

Rajib Pramanik

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BSc: Chemistry, 2002, University of Burdwan

MSc: Physical Chemistry, 2004, University of Burdwan

PhD, Indian Institute of Technology Kharagpur, India

Dissertation: *Dynamics of Solvent and Rotational Relaxation in Ionic Liquids Containing Mixed Solvent and Microheterogeneous Systems*"

Advisors: Prof. Nilmoni Sarkar, Department of Chemistry, Physical Chemistry.

Research experience:

October, 2018-December, 2019, Post-Doctoral Research Associate, Italian Institute of Technology, Genova, Italy

PI: Francesco De Angelis, Nano-Plasmonics

- Designing and development of devices for solid-state nanopores chips to access the single nanopore by inverted microscopy objective. The nanopore are fabricated in SiNx substrate with pore diameter 100-200 nm. Substrate are coated with gold to generate plasmon enhancement at the surface. Generate potential difference across the membrane to transport charge molecules through the nanopore. Integrate this device into inverted microscope setup for single-molecule detection. Studying single molecules/DNA translocation and functionalization of nanopore controlling translocation capture rate and speed through nanopores. Eventually, these devices will be used to access the plasma membrane of live cells for sensor, transfection (electroporation) and vesicle mediated drug transportation.
- Development and alignment fluorescence spectroscopy (including FCS) and microscopy for DNA/charge molecule translocation measurement in plasmonic solid-state nanopores. Data acquisition of single-molecule fluorescence signal using LabVIEW (NI data card).

October, 2015-September 2017, Post-Doctoral Research Associate, Upstate Medical University, Syracuse, New York

PI: Peter D Calvert, Ophthalmology Department

- Study structural and dynamic properties of transmembrane proteins in live rod photoreceptor cells to understand the protein-protein (rhodopsin G-Protein interaction), protein-membrane interaction (using myristoyl substituted eGFP), and transport behavior in live photoreceptor cells to understand the signal transducing pathway. Cell culture and transfection of eGFP protein in IMCD3 and rod photoreceptor cell using chemical reagent methods.
- Development of multi-photon optical microscopy for lifetime and anisotropy imaging. Data Analysis of fluorescence lifetime imaging (FLIM), fluorescence anisotropy imaging microscopy (FAIM) in Live Rod photoreceptor cell. Fit intensity profile in single-pixel with model function and extract information regarding homo-fret and rotation coefficient of protein. Studied homo-fret by developing time-resolved fluorescence anisotropy.

May 2013-September 2015, Post-Doctoral Research Associate, Los Alamos National Laboratory, Los Alamos, New Mexico.

PI: Stephen K Doorn, Center for Integrated Nanotechnologies.

- Encapsulated and dispersion single-wall carbon nanotube using surfactant and polymer for fluorescence imaging. Separation of single-wall carbon nanotube-based on their size using various salt and external stimuli to change the surfactant, polymer aggregation at nanotube surface. Preparation of silica gel to immobilize the carbon nanotube at the glass surface. Use wide field microscopy and confocal microscopy to image single nanotube for surface structure measurement.

- Convolution, deconvolution of CNT PL image with point spread function (PSF) of microscopy and investigates intensity profile along the nanotube axis. Developed Python-based programming for carbon nanotube surface fluorescence emission fitted with model function to measure the exciton diffusion. Construction of spectroscopy imaging and analysis individual pixels by developing python programming codes.

- Structural and dynamics investigation structure of surfactant and block copolymer at the surface of single-wall carbon nanotubes (SWCNTs) using single-molecule spectroscopy.

August, 2011-May, 2013, Post-Doctoral Research Associate, Kansas State University, Manhattan, KS

PI: Prof. Daniel A Higgins, Department of Chemistry.

- Preparation of cylindrical micelle, hexagonal phase micelle. Preparation silica gel to make a stable and rigid structure. Spin coated surfactant sol in coverslips to design locally align 1D mesopores. Fabrication of microfluidic devices and flow cylindrical micelle to align them and make 1D nanoporous materials structure.

