O 95: Other And Miscellaneous

Time: Thursday 12:00–13:00 Location: MA 144

O 95.1 Thu 12:00 MA 144

Sub-Pulse Formation and Limit-Cycle Oscillations in an Infrared FEL Oscillator — •Riko Kiessling[1], Sandy Gewinner[1], Wieland Schöllkopf[1], William Bill Colson[2], Martin Wolf[1], and Alexander Paarmann[1] — [1]Fritz-Haber-Institut der MPG, Berlin, Germany — [2]Naval Postgraduate School, Monterey, California, USA

Due to their high brightness, ultrashort pulse generation and widely tunable spectral range - from THz photons up to hard X-ray radiation - free-electron laser (FEL) light sources provide unique possibilities for scientific research. Besides that, the FEL itself posseses interesting nonlinear dynamics in the relativistic regime governed by short optical pulses and electron bunches.

Here, we present experimental and theoretical investigations on the sub-pulse formation and limit-cycle oscillations in an infrared FEL oscillator. Cavity shortening is found to be critical for the optical pulse creation. Utilizing a cross-correlation technique with a low-jitter synchronized table-top laser, we observe the build-up and evolution of multiple-peaked FEL pulses, composed of ps-short sub-pulses. The resulting oscillations of the emitted FEL power on a micro-second timescale represent a stable limit-cycle mode of the nonlinear FEL electron-photon system. Our observations are in agreement with predictions based on Maxwell-Lorentz theory [1] and might be of relevance also for recently proposed X-ray FEL oscillators [2].

[1] W. B. Colson, Phys. Quantum Electron. 8, 457 (1982)
[2] K.-J. Kim et al., Phys. Rev. Lett. 100, 244802 (2008)

O 95.2 Thu 12:15 MA 144

Conductance of a Freestanding Conjungated Wire — •Torben Jasper-Tönnies[1], Aran Garcia-Lekue[2,3], Thomas Frederiksen[2,3], Sandra Ulrich[4], Rainer Herges[4], and Richard Berndt[1] — [1]Institut für Experimentelle und Angewandte Physik, Christian-Albrechts-Universität, 24098 Kiel, Germany — [2]Donostia International Physics Center, Paseo Manuel de Lardizabal 4, Donostia-San Sebastián, Spain — [3]IKERBASQUE, Basque Foundation for Science, Bilbao, Spain — [4]Otto-Diels-Institut für Organische Chemie, Christian-Albrechts-Universität, 24098 Kiel, Germany

A free-standing molecular wire is placed vertically on Au(111) using a platform molecule and contacted by a scanning tunneling microscope. Despite the simplicity of the single-molecule junction its conductance G reproducibly varies in a complex manner with the electrode separation. Transport calculations show that G is controlled by a deformation of the molecule, a symmetry mismatch between the tip and molecule orbitals, and the breaking of a C≡C triple in favor of a Au–C bond. This tip-controlled reversible bond formation and rupture alters the electronic spectrum of the junction and the states accessible for transport, resulting in an order of magnitude variation of the conductance. Financial support by the Deutsche Forschungsgemeinschaft (SFB 677) and the Basque Department of Education (PI-2016-1-0027) is gratefully acknowledged.

O 95.3 Thu 12:30 MA 144

Surface characterisation of bacteria and biofilms with near-ambient pressure X-ray photoelectron spectroscopy — •Marit Kjaervik[1], Paul Dietrich[2], Andreas Thissen[2], Karin Schwibbert[1], and Wolfgang Unger[1] — [1]Bundesanstalt für Materialforschung und -prüfung, Berlin, Germany — [2]SPECS Surface Nano Analysis GmbH, Berlin, Germany

The XPS information depth of approximately 10 nm is in the same size range as the outer membrane of the gram-negative bacteria, which makes XPS a suitable tool for determining the elemental composition of the bacterial surface and monitor changes caused by outer stress like dehydration or exposure to antimicrobials. However, bacteria are inherently in a hydrated state, and therefore only compatible to ultra-high vacuum after extensive sample preparation, which may degrade the sample constituents. This issue is addressed by the development of near-ambient pressure (NAP)-XPS, which enables bacteria and biofilms to be characterised in their native wet state. Artificial biofilms, bacteria and biofilms of Escherichia coli have been characterised with the laboratory NAP-XPS instrument EnviroESCA from SPECS GmbH, at pressures ranging from high vacuum to 12 mbar, and in both humid and dry environment. By studying biological samples in their native wet state, new insight about composition and transport of drugs through cell membranes and the extracellular polymeric substance (EPS) of biofilms can be obtained. In this contribution, the latest progress on biofilm characterisation by NAP-XPS will be presented, and measurement capabilities and limitations will be discussed.

O 95.4 Thu 12:45 MA 144

Development of a Novel Reflection High-Energy Positron Diffractometer at NEPOMUC — •Matthias Dodenhöft, Sebastian Vohburger, and Christoph Hugenschmidt — Heinz Maier-Leibnitz Zentrum (MLZ) and Physik Department E21, Technische Universität München, 85748 Garching, Germany

The arrangement of surface atoms is an important input parameter for density functional theory (DFT) calculations of the electronic structure at the surface. It has been shown that Total Reflection High-Energy Positron Diffraction (TRHEPD) is an ideal technique to determine the structure of the topmost and the immediate subsurface atomic layer of crystal surfaces. In contrast to electrons that are used in Reflection High-Energy Electron Diffraction (RHEED), positrons exhibit the phenomenon of total reflection for glancing angles smaller than the critical angle θc leading to the outstanding surface sensitivity of TRHEPD. Additional information about near-surface layers can be obtained by increasing the glancing angle above the critical angle.
Currently, we develop a new TRHEPD setup that will be coupled to the high-intensity positron source NEPOMUC in 2018. The TRHEPD setup features UHV down to 10^{-10}mbar, sample temperatures up to 1000°C and a RHEED system for complementary measurements. In combination with the existing Surface Spectrometer (SuSpect), NEPOMUC will provide a unique ensemble to characterize surfaces using positrons. This project is supported by the BMBF (funding number 05K16WO7).