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

Program
22nd Sede Boqer Symposium on Solar Electricity Production
September 24-25, 2019

George Evens Family Auditorium

Jacob Blaustein Institutes for Desert Research

Sede Boqer Campus

Organized by the Department of Solar Energy and Environmental Physics

Organizing Committee:

Eugene A Katz
Daniel Feuermann

During the symposium, we will honor Prof. David Faiman on the occasion of his 75th birthday

Our Sponsors:

The Jacob Blaustein Center for Scientific Cooperation
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משרד המדע והטכנולוגיה
Ministry of Science & Technology

Tuesday, September 24, 2019

9:00 – 9:20 Arrival and Registration at the George Evens Family Auditorium, Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev (Midreshet Ben-Gurion)

9:20-10:00 **Opening Greetings – 22nd Sede Boqer Symposium**

Chair: Eugene Katz
Gal deBotton, Vice Rector, Ben-Gurion University of the Negev
David Saltz, Director of the Swiss Institute for Dryland Environmental & Energy Research, Ben-Gurion University of the Negev
Ela Strauss, Ministry of Science and Technology
Yael Harman, Ministry of Energy

10:00-11:30 **Session 1.1: Broad Perspectives and new ideas in photovoltaics**

Session chair: Eugene Katz, Ben-Gurion University of the Negev

10:00-10:30 *Photovoltaics and Halide Perovskites* – Invited Talk
David Cahen
Weizmann Institute of Science (Rehovot) and Bar-Ilan University (Ramat Gan)

10:30-11:00 *Optical, Electrical and Electro-Optical Properties of MS_2 (M=Mo,W) Nanotubes* – Invited Talk
Reshef Tenne
Weizmann Institute of Science (Rehovot)

11:00-11:30 *Quantum simulations with artificial lattices in an STM and the relevance for real 2-D electronic materials* – Invited Talk
Daniel Vanmaekelbergh,
Utrecht University (The Netherlands); and T. Prins, and M. Alimoradi Jazi, Utrecht University (The Netherlands); A. J. Houtepen, Delft University of Technology (The Netherlands); W. Heiss, Friedrich-Alexander Universität Erlangen (Germany) and C. Delerue, UMR CNRS (France)

11:30-11:45 **Coffee break**

11:45-12:30 **Session 1.2: Keynote Talk**

Session chair: Gary Hodes, Weizmann Institute of Science

From Perovskite Solar Cells to Modules and Panels
Aldo di Carlo
"Tor Vergata" University of Rome

12:30-13:30 **Lunch – Student Club**

13:30-14:30 **Poster session I in lobby of Evens Auditorium**

14:30-15:50 **Session 1.3: Perovskite-based Photovoltaic Materials and Devices**

Session chair: Iris Visoly-Fisher, Ben-Gurion University of the Negev

14:30-15:00 *Why do bromide perovskite solar cells have a larger voltage loss than iodide ones?* – Invited Talk
Gary Hodes, Weizmann Institute of Science (Rehovot)

15:00-15:30 *Towards more stable hybrid perovskite solar cells: unravelling the bulk and interface-induced degradation mechanisms* – Invited Talk

Pavel Troshin

Institute for Problems of Chemical Physics of RAS and Skolkovo Institute of Science and Technology; Azat F. Akbulatov, RAS; Alexandra Boldyreva, Skolkovo Institute of Science and Technology; Mohamed Elnaggar, Moscow Institute of Physics and Technology; Olga Yamilova, Skolkovo Institute of Science and Technology and RAS; Keith Stevenson, Skolkovo Institute of Science and Technology (Russia)

15:30-15:50 *How to assess the operational stability of perovskite solar cells?*

Eugene Katz,

Mark Khenkin, Iris Visoly-Fisher (Ben-Gurion University of the Negev) and Monica Lira-Cantu ICN2, CSIC and The Barcelona Institute of Science and Technology (Spain)

15:50-16:10 Coffee break

16:10-17:00 Session 1.4: Keynote Talk

Session chair: **David Cahen**, Weizmann Institute and Bar-Ilan University

Photovoltaic Research and Technology: Current Status and Future Prospects

Martin Green

University of New South Wales

17:00-18:20 Session 1.5. Round table discussion "Perovskite-based photovoltaics: prospects vs challenges"

Chairs: **Iris Visoly Fisher** and **Eugene Katz**

17:05-17:20 *The Ministry of Science in support of alternative energy sources*

Dr. **Ela Strauss** (Israel Ministry of Science and Technology)

