**RESUME**

**CARMEL ROTSCHILD**

Identity No.: 028661700

Date and place of birth: 10/06/1971 Tel-Aviv

Marital status: Married to Sara and father to Yael, Sol, and Yotam

Web site: <http://excitonics.net.technion.ac.il/>

**ACADEMIC DEGREES**

2002 -2008 Direct Ph.D., Faculty of Physics, Technion - Israel Institute of Technology, Haifa, Israel

1996 - 2000 B.Sc., Cum Laude, Mechanical Engineering (Optical engineering), Technion - Israel Institute of Technology.

**ACADEMIC APPOINTMENTS**

2017-to date Associate Professor, Faculty of Mechanical Engineering, Technion– Israel Institute of Technology, Head of the Laboratory for Excitonics.

Summer 2012 Visiting scientist, Electrical Engineering Department, MIT,

2011- 2017 Assistant Professor, Faculty of Mechanical Engineering, Technion – Israel Institute of Technology, Head of the Laboratory for Excitonics 2008-2011 Postdoctoral Associate, Electrical Engineering Department, MIT (supervised by Prof. Marc Baldo.

**PROFESSIONAL EXPERIENCE**

2020-to date *Co-founder, & CTO at Luminescent heat engines*

 <https://luminescentpower.com/>

2008-to date *Co-founder, & scientific director at RealView display technology*

 [http://www.realviewimaging.com/](http://www.realviewimaging.com/%20)

2000- 2002 *R&D Scientist, Trellis Photonics LTD.*

Experimental study of electro-holography in nonlinear crystals.

1990-1994 IDF-Navy

**RESEARCH INTERESTS**

Nonlinear optics in small molecules; Nano-photonics; Solar energy;

Thermodynamics of light; Holography; New isothermal heat engines.

**Relevant applications:**

 Holographic 3D displays; Optical heat pumps; Solar powered micro-lasers; Nano-scale optical devices; Nonlinear optics in incoherent light for solar applications; Up-conversion of thermal radiation. Isothermal organic cycle for waste heat recovery, isothermal heat pumps, Carnot battery,

**TEACHING EXPERIENCE**

• Experimental Methods Laboratory - 034039: Undergraduate (Renewed and supervising the course)

• Radiation Heat Transfer - 038731: The course designed for the broad mechanical engineering graduate students (Designed and supervising the course)

• Optical Systems Design - 035050: The course is designed for the broad mechanical engineering undergraduate students (Designed and supervising the course).

• Opto-Mechanical Design - 035051: The course is designed for the broad mechanical engineering undergraduate students (Designed the course and supervising the adjunct lecturer Dr. Daviv Aziz.

• Nano Metric Transport Phenomena - 648013: The course is designed for graduate students at the nano program (Designed and supervising the course).

**DEPARTMENTAL ACTIVITIES**

2012-to date Head of the Optical Engineering major, Faculty of Mechanical Engineering, Technion-Israel Institute of Technology

**PUBLIC PROFESSIONAL ACTIVITIES**

**Editorial board:**

*Scientific Reports*

**Reviewer:**

Energy & Environmental Science, Nature Communication, Advanced Materials, Physics Review Letters, ASC-photonics, Advanced Optical Materials, Optics Letters, Optics Express, JOSA B, Applied Optics, US Israel Binational Science Foundation [BSF], German Israeli foundation [GIF], NEVET 2014 Technion grant.

**FELLOWSHIPS, AWARDS and HONORS**

2020 **Uzi & Michal Halevy Award** for Innovative Applied Engineering

2018 **Hilda and Hershel Rich** Technion innovation awards.

2017 **Krill prize** granted by the Wolf Foundation for Excellence in Scientific Research.

2012 **Alon fellowship** granted by the Israeli National academy for Arts and Sciences.

2011 Leaders in Science and Technology – **Horev Fellow**.

1. **Bikura** Post Doctorate Fellowship – granted by the Israeli National academy for Arts and Sciences.
2. Outstanding Student Presentation Award at the Frontiers in Optics conference. (One of the three largest international conferences in optics worldwide).
3. **Fulbright** Postdoctoral Fellowship for post doctorate studies.
4. **Adams Fellowship** - the most prestigious fellowship for PhD students in Israel granted by the Israeli National academy for Arts and Sciences.
5. Applied Materials Scholarship.
6. 2nd Place Award in the National Contest among all finals student projects in Mechanical Engineering. The project title: “Optical test device for a pilot’s vision system".

**GRADUATE STUDENTS**

**Graduated PhD students:**

* Sergey Nechayev, started in 2011, "Solar Powered Laser", Graduated 2016. currently: a post-doctoral fellow, Max Planck Institute for the Science of Light, Erlangen, Germany, at the group of Prof. Peter Banzer.
* Assaf Manor, started in 2011, "Non-linear optics for solar energy conversion: Thermal light management", Graduated2016. [awarded the **Adams fellowship** for his research in the group], 2017: a post-doctoral fellow, at the University of Michigan, Ann Harbor, at the group of Prof. Stephen Forrest
* Karni Wolowolski, started in 01/2014," Dynamic control over spectral response", graduated in 2017
* Nimrod Kruger, started PhD in 10/2014, “Excitonic fission for Solar conversion”, Graduated2018**.**
* Shimri Haviv, started in 10/2014, “Fully integrated on-chip high-Q micro-laser”.
* Matej Kortulik, Started Direct PhD in 10/2015, “Generelized Kirchoff’s law to non-equilibrium”.

