

Efrat Lifshitz

Professor of Chemistry

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PERSONAL INFORMATION

Date of birth: July 5, 1956.

EDUCATION

1981–1984 Ph.D., Physical Chemistry, University of Michigan, Ann Arbor, Michigan, USA
1979–1981 M.Sc., Physical Chemistry, University of Michigan, Ann Arbor, Michigan, USA
1976–1979 B.A., Chemistry, Hebrew University of Jerusalem, Israel

ACADEMIC EMPLOYMENT

1990–present Technion–Israel Institute of Technology, at the Schulich Faculty of Chemistry:
2009–present, Gunsbuourgh Academic Chair
2005–present, Full Professor
1996–2005, Associate Professor
1990–1996, 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

Pioneering contribution to the arena of low-dimensional semiconductor solids with a recognized impact on the development of new nanostructures and a thorough exploration of the interface between magnetism and their optical properties, accompanied by the study of special effects like spin-orbit coupling, Auger relaxation, Rashba effect, electron-nuclei, and electron-electron spin-exchange couplings, anisotropy in g-factors, as well as the creation of local or global magnetism. The studies were carried out with the skilled use of spectroscopic tools (e.g., optically detected magnetic resonance or microwave modulation spectroscopy) corroborated by theoretical models. A few unique contributions include (a) paying special attention to the role of surface and interface centres, achieving suppression of an Auger process in core/shell QDs, and the appearance of multiple excitons in a single particle luminescence via the formation of alloying composition at the core/shell interface. Also, intentional incorporation of magnetic dopants involving guest-host spin-exchange interaction, consequentially tuning the magneto-optical properties; (b) proving anharmonicity and Rashba effect in perovskite materials, seen as an energy split and circularly polarized emission in a single QD or a bulk crystal. This effect was also accompanied by an Overhauser effect, the electron-nuclear interaction. (c) Exposing a strong correlation between long-range magnetic order (Ferro- or Anti-ferromagnetic) and optical properties of magnetic van der Waals semiconductors (MPS₃). The mentioned highlights have essential impacts on emerging spin-electronic and spin-optical properties.

AWARDS AND FELLOWSHIPS

Selective list (recent years): Taub, Excellence in Science Award, Technion, Israel Institute of Technology (**2019**); 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).

Grants (selective list): EC-NMP "Nanospec" (2010-2014); EC-NMP "SANS" (2010-2014); GIF (partner: LMU) (2011-2015); VW-Foundation (2014-2018); ISF-Bikura (2014-2018); EC-Horizon2020 Marie Curie-ITN (2016-2019); ISF-regular (2015-2019); ISF-China-Israel, (2017-2021); BSF-regular (partner: Washington Univ.) (2017-2022); NSF-BSF (partner: Columbia Univ.) (2018-2021); ISF-regular (2019-2013); BSF-regular (partner: Washington Univ.) (2021-2025); MOST (partner: HUJ) (2011-2014); Kamin (partner: Ariel Univ.) (2012-2014); MAAFAT (2014-2018); MOST (partner: Technion) (2018-2021); Kamin (partner: Technion) (2020-2022); Deutsch-Israel Program (partners: BIU, Duisburg, Dresden) (2022-2027); NOFAR-Maymad (partner: Technion) (2022-2024).

MEMBERSHIP ON EDITORIAL BOARDS

Guest Editor of *J. Chemical Physics* for a special issue on Transport properties in low dimensional Materials (2021); Editorial Board of *Nanomaterials* (2020-present); Editorial Board of *Materials*, (2018 – present); Editorial Advisor of the *Advanced Device Materials Journal* (2014–present) and *PhysChemPhys* (2010–2017); Guest Editor of the *Journal of Chemical Physics* for a special issue on the Transport of Charge and Energy in Low-Dimensional Materials (2022); Guest Editor of *PhysChemPhys* for a special issue on Frontier in Colloidal Quantum Dots (2014); the *Israel Journal of Chemistry* for a special issue on Magnetic Resonance and Spintronics (2006).

ORGANISATION OF SCIENTIFIC MEETINGS

Selective list: Chairperson of the Material Research Society on 2D Materials, November 2023; Chairperson of Gordon Research Conference on Colloidal Nanostructure and Nanocrystals, July 2024; Co-chair of Gordon Research Conference on Colloidal Nanostructure and Nanocrystals, July 2022; Member of the program committee at the Optics of Excitons in Confined Systems (OECS), September 2021; Chairperson of nanoGe- 2D materials, October 2021; Chairperson of the Quantsol, March 2019; Chairperson of the nanoGe meeting on 2D materials, September 2019. Chairperson of the PHONSI meeting (Marie Currie European Community Program) February 2017; Member of the program committee at the Optics of Excitons in Confined Systems (OECS) July 2018; Member of the program committee for nanomaterials at the 2017 NOMA conference, part of the OSA Advanced Photonics Congress, August 2017; Chairperson of the Quantsol International Meeting, March 2015; Chairperson of a nanoGe International Meeting with a Nobel Laureate speaker on the topic of Fundamental Properties in the Chemistry and Physics of Colloidal Quantum Dots, September 2014.