17:20-18:20 **Panel Participants**: Aldo di Carlo, Martin Green, David Cahen, Gary Hodes, Pavel Troshin, Eli Yablonovitch

Free time (final registration, room check-in)

19:00-20:15 Festive dinner - Lobby French Associates Institute for Agriculture & Biotechnology Drylands Building [#25]

20:30-21:30 Concert – *A Festive Evening of Musical Delights: A Potpourri of Folk Songs, Including Sicilian folk songs by Giacomo Meyerbeer.*

Introduction by Sivan Rotem, "David Faiman – The Meyerbeer Knight"

Sivan Rotem (Soprano), **Oded Shoub** (Guitar) and **Inbar Solomon** (Recorder)

Wednesday, September 25, 2019

8:30-9:00 **Arrival at the George Evens Family Auditorium, Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev (Midreshet Ben-Gurion),** (*and checking out of rooms*)

9:00-10:00 **Two parallel sessions**

Session 2.1a: Thermosolar location: Evens Auditorium

Session chair: **Daniel Feuermann**, Ben-Gurion University of the Negev

9:00-9:30 *From particles and solar heat to power, design issues* – Invited Talk
Gilles Flamant
Benjamin Grange and Omar Behar, PROMES-CNRS (France)

9:30-10:00 *Solar electricity and storage with a lithium-air thermo-electro-chemical cycle* – Invited Talk
Abraham Kribus
Tel Aviv University; Michael Epstein, Tel Aviv University

Session 2.1b: Organic Photovoltaics location: Albert Katz International School, Classroom 1.

Session chair: **Pavel Troshin,** Institute for Problems of Chemical Physics of RAS and Skolkovo Institute of Science and Technology

9:00-9:30 *Metal Oxide Interlayers for Organic Photovoltaic Devices and Modules* – Invited Talk

Morten Madsen,
University of Southern Denmark; Mehrad Ahmadpour, Andre L. Fernandes Cauduro, Mina Mirsafaei, Vida Turkovic and Horst-Günter Rubahn, University of Southern Denmark; Roland Resel, Graz University of Technology (Austria); Brian Julsgaard and Peter Balling, Aarhus University (Denmark); Andreas K. Schmid, Lawrence Berkeley National Laboratory (U.S.A.); and Nadine Witkowski, Sorbonne Université (France)

9:30-10:00 *Additive-assisted Stabilization of Organic Solar Cells* – Invited Talk

Vida Turkovic
University of Southern Denmark; Michela Prete, University of Southern Denmark; Mikkel Bregnhøj, Aarhus University (Denmark); Liana Inasaridze, IPCP of Russian Academy of Sciences (Russia); Dmytro Volyniuk, Kaunas University of Technology (Lithuania); Filipp Obrezkov, Skolkovo Institute of Science and Technology (Russia); Juozas Vidas Grazulevicius, Kaunas University (Lithuania); Sebastian Engmann, Theiss Research and National Institute of Standards and Technology (USA); Horst-Günter Rubahn, University of Southern Denmark; Pavel A. Troshin, IPCP and Skolkovo Institute (Russia); Peter Remsen Ogilby, Aarhus University (Denmark) and Morten Madsen, University of Southern Denmark

10:00-10:15 **Coffee break**

10:15-11:00 **Session 2.2: Keynote Talk**

Session Chair: **Daniel Vanmaekelbergh**, Utrech University

Mass Production of Thin-Film Single-Crystal GaAs Solar Cells
Eli Yablonovitch
University of California - Berkeley

11:00-12:00 **Session 2.3. New Materials, Devices and Ideas for Solar Energy conversion (1)**

Session Chair: **Rodolphe Vaillon**, University of Montpellier

11:00-11:30 *Quantum separation between free-energy and heat for cost-effective base-load solar energy generation* – Invited Talk
Carmel Rotschild, Technion Institute of Technology (Haifa)

11:30-12:00 *Photonic front structures for Efficiency and stability improvement of Silicon and Perovskite photovoltaics* – Invited Talk
Manuel João Mendes,
i3N/CENIMAT; Olala S. Sobrado, Sirazul Haque, Miguel F. Alexandre, Manuel M. Chapa, Pedro Centeno, Jenny Boane, Tiago Mateus, Ugur D. Menda, Hugo Águas, Elvira Fortunato and Rodrigo Margins, i3N/CENIMAT, Universidade Nova de Lisboa and CEMOP/UNINOVA (Portugal)

