IBS Center for Multidimensional Carbon Materials

Special Guest Speaker

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Bioanalytics using Single Plasmonic Nanostructures

JULY 20
THUR 16:00

Bldg. 101
Seminar Room on the 1st floor

Novel requirements for bioanalytical methods are driven by emerging trends such as personalized medicine or pathogen detection in environment or food. Therefore, innovative tools for diagnostics are needed, to be used outside of dedicated laboratories and with less qualified personnel at minimal costs. Plasmonic nanostructures promise to provide sensing capabilities with the potential for ultrasensitive and robust assays in a high parallelization, and without the need for marker. Upon binding of molecules, the localized surface plasmon resonance (LSPR) of these structure is changed, and can be used as sensoric readout. Here the use of individual nanostructures (such as gold nanoparticles) for the detection and manipulation of biomolecules (e.g. DNA) based on optical approaches is presented [1]. Holes in a Cr layer present an interesting approach for bioanalytics. They are used to detect even single plasmonic nanoparticles as labels or to sense the binding of DNA on these particles. This hybrid system of hole and particle allows for simple (just using RGB-signals of a CCD [2]) but a highly sensitive (one nanoparticle sensitivity) detection. Moreover, the binding of a molecular layer around the particles can be detected using spectroscopic features of just an individual particle [3]. The change in LSPR of individual metal nanoparticles is utilized to monitor the binding of DNA directly or via DNA-DNA interaction. The influence of different size (length) as well as position (distance to the particle surface) is thereby studied [4] using a dark-field approach developed a century ago [5]. The established serial approach is compared with traditional SPR [6] and now further developed into a parallel readout using imaging spectrometric sensing based on interferometry and Fourier transformation [7]. Besides sensing, individual plasmonic nanostructures can be also used to optically manipulate biomolecular structures such as DNA. Attached particles can be used for local destruction [8] or cutting as well as coupling of energy into (and guiding along) the molecular structure upon laser irradiation [9]. The resonance wavelength of these particles can not only manipulated by their inherent properties (material, geometry) or their surrounding, but also by coupling with adjacent metal films due to interferometric effects [10] or gap modes.

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[7] D. Zopf, J. Jatschka, A. Dathe, N. Jahr, W. Fritzsche, O. Stranik: Hyperspectral imaging of plasmon resonances in metallic nanoparticles. Biosensors and Bioelectronics 81, 287-293 (2016)
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[9] J. Wirth, F. Garwe, G. Haehnel, A. Csaki, N. Jahr, O. Stranik, W. Paa and W. Fritzsche, *Nano Letters* 11 (4), 1505-1511 (2011).; J. Toppari, J. Wirth, F. Garwe, O. Stranik, A. Csaki, J. Bergmann, W. Paa, W. Fritzsche, ACS Nano 7, 1291-1298 (2013); J. Wirth, F. Garwe, J. Bergmann, W. Paa, A. Csaki, O. Stranik, W. Fritzsche. Nano Letters 14, 570-577 (2014)
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You are cordially invited to attend!