INVITED PRESENTATIONS AT RENOWNED INTERNATIONAL CONFERENCES AND ADVANCED SCHOOLS

Selective list (out of >120): Flatlands Beyond Graphene (September 2022, July 2019 and September 2018); Hybrid Nanomaterials, October 2022; NANOMEETING on 2D-Materials, September 2021; NanoGe-CQDs, July 2020; Spins in 2D magnets, August 2020; NanoGe-Colloidal 2D Material, October 2020; NanoGe-Perovskites, October 2020; Keynote Speaker, NanoGe, September 2019; Material Research Society on Perovskite Materials, November 2019; Quantsol Meeting, March 2019; E-MRS, on Perovskite Materials, September 2018; Plenary Talk, Nanoday, Bilkent University, May 2018; NanoGe-2D Materials, September 2018; Quantsol, March 2018; Optical Materials and Applications, July 2017; American Vacuum Society, August 2017; NanoGe on Two-dimensional, April 2017; Plenary talk at the Annual Israel Vacuum Society meeting, September 2016; NanoGe on Fundamental Properties in the Chemistry and Physics of Colloidal Quantum Dots, September 2016; NanoGe on Solar 2D Materials, Berlin, 2016; 2nd Greece-Israel meeting in Nanoscience and Nanotechnology, September 2016; Plenary talk at the IPS 21, St. Petersburg, June 2016; Gordon Conference on Colloidal Quantum Dots, July 2016; 80th birthday of Prof. Art Nozik, Boulder, April 2016; NanoGe-Fundamental Properties in the Chemistry and Physics of Colloidal Quantum Dots, September 2015.

COMMISSIONS OF TRUST

Selective list: Member of the Scientific Board of Nanotechnology Centre at Bilkent University, Turkey (2022-on); Chair, Israel Ministry of Science, Material division (2020); Member of the ERC Synergy Program (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: Israel Science Foundation (multiple times), German-Israel Foundation, USA-Israel Binational Science Foundation. A reviewer of numerous international and national funding agencies.

SUPERVISION AND TEACHING ACTIVITIES

- Advised ~40 Ph.D. students, 19 M.Sc. students, 17 postdoctoral and research fellows, and 12 undergraduate students. Currently advising 9 graduate students and 2 postdoctoral fellows. The graduated students currently hold postdoc positions, are members of the established or start-up companies, and young faculty members at academic institutes in Israel and abroad (Technion, Ben-Gurion, Ariel, HUJI; Mason, Michigan (USA), Goa (India)).
- 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, Physical Chemistry of Quantum materials (1990–present).

INSTITUTIONAL RESPONSIBILITIES

Selective list: Member of the academic promotion committee, Technion (**2021–present**); Member of Quantum Centre Infrastructure Committee (**2019–present**); 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 OF SCIENTIFIC SOCIETIES

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

MOST INFLUENTIAL PUBLICATIONS (*The complete list includes ~ 260*)

1. Kagan, Ch. R.; Talpin, D.; Sargent, E.; **Lifshitz, E.** Building Devices from Colloidal Quantum Dots. Science **2016**, vol 353, issue 6302, aac5523. [*Citations: 759*]
2. 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 Letters **2017**, *17*, 5020-5026. [*Citations: 144*]
3. Tilchin, J.; Dirin, D. N.; Maikov, G. I.; Sashchiuk, A.; Kovalenko, M. V.; and **Lifshitz, E.** Hydrogen-like Wannier-Mott Excitons in Single Crystal of Methylammonium Lead Bromide Perovskite. ACS Nano **2016**, *10*, 6363-6371. [*Citation: 124*]
4. Osovsky, R.; Cheskis, D.; Kloper, V.; Sashchiuk, A.; **Lifshitz, E.** Continuous-Wave Pumping of Multiexciton Bands in Photoluminescence Spectrum of a Single CdTe-CdSe Core-Shell Colloidal Quantum Dot. Physics Review Letter **2009**, *19*, 197401. [*Citation: 126*]
5. Vaxenburg, R.; Rodina, A.; Shabaev, A.; **Lifshitz, E.**; Efros, A.L. Nonradiative auger recombination in semiconductor nanocrystals. Nano Letters **2015**, *15*, 2092-2098. [*Citations: 61*]
6. Maikov, G. I.; Vaxenburg, R.; Sashchiuk, A.; **Lifshitz, E.** Composition-Tunable Optical Properties of Colloidal IV-VI Quantum Dots, Composed of Core/Shell Heterostructures with Alloy Components. ACS Nano **2010**, *11*, 6547-6556. [*Citations: 60*]
7. Jang, Y.; Shapiro, A.; Isarov, M.; Rubin-Brusilovski, 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: Feature Article: Chemical Communication **2017**, *53*, 1002-1024. [*Citations: 61*]
8. **Lifshitz, E.** Evidence in support of exciton to ligand vibrational coupling in colloidal quantum dots. Invited Perspective: The Journal of Physical Chemistry Letters **2015**, 4336-4347. [*Citations: 50*]
9. Shentcis, M.; Budniak, A. K.; Shi, X.; Dahan, R.; Kurman, Y.; Kalina, M.; Herzig Sheinfux, H.; Blei, M.; Svendsen, M. K.; Amouyal, Y.; Koppens, F.; Tongay, S.; Thygesen, K. S.; **Lifshitz, E.**; García de Abajo, F. J.; Wong, L. J.; and Kaminer, I. Tunable free-electron X-ray radiation from van der Waals materials. Nature Photonics **2020**, *14*, 686–692. [*Citations: 18*]