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## NANOSCIENCE COLLOQUIUM

Thursday March 19th 2015 at 15:15, K-space, Fysicum

# Optical control and biomedical applications of HOT nanoparticles

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Precise optical control over individual metallic nanoparticles has huge potential for nano-architectural purposes. The talk will commence by explaining how a focused laser beam can control not only the position, but also the orientation of a single nanoparticle [1]. While optically manipulating metallic nanostructures, it is worth noting that absorption and heating associated with resonant irradiation of metallic nanoparticles can be extreme [2]. Moreover, the heating of a nanoparticle cannot be theoretically predicted as the precise focal intensity distribution on the nanoscale is unknown and typically highly aberrated [3]. Utilizing a novel membrane-based assay we directly quantify the heating of an individual irradiated gold nanoparticle and show how this depends on laser power and particle size, shape, orientation and composition [4,5]. Also, our novel results show how the photo-thermal effect of metallic nanoparticles can be used to create localized heat gradients inside living cells, which is highly useful for targeted drug delivery and for photothermal treatment of cancers.



- [1] Selhuber-Unkel et al., Quantitative optical trapping of single gold nanorods. *Nano Letters*, vol. 8, p. 2998-3003 (2008).
- [2] Bendix et al., Direct measurements of heating by electromagnetically trapped gold nanoparticles on supported lipid bilayers, *ACS Nano*, vol. 4 p.2256-2262 (2010).
- [3] Kyrsting et al., Mapping 3D focal intensity exposes the stable trapping positions of single nanoparticles. *Nano Letters* vol.13 p.31-35 (2013).
- [4] Ma et al., Large-Scale Orientation Dependent Heating from a Single Irradiated Gold Nanorod. *Nano Letters* vol.12 p.3954-3960 (2012).
- [5] Ma et al., Heat generation by irradiated complex composite nanostructures. *Nano Letters*, vol. 14 p.612-619 (2014).

Host: Heiner Linke (Solid State Physics)

*This is one in a regular series of Nanoscience Colloquia, aimed at all researchers and students with an interest in nanoscience. The series is arranged by the Strategic Research Environment "The Nanometer Structure Consortium at Lund University" (nmC@LU) and by the Linnaeus environment "Nanoscience and Quantum Engineering", funded by the Swedish Research Council (VR).*



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