**Graduated MSc students:**

* Nimrod Kruger, started MSc in 10/2011, “Excitonic fission for Solar conversion”, Graduated2014**.**
* Dafna Granot, started in 03/2013, "Entropy driven up-conversion". Graduated **cum laude**, 2016.
* Daria Nagri. started in 03/2017, "Ideal light source". Graduated 2019.
* Natali Revivo, Thermal-photoluminescent spectral shaping for enhanced energy harvesting in luminescent solar power, Graduated 2021.
* Michal Shimanovich, Generalization of Kirchhoff's Law to NonEquilibrium – Experimental Demonstration, graduated in 2021.
* Josef castile, Started in 2020 “Heat engine for solar ans waste hate applications”. Graduated in July 2022.

**Thesis in progress** (Relevant awards, papers and conferences are in parenthesis)

**PhD students:**

* Dror Miron, Started in 2020, “Luminescent Solar Power”. Expected to graduate in 10/2024
* Karinne Attali, Started in 01/2022 “Doubeling solar field efficiency for CSP”

**MSc students**:

* Shay Fartuk, Started in 2020 “Luminescent Solar Power”. Expected to graduate in 10/2022.
* Tomer Bar-Lev, Started in 2022. “ Ideal light source”. Expeted to graduate in 2024.
* Adi Vert, Strated in 2022. “waste heat recovery from data centers”. Expeted to graduate in 2024.
* Orjuwan Abu Najeeb, Started 2022. “solar field efficiency enhancment”. Expeted to graduate in 2024.
* Yuval Newman, Started 2022. “Heat enging for waste heat recovery”. Expeted to graduate in 2024.

**RESEARCH GRANTS** (Carmel is the single PI unless stated otherwise)

2011 **Bikura** (ISF), $24,000, “Bikura post doctorate fellowship”

2011 **Alon** (ISF), $48,000, "Alon fellowship"

2012 **Helmsley**, $300,000 in Four years, Co-PI, Part of Technion-Weizmann joined grant

2012 **Marie Curie Career Integration Grants** (FP-7 RIG European Community), €100,000

2012 **Focal Technology Area (FTA)**, $300,000 in Four years, Co-PI, Part of the Center lead by Prof. Meir Orenstein and supported by the Israeli National Nanotechnology Initiative (INNI)

2013 **Israeli Strategic Energy Foundation (I-SAEF)**, $200,000 in three years for "solar powered laser"

2013 **Israeli Strategic Energy Foundation (I-SAEF)**, $100,000 in three years for "lipid rich alga production". As part of a $200,000. Co-Pi joint grant with Prof. Zvy Dubinsky at Bar Ilan University

2014 **Niedersachsen Israeli Research Cooperation**, €56,000 in three years as part of €224,500.00 leading PI

2015 **European Research Council ERC starting grant** €1,500,000 for five years “New Thermodynamic ideas for frequency conversion and photovoltaics”

2015 **Nofar** *NIS* 500,000 for one year “Bi spectral dynamic filter based on liquid crystals for sensing and detection", with industrial partner CI-systems.

2017 **Meimad** *NIS* 500,000 for one year “High-frequency dynamic notch-filter at pre-requested spectral band for low cost detection and monitoring ", with industrial partner CI-systems.

2017 **Ministry of Energy** *NIS* 750,000 for three years “Nonthermal radiation for direct conversion of gas to electricity”.

2018 **Ministry of Energy** *NIS* 750,000 for three years “low cost base load energy conversion system”.

2018 **European Research Council ERC-PoC** €160000, for one year.” Low cost solar energy”.

2018 **KAMIN** $220000 “CSP-CPV on a single crystal”.

2019 **“HALUTZ”** $500000 “Luminescent Solar power” ministry of energy (Luminescent company)

2021 **Ministry of Energy**, *NIS* 750000“Small and efficient heat engine for solar energy and waste heat recovery” (End 2023)

2021 **Israeli Science Foundation** (ISF) *NIS* 1000000 “ Expending Kirchhoff's law of thermal radiation to include (nonthermal) quantum efficiency” (Ends 2024).

2021 **Nichia** $100000, “ Near IR absorption for luminescent solar power” (Ends 2023).

**PUBLICATIONS,**

**Thesis**

Ph.D., Faculty of Physics, Technion - Israel Institute of Technology, under the supervision of Distinguished Professor, Mordechai (Moti) Segev**,** "Solitons in nonlocal media" (2008).

**Book Chapters**

 E. Bruckheimer, and **C. Rotschild**, “Holography in congenital heart disease diagnosis and transcathter treatment”, Springer Atlas Book – INVITATION (Submitted)

**Published papers at refereed journals,** (H-index 16 according to ISI web of knowledge and 17 according to Google scholar)

J1. C. Rotschild, S. Zommer, S. Moed, O. Hershcovitz, S. G. Lipson, Adjustable spiral phase plate, ***Appl. Opt.*** **43,** 2397, (2004).

J2. C. Rotschild , O. Cohen, O. Manela, T. Carmon, and M. Segev, Interactions between spatial screening solitons propagating in opposite directions, ***JOSA B***, **21**(7),1354,(2004).

J3. C. Rotschild, T. Carmon, O. Cohen,O. Manela, and M. Segev, Solitons in nonlinear media with an infinite range of nonlocality: first observation of coherent elliptic solitons and of vortex-ring solitons, ***Phys. Rev. Lett****.*. 95, 213904 (2005).

J4. C. Rotschild, Z. Xu, O. Cohen, Y. aroslav V. Kartashov, L Torner, and M. Segev, Two-dimensional multipole-mode solitons in nonlocal nonlinear media, ***Opt. Lett*.** 31, 3312, (2006).

