



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

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

## **DEPARTMENTAL SEMINAR**

# **Physics of Complex Systems**

**12<sup>th</sup> July, 2024**

**4.00 PM**

**ONLINE / FERMION**

### **SPEAKER**

**Prof. Dibyendu Das,  
Professor, Physics Dept, IIT Bombay**

### **TITLE OF THE TALK**

**Analytical Distribution of Released Synaptic Vesicles: Binomial or Not?**

### **ABSTRACT**

Release of synaptic vesicles carrying neurotransmitters (also called “quantal content”), form the basis of electrochemical signal transmissions across all synapses. For 70 years, it has been known experimentally that the statistical distribution of each such individual release is a Binomial. Yet the size of the reservoir from which these vesicles get released, fluctuates. Hence the question of the actual distribution of quantal content averaged over these fluctuations, remained open. The problem is difficult due to history dependence -- we make progress by focusing on the steady state. Our work reveals that for fixed frequency electrical input stimulation, the statistically averaged distribution is still a Binomial, while for random input stimulations the averaged distribution is generically non-Binomial. Often under physiological conditions presynaptic input signals are random. So, the exact results in our paper will hopefully help in analyzing experimental distributions in such cases, and make estimates of the model parameters associated with the concerned neuron. We also compare our theory to experimental data for fixed frequency stimulation from MNTB-LSO synapses of juvenile mice.

Reference: Phys. Rev. Lett. 132, 228401 (2024)

### **HOST FACULTY**

**Prof. Sakuntala Chatterjee,**  
Professor, Dept. of Physics of Complex Systems

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