



אוניברסיטת בן-גוריון בנגב
Ben-Gurion University
of the Negev

Program
20th Sede Boqer Symposium
on Solar Electricity Production
jointly with the
IKI Annual Nano-Day
and the
BGU-ENEA WORKSHOP
September 26-28, 2016

Saluting the Adelis Foundation for their
Vital Partnership with Ben-Gurion
University

Sponsored by:



The Jacob Blaustein Center for Scientific Cooperation
The Jacob Blaustein Institutes for Desert Research
Ben-Gurion University of the Negev



Ilse Katz Institute for
Nanoscale Science and Technology



Italian National Agency for New Technologies,
Energy and Sustainable Economic Development



Ministry of National Infrastructure,
Energy and Water Resources
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Via the Italian Ministry of Foreign Affairs and
International Cooperation (MAECI)

Program

Monday, September 26, 2016

9:00-10:00 Arrival at the **Ilse Katz Institute for Nanoscale Science & Technology**, Marcus Family Campus, Ben-Gurion University of the Negev, Beer-Sheva. **Registration. Coffee & refreshments**

10:00-10:30 **Opening Greetings – IKI Nano-Day**

Chair: Prof. **Yuval Golan**, Director, **IKI**

Prof. **Steve Rosen**, Vice-President for External Affairs, Ben-Gurion University

Prof. **Daniel Feuermann**, Blaustein Institutes for Desert Research, on the Adelis contribution to alternative energy research

Dr. **Rona Sarfaty**, Ministry of National Infrastructures, Energy and Water Resources

10:30-12:10 **Session 1.1: Nanostructured Materials and Devices for Solar Energy Conversion**

Chair: Prof. **Nurit Ashkenazi**, Ben-Gurion University

1. *Carbon Nanotubes-Polythiophene Polymer and Fullerene Polythiophene: From Challenge of dispersion to incorporation in electrospun fiber*
C. Biounioux¹, R. Avrahami², G. Vasilyav², N. Patil², A. Shames⁴, E. Zussman², E. Katz^{3,5}, R. Yerushalmi-Rozen^{4,5}, ¹Dept. of Materials Science & Univ. Center for Nano Science and Nanotechnology, Tel Aviv University, Tel Aviv, Israel, ²Dept. of Mechanical Engineering, Technion, Haifa, Israel, ³Blaustein Institutes, Sede Boqer Campus, Ben-Gurion University, Beer-Sheva, Israel, ⁴Dept. of Chemical Engineering, Ben-Gurion University, Beer-Sheva, Israel, ⁵Ilse Katz Institute for Nanoscale Science and Technology, Ben-Gurion University, Beer-Sheva, Israel
2. *Improving the Radiation Hardness of Space Photovoltaic Cells using Nano-Photonic Light Trapping Structures*
A. Mellor¹, N.P. Hylton¹, H. Hauser², T. Thomas¹, Y. Al-Saleh¹, V. Giannini¹, **A. Braun**¹, B. Bläsi², S. A. Maier¹, N.J. Ekins-Daukes¹, ¹Dept. of Physics, Imperial College, London, U.K., ²Fraunhofer Institute for Solar Energy Systems ISE, Freiburg, Germany
3. *Entirely-inorganic Sensitizers for Anatase Nanocrystals in Water*
M. Raula and **I. A. Weinstock**, Dept. of Chemistry and the Ilse Katz Institute for Nanoscale Science and Technology Ben-Gurion University, Beer-Sheva, Israel
4. *Designing Bimetallic Reduction Co-Catalysts – Correlating Atomic Structure with Properties*
M. Bar Sadan, Dept. of Chemistry and the Ilse Katz Institute for Nanoscale Science and Technology, Ben-Gurion University, Beer-Sheva, Israel
5. *Heterojunction Based Hybrid Silicon Nanowire Solar Cell*
M. Y. Bashouti¹, J. Ristein², S. H. Christiansen³, ¹Blaustein Institutes, Ben-Gurion University, Sede Boqer Campus, Israel, Dept. for Laser Physics, University of Erlangen-Nürnberg, Germany, ³Max-Planck Institute for the Science of Light, Erlangen, Germany

