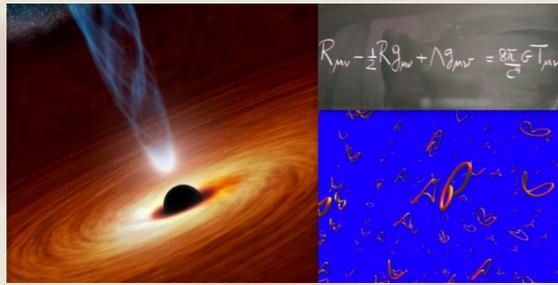


# STRING THEORY AND QUANTUM GRAVITY



Rajesh Gopakumar



Loganayagam R.

**H**ow do we understand the origin of the universe - the big bang?



Suvrat Raju



Ashoke Sen

**W**hat are the fundamental interactions in nature?



Spenta R. Wadia

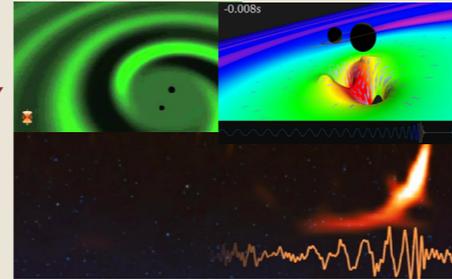
**W**hat happens inside a black hole?

**C**an we understand the behaviour of states of matter in extreme conditions?

**H**ow do we describe the transitions between various states of matter?

**W**hy are strings fundamental objects of physics?

# ASTROPHYSICS & RELATIVITY



P. Ajith



Pallavi Bhat

**I**s Einstein's General Theory of Relativity the correct (classical) description of gravity?



Bala Iyer



Prayush Kumar

**W**hat is the nature of gravity in highly dynamical astrophysical situations?



Joseph Samuel



Rajaram Nityananda

**A**re nature's black holes the same as the black holes of General Relativity?

**H**ow does the Universe form merging binary systems of black holes?

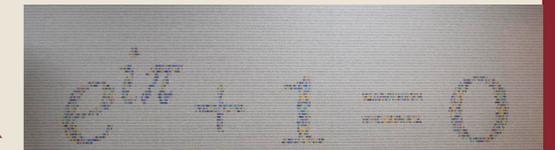
**D**o primordial black holes exist?

**I**s (at least a part of) the elusive "dark matter" constituted by compact objects such as black holes?

**W**hat is the origin of big beautiful magnetic fields in stars, galaxies, accretion disks?

**H**ow can we understand typical energetic events occurring in astrophysical plasmas?

# MATHEMATICS & COMPUTER SCIENCE



Amit Apte



Siva Athreya

**W**ill a marriage of (too noisy) data with (too chaotic) dynamics predict the future accurately?



Anirban Basak



Riddhipratim Basu

**I**f it rains here, where else will it rain? Should we even try to predict rain with certainty?



Rukmini Dey



Pranav Pandit

**W**hy are patterns formed and why do they persist? Can we engineer specific patterns or use them to infer system details?



Jaikumar Radhakrishnan



Mythily Ramaswamy

**H**ow can we use mathematics to model the randomness and understand large scale systems?



Joseph Samuel



Jim Thomas

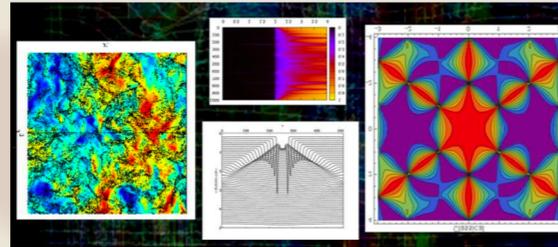
**W**hat is the beautiful math behind soap films and bubbles?



Vishal Vasani

**W**hat is the quantum theory behind the physics and can it be understood from the solution space?

# STATISTICAL PHYSICS & CONDENSED MATTER



**What is the probability of rare and extreme events and large deviations in physical systems like current fluctuations in nanoscale systems ?**



**What is the fundamental physics in the design of novel quantum devices like diodes, transistors, lasers etc?**



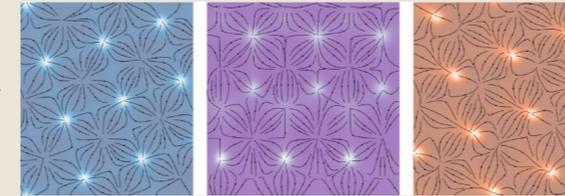
**How does the physics of glass-like and liquid-like behaviour of cells apply to biological systems (wound healing, spreading of cancer etc) or dense systems (self-propelled objects such as bacteria, birds and fish etc)?**



**How do quantum effects manifest in many-particle systems around us?**

**What is the origin of the arrow of time and how does irreversibility arise from reversible microscopic laws?**

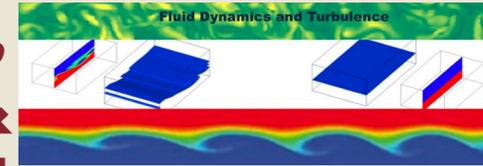
# PHYSICAL BIOLOGY



**How do living organisms generate the shapes of their various body parts? What is the physics behind the emergence of these geometrical shapes?**

**How does a cell arise in the first place? What is the minimal configuration for a cell?**

# FLUID DYNAMICS, TURBULENCE & CLIMATE SCIENCE



**Why do knotted vortices tend to unknot? How does this affect turbulence?**



**How does the addition of dust affect the laminar-turbulent transition?**



**Which clouds will rain?**

**How can we compute the dynamics of small particles in fluid at low computational cost?**

**How do interacting particles behave in flow?**