12:00-13:00 **Lunch – Student Club**

13:00-13:40 **Poster session II in lobby of Evens auditorium (TBD)**

13:40-14:00 **Session 2.4: Special talk**
Session chair: **Lucien Yehuda Bronicki**, Ormat Industries Ltd

Could the World Stop Building New Fossil-Fueled Power Plants?
David Faiman
Ben-Gurion University of the Negev

14:00-15:40 **Session 2.5: New Materials, Devices and Ideas for Solar Energy conversion (3)**
Session chair: **Carmel Rotschild**, The Technion

14:00-14:30 *Operando characterization of charge extraction profiles in semiconductor photoelectrodes with nanoscale resolution* – Invited Talk
Gideon Segev, Lawrence Berkeley National Laboratory, Tel-Aviv University and the Technion Institute of Technology (Israel); Hen Dotan, David S. Ellis, Yifat Piekner, and Dino Klotz, The Technion; Jeffrey W. Beeman and Jason K. Cooper, Lawrence Berkeley National Laboratory (USA); Daniel A. Grave, The Technion; Chang-Ming Jiang, LBNL and Technische Universität München; Gregory Zaborski and Francesca M. Toma, LBNL (USA); Ian D. Sharp, LBNL and Technische Universität München; and Avner Rothschild, The Technion.

14:30-14:50 *Light Manipulation in silicon at Nanoscale for efficient light absorption in energy harvesting devices*
Alina Karabchevsky
Ben-Gurion University of the Negev

14:50-15:10 *2D Materials for Atomically-Thin Photovoltaics* – Invited Talk
Ariel Ismach
Tel Aviv University

15:10-15:30 *Progress in photoluminescence-based characterization of silicon bricks, wafers and modules*,
Ziv Hameiri, University of New South Wales (Australia).

15:30-15:50 *Compact hybrid solar photovoltaic/thermal systems: recent progresses and remaining challenges* – Invited Talk
Alexis Vossier
PROMES – CNRS (France); Dounia Ziyati, PROMES and Université de Perpignan; Alain Dollet, Gilles Flamant and Yann Volut, PROMES; Eugene A. Katz and Jeffrey M. Gordon, Ben-Gurion University (Israel)

15:50 – 16:05 Coffee break

16:05-18:30 Session 2.6: New Materials, Devices and Ideas for Solar Energy conversion (4)
Session chair: **Gilles Flamant**, PROMES-CNRS

16:05 – 16:35 *Photovoltaic concentrators tailored to the special requirements of private commercial space missions* – Invited Talk
Jeffrey M. Gordon
Ben-Gurion University of the Negev; Christian J. Ruud and Noel C. Giebink, Pennsylvania State University (USA); Daniel Feuermann, Ben-Gurion University

16:35 – 16:55 *Aplanatic solar towers that increase concentration, reduce geometric losses, and permit ground-level receivers*
Jeffrey M. Gordon
Ben-Gurion University of the Negev and Daniel Feuermann, Ben-Gurion University of the Negev

16:55-17:15 *Roadmap on thermophotovoltaics for solar energy conversion*
Alejandro Datas
Technical University Madrid (Spain) and Rodolphe Vaillon, CNRS (France)

17:15-17:35 *Thermodynamic detailed balance of a single junction solar cell*
Avi Niv
Ben-Gurion University of the Negev, Ido Frenkel, Ben-Gurion University of the Negev

17:35-17:55 *Differentiating between mobile and non-mobile optically excited states in complex materials*
David Ellis
The Technion Institute of Technology, Daniel A. Grave, The Technion Institute of Technology; Dennis Friedrich, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH (Germany); Yifat Piekner, Asaf Kay and Hen Dotan, The Technion; Roel van de Krol and Fatwa F. Abdi, Helmholtz-Zentrum (Germany) and Avner Rothschild, The Technion

17:55-18:25 *Graphitic Carbon Nitride Layers as Light-Harvesting Semiconductors for Photo-electrochemical Cells* – Invited Talk
Menny Shalom
Ben-Gurion University of the Negev

18:25 Closing remarks and announcement of Poster Session Awards (Daniel Feuermann)

18:40 Bus returns to Beer-Sheva

ABSTRACTS FOR THE POSTER SESSION

(In Alphabetical Order by Presenter)

