Abstract Title

Optical detection of single absorbing nanoobjects

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Abstract body

In the fast evolving field of nanoscience, where size is crucial for the properties of the objects, simple and sensitive methods for the detection and characterization of single nano-objects are needed. The most commonly used optical techniques are based on luminescence. Single fluorescent molecules have been studied on their own and are now routinely applied in various research domains ranging from quantum optics to life science. Yet, fluorescent molecules allow only for short observation times due to inherent photo-bleaching. The development of brighter and more stable luminescent objects, such as semiconductor nano-crystals has remedied some of this shortcoming. An interesting alternative to fluorescence methods relies solely on the absorptive properties of the object. In general, nanoparticles with large absorption cross sections and short time intervals between successive absorption events (such as metal nanospheres) are likely candidates for detection with absorption methods.
We have recently demonstrated a new two-color photothermal heterodyne technique for the detection of small absorbing nanoparticles. We have imaged gold colloids down to 1.4 nm in diameter, with large signal-to-noise ratios and short integration times. This photothermal method has been applied to the detection of single non-fluorescent quantum dots and to the spectroscopy of single metal nanoparticles plasmon resonance.

For biological applications, we developed a method based on a triangulation procedure for tracking individual 5 nm gold nanoparticles on live cells at video rate during arbitrary long times. We also showed the applicability of PHI for new types of gold nanoparticles based DNA microarrays. PHI does not require silver staining enhancement as with previous methods and permits to push the signal dynamics of such microarrays from the single nanoparticle detection to almost the full surface coverage. The use of Photothermal Heterodyne Imaging is a promising approach for applications in biochips.

Keywords

Single nanoparticle, photothermal detection,

References

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