Scilight

NEWS | AUGUST 17 2022

Optical tweezers made more versatile and powerful FREE

Leigh Ann Green

Scilight 2022, 341101 (2022)
https://doi.org/10.1063/10.0013730

AIP Publishing

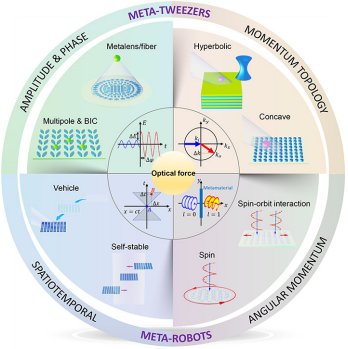
Scilight

17 August 2022

Optical tweezers made more versatile and powerful

Leigh Ann Green

The dual fields of optics and metamaterial structures may significantly impact physical and biological research.



Optical tweezers have revolutionized the manipulation of tiny objects, such as viruses, DNA, and proteins. Optical manipulation has been further enhanced through the use of metamaterials. Shi et al. reviewed recent advances in this hybrid field of unique technologies.

Metamaterials, artificially designed architectures which interact with light and other forms of energy in ways not seen in nature, can be used to tailor designated optical fields for the manipulation of particles. Compared to conventional optical tweezers, meta-tweezers exhibit advantages in power efficiency, functionality, tunability, and scalability.

The comprehensive review discusses the fundamental physics of optical forces and metamaterials and presents several specific examples of optical manipulations using metamaterial structures.

“Intriguing research work in this hybrid research field has emerged rapidly in the past few years either to manipulate particles or to mobilize meta-structures,” said Yuzhi Shi. “This has attracted enormous attention in physical and biological science communities.”

The researchers believe this work can provide fundamental theories for the design of metastructures and will aid in the investigation of optical forces with regards to amplitude and phase, momentum topology, and spatiotemporal and angular momentum.

Future work will focus on the miniaturized and compact design of meta-robots moving in arbitrary three-dimensional paths and in complex environments such as body fluids.

“This research topic will evolve with the advances of metamaterials to provide unprecedented tools to multifunctionally manipulate nanoparticles at a low power using cutting-edge metamaterial designs,” said Shi.

Source: “Optical manipulation with metamaterial structures,” by Yuzhi Shi, Qinghua Song, Ivan Teftul, Tongtong Zhu, Yefeng Yu, Weiming Zhu, Din Ping Tsai, Yuri Kivshar, and Ai Qun Liu, *Applied Physics Reviews* (2022). The article can be accessed at https://doi.org/10.1063/5.0091280.