Theoretical Analysis of Dimers' Diffusion in Optical Lattices

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Abstract

During last years, optical forces have been an active field of research with applications in many areas of interdisciplinary science. In particular, the force exerted by light and the influence on the diffusion properties of a single Rayleigh nanoparticle evolving in an optical lattice have been analyzed [1,2]. Although optically induced interacting forces between two or more nanoparticles have been also deeply studied, not much attention has been paid to effect that such interactions have on the dynamical properties of complex systems of nanoparticles. Here we propose a simple model to study this problem. Our system is made up of two linked polarizable nanoparticles with fixed separation (dimer) subject to thermal fluctuations and immersed in a two dimensional optical lattice arising from the interference of two perpendicular monochromatic standing waves. The diffusion behavior as a function of dimers' length and polarizability, as well as the probability distributions for positions and orientations, have been analytically and numerically studied. In order to highlight the effects due to the mutual interaction between nanoparticles, the results have been compared to the case where multiple scattering is neglected.

References

[1] S. Albaladejo, M.I. Marqués, F. Scheffold, J.J. Sáenz, Nanoletters, **9** (2009) 3527.

[2] S. Albaladejo, M.I. Marqués, J.J. Sáenz, Optics Express, **19** (2011) 11471.