

Prof. Murugappan Muthukumar

University of Massachusetts, Amherst, MA 01003 USA & FRIAS, Freiburg, Germany

„Virus Assembly: Organizing Principles from Polymer Physics“

Myriads of viruses keep on proliferating around us. How are the virus genomes, which carry information for making the next generation of viruses, organized inside viruses? Guided by experimental facts, and using field theoretic and statistical mechanics tools in combination with computer simulations, we show that simple physical principles underlie virus assembly. Our result is in contrast to the long-held view that specific interactions between the chemical sequences of proteins and polynucleotides dictate the assembled genome structure. Electrical charge balance between the genomes and the proteins enclosing them dictates the genome assembly and the kinetics follows the same nucleation and growth mechanism as seen in first order phase transitions. Our predictions capture the essential aspects of genome packing in diversely different viruses evolved over billions of years, and provide new strategies for packaging genes for medical applications while questioning the general applicability of the central dogma.