Investigating the Dissociation of Oligonucleotides by Laser Activation for nanoscale Thermometry Relying on Energy exchanges

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Gold nanoparticles (NPs) under illumination at their plasmon resonance behave like miniature converters of light into heat, which has been recently exploited in a range of developments like targeted therapies or functional materials. When illumination is achieved by ultrashort laser pulses, the heating is brief, intense and precisely localized. While simple models have predicted the properties of this photothermal conversion at the nanoscale, experimental proofs for several characteristics are still are missing. Our project offers to assess experimentally the photoheating topography, with a very fine space resolution, in different conditions of illumination. For this, DNA with varying strand length will be grafted onto gold nanorods. Single-strand DNA release will be controlled by laser-induced photothermal conversion, using a precise thermal management at the nanoscale, and monitored by fluorescence microscopy. The resulting heating topography will be determined in different conditions of laser power, pulsewidth and repetition rate. Multiscale modelling and numerical simulations will support the analysis of the experimental results. Our findings will be relevant for instance in applications of plasmonics to targeted gene therapy or optically-driven functionalities in metasurfaces.

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