



भौतिक अनुसंधान प्रयोगशाला, अहमदाबाद

Physical Research Laboratory, Ahmedabad

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**PRL Ka Amrut Vyakhyaan-03**

**on**

**Wednesday, 18 August 2021 @**

**16:00 hrs. IST**



**“CONFINED WATER:  
MANY SURPRISES”**

**Prof. Prabal K Maiti**

Chair, Department of Physics,  
Indian Institute of Science, Bangalore



<https://youtu.be/2KjsbLXwSVM>

## **PRL ka Amrut Vyakhyaan-03**

**Title: “CONFINED WATER: MANY SURPRISES”**

**Speaker: Prof. Prabal K Maiti**

**Chair, Department of Physics, Indian Institute of Science, Bangalore**

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### **Abstract**

Water enters the hydrophobic cavity of narrow CNTs despite enthalpy penalty due to loss of hydrogen bonds and forms ‘solid-like’ ordering at room temperature. We give the thermodynamics of water entry inside hydrophobic nanotube by calculating the free energy of water. We also show that the water molecules inside the CNT cavity get aligned by flow to have a net dipole moment along the flow direction. With increasing flow velocity, the net dipole moment first increases and eventually saturates to a constant value. This behavior is similar to the Langevin theory of paraelectric with the flow velocity acting as an effective aligning field. This observation provides a way to control the dipolar alignment of water molecules inside nanochannels with possible applications in nano-electrical devices. If time permits, we will discuss two other interesting problems in confined water namely: (i) the mechanism of water permeation in helium impermeable grapheme oxide (GO) membrane based on potential of mean force (PMF) calculation and (ii) proton kinetic energy anomalies in the confined water and compare our calculated mean proton kinetic energy to those obtained by deep inelastic neutron scattering (DINS) experiments.

### **The Speaker**

Prof Prabal Maiti, is currently the Chair – Department of Physics and the Center for Cryogenic Technology, Indian Institute of Science, Bangalore. He is currently the Associate Editor for the Physical Chemistry Chemical Physics journal of the Royal Society of Chemistry. He is a Fellow of the Royal Society of Chemistry (2021) and also Fellow of the Indian Academy of Science (2018). He has authored nearly 175 journal publications and 4 book chapters. He is recipient of the CRAY Dr A P J Abdul Kalam HPC Award (2020), DAE-SRC Outstanding Investigator (2012-2017), Microsoft Research (MSR) India Outstanding Young Faculty Award (2009, 2010), Fulbright-Nehru Senior Research Fellowship (2012) and an Alexander Von Humboldt Fellowship (1998-1999). The broad areas of his current research interest include; Charge transport in molecular systems, Computational biophysics, Fluids and polymers under confinement, Activity induced phase separation and Nucleic acid nanotechnology.

## About PRL

The Physical Research Laboratory (PRL), known as the “cradle of space science” in India, is



one of the premier research institutes founded in 1947 by Prof. Vikram Sarabhai, a renowned Cosmic Ray Scientist, a great visionary and institution builder. PRL played a seminal role in producing a highly motivated cadre of space scientists and the technologists of highest international repute. The first scientific rocket launched from Thumba on 21st November-1963 and many other rockets launched thereafter contained payloads developed at PRL. Dr. Sarabhai initiated many of these scientific and technical activities at PRL which eventually led to the formation of the Indian Space Research Organization (ISRO). Therefore, PRL is known as the “cradle of space science” in India. Further, the research in the

area of Plasma Physics expanded to the formation of the Institute of Plasma Research (IPR).

As an institution PRL is unique in that it conducts fundamental research in a wide range of research areas from the Earth to the cosmos, and comprising Astronomy and Astrophysics; Solar Physics; Space and Atmospheric Sciences; Theoretical Physics; Geosciences; Atomic, Molecular and Optical Physics, Astrochemistry; and Planetary Sciences and Space Exploration. PRL is one of the rare research institutes of international repute wherein research in such diverse fields of sciences is carried out using several state-of-the-art experimental facilities that exist under one umbrella.

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