Brief Biography of Professor Biman Bagchi

Biman Bagchi (born 1954) is an Indian theoretical chemist and an Amrut Mody Professor at the Solid State and Structural Chemistry Unit of the Indian Institute of Science. He is known for his studies on statistical mechanics; particularly in the study of phase transition and nucleation, solvation dynamics, mode-coupling theory of electrolyte transport, dynamics of biological macromolecules (proteins, DNA etc.), protein folding, enzyme kinetics, supercooled liquids and protein hydration layer. He is a recipient of the Bhatnagar award, an elected fellow of all the Indian Science Academies, and Fellow of The World Academy of Sciences (TWAS).

Besides nearly 450 published scientific articles, Prof. Bagchi has authored two books, *Molecular Relaxation in Liquids* and, *Water in Biological and Chemical Processes: From Structure and Dynamics to Function*. He coined the term Biological Water. American Chemical Society has recognized his outstanding contribution to Theoretical Chemistry by publishing a special issue of Journal of Physical Chemistry in 2015.

Professor Biman Bagchi is also an Honorary Professor of S. N. Bose National Centre for Basic Sciences.

CENTRE FOR S. N. BOSE NATIONAL BASIC SCIENCES 1986
1894-1974
विज्ञानेन परिपश्यन्ति धीराः

BOSE 125 Celebrating 125th Birth Anniversary

BOSE-125 Distinguished Lecture

on

SEVENTEENTH JULY
2018

सत्येन्द्र नाथ बसु की 125 वीं जयंती

1894 - 2018

125th Birth Anniversary of Satyendra Nath Bose

सत्येन्द्र नाथ बसु राष्ट्रीय मौलिक विज्ञान केन्द्र

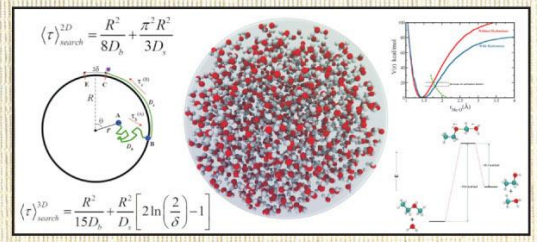
Satyendra Nath Bose National Centre for Basic Sciences

Dynamics within Small Droplets: Dynamics of Water in Nano Spherical Confinement

Biman Bagchi

ABSTRACT

Small droplets exhibit an amazing array of properties distinct from bulk that are yet to be understood. Several chemical reactions that do not seem to occur at in the bulk water are found to proceed with a measurable rate when water and the reactants are confined inside small sized droplets of sizes ranging from nano to micrometers. In some special cases reactions (such as hydrolysis of ethers, phosphorylation of sugars etc.) exhibit vastly different mechanisms, energetics and accelerated kinetics in droplet medium from that in the bulk. These reactions can be studied experimentally in recent times because of the advents in mass spectrometry fused with electrospray techniques. We analyze the origin of such differences and point out the need for different thermodynamic description of small sized systems.[1] We develop, for the first time, a theoretical treatment to unveil the unusual properties observed in droplets. The theory consists of several parts, starting from quantum chemical calculations to a stochastic theory of chemical dynamics in droplets that gives the mean first passage time (in this case, mean reaction time).[2,3] Additionally, the scenario changes in the presence of surface ions. Our theory can successfully explain the rate enhancement. Subsequently, we study the dielectric properties of the aqueous droplets. We find that the static dielectric constant shows a marked reduction even for a droplet of size 2 nm. Polarization relaxation and dielectric dispersion display markedly different relaxation behaviour. Dipolar solvation dynamics also undergo significant change from bulk behaviour. Importantly, the dynamics of water molecules inside the droplet varies with varying types of wall materials that enclose the droplet.[4] This might allow us to tune the properties of a liquid by changing the enclosing surface which is of immense importance in physical sciences and biology.



References:

1. **Hill, Terrell L. Thermodynamics of small systems. Courier Corporation, 1994.**
2. **Bagchi, B. Molecular Relaxation in Liquids, Oxford University Press, NY, 2012**
3. **Mondal, S., Acharya, S., Biswas, R., Bagchi, B. And Zare, R. N. J. Chem. Phys. 148 (24), 2018 .**
4. **Mondal, S., Acharya, S. and Bagchi, B. (Manuscript under preparation)**

CENTRE FOR BASIC SCIENCES 1986 — S. N. BOSE NATIONAL 1894-1974 — विज्ञानेन परिवर्त्यन्ति धीराः

S. N. BOSE NATIONAL CENTRE FOR BASIC SCIENCES

KOLKATA

Director

and

Staff and students of S. N. Bose National Centre for Basic Sciences request the pleasure of your company at the

BOSE-125 Distinguished Lecture

by

Prof. Biman Bagchi

IISc., Bangalore

on

Tuesday, 17th July, at 4:00 pm

to celebrate

125th Birth Anniversary of Professor Satyendra Nath Bose

Prof. Samit Kumar Ray
Director

Venue :
Silver Jubilee Hall
S. N. Bose National Centre for Basic Sciences
Block JD , Sector-III, Salt Lake City,
Kolkata - 700 106, India
Phone: +91-33-2335 1313/0312/3057/3061/5705/6/7/8
Web: www.bose.res.in