PHYSICS BEHIND BIOLOGY: INTERNATIONAL COLLOQUIUM

St. Xavier's College (Autonomous), Kolkata

POSTGRADUATE AND RESEARCH DEPARTMENT OF PHYSICS

PHYSICS BEHIND BIOLOGY: INTERNATIONAL COLLOQUIUM

UNDER THE GUIDANCE OF:

REV. DR. DOMINIC SAVIO, SJ
PRINCIPAL
ST. XAVIER'S COLLEGE (AUTONOMOUS), KOLKATA

TITLE: THE PHYSICS BEHIND LIFE: EXPLORING NATURE'S SECRETS THROUGH PHYSICAL PRINCIPLES

Speaker:
Dr. Kausik S Das

Director, SANS Center for Student Excellence,
University of Maryland Eastern Shore

TITLE: CLUSTER FORMATION, ORDER, AND AGGREGATION IN ACTIVE MATTER: DIFFERENT CLASSES OF ACTIVE PHASE SEPARATION

Speaker:
Dr. Sudipta Pattanayak

Institut Curie, Universit´e Paris Sciences et
Lettres, Physique de la Cellule et cancer

12:45PM

FR. DEPELCHIN AUDITORIUM

10TH JANUARY 2025, FRIDAY

SCAN TO REGISTER

ABHINAB CHANDRA: +91 86974 55629

Link to register: *https://forms.gle/XucJeTt7PtV4RJCQ9*

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FLOW OF EVENTS

Date: 10th January, 2025

Venue: Fr. Depelchin Auditorium St. Xavier's College (Autonomous), 30, Mother Teresa Sarani (Park Street), Kolkata – 700016, West Bengal, India.

Time: 1:00 p.m. onwards (IST)

Sl.No.	Time	Event Details
1.	1:00 p.m.	Dignitaries enter the auditorium and take their seats; Introduction by emcee (Abhinab Chandra)
2.	1:05 p.m.	Dignitaries escorted on stage
3.	1:07 p.m.	Inauguration of the seminar by lighting of lamp
4.	1:10 p.m.	Welcome address by The Rev. Fr. Principal
5.	1:15 p.m.	Address by Dr. Shibaji Banerjee, Head, Department of Physics
6.	1:20 p.m.	Felicitation of the speakers
7.	1:23 p.m.	Dignitaries escorted off stage
8.	1:25 p.m.	Dr. Kausik S Das is introduced and called on stage; Talk begins thereafter
9.	2:30 p.m.	Talk ends; QnA session
10.	2:40 p.m.	Dr. Sudipta Pattanayak is introduced and called on stage; Talk begins thereafter
11.	3:45 p.m.	Talk ends; QnA session
12.	3:55 p.m.	Vote of Thanks
13.	4:00 p.m	Conclusion of the colloquium; refreshment

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INTERNATIONAL COLLOQUIUM

The Post Graduate and Research Department of Physics, St. Xavier's College (Autonomous), Kolkata, under the guidance and blessings of Father Principal, Rev. Dr. Dominic Savio S.J., has planned to organise a one-day international seminar, Physics behind Biology: International Colloquium, on 10th January, 2025 from 1:00 p.m. onwards at Fr. Depelchin Auditorium. Two lectures will be delivered by Dr. Kausik S Das, Director, SANS Centre for Student Excellence, University of Maryland Eastern Shore and Dr. Sudipta Pattanayak from Curie Institute, Paris, France. E-Certificates will be issued to all attendees upon attending both the lectures.

PHYSICS BEHIND BIOLOGY: INTERNATIONAL COLLOQUIUM

LECTURE BY DR. KAUSIK S DAS:-

TITLE: THE PHYSICS BEHIND LIFE: EXPLORING NATURE'S SECRETS THROUGH PHYSICAL PRINCIPLES

Abstract: Nature's brilliance is not only a result of biology but is deeply intertwined with physics. In this talk, we will explore how fundamental physical principles shape both the evolution of living organisms and technological innovations. We'll begin with the role of surface-to-volume ratio, uncovering why size impacts strength, metabolism, and heat dissipation in biology, and how this same principle influences the efficiency and design of modern technologies, from nano-materials to heat exchangers. Next, we'll examine the mystery behind how geckos stick to walls, hinting at nano-scale physics that enable this remarkable feat. We'll also dive into the world of the pistol shrimp, whose claw snap creates plasma and temperatures rivalling the surface of the sun. Moving towards innovation, we'll explore how insights into the structural properties of leaves can revolutionize the battery industry, inspiring designs for efficient energy storage. Finally, we'll introduce the cuttingedge concept of irradiative cooling, presenting our lab's latest results: how engineered cotton can cool objects below ambient temperature without any energy input. This interactive talk highlights how physics provides a unifying framework for understanding natural phenomena and translating them into technological advancements. Join us as we uncover the hidden physics shaping our world and inspiring the future.

PHYSICS BEHIND BIOLOGY: INTERNATIONAL COLLOQUIUM

LECTURE BY DR. SUDIPTA PATTANAYAK:-

TITLE: CLUSTER FORMATION, ORDER AND AGGREGATION IN ACTIVE MATTER: DIFFERENT CLASSES OF ACTIVE PHASE SEPARATION

Abstract: Living or Active Matter is a new, fast growing interdisciplinary fieldat the interface between biology and statistical physics that aims to understand ense blesof living particles. In this seminar, I will try to take you through some of the important results from the literature of Active matter. The term “living” refers to the ability of the particle to convert energy into work. One motivation of the study of living matter by physicists is the rich phenomenology associated to this field. Collective motion and swarming are among the most studied phenomena. Within the huge number of models that have been developed to catch such behavior from a microscopic description, the most famous is the model introduced by Tamas Vicsek et al. in 1995. The underlying assumption in these systems is that, as in equilibrium, “universality classes" depend only on the symmetry and range of the interactions, as well as on the presence or absence of conserved quantities. For example, the emergence of polar ordered is explained assuming the existence of a short-range velocity alignment mechanism, which is believed to lead generically to active fluids that fall into the Toner-Tu class. Similarly, phase separation in active systems is usually rationalized in the context of short-range repulsive active Brownian particles that are believed to fall into the mobility-induced phase separation (MIPS) class. Similarly, active particles with nonreciprocal interactions phase separate via a distinct process, inconsistent with MIPS, into high-density structures displaying either polar, neutral or nematic order depending on noise value and the non-reciprocity parameter. Finally, I will talk briefly about our ongoing work about how the internal organization of cells is largely determined by the architecture of the microtubule network.