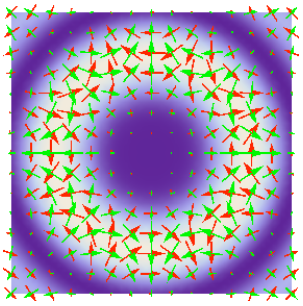
MM

Michael Mazilu

Lecture I: Decomposing angular momentum into spin and orbital momentum.

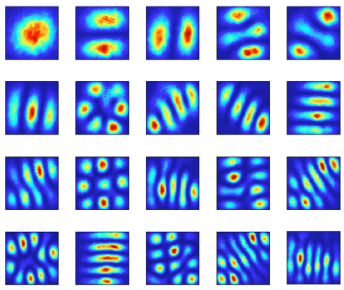
Energy, linear momentum, angular momentum and optical spin are all quantities of the



electromagnetic field that are conserved. More generally, each of those quantities is associated with a linear transformation of the electromagnetic field that leaves Maxwell's equations invariant. Here, we generalize Lorentz's reciprocity lemma to deduce the interference conservation of electromagnetic waves. Together with Noether's theorem, this relation describes the conserving density, optical flux and stress tensor associated with any invariant transformation. This approach can be used to define a possible decomposition of the angular momentum into spin and orbital parts.

Lecture II: Micromanipulation using optical eigenmodes.

Singular beams such as Bessel beams, Laguerre Gaussian beams or Mathieu beams are all of interest



for various applications in micromanipulation. However, which beam shape, what polarization and/or topological charge is the optimum for trapping, sorting, manipulating or focusing? Here, we present a general method based on optical eigenmodes, which allows the determination of the beam shape optimizing each of the cases considered. The method is applied to deduce the optimal superposition of singular beams enhancing the total linear, spin and angular momentum of beams and the transfer of these quantities to microparticles.