

Program of the delayed 32nd winter workshop on quantum solar energy conversion, Rauris, March 20-25, 2022

As a result of the Corona pandemic, the 32nd winter workshop of 2020 has been delayed until the year 2022. This is thus an attempt to restart with the intense and high-level presentations and discussions on the chemistry and physics of photovoltaic materials and the science&engineering of solar (fuel) cells.

All measures are taken that the workshop can proceed in legal and safe conditions. The lectures are given in the spacious "Mesnerhaus" a few minutes away from the hotel. Facial FFP2 masks have to be worn during the lectures (except for the lecturer). All other activities are taking place under close-to-normal conditions in the hotel Rauriserhof.

A proof of vaccination or recent recovery from a Covid infection („2G“) is required for the participants of the workshop. Further requirements may apply for entering Austria or re-entering your country of permanent residence.

Organizers: Daniel Vanmaekelbergh, Linda Kumeling and Christian Königstein

Contents:

- Physics of solar cell materials, solar cell analysis
- Organic solar cells, Dye cells
- Structure and dynamics at interfaces: Dye cells, fuel generation, photocatalysis
- Perovskite materials and solar cells

Lecturers: please be aware that this is a workshop with *a key-role for interaction and discussion*. Please, prepare your lecture as follows: general framework with open questions (5 minutes), research results (15-20 min), discussion time: 5-10 minutes.

The Friday is open for more contributions and (organized) discussions.

Program updated on March 11, 2022

Programm

Sunday 20 March 2022

18:00 -18:30	Reception	Reception, Welcome and Introduction by Daniel Vanmaekelbergh
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Monday 21 March

Chemistry&Physics of solar cell materials	Lecturer, University, research area	Title of the contribution
9.00 – 9.30	Avi Niv, Ben Gurion Univ. <i>Optics, solar cell analysis</i>	Thermodynamic lessons of the detailed-balance principle of the photovoltaic effect
9.30 – 10.00	Hai Wang, Max Planck Institute for Polymer Research, Mainz <i>Low-dimensional opto-electronic materials</i>	Good defects at interfaces: exploiting defects at van der Waals interfaces between layered materials
10.00 – 10.30	Celso de Mello Donega, Univ. Utrecht <i>Low-dimensional semiconductors</i>	Emerging Strategies for the Rational Synthesis of Copper-Chalcogenide Based Hetero-Nanorods
10.30 – 11.00	Coffee break	
11.00 – 11.30	Laurens Siebbeles, TUDelft <i>Carrier Dynamics in low-dimensional materials</i>	Stability and quantum-motion of multiple excitons in CdSe nanoplatelets
11.30 – 12.00	Oskar Sandberg, Swansea Univ. <i>Carrier dynamics, transport</i>	Understanding processes limiting the collection of photogenerated carriers in organic photovoltaic devices

Perovskite materials & Cells	Lecturer, University, research area	Title of the contribution
17.00 – 17.30	Efrat Lifshitz, Technion, Haifa <i>Magneto-optical spectroscopy of low-dimensional semiconductors</i>	The influence of intrinsic magnetism on optoelectronic properties of 2D semiconductors
17.30 – 18.00	Leor Kronik, Weizmann Institute, Rehovot <i>Quantum theory of materials</i>	Defects, defect tolerance, and self-healing in lead halide perovskites: a first principles perspective
18.00 – 18.30	David Cahen, Weizmann Institute, Rehovot <i>Chemistry of materials</i>	Tautology, Oxymoron, or a matter of timescales? Defects and Halide Perovskites

Tuesday 22 March

Chemistry&Physics of solar cell materials	Lecturer, University, research area	Title of the contribution
9.00 – 9.30	Alessio Gagliardi, TU München <i>Simulation of nanostructured solar cells</i>	Machine learning to investigate material properties: how to improve machine performance
9.30 – 10.00	Susanne Siebentritt, Univ. de Luxembourg <i>Physics of solar cell materials</i>	The diode factor in solar cells with metastable behavior
10.00 – 10.30	Daniel Vanmaekelbergh, Univ. Utrecht <i>Low-dimensional semiconductors and topological insulators</i>	The band-edge light absorptance of all semiconductors is ruled by the fine structure constant.
10.30 – 11.00	Coffee break	
11.00 – 11.30	John Lupton, Univ. Regensburg <i>Optical spectroscopy of solar materials</i>	Single-photon spectroscopy for energy conversion applications
11.30 – 12.00	Doron Naveh, Bar Ilan Univ. Two-dimensional (layered) materials	Photoconductivity of intercalated MoS ₂

