

Short Curriculum Vitae

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PERSONAL INFORMATION

Name: **Professor Efrat Lifshitz**
Date of birth: July 5, 1956
Status: Married plus three children plus three grandchildren
Website: <https://sites.google.com/site/elifgrouptech/>

EDUCATION

1979–1984 Ph.D., Physical Chemistry, University of Michigan, Ann Arbor, Michigan, USA
1976–1979 B.A., Chemistry, Hebrew University of Jerusalem, Israel

ACADEMIC EMPLOYMENT

1991–present Technion–Israel Institute of Technology: Various positions in the Schulich Faculty of Chemistry: 2009–present, Gunsbuourgh Academic Chair; 2005–present, Full Professor; 1997–2005, Associate Professor; 1991–1997, Assistant Professor
1986–1990 Research Associate, Chemistry Department, University of Michigan, USA
1984–1985 Postdoctoral Fellow, Isotope Department, Weizmann Institute of Science, Israel
1979–1983 Research and Teaching Assistant, University of Michigan, USA

VISITING PROFESSORSHIP

2018 Visiting Professor, Columbia University, Department of Chemistry, New York City, USA
2015 Visiting Professor, Freiburg Institute of Advanced Studies, University of Freiburg, Freiburg, Germany; Oxford University, Oxford, England
2012 Visiting Professor, Renewable Energy Centre, Columbia University, New York City, USA, and at the Department of Physics, Ludwig Maximilian University, Munich, Germany
2006 Visiting Professor, Photonic Institute, University of Lyon1, Lyon, France
2003 Visiting Professor, Chemistry Department, University of Hamburg, Germany
1996 Visiting Professor, Chemistry Department, University of California, Berkeley, USA

MAJOR SCIENTIFIC ACHIEVEMENTS

Prof. Lifshitz's scientific achievements are based on a multifaceted and interdisciplinary approach, starting from synthetic efforts, and continuing in the fundamental studies of the optical and magneto-optical properties. Skilled implementation of magnet resonance, thermal and microwave modulated optical spectroscopy typify the excellent research results. A selective list of significant pioneering projects is presented below:

- Materials: (a) Development of semiconductor core/shell colloidal quantum dots or rods with optical tunability in the near infrared, addressing the fundamental importance of a close crystallographic and dielectric match at the core/shell interface, facilitated through the introduction of *alloyed shells*. A smooth interface controls the distribution of carriers between core and shell, assisting the reduction of many-body Coulomb interactions (Auger quenching) that, combined in series, eliminated fluorescence intermittency and enabled observation of *multiple-exciton emissions* and *blinking-free stable fluorescence* [e.g., PRL, 2009; ACS Nano 2015, Nanoscale 2013; JPCL 2015, Adv. Matt. (2018) and many more]. (b) Implementation of the spectrally stable colloidal nanostructure for the generation of diluted magnetic semiconductors in the nanoscale, showing giant magnetization and g-factor values with benefits for spin-based devices [e.g. JPC, 2013)]. (c) Preparation and a thorough investigation of perovskites and transition metal chalcogenides materials in the bulk and nanoscale sizes [e.g. NanoLetters, 2017, ACS Nano 2015].
- Use of optically detected magnetic resonance to identify spin specie and their surrounding (e.g. trapping sites) in bare and core/shell colloidal nanostructures. This method explores the sequence influence of local surrounding on the band-edge carriers and on the optical properties of the materials, information that has significant impact on future design of opto-electronic devices based on the nanostructures [e.g., Review at Feature Article, 2004 and many more].

AWARDS AND FELLOWSHIPS

Selective list (recent years): Lectureship speaker, Birkent University, Ankara, Turkey, (2018); The 2016 Israel Vacuum Society Excellence Award for Research (2016); Lectureship speaker, ETH, Switzerland, (2016); UK-Israel Lectureship Award, Oxford University (2015); Tenne Family Prize in Memory of Lea Tenne for Nanoscale Sciences, awarded by the Israel Chemical Society (2015); Fellow of the Freiburg Institute of Advanced Studies, University of Freiburg (2015); Matwei Gunsbuourgh Academic Chair at the Technion (2009).

MEMBERSHIP ON EDITORIAL BOARDS

Editorial Board of journal *Materials* (2018–present); Editorial Advisor of the *Advanced Device Materials Journal* (2014–present); *PhysChemPhys* (2010–present), new on-line journal of *Translational and Applied Research of Vision*, including topics in Nanotechnology (2011–present); Guest Editor of the *PhysChemPhys* for special issue on Frontier in Colloidal Quantum Dots (2014) and of the *Israel Journal of Chemistry* for special issue on Magnetic Resonance and Spintronics (2006); Book Editor: *Excitons in Colloidal Quantum Dots* (in process).

