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Negative Radiative Pressure on Plasmonic Supercavitating Nanoparticles EUNGKYU LEE, TENGFEI LUO, University of Notre Dame — Driving nano swimmers with light is very useful for many applications like in-situ nanofabrication, targeted-molecular assembly, or biosensor array. Here, we demonstrate the optical pulling of plasmonic nanoparticles (NPs) in water, which moves against the light propagation direction. A plasmonic nanobubble encapsulating the NP (i.e., supercavitation) transforms the incident plane wave into a unique internal mode to exert a negative radiative pressure on the NP. We theoretically study the optical force on an Au NP consisting of a 100-nm SiO_2 core and 10-nm-thick Au shell. It is found that the single plane wave at the wavelength (λ) of 800 nm can attract the NP when the NP is inside a nanobubble with the size between 100 nm – 400 nm. The pulling force becomes apparent when the NP is close to the bubble surface directly facing the light incident. We suspend the NP in water and use a loosely focused Gaussian beam, which can create a nanobubble with a size of ~O(100 nm) around the NP. We demonstrate that the laser pulls the NP against the photon stream and enable a speed of $10^5 \mu$m/s for a typical travel distance of ~100 μm. Moreover, we deposit the optically pulled NPs on a quartz/water interface with a spot size of ~10 μm and successfully create a surface bubble on the interface.

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