Poster Session – Day 1, September 24, 2019

1. *Sunlight confocal photoluminescence spectroscopy of perovskite thin films*, **Georgios E. Arnaoutakis**, Natalya Samoylova, Mark V. Khenkin, Renjun Guo, Eugene A. Katz, Ben-Gurion University of the Negev.
2. *Effective control of optical absorption in bilayer graphene nanomeshes by application of a transverse electric field or mechanical loadings* , **Leonid Chernozatonskii**; Anastasiya Artyukh, Dmitry Kvashnin, Emanuel Institute for Biochemical Physics
3. *Breakdown of the static picture of defect energetics in halide perovskites: the case of the Br vacancy in CsPbBr*, **Ayala V. Cohen**, Weizmann Institute of Science; David A. Egger, University of Regensburg (Germany); Andrew M. Rappe, University of Pennsylvania (USA) and Leeor Kronick, Weizmann Institute.
4. *Effect of organic photovoltaic modules on top of a greenhouse tunnel on its microclimate*, **Maayan Friman Peretz**, Agricultural Research Organization at The Volcani Center and Ben-Gurion University of the Negev; Farhad Geoola, Volcani Center; Ibrahim Yehia, Triangle Research and Development Center; Shay Ozer and Asher Levi, Volcani Center; Esther Magadley, Triangle R&D Center, Roman Brikman and Lavi Rosenfeld, Volcani Center; Shely Gantz, Ministry of Agriculture; Avi Levy, Ben-Gurion University; Murat Kacira, University of Arizona (USA); and Meir Teitel, The Volcani Center.
5. *Metal-Organic Framework Based Photoelectrochemical Cells*, Raya Ifraemov, Ben Gurion University of the Negev; Dryalys Cardenas-Morcoso and Miguel Garcia-Tecedor, Universitat Jaume I (Spain), Itamar Liberman, Ben-Gurion University; Sixto Gimenez, Universitat Jaume I (Spain); and **Idan Hod**, Ben-Gurion University of the Negev
6. *Surface passivation of oxide selective contacts by ultra-thin metal nitride layer*, David Keller, **Anat Itzhak** and David Cahen, Bar Ilan University and Weizmann Institute of Science
7. *Can Self-healing kinetics in Halide Perovskites be related to their entropy?* **Naga Prathibha Jasti**, Bar-Ilan University; Davide Ceratti and Gary Hodes, Weizmann Institute of Science; David Cahen, Bar-Ilan and Weizmann Institute.
8. *How MnO Affects NiO as Hole-Selective Contact for Halide perovskite Solar Cells*, **Adi Kama**, Anat Itzhak, Isaac Buchine and David Cahen, Bar-Ilan University
9. *Sunlight concentration-dependent degradation of perovskite solar cells*, **Anoop K. Madhusoothanan**, Mark V. Khenkin, Eugene A. Katz, Ben-Gurion University of the Negev; Yulia Galagan and Francesco Di Giacomo, Holst Centre-Solliance, Eindhoven (The Netherlands); Stav Rahmany and Lioz Etgar, Hebrew University of Jerusalem; and Iris Visoly-Fisher, Ben-Gurion University.
10. *Greenhouse integrated organic photovoltaics*, **Esther Magadley** and Ibrahim Yehia, Triangle Research and Development Center; Meir Teitel, Maayan Friman Peretz, The Volcani Center, and Ben-Gurion University; Murat Kacira, The University of Arizona (USA).
11. *GaN/InGaN Multi-quantum-well solar cells under high solar concentration and elevated temperature for hybrid photovoltaic-thermal power plants*, **Gilad Moses**, Ben-Gurion University of the Negev; Xuanqi Huang and Yuji Zhao, Arizona State University (USA); Eugene A. Katz and Jeffrey M. Gordon, Ben-Gurion University.
12. *Mapping the photocurrent and photovoltage of perovskite films at the nanoscale for stability studies*, **Chandra S. Pathak** and Iris Visoly-Fisher, Ben-Gurion University of the Negev.
13. *Roll-to-Roll processing of ITO-free non-fullerene based organic photovoltaic cells and modules using green solvents*, **Bushan R. Patil**, Jani Laminaho, Horst-Günter Rubahn and Morten Madsen, University of Southern Denmark.
14. *Two-step conversion of PbSe thin films to perovskites*, **Sa'ar Peled**, Maayan Perez, Dafna Meron and Yuval Golan, Ben-Gurion University of the Negev.