Structure of- and dynamics at interfaces		
17.00 – 17.30	Thomas Hannappel, TU Ilmenau <i>Concentrated III-V photovoltaics, fuel production</i>	Electrical multi-probe studies on nanowires for solar energy conversion
17.30 – 18.00	Wolfram Jägermann, TU Darmstadt <i>Material science for renewable energy</i>	The Role of Electronic Bulk and Surface Structures for Efficient Photo-electro-synthesis
18.00 – 18.30	Thomas Mayer, Surface Science Lab, TU Darmstadt, Germany	Is the working principle of perovskite solar cells n-i-p or n-n-p? The controversy on perovskite doping
21.00 – 22.00	General Assembly	Future of ESQSEC, introductory discussion on new Director, summerschool, next workshop

Wednesday 23 March

Perovskite materials and cells	Lecturer, University, research area	Title of the contribution
9.00 – 9.30	David Egger, TU München <i>Theory of Energy Materials</i>	Optoelectronic Properties of Halide Perovskites at Finite Temperature
9.30 – 10.00	Norbert Koch, Humboldt Univ., Berlin <i>Low-D semiconductors, perovskites</i>	Electronic properties of hybrid metal halide perovskites: Contemporary understanding and future challenges
10.00 – 10.30	Omer Yaffe, Weizmann Institute, Rehovot <i>Structural reconfiguration in solids</i>	Inelastic light scattering from disordered crystals
10.30 – 11.00	Coffee break	
11.00 – 11.30	Gary Hodes, Weizmann Institute <i>Low-dimensional semiconductors, perovskites</i>	Metal-free halide perovskites
11.30 – 12.00	Bruno Ehrler, AMOLF, Center for Nanophotonics, Amsterdam <i>Perovskite materials, nanostructures</i>	What can we learn from capacitance measurements about ion migration in metal halide perovskites?

Perovskite materials and cells		
17.00-17.30	Simon Zeder, Ecole Polytechnique, Lausanne <i>Optics of photovoltaic materials</i>	Analysis of photon recycling in perovskite solar cells based on fully coupled opto-electronic simulation
17.30 – 18.00	Ute Cappel, KTH - Royal Institute of Technology, Sweden <i>Dye cells and organic cells</i>	Perovskite interfaces for solar cells investigated with photoelectron spectroscopy
18.00 – 18.30	Davide Cerrati, CNRS, France	Light-Soaking, Photo-Damage and Self-Healing in Halide Perovskites

Thursday 24 March

Perovskite-, organic-, and Dye cells	Lecturer, University, research area	Title of the contribution
9.00 – 9.30	Igal Levine, HZB Berlin	Understanding sub-bandgap luminescence in Ruddlesden-Popper 2D hybrid perovskites
9.30 – 10.00	Carsten Deibel, Chemnitz Univ. <i>Organic Photovoltaics</i>	Defect spectroscopy in perovskite solar cells: trapped electrons or moving ions?
10.00 – 10.30	Rowan MacQueen, Helmholtz Berlin Organic/inorganic interfaces	Carrier dynamics in upconverting thin-film perovskite/rubrene bilayers studied by surface photovoltage and photoluminescence
10.30 – 11.00	Coffee break	
11.00 – 11.30	Marina Freitag, Newcastle University, UK	Diffuse light harvesting to structured information
11.30 – 12.00	Armin Ardalan, Univ. of Swansea <i>Organic solar cells</i>	Sub-bandgap Photo-response of Organic and Inorganic Solar Cells: Measurement Limitations, and Possible Improvements

Chemistry & Physics of solar cell materials		
17.00-17.30	Branislav Dzurnak Tech. Univ. of Praag	Universal figure of merit of luminescent dye solar concentrators
17.30 – 18.00	Wilfried van Sark (Utrecht Univ.) <i>Luminescent light concentrators, solar cell integration</i>	Luminescent solar concentrators based on quantum dot luminophores
18.00 – 18.30	Conclusions	

Friday is open for further contributions or individual discussions