

**Dr. Anup Ghosh**  
**DST INSPIRE FACULTY**  
**S N Bose National Centre for Basic Science**  
**Phone: +91-9064368183, +918967621477**  
**Email: [anup.ghosh@bose.res.in](mailto:anup.ghosh@bose.res.in), [anupg86@gmail.com](mailto:anupg86@gmail.com)**



## Academic Credentials

### *Research Experience:*

- DST INSPIRE FACULTY – S N Bose National Centre for Basic Science, **Kolkata**  
**1<sup>st</sup> January 2019- continuing.....**
- Postdoctoral Researcher with **Prof Lev Chuntonov**, **Department of Chemistry, Technion-Israel Institute of Technology, Israel**  
**2016 (May)-2018 (December)**
- Postdoctoral Researcher with **Prof. Jyotirmayee Dash**, **Department of Organic Chemistry, Indian Association for the Cultivation of Sciences (IACS), Kolkata, India.**  
**2015(August)-2016 (May)**

**PhD in Chemistry, (23/06/2015) Indian Institute of Science Education and Research Kolkata (IISER-Kolkata), West Bengal, India.**

**Thesis title:** Optical Spectroscopic investigation of nanoscopic environment in neat room temperature ionic liquids and in presence of dissolved solutes

**PhD supervisor:** **Dr. Prasun K. Mandal**, Department of Chemical Sciences. **IISER-Kolkata.**

**Master of Science (M.Sc., Chemistry, 2009)**, 1<sup>st</sup> Class, Department of Chemistry, **Vidyasagar University.**

**MS thesis:** Charge Transfer Complex of Nonionic Surfactant (Tween 80) with Iodine in Aqueous Medium.

**Instructor:** Prof. Sanat Saha, Department of Chemistry, Vidyasagar University.

**Bachelor of Science (B.Sc., Chemistry, 2007)**, 1<sup>st</sup> Class, Vidyasagar University.

**(10 + 2)<sup>th</sup> level, 2003**, Science, 1<sup>st</sup> class, West Bengal, India.

**10<sup>th</sup> level, 2001**, Science, humanities, and language group. 1<sup>st</sup> Class, West Bengal, India.

## Research Work:

### **Present Work:**

#### **2019 (January)- Continuing**

- Over the past few years, Functionalized nanomaterials play a key role in modern medicine being a contrast carrier for drug delivery to the target cells. We have discussed the surface assembled structure of tri-peptide glutathione (GSH) on silver (AgNP) and gold (AuNP) nanostructures for biomedical applications: surface chemistry, localized surface plasmon resonance (LSPR), and morphology. Presently we are working on surface structure analysis of synthetic peptides capped gold and silver nanoparticles for targeted drug delivery. We are using peptides only because of biocompatibility.
- Understanding the structural information of proteins, peptides, and nucleosides having hydrogen bond interaction with any drug or ligand molecules. Our work provides an insight into the vibrational coupling of carbonyl (amide I) and C=C transition of nucleobases. This work is the preliminary work of my future goal (structural dynamics of G quadruplex/DNA)
- **Future Work**  
Structural analysis of G quadruplex/DNA before and after drug binding by using mainly linear infrared (IR) and **nonlinear two-dimensional infrared (2D IR) spectroscopy**.

### **Postdoctoral Research:**

#### **2016 (May)- 2018 (December)**

- I was working on an infrared probe (mainly ester) dynamics in organic and aqueous solvent employing both linear IR and **nonlinear ultrafast multidimensional infrared (2D IR) spectroscopy**. Solvatochromism of local vibrational probes provides an opportunity to explore the structure, environment, and ultrafast dynamics in biomolecules; which allows one to elucidate details of complex biochemical processes. Carbonyl esters are informative probes that can be incorporated into biomolecules without significant perturbations to their structure and function. Calibration of the probe's response to local fields and solute-solvent interactions is typically done with small-molecule models, which serve as the basis for understanding the vibrational solvatochromism. We combined linear and third-order two-dimensional infrared

spectroscopy with chemometric analysis to quantify hydrogen-bonded conformations of ester in aqueous solutions.

