ICTS SEMINAR

Title : On some of the statistical properties of motor-driven intra-cellular transport

Speaker : Deepak Bhat (IITM), Chennai

Date : 23rd February, 2015

Time : 2:00 p.m.

Venue : ICTS Seminar Room, IISc Campus, Bangalore

Abstract : Inside eukaryotic cells, motor proteins are enzymes that convert chemical energy acquired from hydrolysis of adenosine tri-phosphate (ATP) to mechanical work [1]. Dynein and kinesin are two such proteins that perform directed motion on cytoskeletal filaments(microtubules), in opposite directions. They move typically with speed of hundreds of nano-meters per second, exerts forces of few peco-newtons to drag and deliver different cargoes like endosomes, vesicles etc. from one place to other. Often, presence of motors of two opposing directionality leads to tug-of-war and bidirectional motion of cargoes [2,3].

Motor-driven cargo transport on a cytoskeletal network interests biologists and physicists alike because of its relevance in understanding spatial organization of various organelles inside eukaryotic cells. However, many statistical properties of this transport are not known in detail and, here I will present some of my work along this direction. In the first part of the talk, I will briefly explain how non-Kramer form of load sensitivity of dynein detachment rate is crucial for obtaining experimentally consistent stall-time and tug-of-war duration [4]. In the second part, by visualizing the motor driven bidirectional cargo motion as a random walk, using a memory parameter constructed by the direction reversal probabilities, I will show you that the walk is, in general, correlated [5]. In particular, the motion of cargo driven by two

opposing motor is Markovian while, the motion becomes history dependent when more than one motor of one or either directionality is engaged in pulling the cargo. We studied bias and correlation in this random walk, also established their dependence on the memory parameter. In the last part of the talk, I will make an attempt to convey the effect of elastic nature of motor-cargo complex on the characteristics like average velocity, diffusion coefficient of the motor-cargo assembly [6]. The formalism developed in [6] is more general compare to many earlier studies [7-9] and allows to quantify the statistics of forces experienced by the individual motor and their correlations systematically.

Ref:

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