



Institute Colloquium



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



30 September 2022



12.00 Noon
at FERMION, SNBNCBS



Webinar Link

YouTube YouTube Link

Title:

Complexity and entropy crisis in the amorphous glassy state

Abstract:

The relaxation behaviour of supercooled liquids approaching amorphous solid-like states differs over different temperature ranges. It has been modelled using microscopic descriptions based on the statistical mechanics of many particle systems. After a broad review of the basic models, we will discuss extending the usual thermodynamic approach. In the latter, the metastable supercooled liquid is studied in terms of the free energy landscape (FEL) for a suitable free energy functional $F[\psi]$. The field $\psi(x)$ models a continuum field theoretic description of the many-particle system. In the deeply supercooled state, distinct basins form in the FEL, corresponding to different local minima of the free energy. Well below the freezing point, the FEL breaks up into an exponentially large number of basins with local minima. The metastable liquid close to vitrification is caught in one of these many possible basins. This transformation of the FEL for the supercooled liquid has been termed a spontaneous breakdown of ergodicity. In the case of structural glasses, this fragmentation of the FEL occurs without the presence of any quenched disorder. Calculating the corresponding partition function is facilitated using a composite system of m identical Replicas of the original system. We will describe these models of supercooled liquid with the role of multi-particle correlations taken into account. We will discuss a calculation of the so-called Complexity or the configurational entropy of the supercooled liquid using this description in terms of the continuum or coarse-grained field theoretic models.

Speaker:

Shankar Prasad Das

Professor, School of Physical Sciences, Jawaharlal Nehru University, New Delhi

Short biography of the Speaker

Prof. Shankar P. Das is a renowned theoretical physicist, a professor at the Jawaharlal Nehru University, New Delhi, and has been working in the broad area of statistical and condensed-matter physics. He has primarily focussed on addressing the problems of characterizing time-dependent properties of many-particle systems, in as well as out of equilibrium, particularly physics of liquids and glasses.

He was associated with the Bhabha Atomic Research Centre, Bombay, India, (1991-1992) and the S. N. Bose National Center for Basic Sciences, Calcutta (1992-1993) as a visiting scientist. He did his post-doctoral research at the University of Florida, Gainesville, the USA and at the Institute for Theoretical Physics, Utrecht, the Netherlands.

He is a Fellow of the National Science Academy of India (NASI), Allahabad (2018), the Indian National Science Academy (INSA), New Delhi (2016), the Indian Academy of Sciences (IAS), Bangalore (2004) and also a recipient of the J. C. Bose National Fellowship, DST, India (2017)