- The conformation of small molecules, peptides, and proteins, self-assembled into structured monolayers on the surface of metal nanoparticles (NPs), can strongly affect their properties in chemical or nano-biomedical applications. Elucidating molecular conformations on the NP surface is highly challenging, and the microscopic details mostly remain elusive. We demonstrate an application of a full arsenal of tools of the powerful polarization-selective third-order **two-dimensional ultrafast infrared spectroscopy (2D IR)** to reveal the intermolecular ordered structure of  $\gamma$ -tripeptide glutathione on the surface of silver NPs in aqueous solution.

### **2015 (September) -2016 (May)**

- I was working on the chemical structure and origin of the fluorescence behavior of nucleotide-based Carbon Dots in Prof Dash's lab. We have described an intriguing property of nucleotides to form blue-emitting chiral carbon dots (G-dots) that exhibit excitation dependent down-conversion and up-conversion fluorescence signature and self-assemble to form fluorescent hydrogels.

### **Doctoral Research:**

#### **2010 (January)– 2015 (May)**

- Nanoscopic environment (heterogeneous/homogeneous) of dissolved solutes in neat **room temperature ionic liquids (RTILs)**.
- The role of alkyl chain length of the cation and the size of anion, on the size of the nano-aggregation of RTILs
- Diffusion of fluorescent dyes in RTILs
- Study of excited-state processes (energy transfer)

### **Techniques:**

I have expertise in handling sophisticated spectroscopic techniques, such as

- **Ultrafast multidimensional Infrared (2D IR) spectroscopy**
- FTIR spectrophotometer

- UV-Vis spectrophotometers
- Steady-state and Time-resolved fluorescence spectroscopy
- Time correlated single photon counting (TCSPC)
- Förster Resonance Energy Transfer (FRET)
- NMR, Raman, ESI-MS, MALDI TOF, DLS. TEM, DSC. AFM, PXRD, CD, XPS

**Theoretical methods:** Gaussian 03 program (DFT), MD simulation, Docking, MATLAB

### Conference Presentations:

#### **Talks:**

- 1st Inter IISER MEET. 2012. Indian Institute of Science Education and Research Kolkata (IISER Kolkata) Kolkata, India.

#### **Posters:**

- \*10th CRSI National Conference in Chemistry-Kolkata Chapter, Department of Chemistry, IISER-K, 2012
- 15th CRSI National Conference in Chemistry in the Department of Chemistry, Faculty of Science, Banaras Hindu University, Varanasi, 2013.
- Light in Chemistry, Materials & biology (LCMB 2014), Department of Chemistry, IIT-Kharagpur.
- An International Symposium on Advances in Spectroscopy and Ultrafast Dynamics (ASUD-2014). Department of Physical Chemistry, IACS.
- Asian Academic Seminar 2015. Department of Chemistry Sciences, IISER Kolkata.
- ICONSAT-Kolkata chapter, 2020, S N Bose National Centre for Basic Science-Kolkata

#### **Award and Scholarship:**

- [National Eligibility Test \(NET\)](#), December 2009.
- Qualified in [Graduate Aptitude Test in Engineering](#), February 2010.
- Junior Research Fellowship (July 2010- June 2012)- CSIR-UGC NET
- Senior Research Fellowship (July, 2013-May 2015) -CSIR-UGC NET
- Inspire Faculty Fellowship

