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Long range excitation transfer in DNA nanowire

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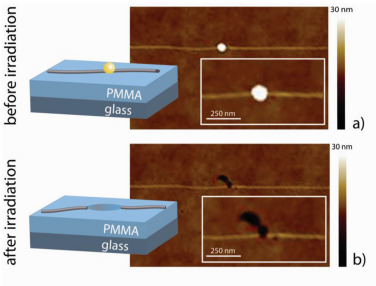

The conduction electrons of metal nanoparticles can be resonantly excited at their plasmonic frequencies in the visible wavelengths as localized surface plasmon resonance (LSPR). It results in intense scattering and absorption of light, what can be utilized for biosensing down to the single particle level.

It leads to large enhancements of the electromagnetic field near the particles. Short-pulsed (fs) laser pulse excited electrons of the nanoparticle can even couple into attached aligned molecular wires consisting of double-stranded (ds) lambda DNA. We present studies of fs laser irradiated silver and gold nanoparticles attached to these dsDNA molecules that show that such a plasmonic excitation of the particle can couple to dsDNA and cause a long-range excitation transfer along these molecules. This was demonstrated by a micrometer long destruction of the DNA, under certain conditions even of an underlying PMMA film along these molecules. This phenomenon was studied more thoroughly by fluorescence experiments, where a fs pulse plasmonic excitation of an acceptor AgNP induced bleaching of fluorophores at a donor AgNP by excitation transport along DNA molecules, which connected both nanoparticles over a distance of 5.7 µm.