ORGANISATION OF SCIENTIFIC MEETINGS

Selective list: Chairperson of the Quantsol, Rauris, Austria 2019; Chairperson of the nanoGe meeting on 2D materials, Berlin, 2019. Chairperson of the PHONSI meeting (Marie Currie European Community Program), Haifa, Israel (2017); Member of program committee at the Optics of Excitons in Confined Systems (OECS), Zurich, 2018; Member of the program committee for nanomaterials at the 2017 NOMA conference, part of the OSA Advanced Photonics Congress, New Orleans, 2017; Chairperson of the Quantsol International Meeting (~50 participants), Austria 2015; Chairperson of a nanoGe International Meeting (~100 participants with a Nobel Laureate speaker) on the topic of Fundamental Properties in the Chemistry and Physics of Colloidal Quantum Dots, Oxford 2014.

INVITED PRESENTATIONS TO INTERNATIONALLY ESTABLISHED CONFERENCES AND/OR INTERNATIONAL ADVANCED SCHOOLS

Selective list (from approximately 150): E-MRS, Warsaw, Poland, 2018, Nanoday, Bilkent, Turkey, **Plenary Talk**, 2018; Flantlands, Leibzig Germany, 2018; nanoGe, Two-dimensional Materials, Malaga, Spain, 2018; Quantsol, Rauris, Austria, 2018; Optical Materials and Applications, New Orleans, USA, 2017; American Vacuum Society, Miami, USA, 2017; Two-dimensional, NanoGe meeting, Barcelona, 2017; **Plenary talk** at the Annual Israel Vacuum Society meeting, Beer Sheva, Israel 2016; NanoGe on Fundamental Properties in the Chemistry and Physics of Colloidal Quantum Dots, Berlin, Germany, 2016; NanoGe on Solar 2D Materials, Berlin, 2016; 2nd Greece-Israel meeting in Nanoscience and Nanotechnology, Crete, Greece, 2016; **Plenary talk** at the IPS 21, St. Petersburg, Russia, 2016; Gordon Conference on Colloidal Quantum Dots, Mount-Snow, Vermont, USA, 2016; 80th birthday of Prof. Art Nozik, Boulder, USA, 2016; NanoGe on Fundamental Properties in the Chemistry and Physics of Colloidal Quantum Dots, Santiago de Compostela, Spain, 2015.

COMMISSIONS OF TRUST

Selective list: Member of the **ERC Synergy Program** (2018-2019); Member of the **ERC Advance Program** (2010–2014); Scientific Committee of a **COST FP7 Program** (2007–2009); Member of the **Wolf Prize** Committee in Chemistry (2006–2008); **Trustee of the German-Israel Foundation Board** (2005–2010); (2000–present); Member of the Scientific Committee of the Rothschild Foundation of Postdoctoral Fellowships (2009–2011); Member of the Scientific Committee of the **Israel Prize** in Chemistry (2006); Chairperson or a member of numerous scientific committees for competitive research funds in Israel, as well as of the binational science programs: Member of Scientific Committees of Prestigious Research Foundations: German-Israel Foundation, USA-Israel Binational Science Foundation.

SUPERVISION OF GRADUATE STUDENTS AND POSTDOCTORAL FELLOWS

Advisor of 40 Ph.D. students, 10 M.Sc. students, 16 postdoctoral and research fellows, and 12 undergraduate students. **Currently** advising 11 graduate students (two are Marie Currie [ITN Horizon 2020] fellows), 1 postdoctoral fellow, and 4 undergraduate students.

TEACHING ACTIVITIES

- Undergraduate courses: General Chemistry, Thermodynamics, Group Theory, Molecular Spectroscopy, Electronics for Chemists, Introduction to Solid State (1990–present).
- Graduate courses: Advanced Spectroscopy, Advanced Methodologies in Physical Chemistry, Chemistry of Semiconductors, Chemistry and Physics of Small Systems, Photovoltaic Devices (1990–present).

INSTITUTIONAL RESPONSIBILITIES

Selective list: Co-founder of the Interdisciplinary Nanotechnology Institute, \$90,000,000 project (2002–2005); Board Member of the Nanotechnology Institute (2005–present); Board Member of the Renewable Energy Centre, \$50,000,000 project (2009–2011); Member of the Technion Senate and the Senate Research and Academic Committees (2006–present); Board Member of Multidisciplinary Graduate Programs Committee Nanotechnology (2005–present) of the Energy Program (2009–present); Departmental activities (1991–present).

