Westfälische Wilhelms-Universität Münster

Fachbereich Physik

› Allgemeines Physikalisches Kolloquium

› Donnerstag, 20.07.2017 um 16 Uhr c.t.

Prof. Dr. Kobus Kuipers

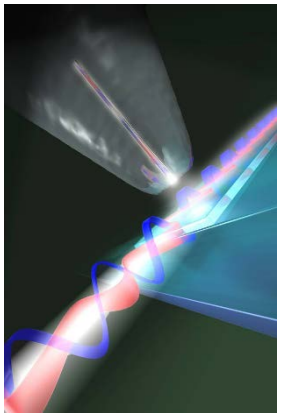
Technische Universität Delft, NL

Light twists at the nanoscale – incl. a singular story about lifelong fidelity -

We use a near-field microscope to visualize light fields in and around nanophotonic structures. The microscope gives us access to the amplitude and phase of not only the electric but also the magnetic in-plane field components [1,2]. Thus, we gain access to the full in-plane electric and magnetic "Poincaré sphere".

The interplay between the various components of either the magnetic or the electric fields leads to optical entities that, in their size, put nanophotonics to shame: these optical singularities have a size zero. In this lecture I will tell the story of phase singularities in a chaotic cavity (which actually can support rogue waves [3]). The chaotic nature of the cavity leads to a superposition of random waves that causes the distribution of phase singularities in space to be reminiscent of that of particles in an ionic liquid, but not quite due to lights vectorial nature [4]. As a parameter of the system is changed, e.g., the optical frequency, the singularities perform a Brownian motion. Sometimes they are also created in pairs. And sometimes a pair of singularities annihilates. We observe that the "life and death" of pairs that annihilate with their creation partner and therefore exhibit *life-long fidelity*, seems to take place predominantly in the parameter range where the random light field patterns show coherence. Promiscuity occurs all the time [5].

Moreover, we show that polarisation singularities and their associated local helicity can be applied for new quantum technology as they can be used to deterministically couple a spin-transition to emission direction [6], useful for novel quantum technology [7].



[1] B. le Feber, et al., *Nature Photonics* Vol. 8, 43-46, (2014).
[2] N. Rotenberg and L. Kuipers, *Nature Photonics* Vol. 8, 919-926, (2014).
[3] C. Liu, et al, *Nature Physics* **11**, 358-363 (2015)
[4] L. De Angelis, et al., *Phys. Rev. Lett.* **117**, 093901 (2016).
[5] L. De Angelis, et al., unpublished.
[6] B. le Feber, et al., *Nature Communications* **6**, 6695 (2015).
[7] A. B. Young, et al., *Phys. Rev. Lett.* **115**, 153901 (2015)

Kolloquiums-Kaffee
ab 16 Uhr vor dem Hörsaal

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