Universität Münster

Aktuelle Fragen der Nanophysik

Montag, 20.10.2025 um 15:15 Uhr
R87, Wilhelm-Klemm-Str. 10

Colloidal synthesis as a pathway to nanoscale optics

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Controlling the behavior of light on the nanoscale is becoming increasingly important as emerging photonic nanotechnologies, such as photochemistry and light-emitting devices, progress to real-world applications. Introducing micron-scale or even nanoscale optical components enables precise control over how light enters and exits these photonic systems. However, conventional top-down fabrication methods are often costly and face limitations in further miniaturization, which restricts their widespread use.

To overcome these challenges, bottom-up colloidal synthesis methods offer a promising route to creating microscale optical components [1]. In this talk, I will discuss how we can develop nanolenses through colloidal synthesis strategies [2]. I will demonstrate how colloidally synthesized nanolenses control in- and out-coupling of plasmonic nanoarchitectures (Fig. 1), and highlight how they have facilitated investigation of diverse optical phenomena, including the tracking of chemical transformations on a single molecule level [3].

[1] M. Kamp et al. Cascaded nanooptics to probe microsecond atomic-scale phenomena, PNAS 2020, 117:26, p. 14819.
[2] M. Kamp et al. Contact angle as a powerful tool for colloidal synthesis. JCIS 2021, 581 Part A, p. 417.
[3] J. Huang et al. Tracking interfacial single-molecule pH and binding dynamics via vibrational spectroscopy, Science Advances 2021, 7:23, eabg1790.

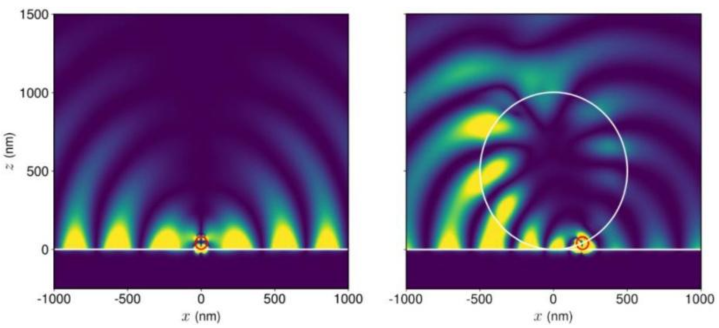

Figure 1. Snapshots of outcoupling broadband light from a local dipole between a gold nanoparticle and mirror (left, 80 nm AuNP) and with a nanolens on top (right, 80 nm AuNP and 800 nm silica lens), 15 fs after excitation. Scale bars: 500 nm.