DPG-Frühjahrstagung 2015
(DPG Spring Meeting)
79th Annual Meeting of the DPG
and DPG-Frühjahrstagung of the
Condensed Matter Section (SKM)

together with the Divisions
History of Physics
Gravitation and Relativity (together with the Astronomische Gesellschaft e. V.)
Microprobes
Theoretical and Mathematical Physics

and Working Groups
Energy
Equal Opportunities
Information
Philosophy of Physics
Physics and Disarmament
young DPG

Job Market
Symposia
Tutorials
Exhibition of Scientific Instruments and Literature

Berlin
March 15 – 20, 2015
### HL 45: Organic electronics and photovoltaics: OPV II (CPP with HL/TT)

**Location:** C 130

**Time:** Wednesday 9:30–13:00

**Details:** CPP 36 for details of this session.

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<th>Time</th>
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<td>10:30–13:30</td>
<td><strong>HL 46: Graphene: Dynamics (O with HL/TT)</strong></td>
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<td>10:30–13:30</td>
<td><strong>HL 47: Frontiers of electronic structure theory: Organics and materials</strong></td>
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<td>11:00–13:30</td>
<td><strong>HL 48: Focus Session (with O): Nanophotonic concepts and materials for energy harvesting - Plasmonics, transformation optics, upconversion, and beyond!</strong></td>
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Nanostructured and novel photonic materials can control the spectral composition of light, its propagation characteristics, and its interaction with matter. The use of these abilities is particularly rewarding in the context of energy harvesting in semi-conductor materials. This focused session appreciates and presents the most recent advancement in this field of research, where progress has been made from a conceptual but also from a materials perspective.

**Organizers:** Carsten Rockstuhl (KIT, Karlsruhe), Jan Christoph Goldschmidt (FhG ISE, Freiburg), Ralf Wehrspohn (MLU Halle), Uli Lemmer (KIT, Karlsruhe)

**Location:** EW 201

**Time:** Wednesday 11:00–13:00

**Talk:**
- **HL 48.1** Wed 11:00 EW 201
  - **Transformation Optics: From Fundamentals to Applications for Energy Harvesting**
  - **Martin Wegener** and **Martin Schumann** — Institute of Applied Physics and Institute of Nanotechnology, Karlsruhe Institute of Technology, D-76138 Karlsruhe, Germany
  - **Involvement optoelectronics can be seen as a versatile tool for designing devices in space and other areas of physics. In this talk, we start by giving a broad introduction to this concept. A striking paradigm is invisibility cloaking. We briefly review the experimental demonstrations in optics, thermodynamics, and mechanics.**
  - **To this end, we discuss a possible application:** In order to extract the electrical current from solar cells, metal contacts at the sun-facing surface are required. Unfortunately, these contacts create optically dead areas, reducing the overall energy per area by a few percent. We present a solution to this problem by using nanostructures that are designed by transformation optics and that cloak solar cells. An experimental proof-of-principle demonstration based on three-dimensional direct-laser-writing optical laser lithography is given.

**Talk:**
- **HL 48.2** Wed 11:30 EW 201
  - **Nanostructures and materials for intermediate band solar cells — Antonio Lázaro**
  - **Instituto de Energía Solar, ETSI Telecomunicación, Universidad Politécnica de Madrid, Spain**
  - **Solar cells seek materials that can harvest photons of energy lower than the semiconductor bandgap without degrading the efficiency of the cell. One of these material systems relies on the use of quantum dots (QD). Under this approach, photons are harvested thanks to the absorption of the electrons confined in the quantum dots. In this contribution, we review the theory that sustains the use of QDs for ISBC applications, the development of these kind of solar cells, its limitations and challenges as well as the most recent experimental results. These experimental results refer to the demonstration of the use of two below bandgap energy photons to excite the electron-hole pair and the preservation of the output voltage of the cell.**

**Talk:**
- **HL 48.3** Wed 12:00 EW 201
  - **Emission quenching of magnetic dipole transitions near an absorbing optical nanoantenna**
  - **Dmitry Chigrin** and **Gero von Plessen** — RWTH Aachen University, 52074 Aachen, Germany
  - **This work demonstrates the feasibility of using plasmonic nanostructures to enhance the emission of quantum emitters.**

**Talk:**
- **HL 48.4** Wed 12:15 EW 201
  - **Light trapping with combined photonic elements**
  - **Audi Abas** and **Björn Madsen** — **Institute of Nanotechnology, Karlsruhe Institute of Technology, 76121 Karlsruhe, Germany**
  - **Photonic Research Group (INTIC), Gifant University-Inno, Stift-Postnauwewstraat 41, B-9000 Ghent, Belgium**
  - **Micro- and Nanophotonic Materials Group, Faculty of Science, University of Mons, 20 place du Parc, B-7000 Mons, Belgium**
  - **This work demonstrates the feasibility of using plasmonic nanostructures to enhance the emission of quantum emitters.**

**Talk:**
- **HL 48.5** Wed 12:30 EW 201
  - **Tailoring Disorder of Nanophotonic Light-Trapping Concepts for Thin-Film Silicon Solar Cells**
  - **This work demonstrates the feasibility of using plasmonic nanostructures to enhance the emission of quantum emitters.**

**Talk:**
- **HL 48.6** Wed 12:45 EW 201
  - **Opaline Photonic Crystals as Back Side Reflectors for Thin-Film Silicon Solar Cells**
  - **Daniela Schiavon**, **Frederik Birn**, **Alexandru N. Sprake**, **Ralf B. Wehrspohn**, **André Hoffmann**, **Karsten Bittrka**, **Reinhart Carus**, **Samuel Wiesendanger**, and **Carsten Rockstuhl** — **Martin-Luther-Universität Halle-Wittenberg, Germany**

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Contribution submission to the conference Berlin 2015

Light trapping with combined photonic elements — ●Aimi Abass\textsuperscript{1} and Bjorn Maes\textsuperscript{2,3} — \textsuperscript{1}Institute of Nanotechnology, Karlsruhe Institute of Technology, 76021 Karlsruhe, Germany — \textsuperscript{2}Photonics Research Group (INTEC), Ghent University-imec, Sint-Pietersnieuwstraat 41, B-9000 Ghent, Belgium — \textsuperscript{3}Micro- and Nanophotonic Materials Group, Faculty of Science, University of Mons, 20 place du Parc, B-7000 Mons, Belgium

Nanophotonics offers many avenues for enhancing solar cells. For example, one can tailor the incoming light flow to boost absorption via nanostructures. To ensure strong absorption over the whole spectral range of interest, one has to utilize many photonic phenomena. Oftentimes however, the nanoscale geometrical requirements for optimum excitation of one phenomenon can be at the expense of another. To address this challenge, we examine light trapping strategies with combined photonic elements and study conditions under which different elements complement each other. Here, we discuss the usage of dual interface gratings (DIGs) and diffuser-grating structures. The former enhances absorption by relying on guided mode excitation while the latter focuses on antireflection and scattering management. In such structures the responsibility of different optical components is split, enabling more flexibility in optimization. One main point of discussion is multiperiodic DIG systems, which provide a rich Fourier spectrum, while maintaining a straightforward geometry. In studying combined diffuser-grating structures, we developed a memory efficient calculation method, which evades dealing with rough diffuser geometries directly.

Part: HL
Type: Post-Deadline-Vortrag;Post Deadline Talk
Topic: Post-deadline-Beiträge; Post-deadline contributions
Email: aimiabass@gmail.com