O 64: Poster: Surfaces, Interfaces and Heterostructures (HL jointly with O)

Time: Wednesday 17:00–20:00 Location: P1

O 64.1 Wed 17:00 P1

Waveguide Quantum Electrodynamics - Nonlinear Physics at the Few-Photon Level — Tobias Sproll[1], Christoph Martens[1], •Michael Schneider[1], Peter Schmitteckert[2], and Kurt Busch[1,3] — [1]Max-Born-Institut, Max-Born-Str. 2A, 12489 Berlin, Germany — [2]Institut für Nanotechnologie, Karlsruher Institut für Technologie (KIT), 76344 Eggenstein-Leopoldshafen, Germany — [3]Humboldt-Universität zu Berlin, Institut für Physik, AG Theoretische Optik und Photonik, Newtonstr. 15, 12489 Berlin, Germany

The transport of few photons in 1D structures coupled to a fermionic impurity gives rise to a set of non-linear effects, induced by an effective interaction due to Pauli blocking such as photon bunching and the formation of atom-photon bound states.
We analyze a specific example of such systems, namely a 1-D waveguide coupled to a 2-level system, for the case of one and two-photon transport. Therefore we have developed a general theoretical framework, which contains analytic approaches originating in methods of qutantum field theory, like path integrals and Feynman diagrams as well as powerful numerical tools based on solving the time-dependent Schrödinger equation.
Owing its generality, our approach is also applicable to more involved setups, including disorder and dissipation as well as more complicated impurities such as driven and undriven 3-level systems.

O 64.2 Wed 17:00 P1

Defect states and band bending effects at c-Si(111)/a-SiN:H interfaces — •Leif Eric Hintzsche[1], Changming Fang[1], Gerald Jordan[1], Martijn Marsman[1], Machteld Lamers[2], Arthur Weeber[2], and Georg Kresse[1] — [1]University of Vienna, Faculty of Physics and Center for Computational Materials Science, Sensengasse 8/12, A-1090 Vienna, Austria — [2]ECN Solar Energy, P.O. Box 1, 1755 ZG Petten, Netherlands

High performance solar cells based on crystalline silicon (c-Si) still play a major role in the photovoltaic market, and amorphous silicon nitride (a-SiN:H) often serves as anti-reflection coating (ARC) and passivation layer on top of those cells. The passivation properties are, thereby, strongly influenced by electronic defect states at the interface. In present study, these defects have been investigated by using ab intio molecular dynamics. We prepared 900 different c-Si/a-SiN:H structures and classified the most important defect types at the interface. Afterwards, we examined their energetic and spacial localization, and their band structure. We generally find higher defect concentrations at the interface, which are dominated by occupied, localized states in the a-SiN part and unoccupied, delocalized states in the c-Si part. While the former are mainly localized at under-coordinated Si atoms, the latter have rather inherited the character of the c-Si conduction band. We argue that this difference is a strong evidence for the band bending effect at the c-Si/a-SiN:H heterojunction.

O 64.3 Wed 17:00 P1

Influence of surface treatment on NV centers in diamond — •Stefan Borgsdorf[1], Lina Elbers[1], Aniela Scheffzyk[1], Daniel Laumann[1], Christian Klump[1], Andreas Kaivas[1], Ulrich Köhler[1], Dieter Suter[2], and Frederico D. Brandao[2] — [1]Experimentalphysik IV, AG Oberflächen, Ruhr-Universität Bochum — [2]Experimentelle Physik IIIA, TU Dortmund

Color centers in diamond, especially NV centers, are practical single photon emitters due to RT operation and candidates for applications in quantum computing. We present a setup for low energy implantation of NV centers near the surface possibly allowing electrical addressing. Furthermore, we survey the influence of different surface and bulk treatments on the diamond and its NV centers. To purify the diamonds we reduced the amount of natural NV centers in optical grade diamonds by heating up to 1500 °C in hydrogen. The luminous intensity could be reduced down to 1/8. The optical grade diamonds were used for first implantations with N15 in discrete lines. Further, electronic grade diamonds will be applied. To control the charge state of the NV centers, the surface was terminated by Hydrogen or Fluorine via a H2- and a CF4-Plasma, respectively. HREELS and AFM measurements were executed to study the surface after plasma treatment. Likewise, the influence of optical transparent passivation layers on the intensity and charge state are object of interest. Finally a UHV chamber is modified to implant directly under UHV conditions and to allow in situ spectroscopic access to the diamond samples.

O 64.4 Wed 17:00 P1

Investigation of Charge Transport across GaN-Pt Interfaces by Conductive Atomic Force Microscopy — •Sebnem Tuncay, Andrea Winnerl, Rui Nuno Pereira, and Martin Stutzmann — Walter Schottky Institut, Technische Universität München, Germany

GaN-based semiconductors have attracted great attention for applications including optoelectronics, high-power, high-frequency electronics and biosensing. Besides that, GaN-Pt systems have a considerable potential for future applications in photocatalysis and photoelectrochemical processing. For the latter applications charge transport across interfaces between GaN and metals or electrolytes are of central importance.

In this context, we investigate the charge transport across GaN-Pt interfaces. For sample preparation we use spin-coating in order to deposit Pt nanoparticles on n-type or p-type GaN layers. Using atomic force microscopy and scanning electron microscopy, we image the surface morphology of GaN layers grown on sapphire substrates and characterize the spatial distribution of Pt nanoparticles on such GaN surfaces. Conductive atomic force microscopy enables us to measure and map currents between the Pt nanoparticles and the GaN surface. The current-voltage characteristics of Pt nanoparticles on GaN show Schottky behaviour. Comparing the current-voltage characteristics measured on Pt nanoparticles and directly on the GaN surface is used to understand details of the charge transport across GaN-Pt interfaces.

O 64.5 Wed 17:00 P1

Impact of high temperature annealing on Pd/GaN(0001) contact morphology — •Justyna Pers[1], Miłosz Grodzicki[2], Piotr Mazur[3], Stefan Zuber[4], and Antoni Ciszewski[5] — [1]Institute of Experimental Physics, University of Wrocław, pl. Maksa Borna 9, 50-204 Wrocław, Poland — [2]Institute of Experimental Physics, University of Wrocław, pl. Maksa Borna 9, 50-204 Wrocław, Poland — [3]Institute of Experimental Physics, University of Wrocław, pl. Maksa Borna 9, 50-204 Wrocław, Poland — [4]Institute of Experimental Physics, University of Wrocław, pl. Maksa Borna 9, 50-204 Wrocław, Poland — [5]Institute of Experimental Physics, University of Wrocław, pl. Maksa Borna 9, 50-204 Wrocław, Poland

Metal/GaN junction is the necessary part of each modern electronic and optoelectronic devices based on GaN; on the one hand as the ohmic contact for communication, and on the other as Schottky contacts in active devices or diodes. This report concerns Pd layers deposited under ultrahigh vacuum conditions onto n-type GaN(0001) crystals kept at room temperature. Combined surface techniques as XPS, UPS, STM and LEED were used to investigate physicochemical properties of the Pd/GaN(0001) contacts. The obtained Pd films have a grainy morphology beginning from the earliest stage of growth. Electron affinity of the clean n-GaN surface amounts to 3.1 eV. The work function of the Pd film of mean thickness of 1 nm is equal to 5.3 eV. The Schottky's barrier height of the Pd/GaN(0001) junction has the value to 1.60 eV. After heating at 800°C of the Pd/GaN interface, the formation of Pd-Ga alloy is observed.