Tailored optical trapping geometries based on complex light fields

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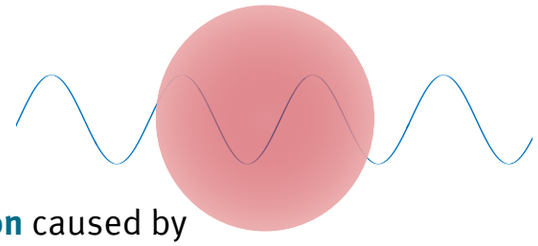
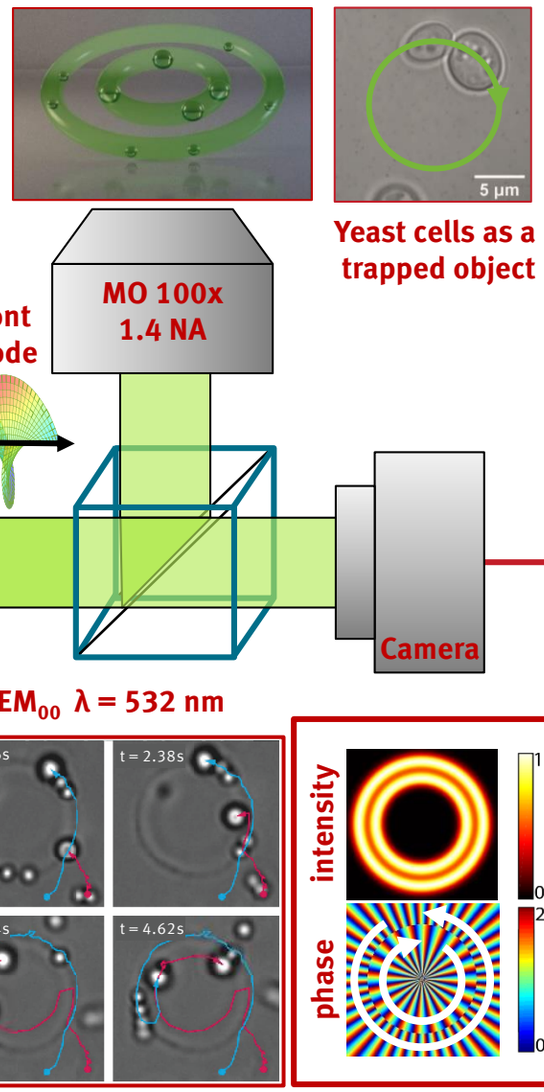
Mie regime (geometrical optics approximation) α«a

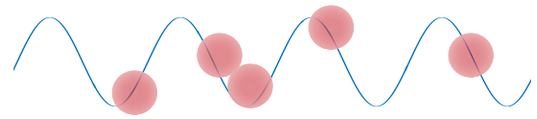


We investigate **particle motion** caused by the transfer of **orbital angular momentum** in **holographical optical tweezer** and employ **complex light fields** for **trapping**. The proposed **light field** geometry with **high topological charges** and **opposite handedness** yields to a **"milling" scenario**. It results in spatial particle **sorting by size**.

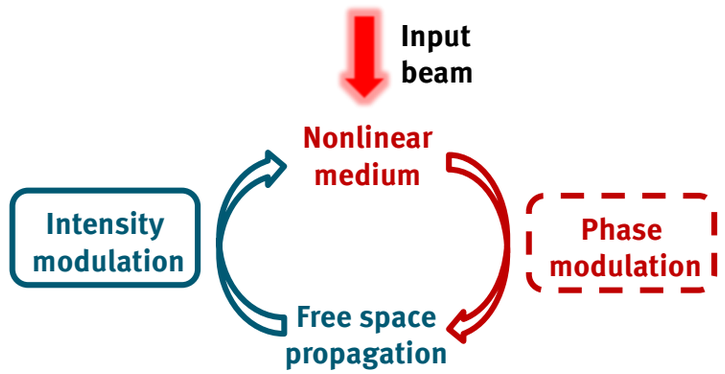


The timelapse shows **silica** particles, **orbiting** in an optical trap, consisting of two **Laguerre-Gaussian (LG)** modes.

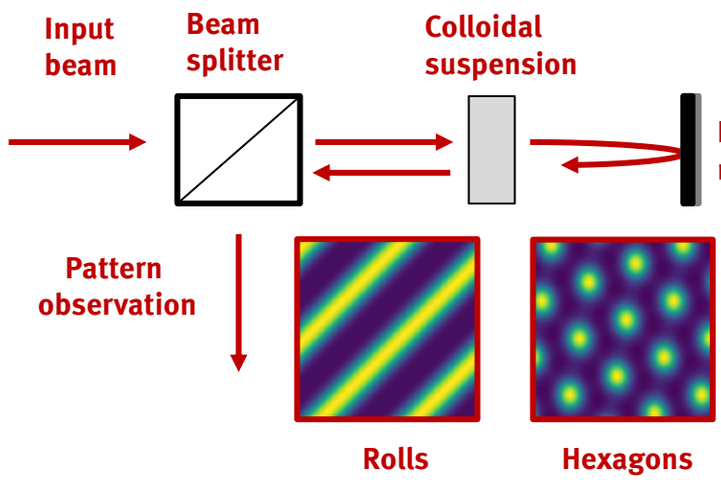
Rayleigh regime (dipole approximation) α»a



We combine the concept of **single feedback system** with **optical trapping** by **collective** light-matter interaction and **nonlinear coupling** of a high number of polystyrene nanoparticles, thus representing a **colloidal suspension**.



Spatial coupling is achieved by **diffraction** and **particle displacement** in the transversal plane, induced by **the optical gradient force** initiates the spatial **refractive index redistribution.** It in turn grants the **optical nonlinearity.**



Numerical results of **the linear** and **nonlinear** stability analysis show, that **rolls** and **hexagons** are **stable solutions** for the system.

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