

Abstract Submitted  
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**Molecular motors and the 2<sup>nd</sup> law of thermodynamics<sup>1</sup>** ZHISONG WANG, Natl Univ of Singapore — Molecular motors from biology and nanotechnology often operate on chemical energy of fuel molecules in an isothermal environment, unlike macroscopic heat engines that draw energy from a heat flow between two temperatures. Nevertheless, isothermal molecular motors are still subject to the 2<sup>nd</sup> law of thermodynamics in a fundamental way: their directional motion must cost a finite amount of energy other than the environmental heat even though no work is done; otherwise the 2<sup>nd</sup> law would be violated. Hence the 2<sup>nd</sup> law requires a finite energy price for pure direction of molecular motors. But what is the lowest price of direction allowed by the 2<sup>nd</sup> law? And how does the 2<sup>nd</sup> law-decreed price of direction limit performance of molecular motors? In the talk, I shall present our theoretical study of the 2<sup>nd</sup> law-molecular motor link on basis of the accumulated biomotor phenomenology, and also introduce our experimental effort to develop biomimetic DNA bipedal nanomotors following the mechanistic guidelines out of the theoretical study. [Main contents of this talk are from references: J. Chem. Phys. 139, 035105 (2013); Phys. Rev. E 88, 022703 (2013); Phys. Rev. Lett. 109, 238104 (2012)]

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Zhisong Wang  
Natl Univ of Singapore

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