

Selective Trapping, Rotation and Propulsion of Isotropic Dielectric and Composite Janus Microparticles in the Evanescent Field of Optical Nanofibres

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Abstract: The long-range and precise manipulation of spherical isotropic and, composite, anisotropic microparticles is a topic of enduring interest. Here, we present all-optical forces and torques that can be used to control the spin, precession, or long-range propulsion of dielectric and composite Janus microparticles using the linear and angular momenta of light guided in optical nanofibres. We discuss how to transfer these momenta to microparticles trapped near the fibre surface.¹ We find that linearly polarized light, generating linear momentum in the nanofibre, causes Janus particles to exhibit strong transverse localization near the nanofibre's surface and much faster propulsion compared to all-dielectric particles of the same size.² Moreover, angular momentum, generated by circularly polarized light, provides additional azimuthal optical forces and torques to rotate particles around the nanofibre axis.³ These results establish a first step towards the precise long-range trapping and control of microparticles.

Key words: Optical nanofibre, linear and angular momenta, microparticle trapping and manipulation.

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