- Single-molecule level mass transport in 1D soft materials using wide-field fluorescence microscopy (TIRF). Single-particle localization to accurate measurement the center position and linked between the frames to generate trajectories in 2D space. Measured translation diffusion using mean-square-displacement (MSD) as a function of the time lag.

- Development of polarization-resolved single-molecule fluorescence imaging microscopy to study the rotational diffusion behavior of molecules in confine mesoporous nanochannels. Model development and measured intensity of molecule in two polarized channels simultaneously. Studied the orientational diffusion of molecule and wobbling angle to explore the single molecule level interaction with the pore interface.

PhD: Indian Institute of Technology Kharagpur, India January 2007- July 2011.

Advisors: Prof. Nilmoni Sarkar, Department of Chemistry.

- Synthesis of various colloidal materials like micelle, reverse micelle, microemulsion, lipids bilayers, niosome. Characterized them by using various technologies such as conductivity measurement, dynamic light scattering, UV and fluorescence spectroscopy. Construct phase diagram to separate different shapes of structure. Control the nanomaterial fusion, size and shape using various polymer. Studied dynamic properties water and polar solvent at surface, interface of the colloidal nanomaterials materials.

- Studied photophysical properties of dye molecules and solvation dynamics in nano-confined environment and interface of the structure. Studied solvation dynamics and rotational relaxation, electron transfer, fluorescence resonance energy transfer, proton transfer, using steady-state and time-resolved fluorescence spectroscopy to study molecular level interaction at surface and interface.

- Applied fluorescence spectroscopy to measure lifetime and anisotropy of dye molecule in organized media with pico-second time resolution.

Sample Preparation:

Synthesis of the micelle, reverse micelle, microemulsion, niosome, liposome, vesicle. Preparation of cylindrical micelle, hexagonal phase micelle. Preparation silica gel to make stable and rigid structure. Fabrication of microfluidic devices and flow cylindrical micelle to align them and make 1D materials structure. Dispersion of single-wall carbon nanotube using surfactant and polymer for fluorescence imaging. Separation of single-wall carbon nanotube-based on their size. Preparation of silica gel to immobilize the carbon nanotube. Design Nanopore devices for single-molecule spectroscopy applications.

Optical skills:

Wide-Field Fluorescence Microscopy, Confocal Laser Scanning Microscopy, Two-Photon Fluorescence Lifetime Imaging Microscopy (2P-FLIM), Time-Resolved Fluorescence Anisotropy Imaging Microscopy (FAIM), Single-Molecule Fluorescence Spectrometers, Time-Correlated Single Photon Counting (TCSPC), Piezoelectric Stage.

Computation Programming Skill:

Python, LabVIEW, Matlab (Data Acquisition and Data Analysis). Algorithm development for image construction, construction of spectra from single pixels of the image, fitting data with model function, point spread function analysis. Algorithm development for fluorescence signal acquisition from single-photon counting detector.

References:

1. Professor Nilmoni Sarkar

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Indian Institute of Technology

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2. Professor Daniel A Higgins

Department of Chemistry

Kansas State University

Manhattan KS

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3. Dr. Stephen K Doorn

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Selective Publications

14. Photoluminescence Imaging of Polyfluorene Surface Structures on Semiconducting Carbon Nanotubes: Implications for Thin Film Exciton Transport.

Nicolai F. Hartmann, **Rajib Pramanik**, Anne-Marie Dowgiallo, Rachele Ihly, Jeffery L. Blackburn, and Stephen K. Doorn. *ACS Nano*, 10 (2016) 11449.

13. Molecular Length Dependence of Single Molecule Wobbling within Surfactant- and Solvent-Filled Silica Mesopores.

Rajib Pramanik, Takashi Ito, and Daniel A. Higgins. *J. Phys. Chem. C* 117(2013) 15438.

12. Single Molecule Wobbling in Cylindrical Mesopores.

Rajib Pramanik, Takashi Ito, and Daniel A. Higgins. *J. Phys. Chem. C* 117 (2013) 3668.

11. To Probe the Interaction of Methanol and Acetonitrile with the Ionic Liquid *N, N, N*-Trimethyl-*N*-propyl Ammonium Bis(trifluoromethanesulfonyl) Imide at Different Temperatures by Solvation Dynamics Study.

