Absorption, luminescence and scattering of single nano-objects

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Propositions

accompanying the thesis

Absorption, luminescence, and scattering of single nano-objects

1. Despite its very low probability –at best $\sim 10^{-7}$–, the absorption of resonant light by a single molecule can be detected at room temperature.
   Chapter 2 of this thesis; Kukura et al., J. Phys. Chem. Lett. 1, 3323 (2010); Chong et al., J. Phys. Chem. Lett. 1, 3316 (2010)

2. Only by means of a nonlinear optical method can the absorption of resonant light by an individual nano-object be discriminated from background scattering.
   Chapter 2 of this thesis

3. Dynamic instabilities at the fluid-air interface of an evaporating suspension of nanoparticles can generate labyrinth-shaped patterns.
   Chapter 3 of this thesis

4. While the luminescence quantum yield of gold nanoparticles is independent of their size, it depends on their shape.
   Chapter 4 and 5 of this thesis

5. The photothermal reshaping of single gold nanorods can already take place at temperatures well below the melting temperature of bulk gold.
   Chapter 5 of this thesis

6. The plasmon resonance frequency of a gold nanorod is modified by interaction with its nearby image.
   Chapter 6 of this thesis

7. In optical microscopy, chromatic aberrations can appear at unexpected places such as pinholes.
   Chapter 5 of this thesis

8. Thermotropic liquid crystals provide higher sensitivity in photothermal microscopy than glycerol.
Chang et al., J. Phys. Chem. Lett. 3, 1393 (2012); Nicholas et al., J. Phys. Chem. Lett. 3, 1400 (2012)

9. The real area of contact between two adjacent solid surfaces can be viewed over extended areas by employing interferometric optical methods.
Krick et al., Trib. Lett. 45, 185 (2012)

10. Fluorescence from a single molecule can be enhanced by three orders of magnitude in the vicinity of a single gold nanorod.
Yuan et al., Angew. Chem. Int. Ed. 52, 1217 (2013)

11. On- and off-times of blinking molecules can be controlled to improve the optical resolution beyond the diffraction limit.
Steinhauer et al., J. Am. Chem. Soc. 130, 16840 (2008)

12. The global climate change is largely influenced by human activities and will have severe consequences in human society. This greatest threat facing the world requires world-wide cooperation and can be fought against by energy conservation, decrease in greenhouse gas emission, and increase in alternative energy sources.

13. We should learn from Nature by mimicking it not only for technological applications but also for efficient recycling of resources.

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