Title:	Dynamics of a dielectric microsphere inside a nonlinear laser trap
Authors:	Devi, A. (/jspui/browse?type=author&value=Devi%2C+A.) Yadav, Sumit (/jspui/browse?type=author&value=Yadav%2C+Sumit) De, A.K. (/jspui/browse?type=author&value=De%2C+A.K.)
Keywords:	Dynamics dielectric microsphere nonlinear laser trap
Issue Date:	2020
Publisher:	American Institute of Physics Inc.
Citation:	Applied Physics Letters, 117 (16)
Abstract:	The 2018 Nobel Prize in Physics was awarded for the invention of optical trapping and generation of ultrashort pulses, which revolutionized many areas of modern science and technology. However,physics of optical trapping under ultra-short pulsed excitation has not been explored much. The nonlinear nature of optical trapping force/potential under ultra-short pulsed excitation was theoretically investigated, however, without any direct experimental demonstration and development of any generalized theory independent of the particle size. In this work, we present a methodology to numerically estimate trapping force/potential including optical as well as thermal nonlinearity under ultra-short pulsed excitation and implement a variety of detection modalities to capture the particle's real-time trajectories. We show how highly asymmetric nonlinear axial potential, created by a femtosecond pulse-train, can be mapped from the dynamics of the trapped particle. Considering fine-tuning of trap-stiffness by changing nonlinearity, we envision far-reaching applications of using ultra-short pulsed excitation in laser trapping and manipulation.
URI:	https://aip.scitation.org/doi/full/10.1063/5.0026334 (https://aip.scitation.org/doi/full/10.1063/5.0026334) http://hdl.handle.net/123456789/3278 (http://hdl.handle.net/123456789/3278)
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