J5. **C. Rotschild**, B. Alfassi, O. Cohen, and M. Segev, Long-range interactions between optical solitons.***Nature Phys****.* **2**, 769, (2006).

J6. R. El-Ganainy, D. N. Christodoulides, Z. H. Musslimani, **C. Rotschild**, and M. Segev, Optical beam instabilities in nonlinear nanosuspensions, ***Opt. Lett***., **32**, 3185 (2007).

J7. I. Kaminer, **C. Rotschild**, O. Manela, and M. Segev., Periodic solitons in nonlocal nonlinear media, ***Opt. Lett***., **32**, 3209 (2007)

J8. B. Alfassi, C. Rotschild, O. Cohen, D. N. Christodoulides, and M. Segev, Boundary Force Effects Extracted on Solitons in Nonlinear Media With a Very Large Range of Nonlocality, ***Opt. Lett***., **32**, 154 (2007).

J9. R. El-Ganainy, **C. Rotschild**, M. Segev, and D. N. Christodoulides, Soliton Dynamics and Self-Induced Transparency in Nonlinear Nanosuspensions, ***Optics Express***, **15**, 10207(2007).

J10. A. Barak, **C. Rotschild**1,2, B. Alfassi, D. N. Christodoulides and M. Segev, Random-Phase Surface-Wave Solitons in Nonlocal Nonlinear Media, ***Opt. Lett*., 32,** 2450 (2007).

J11. B. Alfassi, **C. Rotschild**, O. Manela, D. N. Christodoulides and M. Segev, Nonlocal Surface-Wave Solitons, ***Phys. Rev. Lett.* 98**, 213901 (2007).

J12. **C. Rotschild,** T. Schwartz, O. Cohen and M. Segev, Incoherent solitons in effectively instantaneous nonlocal nonlinear media, ***Nature Photonics,*** 2, 371 (2008).

J13. B. Alfassi, **C. Rotschild**, and M. Segev, incoherent surface solitons in effectively instantaneous nonlocal nonlinear media, ***Phys. Rev. A***, 80,  041808 (2009).

J14. Y. Lamhot, A. Barak, **C. Rotschild**, M. Saraf, E. Lifshitz, A. Marmur,R. El-Ganainy, D.N. Christodoulides, and M. Segev, Optical control of thermo-capillary effects in complex nanofluids, ***Phys. Rev. Lett*.** 103, 264503 (2009).

J15. C.L. Mulder, P. D. Reusswig, A. Beyler, H. Kim, **C. Rotschild**, M.A. Baldo, Dyes Aligned in Luminescent Solar Concentrators II. Horizontal Alignment for Energy Harvesting in Linear Polarizers, ***Optics Express***, 18, A91 (2010)[***Energy express***]**.**

J16. C.L. Mulder, P. D. Reusswig, A. M. Velazquez, H. Kim, **C. Rotschild**, M.A. Baldo, Dyes Aligned in Luminescent Solar Concentrators I. Vertical Alignment for Improved Waveguiding Coupling, ***Optics Express***, 18, A79 (2010) [***Energy express***].

J17. E. Greenfield, **C. Rotschild**, J Nemirovsky, A Szameit, R El-Ganainy, D. N. Christodoulides, M. Saraf, E. Lifshitz, andM Segev,. Light-induced self-synchronizing
flow patterns, ***New Journal of Physics,*** 13, 052021 (2011).

J18. **C. Rotschild**, M. Tomes, H. Mendoza, T. L. Andrew, T. M. Swager, T. Carmon, and M.A. Baldo, Cascaded energy transfer for efficient broad-band pumping of high-quality, micro-lasers, ***Advanced Materials,*** 23: n/a. doi: 10.1002/adma.201100467. (2011).

J19. A. Menéndez-Velázquez, C. L. Mulder, N. J. Thompson, T. L. Andrew, P. D. Reusswig, **C. Rotschild**, and M. A. Baldo, Light-recycling within electronic displays using deep red and near infrared photoluminescent polarizers, ***Energy Environ. Sci.***, **6**, 72  (2013), DOI: 10.1039/c2ee23265k.

J20. A. Manor, L. L. Martin and **C. Rotschild**, Conservation of photon rate in endothermic-photoluminescence and its transition to thermal emission. ***OPTICA***, Vol. 2, [6,](https://www.osapublishing.org/optica/issue.cfm?volume=2&issue=6) 585 (2015).

J21. Svetlana V Boriskina, et al., Roadmap on the Optical Energy Conversion, Ch. 18, A. Manor, and **C. Rotschild,** Endothermic-photoluminescence: Optical heat-pump for next generation PV, **IOP science, *journal of optics*** (2016) doi:10.1088/2040-8978/18/7/073004*.*

J22. R. Bekenstein, R. Schley, M. Mutzafi, A. Ori, C. Rotschild, and M. Segev, Experimental Observation of Optical Wavepackets Overcoming Gravitational Phenomena, *Nature Physics* doi:10.1038/nphys3451, (2015).

J23. P. D. Reusswig, S. Nechayev\*, J. M. Scherer, G. W. Hwang, M. G. Bawendi, M. A. Baldo, C. Rotschild, Solar Pumped Lasers via Cascade Energy Transfer, \*S. Nechayev contribution is equal to first author. *Sci. Rep.* 5, 14758; doi: 10.1038/srep14758 (2015).

J24. D. Granot, N. Kruger, A. Manor and **C Rotschild**, Efficient tenfold up-conversion through steady-state non-thermal-equilibrium excitation, **DOI:** 10.1021/***ACS photonics***.5b00481 (2016).