15. *A New Two-Step Method Towards MAPbI3 Perovskite Films*, **Maayan Perez**, Saar Peled, and Yuval Golan, Ben-Gurion University of the Negev.
16. *The Erasmus Capacity Building Project for Higher Education 'Innovative Photonics Education in Nanotechnology - iPEN': Scopes and Actions*. **Konstantinos Petridis**, Hellenic Mediterranean University.
17. *Photochemical and Mechanical stabilization of organic solar cells using additives*, **Michela Prete** and Vida Turkovic University of Southern Denmark; Mikkel Bregnhøj, Aarhus University (Denmark); Elisa Ogliani, Technical University of Denmark; Liana Inasaridze, IPCP Russian Academy of Sciences; Dmytro Volyniuk, Kaunas University of Technology (Lithuania); Filipp Obrazkov, Skolkovo Institute of Science and Technology, Moscow (Russia); Juozas S. Grazulevicius, Kaunas University of Technology; Sebastian Engmann, Theiss Research and National Institute of Standards and Technology (USA); Horst-Günter Rubahn, Univ. of S. Denmark; A. Ladegaard Skov, Tech. Univ. of Denmark; Pavel A. Troshin, IPCP of Russian Academy of Sciences and Skolkovo Inst. of Science and technology (Russia); Peter R. Ogilby, Aarhus University; and Morten Madsen, Univ. of S. Denmark.
18. *Initial stages of photodegradation of MAPbI3 perovskite: accelerated study by concentrated sunlight*, Renjun Guo, Mark V. Khenkin, Georgios Arnaoutakis, **Nataliya Samoylova**, and Ambrose A. Melvin, Ben-Gurion University of the Negev; Jeremy Barbe, Swansea University (United Kingdom); Iris Visoly-Fisher and Eugene A. Katz, Ben-Gurion University.

Poster Session – Day 2, September 25, 2019

19. *Near-Field study of arrays composed of sub-wavelength non-imaging light concentrators*, **Ankit Chauhan** and Gil Shalev, Ben-Gurion University.
20. *Diffusive external light-trap for solar-cells*, **Ido Frenkel** and Avi Niv, Ben-Gurion University
21. *Luminescent solar power*, **Shimry Haviv**, Natali Revivo, Nimrod Kruger and Carmel Rotschild, The Technion, Israel Institute of Technology.
22. *Light trapping beyond the Yablonovitch limit with Light Funnel Arrays realized on Silicon-on-insulator*, **Sarah Sowmya Priya Konedana**, Eitan Vaida, Vitaly Viller and Gil Shalev, Ben-Gurion University of the Negev.
23. *Is the Use of temperature differences in the photovoltaic panel profitable?* **Yonatan Marmary** and N. Hochberg, Meir Shfeya Youth Village; M. Schechter, University of Haifa.
24. *Light trapping with deep-subwavelength sidewall features in nanopillar arrays*, **Ashish Prajapati**, Yevgeny Faingold, and Shay Fadida, Ben-Gurion University of the Negev; Jordi Llobet, Mariana Antunes, Helder Fonseca, Carlos Calaza and João Gaspar, International Iberian Nanotechnology Laboratory, Braga (Portugal); Gil Shalev, Ben-Gurion University.
25. *Modulating the Photoelectrochemical properties of TIO_2 for cathodic and anodic water splitting*, **Vivek Ramakrishnan**, Kumoh National Institute of Technology (S. Korea) and Ben-Gurion University of the Negev; Hyun Kim, Kumoh National Institute of Technology, Gumi (S. Korea); and Bee Lyong Yang, Ben-Gurion University.
26. *A self-consistent calculation "hot" carriers and temperatures of an illuminated solar cell*. **Subhajit Sarkar**, Yonatan Dubi and Yonatan Sivan, Ben-Gurion University of the Negev.
27. *Hybrid photoelectrochemical and photovoltaic cells for simultaneous production of chemical fuels and electrical power*, **Gideon Segev**, Lawrence Berkeley National Laboratory (USA) and Tel Aviv University; Jeffrey Beeman, Lawrence Berkeley National Laboratory; Jeffrey B. Greenblatt, Lawrence Berkley, and Emerging Futures LLC (USA); and Ian D. Sharp, Lawrence Berkeley and Technische Universität München (Germany)
28. *Sensitivity analysis of parabolic trough collector in soltrace*, **Anupam Sharma**, School of Electrical Sciences, IIT Goa (India).
29. *Second Harmonic Generation From Nano-scaled Heterodimers*, **Maya Shor**, Esti Toledo, Shilpi Shital, Achyut Maiti, Yonatan Sivan, Mark Schvartzman and Avi Niv, Ben-Gurion University of the Negev.