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Complex Non-equilibrium Behavior Induced by Simple Optical Tweezers

Optical tweezers are one of the major tools in biophysics research. A lot of work has been done assuming optical tweezers as potential wells. Our experiment shows clear non-equilibrium behavior of a particle trapped by a simple optical tweezer: non-zero circulating probability flux in the stationary state [1]. When particle size is much small compared with wave length, this can be explained by the fact that radiation pressure is a non-conservative force. But as particle size grows, curl of optical force shows domains of different sign [2], [3] . This implies possible flux reversal for bigger particles, which has been observed in experiments too. In a word, optical tweezers are Brownian motors, we are working on a phase diagram to help understanding the complicated non-equilibrium behavior[3].

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