12:10-13:30 **Lunch**

13:30-14:15 Session 1.2: Invited Keynote Lecture

Chair: Dr. **Alexis Vossier**, CNRS, PROMES Laboratory, Odeillo, France

Ultra-thin solar cells: Promise, Recent Progress and Future Challenges

Dr. Stéphane Collin

Laboratoire de Photonique et de Nanostructures (CNRS/LPN), France

14:15-16:15 Session 1.3: Photonic Nanostructures and Light Management for Highly Efficient Solar Cells

Chair: TBD

1. *Thermally Enhanced Photo-Luminescence Device for Solar Energy Under Practical Conditions*
N. Kruger¹, M. Kurtulik², A. Manor², T. Sabapathy³ and C. Rotschild³, ¹ Grand Energy Program, ²Russell Berrie Nanotechnology Inst., ³Dept. of Mechanical Engineering, Technion, Haifa, Israel
2. *Effect of Plasmonic Features Induced by Au@SiO₂ Particles in Solid-State Dye-Sensitized Solar Cells*
A.A. Melvin¹, M. Abbas², L. Hirsch², S. Mornet³, C. Olivier⁴, M. Tréguer³ and T. Toupance⁴, ¹Blaustein Institutes, Ben-Gurion University, Sede Boqer Campus, Israel, ²Univ. Bordeaux, IMS, Talence, France, ³Univ. Bordeaux, ICMCB, UPR, Pessac, France, ⁴Univ. Bordeaux, ISM, UMR, Talence, France.
3. *Non-Radiative Energy Transfer Mediated High Efficiency Radial p-n Junction Hybrid Solar Cells using Nanocrystalline Si Quantum Dots and Si Nanowires*
M. Dutta, International Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science, Tsukuba, Japan and Blaustein Institutes, Ben-Gurion University, Sede Boqer Campus, Israel
4. *All-Semiconductor Near-Infrared to Invisible Upconversion Nanoparticles*
A. Teitelboim and **D. Oron**, Dept. of Physics of Complex Systems, Weizmann Institute, Rehovot, Israel
5. *Ray optics light trapping beyond the Lambertian limit*
A. Niv and I. Frenkel, Blaustein Institutes, Ben-Gurion University, Sede Boqer Campus, Israel
6. *CdSe Nanoplatelets Sensitized Solar Cells*
M. Kazes¹, S. Luo², H. Lin² and D. Oron¹, ¹Dept. of Physics of Complex System, Weizmann Institute of Science, Rehovot, Israel, ²State Key Laboratory of New Ceramics & Fine Processing, Dept. of Material Science and Engineering, Tsinghua University, Beijing, P.R. China

16:15-16:45 Coffee Break**16:45-18:45 Session 1.4. Organic Photovoltaics**

Chair: Prof. **Guglielmo Lanzani**, Politecnico di Milano

1. *Investigation of the Effect of the Finite Conductivity of the Transparent Anode on the Efficiency of Organic Solar Cells*
D. Gotleyb and R. Shikler, Dept. of Electrical and Computer Engineering, Ben-Gurion University, Beer-Sheva, Israel

2. *Toward Mean Field Theory for Multi-Phase Donor/Acceptor Interfaces in Organic Photovoltaic cells*
A. Shapira¹, N. Gavish², I. Visoly-Fisher^{1,3} and A. Yochelis¹, ¹Blaustein Institutes, Ben-Gurion University, Sede Boqer Campus, Israel, ²Dept. of Mathematics, Technion, Haifa, Israel, ³Ilse Katz Institute for Nanoscale Science and Technology, Ben-Gurion University, Beer-Sheva, Israel
3. *Phthalocyanine Analogous as Promising Hole Transporting Materials for Perovskite Solar Cells**
G. Zanotti, P. Imperatori, G. Mattioli, S. Notarantonio, A. Paolett, G. Pennesi, CNR-ISM Via Salaria, Monterotondo Scalo, Italy
4. *The Role of Contact Injection, Exciton Dissociation and Recombination – Revealed through Voltage and Intensity Mapping of the Quantum Efficiency of Polymer:Fullerene Solar Cells*
L. Tzabari¹, J. Wang², Y.J. Lee², J. W.P Hsu² and N. Tessler¹, ¹Microelectronic and Nanoelectronic Centers, Electrical Engineering Dept., Technion, Haifa, Israel, ²Dept. of Materials Science & Engineering, Univ. of Texas, Richardson, USA
5. *Analysis of Open-Circuit Voltage Losses in Small Molecule Organic Solar Cells*
S. M. Tuladhar, J. Yao, T. Kirchartz and J. Nelson, Dept. of Physics and Centre for Plastic Electronics, Imperial College, London, U.K.
6. *Thermal Stability of Organic Photovoltaics*
H. Hoppe, Center for Energy and Environmental Chemistry Jena, Friedrich-Schiller-Universität, Jena, Germany