J25. E. Bruckheimer, **C. Rotschild**, Holography for imaging in structural heart disease, ***EuroIntervention*** (2016);12:X0-X0 doi: 10.4244/EIJV12SXA*?.*

J26. E. Bruckheimer, **C. Rotschild**, T. Dagan, G. Amir, A. Kaufman, S. Gelman, and E. Birk, Computer-generated real-time digital holography: first time use in clinical medical imaging, ***European Heart Journal – Cardiovascular Imaging*** (2016) doi:10.1093/ehjci/jew087.

\*See also **Editorial choice** and comments, [Karima Addetia, Roberto M. Lang, The future has arrived. Are we ready?](http://ehjcimaging.oxfordjournals.org/content/17/8/850), ***European Heart Journal – Cardiovascular Imaging*** (2016). doi:10.1093/ehjci/jew111

J27. A. Manor, N. Kruger,T. Sabaphati and **C. Rotschild**, Thermally-Enhanced Photoluminescence for Heat Harvesting in Photovoltaics, ***Nat. Commun***. DOI:10.1038/ncomms13167 (2016).

\*The Optical Society of America chose this paper as the most important paper in solar energy for the year 2016, [**OPTICS & PHOTONICS NEWS** December 2016](http://www.osa-opn.org/home/articles/volume_27/december_2016/features/optics_in_2016/) , Efficient Photovoltaics from Photoluminescent Heat Harvesting​.

J28. S. Nechayev, P. D. Reusswig, M. A. Baldo and C. Rotschild, “Designing a Broadband Pump for High-Quality Micro-Lasers via a Modified Net Radiation Method ”, ***Sci. Rep.****,* 6, 38576 (2016) doi:10.1038/srep38576.

J29. S. Nechayev, and **C. Rotschild**, ” Detailed Balance Limit of Efficiency of Broadband-Pumped Lasers”, ***Sci. Rep***., 11497, (2017) doi:10.1038/s41598-017-11857-y.

J31. K. Wolowelsky, A. Gil, M. Elkabets, and C. Rotschild, Gas detection using absorption properties of liquid crystals, *Opt. Exp.*, 25, 32532, (2017). <https://doi.org/10.1364/OE.25.032532>.

J30. N. Kruger, A. Manor, T. Sabaphati and **C. Rotschild**, Thermally enhanced photoluminescence: from fundamentals to engineering optimization, **Emerging leaders**, **Journal of optics**, (2018)\*\*\*

\*\*\* This paper is part of an **Emerging leaders in various fields of optics**.

J32. P. Azunre, J. Jean, C. Rotschild, V. Bulovic, S.G. Johnson, M.A. Baldo, Guaranteed global optimization of thin-film optical systems, New Journal of Physics 21 (7), 073050 (2019).

J33. E. Bruckheimer, C Rotschild, Holography in Congenital Heart Disease: Diagnosis and Transcatheter Treatment, Atlas of Cardiac Catheterization for Congenital Heart Disease, 383-386, (2019)

J34. S. Haviv, N. Revivo, N. Kruger, M. Sokol, B. Ratzker, A. Wagner, S. Kalabuchov, A. Manor, B. Khachatryan, M. Shustov, N. Frage, C. Rotschild, Luminescent solar power – PV/thermal hybrid electricity generation for cost-effective dispatchable solar energy, ACS Appl. Mater. Interfaces 2020, 12, 32, 36040–36045, https://doi.org/10.1021/acsami.0c08185

**Submitted papers**

J35. M. Kurtulik, Shimanovich M, A. Manor, R. Weill, and C.Rotschild, Generalization of Kirchhoff’s Law: The inherent relations between quantum efficiency and emissivity, (2022) under review in Nature Photonics.

J36. D. Meron, C. Rotschild, modular CSP for solar based electricity generation.

**Under prapapretion**

J37. J. Cassell, Yuval Newmann, Dror Meron, S. Fartuk, C. Rotschild, Heat engine for waste heat and baseload solar electricity.

**PATENTS** (Selected from ~50 patent applications over ~35 granted)

P1. **C. Rotschild**, ”Method and system for using a cellular phone in water activity” PCT/IL07/00299 03/08/2007., 19611/US/05. (Provisional 2007)

P2. **C. Rotschild**, Aviad Kaufman., “Broad viewing angle displays and user interfaces”, PCT/IL2009/000686, (Granted in the US, WO 2010004563 A1 and China, CN 102150072 A)

P3. **C. Rotschild**. Christodoulides, D. N. Segev M., Method and system for manipulating fluid medium, PCT/IL2009/000338 (Provisional 2009)

P4. C. L. Mulder, M. Baldo, **C. Rotschild**, “Luminescent Solar Concentrators for Energy Harvesting in Displays” US 61/220,145 (Granted in the US, WO 2011005575 A2)

P5. J. Mapel, M. Baldo, C. L. Mulder, M. Currie, M. Segal, and **C. Rotschild**, “Materials for solar concentrators and devices, methods and systems using them”, US 61/146,550 (Granted in the US WO 2010085561 A3).

P6. **C. Rotschild**, M. Baldo, T Carmon, “Efficient broad-band pumping of high finesse, high quality-factor lasers”, US 61393966.

