Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Rotational manipulation of plasmonic nanoparticles in water by photon angular momentum PETER JOHANSSON, Orebro University, ANNI LEHMUSKERO, ROBIN OGIER, TINA GSCHNEIDTNER, MIKAEL KALL, Chalmers University of Technology — A photon carries energy, momentum and angular momentum, and can transfer each of these properties to material objects. It is well-known that optical gradient and radiation pressure forces caused by a focused laser beam enables trapping and manipulation of objects with strength dependent on the particle's optical properties. Moreover, the transfer of photon spin angular momentum, makes it possible to set objects into rotational motion by targeting them with a beam of circularly polarized light. We show that this effect can set $\sim$200 nm radii gold particles trapped in water in 2D by laser tweezers into rotation at frequencies that reach several kilohertz, much higher than any previously reported light driven rotation of a microscopic object, but still at low Reynolds numbers [1]. We also derive a theory for the fluctuations in light scattering from a rotating particle, and we argue that the high rotation frequencies observed experimentally is the combined result of favorable optical particle properties and a low local viscosity due to substantial heating of the particles surface layer. The high rotation speed suggests possible applications in nanofluidics, optical sensing, and microtooling of soft matter.

[1] A. Lehmuskero, *et al.*, Nano Lett. **13**, 3129 (2013).

Peter Johansson
Orebro University

Date submitted: 15 Nov 2013 Electronic form version 1.4