Optically induced micro-oscillations in optical tweezers: a new application for semi-conductor materials

Trabalho #02

Apresentação Oral

warlleyns@gmail.com

- Warlley Hudson Campos, Universidade Federal de Viçosa - UFV, Estudante de Doutorado (ou mestrado concluído), Física

Autores: Warlley H. Campos - Universidade Federal de Viçosa (UFV) / Johannes Gutenberg Universität Mainz (JGU)

Tiago A. Moura - Universidade Federal de Viçosa (UFV)

Otávio J. B. J. Marques - Universidade Federal de Pernambuco (UFPE)

Jakson M. Fonseca - Universidade Federal de Viçosa (UFV)

Joaquim B. S. Mendes - Universidade Federal de Viçosa (UFV)

Márcio S. Rocha - Universidade Federal de Viçosa (UFV)

Winder A. Moura-Melo - Universidade Federal de Viçosa (UFV)

Optical tweezers (OT) is a powerful tool used to trap and manipulate microscopic objects by using light. Nowadays, it has applications in several areas, such as biological and soft matter physics. The trapping of dielectric beads in OT is a well-known phenomena, being adopted in most experimental setups. In turn, metallic beads are usually not trapped in OT, except under very special conditions. From an electric conducting point of view, topological insulator and semiconductor materials interpolate between dielectrics and metals. Despite the increasing interest of the scientific community in these materials, their possible applications as microparticles in OT have not been investigated so far. In this work, we perform the first experimental studies upon the optical trapping of Bi2Te3, Bi2Se3 and Germanium (Ge) microparticles under a Gaussian laser beam OT. For such materials gradient and radiometric forces compete, generating oscillatory dynamics perpendicular to the optical axis. We describe the oscillations with an effective model that captures the main forces acting on the particle. We investigate the amplitude and periodicity of oscillations, as well as their dependence on particle size. Ge beads oscillate in a preferential direction determined by the polarization of the laser beam. Our results open an avenue for dynamical measurements with unprecedented simplicity and purely optical control. Among the possible applications, stand out the optical rheology of soft matter interfaces and biological membranes, as well as dynamical force measurements in macromolecules and biopolymers.

Comentários adicionais

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