P7. S. Alon-Braitbart, S. A. Gelman, **C. Rotschild**, “Despeckling a computer generated hologram”, US61/678,211 (Provisional 2013)

P8. S. A. Gelman, S. Alon-Braitbart, Y.Y. Yoreh, **C. Rotschild**, “Increasing an area from which a computer generated hologram may be viewed”, (granted in US 9,933,753, EU 2880496, 2019)

P9. A. Manor, N. Kruger, **C.Rotschild**,” Energy conversion system”, (granted in US 10,727,365, EU 2880721, and China ZL201380051151.3)

P10. K. Wolovelsky, M. Bercovici and **C. Rotschild**, IL patent application no. 239998; "Electrically Controllable Variable Color Device" (Provisional 2015)

P11. K. Wolovelsky, Amir Gil, Dario Habib, and **C. Rotschild**, IL patent application no. 245655; "Infrared detection and imaging device with no moving parts", (Granted 2016,Technion have full ownership)

P12. V. Frumkin, M. Bercovici, S. Rubin, **C. Rotschild**, “[Thermally-actuated devices and use thereof](https://scholar.google.com/citations?view_op=view_citation&hl=en&user=vs8NgvcAAAAJ&sortby=pubdate&citation_for_view=vs8NgvcAAAAJ:B3FOqHPlNUQC)”. Granted US Patent App. 16/496,443 (2020)

P13 S.A. Gelman, **C. Rotschild**, E. Bruckheimer, A. Kaufman, D. Dickman, [Method and system for displaying holographic images within a real object](https://patents.google.com/patent/US20200409306A1/en), 17/015,126, Provisional 2016.

P14. **C. Rotschild**, “Non-thermal candoluminescence for fuel cells”, Provisional (2017)

## P15. C. Rotschild, “Harvesting of energy from diverse wavelengths“ WO2019102465A1

 (Provisional 2017).

P16. S. A. Gelman, **C. Rotschild**, S. A. Braitbart, A. Kaufman, Holographic display, US Patent App. 16/078,653 (2019)

P17. S.A. Gelman, **C. Rotschild**, E. Bruckheimer, A. Kaufman, D. Dickman, Method and system for displaying holographic images within a real object, US Patent App. 16/078,639 (2019).

P18. S.A. Gelman, S. Alon-Braitbart, B. Loevsky, O. Peleg, **C. Rotschild**, Zero order blocking and diverging for holographic imaging, US Patent App. 16/106,249 (2019).

P19. D. Negri, M. Shimanovich, M. Kurtulik, **C. Rotschild**, Generating an ideal light source, provisional (2019).

P20. S. A. Gelman, A. Kaufman, **C. Rotschild**, [Pupil tracking in an image display system](https://scholar.google.com/citations?view_op=view_citation&hl=en&user=vs8NgvcAAAAJ&sortby=pubdate&citation_for_view=vs8NgvcAAAAJ:geHnlv5EZngC), 16/464,691, Granted (2020).

P21. C. Rotschild, J. Cassell, Heat engine for heat sources such as solar energy and wasted heat, Provisional Patent Application No. 63/074,485 (Sep. 2020).

P22 S.A. Gelman, **C. Rotschild**, A. Kaufman , [Wide field of view hybrid holographic display](https://patents.google.com/patent/US20210003969A1/en), 10,795,316, granted (2021).

P23 S.A. Gelman, S. Alon-Braitbart, B. Loevsky, O. Peleg, **C. Rotschild**, [Zero order blocking and diverging for holographic imaging](https://scholar.google.com/citations?view_op=view_citation&hl=en&user=vs8NgvcAAAAJ&sortby=pubdate&citation_for_view=vs8NgvcAAAAJ:nb7KW1ujOQ8C), US Patent 10,877,437 Granted, 2020.

P24. S. A. Braitbart, C. Rotschild, S.A. Gelman, [Producing a computer generated holographic image](https://scholar.google.com/citations?view_op=view_citation&hl=en&user=vs8NgvcAAAAJ&sortby=pubdate&citation_for_view=vs8NgvcAAAAJ:8AbLer7MMksC), granted US Patent App. 16/798,464 (2020)

P25. **C. Rotschild**, Ericsson thrmodynamic cycle for heat engine using two phase flow, PCT (Dec. 2022).

P26. **C. Rotschild**, Storage system, PCT (Dec. 2022).

P27. **C. Rotschild**, Heat engine for reducing CO2 emission, Provisional (2022).

P28. J. Cassell, Y, Neumann, C. Rotschild, Isothermal continues two-phase compressor, Provisional (2022).

P29. Y. Neumann, J. Cassell, E. Klein, C. Rotschild Two-phase nozzle for an isothermal phase-change cycle heat engine. Provisional (2022).

P30. E. Klein,, Y. Neumann, D. Tamir, and C. Rotschild, Heat engine based on evaporation of Liquefied Natural gas (LNG) and Liquefied Hydrogen. Provosional (2022)

