S N BOSE NATIONAL CENTRE
FOR BASIC SCIENCES
Block JD, Sector III, Salt Lake, Kolkata 700 106

DEPARTMENTAL SEMINAR

Chemical and Biological Sciences

04th June 2026 **12.00 Noon** **FERMION**

SPEAKER

Dr. Dwaipayan Chakrabarti, Associate Professor, School of Chemistry, University of Birmingham

Short bio : **Dr. Dwaipayan Chakrabarti obtained a PhD from the Indian Institute of Science, Bangalore in 2006 in Theoretical and Computational Chemistry. A Marie Curie Incoming International Fellowship (2006-08) brought him to the University of Cambridge, where he subsequently held an Ernest Oppenheimer Early Career Research Fellowship (2008-11). He also held a Research Fellowship (2009-11) at Clare Hall, a graduate college in Cambridge, where he is now a Life Member. Following a brief stint in the Indian Institute of Technology (IIT) in Delhi as an Assistant Professor (2011-12), where he also held a Ramanujan Fellowship, he returned to Cambridge. He was initially appointed to a Birmingham Fellowship (2013-18) at the University of Birmingham, where he has most recently held a Royal Society Short Industry Fellowship (2021-22) in partnership with IBM. He is currently serving as secretary of the Colloids and Interface Science Group of the Royal Society of Chemistry and on the Steering Committee of the British Liquid Crystal Society.**

TITLE OF THE TALK

Programming Colloidal Self-Assembly for Open Crystals and Empty Liquids

ABSTRACT

Colloidal open crystals — sparsely populated periodic structures, comprising low-coordinated colloidal particles — are attractive targets for self-assembly because of their variety of applications, for example, as photonic materials, phononic and mechanical metamaterials, as well as porous media [1-4]. Colloidal particles in their primitive form offer short-range isotropic interactions and thus tend to form close-packed crystals. Despite remarkable advances over the last two decades in the synthesis of colloidal particles, endowed with anisotropic and/or specific interactions [5-7], programming self-assembly of colloidal particles into open crystals has proved elusive. In this presentation, I will first discuss a series of computational studies that establish facile bottom-up routes for rationally designed patchy particles to self-assemble into a variety of colloidal open crystals, especially those much sought after as photonic crystals [8-12]. The strategies include encoding hierarchical self-assembly pathways and ring size selection, in close connection with advances in colloid synthesis. I will also discuss how hierarchical self-assembly of designer patchy particles can instead be exploited to develop a colloidal model of water – a classic example of an empty liquid [13]. I will demonstrate how this colloidal model unravels a novel topological distinction between the two liquids of different densities involved in the liquid-liquid phase transition (LLPT) [13] – originally hypothesised in connection with the host of anomalous thermodynamic properties in water [14]. Finally, I will illustrate how entanglement can emerge as a general mechanism for densification by uncovering a hierarchy of topological transitions in a network liquid that densifies via two successive LLPTs [15].

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