19:00-20:30 Dinner.

21:00 transportation to Sede Boqer

Tuesday, September 27, 2016

9:00 – 9:15 Arrival at the George Evens Family Auditorium, Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev (Midreshet Ben-Gurion), **Registration and coffee**

9:15-9:45 **Opening Greetings – 20th Sede Boqer Symposium & BGU-ENEA Workshop**

Chair: Prof. **Eugene Katz**, Blaustein Institutes, BGU
 Prof. **Boris Zaltzman**, Director, Blaustein Institutes, BGU
 Dr. **Stefano Boccaletti**, Italian Scientific Attache

9:45-10:30 **Session 2.1: Invited Keynote Lecture**

Chair: Dr. **Franco Roca**

Solution processable photovoltaics: Science and technology *

Prof. Guglielmo Lanzani

Politecnico di Milano, Milano, Italy

10:30-11:00 Coffee Break

11:00-13:00 **Session 2.2: Research Topics in Solar Energy Conversion**

Chair: Prof. **Avner Rothschild**, The Technion

1. *ENEA Activities in Solar Energy**
F. Roca, ENEA DTE-Energy Technologies Department, CR Portici, Naples, Italy
2. *Computer Modelling of Materials for PV Applications**
M. Celino and S. Migliori, ENEA DTE-ICT, Energy Technologies Department – Computing Systems and ICT Technology Development Division, CR Casaccia, Rome, Italy
3. *Biofuels and Biorefineries for Renewable Energy**
V. Pignatelli, ENEA DTE-BBC – Energy Technologies Department Bioenergy, Biorefinery and Green Chemistry Division, CR Trisaia, Italy
4. *Solar Energy in MIB-Solar**
M. Acciarri, MIBSOLAR, Università Milano Bicocca, Milan, Italy
5. *Hydrogen Storage and Spillover Kinetics in Carbon Nanotube-Mg Composites*
 E. Ruse^{1,2}, S. Pevzner¹, I. Pri-Bar², V. M. Skripnyuk³, **E. Rabkin**³ and O. Regev²,
¹Dept. of Chemistry, Nuclear Research Center Negev, Beer-Sheva, Israel, ²Dept. of Chemical Engineering, Ben-Gurion University, Beer-Sheva, Israel, ³Dept. of Materials Science & Engineering, Technion, Haifa, Israel
6. *Photovoltaic (PV) Modules Requirements from an Owner's Point of View*
R. Avin, Shikun & Binui Renewable Energy, Israel

* BGU-ENEA Workshop participant

13:00-14:30 Lunch

14:30-15:15 Session 2.3: Invited Keynote Lecture

Chair: Prof. **Daniel Feuermann**, Ben-Gurion University

State of the Art of Solar Tower Technology

Dr. Clifford Ho

Sandia National Laboratories, USA

15:15-16:45 Session 2.4: Concentrated Solar Power (CSP)

Chair: Prof. David Faiman, Ben-Gurion University

1. *Solar Electricity with Thermo-Electro-Chemical Storage (TECS)*
E. Wenger, M. Epstein and **A. Kribus**, School of Mechanical Engineering, Tel Aviv University, Tel Aviv, Israel
2. *Surface Roughness Metrics and its Relation to Heat Losses from Solar Vacuum Heat Collector Elements*
D. Nakar and D. Feuermann, Blaustein Institutes, Ben-Gurion University, Sede Boqer Campus, Israel
3. *Developments in the Shikun&Binui project at Ashalim*
C. Sugarmen, Shikun & Binui Renewable Energy, Israel
4. *Developments in the Brightsource Project at Ashalim*
B. Koretz, Brightsource Industries, Israel