**INVITED TALKS at international conference**

 (Underlined names for Carmel's group students), first author presented the talk,

1. **C. Rotschild**, B. [Alfassi,](http://ieeexplore.ieee.org/search/searchresult.jsp?searchWithin=p_Authors:.QT.Alfassi,%20B..QT.&searchWithin=p_Author_Ids:37689279900&newsearch=true) O. [Manela,](http://ieeexplore.ieee.org/search/searchresult.jsp?searchWithin=p_Authors:.QT.Manela,%20O..QT.&searchWithin=p_Author_Ids:38322490900&newsearch=true) T. [Schwartz,](http://ieeexplore.ieee.org/search/searchresult.jsp?searchWithin=p_Authors:.QT.Schwartz,%20T..QT.&searchWithin=p_Author_Ids:38328278300&newsearch=true)A. [Barak,](http://ieeexplore.ieee.org/search/searchresult.jsp?searchWithin=p_Authors:.QT.Barak,%20A..QT.&searchWithin=p_Author_Ids:38320197300&newsearch=true) M. [Segev,](http://ieeexplore.ieee.org/search/searchresult.jsp?searchWithin=p_Authors:.QT.Segev,%20M..QT.&searchWithin=p_Author_Ids:37278233100&newsearch=true) O.  [Cohen,](http://ieeexplore.ieee.org/search/searchresult.jsp?searchWithin=p_Authors:.QT.Cohen,%20O..QT.&searchWithin=p_Author_Ids:37278247100&newsearch=true) X. [Zhiyong](http://ieeexplore.ieee.org/search/searchresult.jsp?searchWithin=p_Authors:.QT.Zhiyong%20Xu.QT.&searchWithin=p_Author_Ids:37532826100&newsearch=true), Y. [Kartashov,](http://ieeexplore.ieee.org/search/searchresult.jsp?searchWithin=p_Authors:.QT.Kartashov,%20Y..QT.&searchWithin=p_Author_Ids:38310546300&newsearch=true) L. [Torner,](http://ieeexplore.ieee.org/search/searchresult.jsp?searchWithin=p_Authors:.QT.Torner,%20L..QT.&searchWithin=p_Author_Ids:38329046100&newsearch=true) D.N. [Christodoulides,](http://ieeexplore.ieee.org/search/searchresult.jsp?searchWithin=p_Authors:.QT.Christodoulides,%20D.N..QT.&searchWithin=p_Author_Ids:37278105800&newsearch=true) **IEEE, LEOS 2007, Lake Buena Vista, Florida, USA**, “Solitons phenomena in highly nonlocal media: From soliton wiring and surface solitons to random-phase solitons and controlling solitons from afar”
2. **C. Rotschild, *EilatEilot***“The energy initiative at MIT”, **Eilat Israel** *2010*
3. **C. Rotschild**, M. Tomes, H. Mendoza, T. Carmon, and M. Baldo ***FiO*** 2010 **New York, USA**,“Luminescence Solar Concentrators: from optical heat pump toward solar pumped laser”.
4. **C. Rotschild**, M. Tomes, H. Mendoza, T. Carmon, and M. Baldo, ***OASIS*** 2011**, Tel Aviv Israel**, “Non-resonantly pumped High-*Q* micro-laser For on-chip and solar powered laser applications”
5. **C. Rotschild**, A. Manor, N. Kruger, "Entropy-driven up conversion for sub-bandgap thermal photovoltaics", **OASIS, Tel-Aviv, 2013**
6. **C. Rotschild,** A. Manor,"Optical refrigeration for ultra-efficient photovoltaics" QUANTSOL 2014)  March 16-21, 2014, **Rauris, Österreich.**
7. **C. Rotschild,** "Thermally enhanced photoluminescence for efficient photovoltaics" OSA Incubator meeting on the fundamental limits of optical energy conversion, **Washington 2014**
8. **C. Rotschild,** "Thermally enhanced photoluminescence for efficient photovoltaics" QUANTSOL, **Austria, 2015**
9. **C. Rotschild,** "Optical refrigeration for efficient photovoltaics" Photonic west, **San Jose, 2015**
10. **C. Rotschild,** “On the transition from photoluminescence to thermal emission and its implication on solar energy conversion”, World science conference Israel (WSCI), **Jerusalem 2015**
11. **C. Rotschild,** “Live medical holography - a promise finally kept”, World science conference Israel (WSCI), **Jerusalem 2015**
12. **C. Rotschild**, 3% conversion efficiency in Thermally Enhanced Photoluminescence (TEPL) illuminated solely by sub-bandgap photons, QUANTSOL, **Austria, 2016**
13. **C. Rotschild**, Photoluminescence: An optical heat pump for solar energy, Workshop on Thermionic emission, Technion **Israel 2016**
14. **C. Rotschild ,** Photoluminescence: An optical heat pump for solar energy**, ISES Israel, 2016**
15. **C. Rotschild,** Photoluminescence: An optical heat pump for solar energy**, NEF, South Korea 2016** (Canceled due to accident)
16. A. Manor, **C. Rotschild,** New concepts in photovoltaics**, FiO, San Jose 2016**
17. **C. Rotschild,** Photoluminescence: An optical heat pump for solar energy**, NEF, Qingdao-China 2016**
18. **C. Rotschild,** Thermally Enhanced Photo-Luminescence: Device, QUANTSOL, Austria, 2017
19. K. Wolovelsky, Amir Gil, Dario Habib, and **C. Rotschild,** Gas detection using absorption properties of liquid crystals, SPIE Orlando 2018.
20. N. Kruger, A. Manor, T. Sabaphati and C. Rotschild, Thermally Enhanced Photo-Luminescence solar conversion prototype design SPIE 2018.
21. C. Rotschild, Thermally modified photoluminescence matched to GaAs and Si with 40% optical conversion efficiency and 4-fold reduction in heat load, QUANTSOL, Austria, 2018.
22. C. Rotschild, Luminescent solar power for solar baseload energy solution, QUANTSOL, Austria, 2019.
23. C. Rotschild, Luminescent solar power for solar baseload energy solution, Solar PACES, South Korea 2019.
24. C. Rotschild, Luminescent solar power for solar baseload energy solution, CSP-Madrid, 2019
25. S. Haviv, N. Revivo, N. Kruger, C. Rotschild, Luminescent solar power for solar baseload energy solution, SPIE, California 2020.
26. C. Rotschild, Temperature-dependent photoluminescence: Theoretical study, QUANTSOL 2020.
27. **C.Rotschild**, Generalization of Kirchhoff’s Law: The inherent relations between quantum efficiency and emissivity Elop, Edinburg, 2022.
28. C. Rotschild, New heat engine for waste heat recovery, United Nations Climate Change Conference COP 27, 2022.
29. **C.Rotschild**, Generalization of Kirchhoff’s Law: The inherent relations between quantum efficiency and emissivity, QUANTSOL, 2022

