

Principles of design of artificial and biological molecular engines

Tuesday, September 5, 2017 2:00 PM (30 minutes)

Molecular engines are based on different principles than macroscopic motors. I will present two examples: artificial engine created in our lab namely nano-wind mill driven by evaporation of water and the motion of kinesin motor walking on microtubules. This biological engine, of incredibly efficiency, is driven by thermal noise, while consumption of ATP is mainly used for detachment of its parts from microtubule. The key principle in its design is the proper synchronization of its diffusion driven by thermal noise with the hydrolysis of ATP, detachment of ADP and further attachment of ATP, as we show in our experiment. Our nano-wind mill does work due to spatial organization and synchronization of many motors, which in concerto respond to flux of water.

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[2] P.Niton et al A “nano-windmill” driven by a flux of water vapour: a comparison to the rotating ATPase, NANOSCALE 5, 9732-9738, (2013).

[3] K.Sozanski et al Activation Energy for Mobility of Dyes and Proteins in Polymer Solutions: From Diffusion of Single Particles to Macroscale Flow, PHYSICAL REVIEW LETTERS 111, 228301, (2013).

[4] T.Kalwarczyk et al Motion of nanoprobe in complex liquids within the framework of the length-scale dependent viscosity model, ADVANCES IN COLLOID AND INTERFACE SCIENCE 223, 55-63, (2015).

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