16:45-17:15 Coffee Break

17:15-18:45 Session 2.5: Materials and Devices for Photo-Electrochemical and Photovoltaic Conversion of Sunlight

Chair: **Prof. Abraham Kribus**, Tel Aviv University

- 1+2. *Reflections on Rust: Iron Oxide Photoelectrodes for Solar Energy Conversion and Storage.*
A. Rothschild, Dept. Material Science & Engineering, The Technion, Haifa, Israel
3. *Unfolding Photo-anodic Water Splitting Mechanism on Iron Oxide Surface vis H₂O₂ Reactions*
Y. Y. Avital¹, H. Dotan², I. Visoly-Fisher¹, A. Rotschild² and A. Yochelis¹, ¹Blaustein Institutes, Ben-Gurion University, Sede Boqer Campus, Israel, ² Dept. Material Science & Engineering, The Technion, Haifa, Israel
4. *Generalized Mean-Field Theory for Electrolytes: From Dilute to Molten Salts*
D. Elad¹, N. Gavish¹ and A. Yochelis², ¹Dept. of Mathematics, Technion, Haifa, Israel, ²Blaustein Institute, Ben-Gurion University, Sede Boqer Campus, Israel
5. *Structural, Optical and Photoelectric Properties of Femtosecond Laser-Modified a-Si:H Films*
M. V. Khenkin¹, R. Drevinkas², P. Kazansky² and A. G. Kazanskii³, ¹ Blaustein Institutes, Ben-Gurion University, Sede Boqer Campus, Israel, ²Physics Dept., Lomonosov Moscow State University, Moscow, Russia, ³Opotoelectronics Research Centre, University of Southampton, Southampton, U.K.

18:45-20:15 Dinner

20:15-22:00 Astronomy – The Desert Skies of September

The opportunity of observing the wondrous night sky under the dark-sky conditions available in the Negev Highlands desert is not something that everyone has the opportunity to enjoy on a regular basis. A special program for this time of year will be presented, including telescopes (one of which is the largest mobile one in the region). The program itself last about 2 hours, but aficionados may well be interested in staying even longer (and it's OK with the guides)! (Warm clothing should be brought, as desert nights are chilly). Guiding provided by *Bateva* -



Photo credit: Omer Dubovsky

Wednesday, September 28, 2016

9:00 – 9:15 Arrival at the George Evens Family Auditorium, Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev (Midreshet Ben-Gurion)

9:15-10:30 Session 3.1: Perovskite-based Photovoltaic Materials and Devices I

Chair: **Dr. Iris Visoly-Fisher**, Ben-Gurion University

1. *The Impact of Phase Retention on the Structural and Optoelectronic Properties of Metal Halide Perovskites*
A. Osherov¹, Eline M. Hutter², Krzysztof Galkowski^{3,4}, Roberto Brenes¹, Duncan K. Maude³, Robin J. Nicholas⁵, Paulina Plochocka³, Vladimir Bulović¹, Tom J. Savenije², Samuel D. Stranks^{1,6}, ¹Massachusetts Institute of Technology, Cambridge, MA, USA, ²Delft University of Technology, Delft, The Netherlands, ³CNRS-UJF-UPS-INSA, Toulouse, France, ⁴University of Warsaw, Warsaw, Poland, ⁵University of Oxford, Oxford, U.K., ⁶University of Cambridge, Cambridge, U.K.
2. *A Mesoporous-Planar Hybrid Architecture of MAPbI₃ Perovskite Based Photovoltaic Devices*
R. K. Misra, M. Layani, S. Aharon, S. Magdassi and L. Etgar, Casali Center for Applied Chemistry, Hebrew University of Jerusalem, Jerusalem, Israel
3. *Effect of Solar Spectrum on the Degradation of Methylammonium Lead Halide Perovskite Solar Cells*
V. Stoichkov and J. Kettle, School of Electronic Engineering, Bangor University, Bangor, U.K.
4. *Graphene in High Efficiency Perovskite Solar Cells: Challenges and Perspectives**
F. Brunetti, G. Susanna, M. Dianetti, A. Agresti, S. Pescetelli, A. Di Carlo, CHOSE-University of Rome Tor Vergata, Rome, Italy

