BP 23: Posters: Molecular Motors

Time: Tuesday 14:00–16:00 Location: Poster A

BP 23.1 Tue 14:00 Poster A

Kinesin motors pulling subdiffusive cargos in cytosol: from normal to anomalous transport and motor cyclic kinetics — •Igor Goychuk — Institute for Physics and Astronomy, University of Potsdam, Karl-Liebknecht-Str. 24/25, 14476 Potsdam-Golm, Germany

We study [1] transport of subdiffusing particles by kinesin motors within a generalized flashing potential ratchet model. Here, the binding potential flashes are bidirectionally coupled to a two-state biochemical cyclic kinetics of the motor driven by ATP hydrolysis. The motor catches and pulls on a tether cargo which freely subdiffuses otherwise. Subdiffusion of cargo is modeled within a Generalized Langevin Equation approach featured by a power-law scaling memory kernel with a finite memory cutoff reflecting finite macroscopic viscosity of viscoelastic cytosol [2]. This theory extends our previous modeling [3] which explains how one and the same motors can realize both normal and anomalous transport of submicron cargos in the same cell, depending, in particular, on the cargo size and the motor turnover frequency. We not only confirm our previous major findings, but also explain how anomalously slow enzyme turnover naturally emerges within our description, which is based on the fundamentals of statistical mechanics [2]. Thermodynamic efficiency of the motor can be very high ($> 50\%$) even within this strongly anomalous transport regime.

[1] I. Goychuk, arXiv:1410.2416 [physics.bio-ph] (2014).
[2] I. Goychuk, Adv. Chem. Phys. **150**, 187 (2012).
[3] I. Goychuk, V. Kharchenko, R. Metzler, PLoS ONE **9**, e91700 (2014); Phys. Chem. Chem. Phys. **16**, 16524 (2014).

BP 23.2 Tue 14:00 Poster A

A mechanism to generate stable microtubule overlaps — Dennis Johann, Debajit Goswami, •Christopher Zapp, and Karsten Kruse — Saarland University, Saarbrücken, Germany

The mitotic spindle is a structure generated during cell division that serves to segregate the chromosomes onto the two daughter cells. It consists of microtubules spreading from each of the cell poles towards the division plane. In the spindle, the minus-ends of the tubules are pointing towards the poles, thus generating overlaps of antiparallel filaments near the centre of the cell that are stabilized by proteins, so-called crosslinkers. Controlling these overlaps is vital to the cell as it influences the physical properties of the spindle. In this work, we study a mechanism to generate and control stable overlaps of antiparallel microtubules using the interplay between different crosslinking proteins.

BP 23.3 Tue 14:00 Poster A

Towards synthetic molecular motors: a model study — •Amartya Sarkar and Alexander Mikhailov — Fritz Haber Institute, Berlin 14195, Germany

We study the model of a synthetic molecular motor, whose operation closely emulates that of real molecular motors. The motor is described in terms of an elastic network and is able to perform cyclic conformational motions which in turn is capable of uni-directionally transporting a filament. The mechano-chemical motions are due to energy supplied by the binding of a ligand, its conversion to a product, and the subsequent release of the product. Stochastic simulations of this model motor system under the conditions of both weak and strong coupling with the filament, under varying temperatures, has been performed. A continuous transition between two regimes of operation, from that a deterministic ratchet mechanism to a Brownian ratchet mechanism, has been demonstrated. Further it is shown that the motor can operate even under the influence of an opposing external force. Various statistical and mechanical properties of this model have been studied in detail. We consider a further reduced description of this model system which satisfy both microscopic reversibility and detailed balance and perform extensive statistical analysis of the dynamics.