D. Ray**, C. Belin, F. Hui, B. Fabre, P. Hapiot, D. M. Bassani, [Direct formation of fullerene monolayers using \[4+2\] Diels-Alder cycloaddition](#), *Chem. Commun.* **2011**, *47* (9), 2547-2549.
- [7] C.-C. Chu, G. Raffy, **D. Ray**, A. D. Guerzo, B. Kauffmann, G. Wantz, L. Hirsch, D. M. Bassani, [Self-assembly of supramolecular fullerene ribbons via hydrogen-bonding interactions and their impact on fullerene electronic interactions and charge carrier mobility](#), *J. Am. Chem. Soc.* **2010**, *132*, 12717-12723.
- [6] D. M. Bassani, L. Jonusauskaite, N. D. McClenaghan, J.-L. Pozzo, **D. Ray**, G. Vives, [Harnessing supramolecular interactions in organic solid-state devices: current status and future potential](#), *Coord. Chem. Rev.* **2010**, *254*, 2429-2445.

### **Graduate Research**

- [5] **D. Ray**, A. Nag, A. Jana, D. Goswami, P. K. Bharadwaj, [Coumarin Derived Chromophores in the donor-acceptor-donor format that gives fluorescence enhancement and large two-photon activity in presence of specific metal ions](#), *Inorganica Chimica Acta* **2010**, *363*, 2824-2832.
- [4] **D. Ray**, A. Nag, D. Goswami, P. K. Bharadwaj, [Acyclic Donor-Acceptor-Donor Chromophores for Large Enhancement of Two-Photon Absorption Cross Section in Presence of Mg\(II\), Ca\(II\) or Zn\(II\) Ions](#), *J. Luminescenc* **2009**, *129*, 256-262.
- [3] **D. Ray**, E. S. S. Iyer, P. K. Bharadwaj, [Ag\(I\) induced emission with azines having donor-acceptor-donor chromophore](#), *Dalton Trans.* **2009**, 5683-5687.
- [2] **D. Ray**, P. K. Bharadwaj, [A Coumarin-Derived Fluorescence Probe Selective for Magnesium](#), *Inorg. Chem.* **2008**, *47*, 2252-2254. (citations, 232)
- [1] **D. Ray**, P. K. Bharadwaj, [Alteration in the Binding Property of a Laterally Non-symmetric Aza Cryptand Toward Cu\(II\), Ag\(I\) and Tl\(I\) Ions upon Derivatization with Methylnitrile Group](#), *Eur. J. Inorg. Chem.* **2006**, 1771-1776.

### **Patent (Independent Research)**

- [1] N. Acharya, **D. Ray**, [Purely Organic Thermo-phosphors](#), (patent application under preparation).

### **Invited Lectures**

### Independent Research

- [7] ACS Publications Forum: Expanding Frontiers in Chemical Science, November 1, 2018, Banaras Hindu University (BHU), Varanasi.
- [6] Challenges of Organic Dual-State Light Emitters: Novel Thermal Enhancement Mechanism and Data Security Protection, School of Physical Science, JNU, 12<sup>th</sup> September, 2018.
- [5] Organic white-light emitters from single phase, TIFR Mumbai, July, 21-23, 2017.
- [4] Modulation of Emission Signaling Pathway through Allosteric control, TIFR Mumbai, July, 19-21, 2017.
- [3] Fluorescence Spectroscopy and its Application, IIT Kanpur, November, 23-27, 2015.
- [2] A multistep switching cascade of hydrazone-based switches through coordination coupled proton relays, Kolkata University, April 7, 2014.
- [1] A multistep switching cascade of hydrazone-based switches through coordination coupled deprotonation induced proton relay, National Seminar on Crystallography 43A, March 28-30, 2014, Indian Institute of Science Education and Research (IISER) Mohali.

### Postdoctoral Research

- [2] Supramolecular Control of Photo Reaction in Solids. XXIII<sup>rd</sup> IUPAC International Symposium on Photochemistry, 11-16 July, 2010, Ferrara, Italy.
- [1] GDR “*Electronic Organic*” held in 23-24 November, 2010, Bordeaux 1, France.

### Graduate Research

- [1] Cation and Anion induced two-photon absorption in synthesized organic ligands, Chemfest-2007, Department of Chemistry, Indian Institute of Technology Kanpur, India, 2<sup>nd</sup> March, 2007.