

SHORT VISIT FINAL REPORT

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The aim of visiting professor Lutz Schimansky-Geier at Humboldt University, Berlin, Germany was to study the effect of synchronization emerging in the systems of collectively operating molecular motors.

During my short visit we have discussed about different models, used to describe the collective motion of molecular motors. As a result we have come out with an original proposition of a model which I believe can capture many interesting features of the systems under consideration.

The basic idea is as follows:

N_{TOT} motors, coupled through a transported cargo, begin their walk along microtubule. They initially occupy the same site N . Each step requires energy, coming from chemical reactions cycle. Progress of the reactions is modeled as a motion in a circle of an oscillator, following the equation:

$$(1) \quad \dot{\theta}_{N,i} = \omega_i + \xi_i - \gamma_i \theta_i,$$

where $\theta_{N,i}$ is the progress of the cycle of the i -th motor, occupying site N , ω is the angular frequency of the i -th motor, ξ is the white Gaussian noise and γ_i is the damping coefficient. After at least one of the motors will finish the reactions, it will jump to the next binding site denoted as K (see Fig. ?? and Fig. 2).

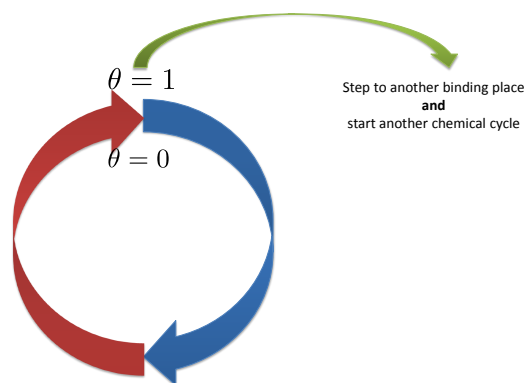


FIGURE 1

Then, we postulate that the oscillators following the cycle K - that is those which have already made a step - can interact with those which have not, e.g. they can speed them up, according to:

$$(2) \quad \dot{\theta}_{N,i} = \omega_i + \xi_i + \frac{K}{N_{TOT}} - \gamma_i \theta_i,$$

Unlike to N oscillators, K oscillators can not make a step, due to sterical constraints, see Fig. 2.

Following this line we would like to study the directed motion of many oscillators and effects of synchronization that can emerge in the minimal, as well as in a more detailed scheme.

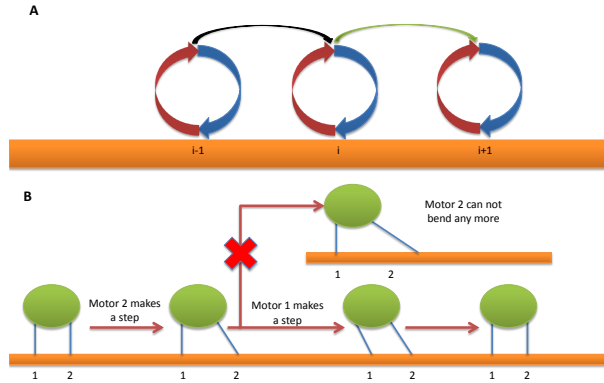


FIGURE 2

During my stay I have prepared a simulation algorithm and have implemented it, so that obtaining first results would be possible in a near future. I have also discussed with prof. Lutz Schimansky-Geier and one of his PhD students about another project that we could do together.

Summarizing, this short stay was very fruitful and I hope for good results.