MEMBERSHIPS IN SCIENTIFIC SOCIETIES

American Chemical Society; American Material Research Society; European Material Research Society; Israeli Chemical Society; European Quantum Solar Energy Society; Israel Vacuum Society, American Vacuum Society, Nano-Optical-Materials of the Optical Society of America (NOMA), Quantsol Society.

MAJOR COLLABORATIONS

Selective list (recent years): Andrew Rappe (Univ. Pennsylvania, USA); Daniel Gamelin (University of Washington, USA); Daniel Vanmaekelbergh (Utrecht University, the Netherlands); Maksym Kovalenko (ETH, Switzerland); Frank Wise (Cornell University, USA); Arthur Nozik (NREL, USA); Alexander Efros (NRL, USA); Alexander Hoegeler (LMU, Germany); Laurens Siebbeles (Delft University of Technology, the Netherlands); Daniel Vanmaekelbergh (Utrecht University, The Netherlands); Zeger Hens, Ghent University, Belgium; Wolfgang Heiss, Nuremberg, Germany; Sandy Ruhman (Hebrew University, Israel); Ronen Rapaport (Hebrew University, Israel); Uri Peskin (Technion, Israel), Nir Tesler (Technion, Israel), Zohar Amitay (Technion, Israel); Yossi Partiel (Hebrew University, Israel).

REPRESENTATIVE PUBLICATIONS AS SENIOR AUTHOR, RECENT (full list includes ~ 220)

- Osovsky, R. et al. Continuous-Wave Pumping of Multiexciton Bands in the Photoluminescence Spectrum of a Single CdTe-CdSe Core-Shell Colloidal Quantum Dot. *Phys. Rev. Lett.* **102**, 197401 (2009).
- Grumbach, N., Rubinfeld, A., Maikov, G. I., Tilchin, E., Lifshitz, E. Manipulation of Carrier-Mn²⁺ Exchange Interaction in CdTe/CdSe Colloidal Quantum Dots by Controlled Positioning of Mn²⁺ Impurities. *J. Phys. Chem. C* **117**, 21021–21027 (2013).
- Tilchin, J. et al. Quantum Confinement Regimes in CdTe Nanocrystals Probed by Single Dot Spectroscopy: From Strong Confinement to the Bulk Limit. *ACS Nano* **9**, 7840–7845 (2015).
- Lifshitz, E., Evidence in Support of Exciton to Ligand Vibrational Coupling in Colloidal Quantum Dots. *J. Phys. Chem. Lett.* **6** (21), 4336–4347, (2015) (Invited Perspective).
- Tilchin, J. et al. Hydrogen-like Wannier–Mott Excitons in Single Crystal of Methylammonium Lead Bromide Perovskite. *ACS Nano* **10**, 6363–6371 (2016).
- Kagan, C. R.; Lifshitz, E.; Sargent, E. H.; Talapin, D. V., "Building devices from colloidal quantum dots". *Science*, 353 (6302), p. 885, aac 5523-1-9 (2016).
- Isarov, M.; Tan, L. Z.; Bodnarchuk, M. I.; Kovalenko, M. V.; Rappe, A. M.; Lifshitz, E., Rashba Effect in a Single Colloidal CsPbBr₃ Perovskite Nanocrystal Detected by Magneto-Optical Measurements. *Nano Lett.* **17** (8), 5020–5026 (2017).
- Jang, Y.; Shapiro, A.; Isarov, M.; Rubinfeld, A.; Safran, A.; Budniak, A. K.; Horani, F.; Dehnel, J.; Sashchiuk, A.; Lifshitz, E., Interface Control of Electronic and Optical Properties in IV-VI and II-VI Core/Shell Colloidal Quantum Dots; *Chem. Commun.*, **53** (6), 1002–1024 (2017) (Invited Review).
- Barak, Y.; Meir, I.; Shapiro, A.; Jang, Y.; Lifshitz, E., Fundamental Properties in Colloidal Quantum Dots. *Adv. Mater.* DOI: 10.1002/adma.201801442, (2018) (Invited Review).
- Shapiro, A.; Jang, Y.; Horani, F.; Kauffmann, Y.; Lifshitz, E., Kirkendall Effect: Main Growth Mechanism for a New SnTe/PbTe/SnO₂ Nano-Heterostructure. *Chem. Mater.* **30** (9), 3141–3149 (2018).