**Project: Ultrafast 2D-IR spectroscopy on the structural dynamics of DNA/G Quadruplex [DST Inspire Faculty Project]**

## Experience in Review-Journal: ACS journals

### Publications

- 1) **Ghosh, A.**; Chatterjee, T.; Mandal, P. K. On the heterogeneity of fluorescence lifetime of room temperature ionic liquids: onset of a journey for exploring red-emitting dyes. **Chem. Commun.** 2012, 48, 6250-6252.
- 2) Chatterjee, T.; Roy, D.; Das, A.; **Ghosh, A.**; Mandal, P. K. Chemical tweaking of a non-fluorescent GFP chromophore to a highly fluorescent coumarinic fluorophore: application towards photo-uncaging and stem cell imaging. **RSC Advances** 2013, 3, 24021-24024.
- 3) **Ghosh, A.**; Chatterjee, T.; Roy, D.; Das, A.; Mandal, P. K. On the Nanoscopic Environment a Neutral Fluorophore Experiences in Room Temperature Ionic Liquids. **J. Phys. Chem. C** 2014, 118, 5051–5057.
- 4) Roy, S. R.; Nijamudheen, A.; Pariyar, A.; **Ghosh, A.**; Vardhanapu, P.; Mandal, P. K.; Datta, A.; Mandal S. K. Phenalenyl in a Different Role: Catalytic Activation through the Nonbonding Molecular Orbital. **ACS catalysis.** 2014, 4, 4307–4319.
- 5) **Ghosh, A.**; De, C. K.; Chatterjee, T.; Roy, D.; Das, A.; Routh, T.; Mandal, P. K. What type of nanoscopic environment does a cationic fluorophore experience in room temperature ionic liquids? **Phys. Chem. Chem. Phys.** 2015, 17, 16587-16593.
- 6) **Ghosh, A.**; Parasar, B.; Bhattacharyya, T.; Dash, J. Chiral carbon dots derived from guanosine 5'-monophosphate form supramolecular hydrogels. **Chem. Commun.** 2016, 52, 11159-11162.
- 7) **Ghosh, A.**; Cohn, B.; Prasad, A. K.; Chuntunov, L. Quantifying conformations of ester vibrational probes with hydrogen-bond-induced Fermi resonances. **J. Chem. Phys.** 2018, 149, 184501-184512.
- 8) **Ghosh, A.**; Prasad, A. K.; Chuntunov, L. Two-Dimensional Infrared Spectroscopy Reveals Molecular Self-Assembly on the Surface of Silver Nanoparticles. **J. Phys. Chem. Lett.** 2019, 10 (10), 2481–2486.

### Corresponding author\_S N Bose National center for Basic Science

- 9) **Ghosh, A.** Vibrational Coupling on Stepwise Hydrogen Bond Formation of Amide I. **J. Phys. Chem. B** 2019, 123,7771-7776. (**Single Author**)
- 10) Chakrabarty, S.; Maity, S.; Darshana, Y.; **Ghosh, A.** Surface Directed Disparity in Self Assembled Structures of Small Peptide -L-Glutathione on Gold and Silver Nanoparticles. **Langmuir** 2020, 36, 11255–11261.

### Submitted

11. **Ghosh, A.**; Perturbation of Fermi Resonance on Hydrogen-Bonded >C=O IR Absorption of Small Ester. (**Under revision in Chemical Physics**)

### To be Submit

12. Deshmukh, S.; Chakrabarty, S.; Bagchi, S.; **Ghosh, A.** On- Off Infrared Absorption of S=O Vibrational Probe of Dimethyl Sulfoxide. (**manuscript under preparation**)
13. Chakrabarty, S.; **Ghosh, A.** Incoherent Symmetric and Asymmetric Vibrational Coupling on Hydrogen Bond Formation of Amide I and Esters. (**manuscript under preparation**)

## **Referees:**

1	Prof. Prasun k. Mandal	DCS, IISER Kolkata	<a href="mailto:prasunchem@iiserkol.ac.in">prasunchem@iiserkol.ac.in</a> , <a href="mailto:prasunchem@gmail.com">prasunchem@gmail.com</a>	+91-9874306747
2	Prof. Jyotirmayee Dash	Organic Chemistry, IACS, Kolkata	<a href="mailto:ocjd@iacs.res.in">ocjd@iacs.res.in</a> , <a href="mailto:dasj06@gmail.com">dasj06@gmail.com</a>	+91-9635350592
3	Dr Sayan Bagchi	Physical Chemistry, NCL Pune	<a href="mailto:s.bagchi@ncl.res.in">s.bagchi@ncl.res.in</a> , <a href="mailto:bsayan@gmail.com">bsayan@gmail.com</a>	+91-8308845503
4	Prof. Lev Chuntanov	Schulich Faculty of Chem. Technion- Israel.	<a href="mailto:chunt@tx.technion.ac.il">chunt@tx.technion.ac.il</a>	
5	Prof. Swadhin Mandal	DCS, IISER Kolkata	<a href="mailto:swadhin.mandal@iiserkol.ac.in">swadhin.mandal@iiserkol.ac.in</a>	+91-9903676563
6	Prof Priyadarshi De	DCS, IISER Kolkata	<a href="mailto:P_de@iiserkol.ac.in">P_de@iiserkol.ac.in</a>	+ 91-9674-629-345

## **Personal Details**

***Permanent Address:*** Anup Ghosh, S/O: Satyakinkar Ghosh, Village: Brajanathpur, PO: Dhadika, Dist.: Paschim Medinipur, Pin: 721127, West Bengal, India