Rajib Pramanik, Vishal GovindRao, SouraviSarkar, ChiranjibGhatak, PalashSetua, and NilmoniSarkar. *J. Phys. Chem. B* 113 (2009) 8626.

10. Effect of polymer, poly(ethylene glycol)(PEG-400), on solvent and rotational relaxation of coumarin-480 in an ionic liquid containing microemulsions.

Rajib Pramanik, SouraviSarkar, ChiranjibGhatak, PalashSetua and NilmoniSarkar. *Phys. Chem. Chem. Phys.* 12 (2010) 3878.

9. Microemulsions with Surfactant TX100, Cyclohexane, and an Ionic Liquid Investigated by Conductance, DLS, FTIR Measurements, and Study of Solvent and Rotational Relaxation within this Microemulsion.

Rajib Pramanik, SouraviSarkar, ChiranjibGhatak, Vishal GovindRao, PalashSetua, and NilmoniSarkar. *J. Phys. Chem. B* 114 (2010) 7579.

8. Ionic Liquid Containing Microemulsions: Probe by Conductance, Dynamic Light Scattering, Diffusion-Ordered Spectroscopy NMR Measurements, and Study of Solvent Relaxation Dynamics.
Rajib Pramanik, SouraviSarkar, ChiranjibGhatak, Vishal GovindRao, NilmoniSarkar. **J. Phys. Chem. B** 115 (2011) 2322.
7. Effect of Ionic Liquid in TX100 Aqueous Micelle: Solvent and Rotational Relaxation Study.
Rajib Pramanik, SouraviSarkar, ChiranjibGhatak, Vishal GovindRao, NilmoniSarkar. **J. Phys. Chem. B** 115 (2011) 6957.
6. Room Temperature Ionic Liquids in Confined Media: A Temperature Dependence Solvation Dynamics Study in [bmim][BF₄]/BHDC/Benzene Reverse Micelle.
Rajib Pramanik, ChiranjibGhatak, Vishal GovindRao, SouraviSarkar, NilmoniSarkar. **J.Phys.Chem.B**115(2011) 5971.
5. Probing the Interaction of 1-Ethyl-3-methylimidazolium Ethyl Sulfate ([Emim][EtSO₄]) with Alcohols and Water by Solvent and Rotational Relaxation.
SouraviSarkar, **Rajib Pramanik**, ChiranjibGhatak, PalashSetua, NilmoniSarkar. **J. Phys.Chem. B** 114 (2010) 2779.
4. Solvent and rotational relaxation of Coumarin-153 in a micellar solution of a room temperature ionic liquid, 1-butyl-3-methylimidazolium octyl sulfate, in ethylammonium nitrate.
Vishal GovindRao, ChiranjibGhatak, **Rajib Pramanik**, SouraviSarkar, NilmoniSarkar. **Chem.Phys.Lett.** 499 (2010) 89.
3. Synthesis of Silver Nanoparticle Inside the Nonaqueous Ethylene Glycol Reverse Micelle: the Effect of the Nanoparticle on the Reverse Micellar Aggregates through Solvation Dynamics and Rotational Relaxation Measurements.
PalashSetua, **Rajib Pramanik**, SouraviSarkar, ChiranjibGhatak, S. K. Das, NilmoniSarkar. **J. Phys. Chem. B** 114 (2010) 7557.
2. Direct Observation of Solvation Dynamics in an Aqueous Reverse Micellar System Containing Silver Nanoparticles in the Reverse Micellar Core.
PalashSetua, **Rajib Pramanik**, SouraviSarkar, Debabrata Seth, NilmoniSarkar. **J. Phys. Chem. B** 113 (2009) 5677.
1. Photoinduced electron transfer (PET) from N,N-dimethylaniline to 7-amino Coumarin dyes in a room temperature ionic liquid (RTIL): Slowing down of electron transfer rate compared to conventional solvent.
SouraviSarkar, **Rajib Pramanik**, Debabrata Seth, PalashSetua, NilmoniSarkar. **Chem. Phys. Lett.** 477 (2009) 102.