Optical tweezers theory near a flat surface: a pertubative method

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Optical tweezers theory near a flat surface: a perturbative method[1] HENRIK FLYVBJERG, RAFAEL S. DUTRA, Department of Micro- and Nanotechnology, Technical University of Denmark, PAOLO A. MAIA NETO, H. MOYSES NUSSENZVEIG, Institute of Physics, Universidade Federal do Rio de Janeiro — We propose a perturbative calculation of the optical force exercised by a focused laser beam on a microsphere of arbitrary radius that is localized near a flat glass surface in a standard optical tweezers setup. Starting from the Mie-Debye representation for the electric field of a Gaussian laser beam, focused by an objective of high numerical aperture, we derive a recursive series that represents the multiple reflections that describe the reverberation of laser light between the microsphere and the glass slide. We present numerical results for the axial component of the optical force and the axial trap stiffness. Numerical results for a configuration typical in biological applicationsa microsphere of 0.5 m radius at a distance around 0.25 m from the surfaceshow a 37[1] Viana N B, Rocha M S. Mesquita O N, et al. (2007) Towards absolute calibration of optical tweezers. Phys Rev E 75:021914-114. [2] Dutra R S, Viana N B, Maia Neto P A, et al. (2014) Absolute calibration of forces in optical tweezers. Phys Rev A 90:013825-113.

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