



# Institute Colloquium

S. N. Bose National Centre for Basic Sciences  
(An Autonomous Research Institute established  
under DST, GOI)



21<sup>st</sup> July, 2025



3.00 PM



Silver Jubilee Hall



YouTube Link



Webinar Link

## Title: Crossing Barriers: Stochastic Dynamics of Polymer Translocation

**Abstract:** Polymer translocation through narrow pores is a fundamental process with broad relevance, ranging from biological phenomena such as DNA transport through nuclear pores to the development of nanopore-based sequencing technologies. In this work, we investigate the stochastic dynamics of polymer translocation using a combination of exact enumeration techniques and coarse-grained molecular dynamics simulations. The exact enumeration provides detailed insights into the entropic landscape and partition functions associated with different translocation states, while the simulation results capture the dynamic aspects of driven and unbiased translocation. We analyze translocation time distributions, and the influence of parameters such as polymer length, driving force, and pore-polymer interaction. Our results reveal distinct dynamical regimes and highlight the critical role of fluctuations and configurational entropy in governing the translocation process. These findings contribute to a deeper theoretical understanding and provide a framework for interpreting and guiding experimental studies in both synthetic and biological contexts.

**Speaker:** Prof Sanjay Kumar

Director & Senior Professor, Institute of Science, Banaras Hindu University

### Short Biography of the Speaker:

Prof. Sanjay Kumar has been appointed as the Director - Institute of Science, BHU in 2024. Prior to this promotion, Prof Kumar was associated with the University as the Head of the Department of Physics as well as the Coordinator of IOE - BHU. He obtained his Ph.D. (Physics) from IIT, BHU in 2002.

His research interests are in the areas of Theoretical Physics, Biological Physics, Statistical Physics, Condensed Matter

He is the recipient of Indian National Science Academy Medal for Young Scientists (1996), Boy Scout Fellow of Department of Science and Technology (1998) and Simons Associates of ICTP, Italy (2015). In 2016, he was elected as a Fellow of the Indian Academy of Sciences, Bengaluru and has been elected as a Fellow of the Indian National Science Academy, New Delhi 2025.