10:30-10:45 Short Coffee Break

10:45-11:45 Session 3.2: Perovskite-based Photovoltaic Materials and Devices II

Chair: **Dr. Harald Hoppe**, Friedrich-Schiller-Universität

1. *Probing Intrinsic Thermal and Photochemical Stability of Hybrid and Inorganic Complex Metal Halides for Perovskite Solar Cells*
A. F. Akbulatov¹, L. A. Frolova¹, S. Luchkin², K. J. Stevenson² and **Pavel A. Troshin**^{1,2}, ¹Institute for Problems of Chemical Physics of RAS, Moscow, Russia, ²Skolkovo Institute of Science and Technology, Moscow, Russia.
2. *Effect of Halide Composition on the Photochemical Stability of Perovskite Photovoltaic Materials**
L. Ciammaruchi¹, Ravi K. Misra², Sigalit Aharon², Dmitry Mogilyansky³, Lioz Etgar², Iris Visoly-Fisher^{3,4} and Eugene A. Katz^{3,4}, ¹The Institute of Photonic Sciences, Barcelona, Spain; ²Casali Center for Applied Chemistry, The Institute of Chemistry, The Hebrew University of Jerusalem, Jerusalem, Israel; ³Ilse Katz Institute for Nanoscale Science & Technology, Ben-Gurion University of the Negev, Be'er Sheva, Israel; ⁴The Jacob Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev, Sede Boqer Campus, Israel
3. *Applying Combinatorial Material Science and High-throughput Characterization Analysis to Perovskite Solar Cells Research*
R. Gottesman and A. Zaban, Bar-Ilan University, Ramat Gan, Israel

* BGU-ENEA Workshop participant

11:45-12:00 Short coffee break

12:00-12:45 **Session 3.3. Invited Plenary Lecture**

Chair: **Prof. Eugene Katz**, Ben-Gurion University

*Materials Modelling and Device Physics for
Molecular and Hybrid Photovoltaics*

Prof. Jenny Nelson

Imperial College, London, UK.

12:45-14:15 **Lunch**

14:15-15:30 **Session 3.4. Photovoltaic Devices and Systems**

Chair: Dr. **Clifford Ho**, Sandia

1. *Large-scale integration of photovoltaics into the Israeli electricity grid*
D. Faiman, Blaustein Institute, Ben-Gurion University, Sede Boqer Campus, Israel
2. *Optimizing the Energy Output of Multi-Junction Solar Cells: A theoretical assessment*
A. Vossier¹, L. Parent¹, A. Dollet², D. Chemisana³, C. Gueymard⁴, ¹CNRS, PROMES Laboratory, Odeillo, France, ²CNRS, PROMES Laboratory, Perpignan, France, ³University of Lleida, Lleida, Spain, ⁴Solar Consulting Services, Colebrook, NH, USA
3. *Interest of Antimonide Compounds Based Multijunction Cells for High Concentrating Photovoltaics*
S. Parola, A. Vauthelin, E. Giudicelli, F. Martinez and Y. Cuminal, Institute d'Electronique et des Systèmes, Université de Montpellier, CNRS, France
4. *Confirmation of a global maximum finding method during partial shading based on permanent monitoring of individual PV panels*
P. Domorad and M. Averbukh, Dept. of Electrical & Electronic Engineering, Ariel University, Ariel, Israel

15:30-17:30 **Scientific Tour** of the large 121 MW Ashalim Solar Tower Thermal Power Station under construction in Israel's Negev desert

http://www.brightsourceenergy.com/ashalim-solar-project#.V6x15_196Uk

Bus returns directly to Beer-Sheva, transportation back to Sede Boker for those with accommodations there.