**Invited talks at universities and institutes**

1. **C. Rotschild**, M. Tomes, H. Mendoza, T. Carmon, and M. Baldo, ***ICEL*** **2010** Michigan, USA,“Non-resonantly Pumped High-quality-factor Lasers ”
2. **C. Rotschild**, M. Tomes, H. Mendoza, T. Carmon, and M. Baldo, ***OASIS*** 2011**, Tel Aviv Israel**, “Non-resonantly pumped High-*Q* micro-laser For on-chip and solar powered laser applications”
3. **C. Rotschild**, " Solar Powered Laser: The next generation of Luminescence Solar Concentrators", **Keynote speaker**, European PV Cluster and the Ephocell consortium, 2012, Barcelona, Spain
4. **C. Rotschild** " Entropy driven up-conversion", Technion-Nangune-BNC Symposium, Barcelona 2012
5. **C. Rotschild**, A. Manor, N. Kruger " Entropy driven up-conversion", MIT, Cambridge, 2013
6. A. Manor, N. Kruger, **C. Rotschild**, “Entropy Driven multi-photon Up Conversion”, SB Symposium, Israel, 2013
7. **C. Rotschild**, A. Manor, N. Kruger, "Entropy driven up-conversion", Indo-Israel Meeting on Materials for Nanoscience, Biosensors and Energy, Bangalore, 2013
8. **C. Rotschild,** S. Nechayev, Solar Powered Laser, Elop, (2013)
9. **C. Rotschild**, A. Manor, N. Kruger, " Optical refrigeration for ultra-efficient photovoltaics ", NTU-Technion workshop in photonics, Singapore 2014
10. **C. Rotschild,** "Thermally enhanced photoluminescence for efficient photovoltaics" MIT, Cambridge, 2014
11. **C. Rotschild,** "Thermally enhanced photoluminescence for efficient photovoltaics" Colombia University**,** New-York, 2014
12. **C. Rotschild,** "Thermally enhanced photoluminescence for efficient photovoltaics" Aarhus University, Denmark, 2014
13. **C. Rotschild,** "QD based Solar powered laser" Niedersachsen, Germany, 2015
14. **C. Rotschild,** "Thermally enhanced photoluminescence for efficient photovoltaics" Green Photonics, Berlin, 2015
15. **C. Rotschild,** "Thermally enhanced photoluminescence for efficient photovoltaics" International Iberian Nanotechnology Laboratory Braga, Portugal, 2015
16. **C. Rotschild,** Photoluminescence: An optical heat pump for harvesting thermal losses in PVs, **MIT**- condensed mater seminar, 2016.
17. **C. Rotschild,** Photoluminescence: An optical heat pump for solar energy, MIT energy club, 2017.
18. **C.Rotschild**, Photoluminescence: from new fundamentals to new solar technology, Bar-illan 2020

**ORAL PRESENTATIONS at international conferences:**

(Underlined names for Carmel's group students), first author presented the talk

C1. C. Rotschild, O. Cohen, O. Manela, T. Carmon, and M. Segev**,** “Interactions between spatial screening solitons propagating in opposite directions“, ***NLGW*** 2004, Toronto Canada

C2. C. Rotschild, T. Carmon, O. Cohen,O. Manela, and M. Segev, “Solitons in nonlinear media with infinite range of nonlocality: first observation of coherent elliptic solitons and vortex-ring solitons”, ***CLEO/QELS*** 2005 Baltimore Maryland U.S.A.

C3. **C. Rotschild**, B. Alfassi,O. Cohen, and M. Segev**,** “long-rang Interactions between solitons in nonlocal nonlinear media”. ***NLGW*** 2005

C4. **C. Rotschild**, B. Alfassi, O. Cohen, M. Segev**,** and D. N. Christodoulides, “Infinite-range interactions between solitons in highly-nonlocal nonlinear media”, ***CLEO/QELS*** 2006, Long-beach California U.S.A

C5. **C. Rotschild**, Z. Xu, O. Cohen, Y. V. Kartashov, L. Torner, M. Segev, “Two-dimensional multipole-mode solitons in nonlocal nonlinear media”, ***CLEO/QELS*** 2006, California U.S.A

C6. B. Alfassi, **C. Rotschild**, O. Cohen, M. Segev**,** and D. N. Christodoulides, “Boundary Force Effects Extracted on Solitons in Nonlinear Media With a Very Large Range of Nonlocality”, ***CLEO/QELS*** 2006, Long-beach California U.S.A.

C7. R. A. El-Ganainy, **C. Rotschild,** Konstantinos G. Makris, Demetrios N.Christodoulides, and M. Segev, Soliton Dynamics in Exponentially Nonlinear Nanosuspensions, ***BGPP/NP*** 2007 Quebec City, Canada

C8. A. Barak, **C. Rotschild**, B. Alfassi, M. Segev, and D.N. Christodoulides,
Random-Phase Surface-Wave Solitons in Nonlocal Nonlinear Media, ***BGPP/NP*** 2007 Quebec City, Canada

C9. B. Alfassi, **C. Rotschild**, O. Manela, D. N. Christodoulides and M. Segev, “Nonlocal Surface-Wave Solitons”, ***CLEO/QELS*** 2007 Baltimore Maryland U.S.A.

