Special Issue

Advances in Levitated Optomechanics

Message from the Guest Editor

Levitated optomechanics has rapidly advanced over the past decade, offering broad applications in fundamental research and metrology. This platform enables studies in macroscopic quantum phenomena, nonlinear thermodynamics, ultrasensitive force/torque detection, gravitational wave astronomy, and many-body physics. By optically trapping dielectric micro/nanoparticles in high-gradient vacuum potentials, the system achieves exceptional isolation and control over mechanical motion, supporting both classical and quantum investigations. Room-temperature operation simplifies experiments, while innovations in Paul traps and magnetic levitation reduce laser-induced heating and expand material compatibility (e.g., NV nanodiamonds). Classical research explores center-of-mass motion, libration, rotation, and couplings, whereas quantum regimes require ground-state cooling via techniques like feedback cooling. High force/torque sensitivity and control over internal-external degree couplings further broaden research possibilities. This Special Issue highlights advancements in methods, experiments, system designs, physical phenomena, and theoretical frameworks in levitated optomechanics.

Guest Editor

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Message from the Editor-in-Chief

You are invited to contribute a research article or a comprehensive review for consideration and publication in *Photonics* (ISSN 2304-6732). *Photonics* is an online open access journal covering both the fundamental and applications of optics and photonics. *Photonics* strives to provide an avenue to allow authors to disseminate their scientific findings—both theoretical/ simulations and experimental works—in highly accessible peer-reviewed journal publications. The manuscript in *Photonics* will be handled with quick turnaround production processing time. We welcome authors to submit their manuscripts for publications in *Photonics*. Our goal in *Photonics* is to enable fast dissemination of high impact works to the scientific community.

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