



**S N BOSE NATIONAL CENTRE
FOR BASIC SCIENCES**

Block JD, Sector III, Salt Lake, Kolkata 700 106

DEPARTMENTAL SEMINAR

Physics of Complex Systems

22nd December, 2022

3.00 PM

ONLINE / FERMION

SPEAKER

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TITLE OF THE TALK

Phase separation of colloidal particles in active suspensions of bacteria

ABSTRACT

Tiny colloidal particles dispersed in liquids show constant jiggling motion as they collide with the solvent molecules. This Brownian motion has fascinated our imagination for over a century. Due to thermal fluctuations and interactions, ensembles of colloids self-assemble to form a variety of phases depending on their shapes and interactions. The underlying physics is governed by the principles of equilibrium statistical mechanics. In contrast, the phase behavior of colloidal particles in nonequilibrium systems has received little attention. Active matter systems represent a large class of nonequilibrium systems that are comprised of self-propelled units, such as bacteria, animals, birds, molecular motors, synthetic colloids, and others, which consume energy and perform directed motion. They display many interesting phenomena, such as flocking, motility-induced phase separation, active turbulence, and superfluidity, that are absent in equilibrium systems. Therefore, active matter systems offer novel approaches to self-assembly in systems far from equilibrium.

In this talk, I will present a combined experimental and numerical investigation of passive colloids dispersed in active suspensions of bacteria. Our study reveals dynamic clustering of colloids in active media due to an interplay of activity and effective attractive interaction between the colloids. The strength of this interaction is set by the size-ratio of colloidal particles to the bacteria. As the relative size of the colloids increases, the effective interaction becomes stronger. So, the average size of the clusters grows as the size-ratio increases, ultimately leading to macroscopic phase separation of colloidal particles when the interactions are sufficiently strong.

HOST FACULTY

**Prof. Jaydeb Chakrabarti, Senior Professor
DEPT. OF PHYSICS OF COMPLEX SYSTEMS**