C10. R. A. El-Ganainy, **C. Rotschild**, Konstantinos Makris, Demetrios Christodoulides, Mordechai Segev,“Cusp Solitons in Exponentially Nonlinear Nanosuspensions”, ***CLEO/QELS*** 2007 Baltimore Maryland U.S.A.

C11. **C. Rotschild,** T. Schwartz, O. Cohen and M. Segev, **“**Incoherent solitons in effectively instantaneous nonlocal nonlinear media *“,* ***CLEO/QELS*** 2007 Baltimore Maryland U.S.A**.**

C12. **C. Rotschild,** T. Schwartz, O. Cohen and M. Segev, “Random-phase spatial solitons in effectively instantaneous nonlocal nonlinear media”, ***BGPP/NP*** 2007 (Quebec City, Canada)

C13. **C. Rotschild,** et.al., **Post deadline** session, ***CLEO/QELS*** 2008 San Jose, California, USA, “Complex Nonlinear Opto-Fluidity”

C14. **C. Rotschild,** et.al., **FiO** 2008 Rochester, New York, USA,“Complex Nonlinear Opto-Fluidity”***.****(* **winner of the *Outstanding Student Presentation Award****)*

C15. P.D. Reusswig, **C. Rotschild** and M.A. Baldo.” Employment Neodymium for Infrared Luminescent Solar Concentrator”, ***OPA/CIPS*** 2009, Boston

C16. C.L. Mulder, H. Kim, P. D. Reusswig, **C. Rotschild**, M.A. Baldo.” Luminescent Solar Concentrators Employing Dyes Aligned by Polymerizable Liquid Crystals”, ***OPA/CIPS*** 2009, Boston

C17. A. Manor, N. Kruger, **C. Rotschild**, " Thermal Lasing", FiO 2012 Rochester New York

C18. P. Reusswig, S, Nechayev, M. Baldo, **C. Rotschild**, “Solar-Powered Laser", FiO 2012 Rochester NY

C19. A. Manor, N. Kruger, **C. Rotschild**, "Entropy driven multi-photon up-conversion", CLEO, San Jose, USA, 2013

C20. A. Manor, L., Martin, **C., Rotschild**, "Thermally assist photoluminescence for efficient photovoltaics ", accepted to GORDON REASERCH, Nanostructure Fabrication, University of New England in Biddeford ME, USA 2014

C21. R. Bekenstein, R. Schley, M. Mutzafi, I. dolev, A. Arie, **C. Rotschild** and M.Segev , Observation of Gravitational effects in nonlocal nonlinearity, CLEO 2014

C22. D. Granot, N. Kruger, A. Manor, **C. Rotschild**, 10-Fold Entropy Driven Frequency Up-conversion, OASIS, 2015

C23. K. Wolowelsky, M. Bercovici, and **C. Rotschild**, CDI controlled spectral emission, CDI&E 2015, Germany 2015

C24. A. Manor, N. Kruger,T. Sabaphati and **C. Rotschild**, Thermally-Enhanced Photoluminescence for Heat Harvesting in Photovoltaics, accepted to SPIE Photonics West 2017

C25. S. Haviv, T. Sabaphati and C. Rotschild, Extreme Up-conversion through Steady State Excitation of 'Hot' Modes”, accepted to SPIE Photonics West 2017

C26. K. Wolowelsky, M. Bercovici, and **C. Rotschild**, CDI controlled spectral emission, SPIE Photonics West 2017.

C27. T.  Sabapathy, C Rotschild, Thermally enhanced photoluminescence in low band gap materials for conversion of industrial waste heat to electricity, SPIE 2018.

C28. T Sabapathy, N Kruger, C Rotschild

Thermally-enhanced photoluminescence in low-bandgap materials for conversion of industrial waste heat to electricity (Conference Presentation), Optical and Electronic Cooling of Solids III 10550, 105500J (2018)

C29. N Kruger, M Kurtulik Sr, A Manor, C Rotschild, Thermally-enhanced photoluminescence solar conversion prototype design (Conference Presentation), Optical and Electronic Cooling of Solids III 10550, 105500I (2018)

C29. S Haviv, N Revivo, N Kruger, C RotschildLuminescent Solar Power–Quantum separation between free-energy and heat for cost-effective base-load solar energy generation, European Quantum Electronics Conference, jsiii\_1\_5 (2019)

C30 M. Kurtulik, A. Manor, R. Weill, and C.Rotschild, Temperature dependent photoluminescence: Theoretical study, SPIE california, (2020)

**Published papers at refereed conference proceedings**

# C28. A. Manor, L. L. Martin and C. Rotschild, Optical refrigeration for ultra-efficient photovoltaics, Proc. SPIE 9380, Laser Refrigeration of Solids VIII, 93800L (2015); doi:10.1117/12.2076275.

C29. A. Manor, N. Kruger,Leopoldo L. Martin and **C. Rotschild**, From photoluminescence to thermal emission: Thermally-enhanced PL (TEPL) for efficient PV (Conference Presentation),” Proc. SPIE 9955, Nonimaging Optics: Efficient Design for Illumination and Solar Concentration XIII—Commemorating the 50th Anniversary of Nonimaging Optics, 995509 (November 2, 2016); doi:10.1117/12.2237114

**Conference activities**

**2018- Member of the organizing committee** QUANTSOL, **Austria, 2018.**

**2019-Head of the organization committee, Novel Concepts in Photonic Research, Ein Gedi, Israel (Participation of Nobel lariat Wolf award and equivalent)**