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Photothermal circular dichroism studies of single nanoparticles

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Stellingen

behorende bij het proefschrift

'Photothermal circular dichroism studies of single nanoparticles'

1. The circular dichroism of supposedly achiral particles can be as large as the circular dichroism of tailor-made chiral particles.
Chapter 2 and 4 of this thesis.
2. "Spherical nanoparticle" is a unfortunate choice of name and leads to misconceptions. "Quasi spherical" or "sphere like" would be better suited.
Chapter 4 of this thesis.
3. Circular dichroism in absorption measurements can significantly differ from circular dichroism in extinction measurements.
Chapter 5 of this thesis.
4. Despite its superior sensitivity for single-particle measurements, PT-CD has one disadvantage compared to extinction methods based on Mueller matrix polarimetry: it cannot differentiate between "extrinsic" chirality and "intrinsic" chirality.
Chapter 4 of this thesis.
5. The circular dichroism signal of a single chiral nanoparticle is not representative in any way for the circular dichroism of a colloidal solution of such chiral particles.
González-Rubio et al., Science 368 1472-1477 (2020).
6. To probe a PCCD effect on a single nanoparticle, one should show the inversion of sign of circular dichroism upon inverting the handedness of the molecule involved. Showing circular dichroism measurements with just one handedness is insufficient.
Zhang et al., Science 365, 1475-1478 (2019).
7. A perfect square-wave modulation of polarization to study circular dichroism, although desirable, is not suitable for single-particle measurements.
T. Narushima, H. Okamoto, Scientific reports, 6, 1-10; Spaeth et al., Nano Lett. 12, 8934-8940 (2019).
8. Plasmonic nanoparticles are not suitable to probe the CD signal of small quantities of molecules, as their own CD by far overshadow the molecular one.
Schäferling et al., Physical Review X 2, 031010 (2012); García-Guirado et al., Nano Lett. 10, 6279-6285 (2018).
9. For an experimental physicist it is admissible not to understand a problem as long as (s)he can solve it.

Patrick Späth
Leiden, January 15, 2022