PARTICLE SELECTION BY AN ATTRACTIVE WELLS LATTICE

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Abstract

We demonstrated via active brownian dynamics simulation an unreported effect of interacting self-propelled particles diffusing on potential energy landscape. For a binary system of N particles, each half subject to a different rotational noise strength, the scape probability out of the wells, for high-noise particles (hnp), is very unlikely, while the low-noise particles (lnp) even reach superdiffusion regime at long time, for certain trapping parameters value. Thus, we show a new manner of selecting particles: in the regions where the confining force is nonvanishing, hpn's tend to accumulate in these regions and, therefore, isolated from the lnp's, a clear noise-induced sorting effect. In order to give support to our analysis, the mean square displacement for each set of particles is computed, exhibiting clear signature of confined motion (for hnp's) and free diffusion (for lnp's). This is due to the persistence motion of the particle, higher for lnp's, and allowing them to move in straight line for longer time than the hpn's, and lower for hnp's. As a consequence, the time-averaged density map for the positions shows high accumulation in the wells for hnp's, unlike for lnp's in which the distribution is more homogeneous over the system. Finally, a quantitative parameter shows us the efficiency of such a noise-induced selectivity. The present study provides a new perspective for processes of particles separation and manipulation by a lattice of optical tweezers, for instance.

Keywords: optical tweezers, brownian motion, diffusion