BIOGRAPHICAL DATA

NAME: Eli Yablonovitch DATE OF BIRTH: December 15, 1946

ACADEMIC DEGREES:

Ph. d.	Harvard University, Cambridge, Massachusetts	1972
A. M.	Harvard University, Cambridge, Massachusetts	1969
B. Sc.	McGill University, Montreal, Canada	1967

POSITIONS HELD:

2021-present	University of California, Berkeley & LA, Professor in the Graduate School, Electrical Engineering & Computer Sciences Dept.
2007-2021	University of California, Berkeley, The James & Katherine Lau Engineering Chair; Professor of Electrical Engineering & Computer Sciences,
2010-2021	Director of the NSF S&T Center for Energy Efficient Electronics Science (E^3S), Member, Kavli Energy Nano-Sciences Institute at Berkeley.
1993-2007	University of California, Los Angeles, The Northrop-Grumman Optoelectronics Chair; Professor of Electrical Engineering.
1984-1993	Bell Communications Research, Director, Solid-State Physics Research, 1991-1993 Distinguished Member of Staff, 1990-1993.
1979-1984	Exxon Research Center, Research Associate and Head of Optical Sciences Group.
1974-1979	Harvard University Associate Professor of Applied Physics, 1976-1979 Assistant Professor of Applied Physics, 1974-1976.
1972-1974	Bell Telephone Laboratories, Member of Technical Staff.
1971,1972	Teaching Fellow, Harvard University.

ADDITIONAL POSTS:

2012-present	Technion, Haifa, Israel, Distinguished Visiting Professor.
2007-2021	Adjunct Professor of Electrical Engineering, UCLA.
2010-2020	Hong Kong University of Science & Technology, Visiting Professor, IAS.

HONORS:

2019	Frederic Ives Medal/Jarus W. Quinn Prize, the highest Award of the Optical Society, for "diverse and deep contributions to optical science including photonic crystals, strained semiconductor lasers, and new record-breaking solar cell physics."
2019	Benjamin Franklin Medal in Electrical Engineering, for "widely-used scientific improvements to radio- and light-based technologies in wireless communications and solar energy".
2018	Edison Medal of the IEEE, for "leadership, innovations, and entrepreneurial achievements in photonics, semi-conductor lasers, antennas, and solar-cells".
2017	William R. Cherry Award; the IEEE's highest award in solar cells & photovoltaics.
2016	Oliver Buckley Condensed Matter Physics Prize, American Physical Society, for "seminal achievements in solar cells, strained lasers, & photonic crystals".

2015 Isaac Newton Medal & Prize, the highest award of the UK Institute of Physics, for "his visionary and foundational contributions to photonic nanostructures".

2014 Rank Prize (UK), for "the idea that strained semiconductor lasers would have superior performance due to reduced valence band (hole) effective mass". With almost every human interaction with the internet, optical telecommunication occurs by strained semiconductor lasers.

2017 Elected to the National Academy of Inventors,
2013 Elected as Foreign Member of the Royal Society of London,
2012 Elected to the American Academy of Arts and Sciences,
2003 Elected to the National Academy of Sciences,
2003 Elected to the National Academy of Engineering.

2012 Harvey Prize of Israel, for "pioneering discoveries in photonics, optoelectronics, and semiconductors--that impacted our lives".

2012 IEEE Photonics Award, for "pioneering contributions to photonic crystals, the photonic bandgap, and photonic bandgap engineering".

2010 Mountbatten Medal of the British IET, for "outstanding contributions to electronics".

2001 Julius Springer Prize in Applied Physics, "for the impact of photonic crystals on basic research, as well as on a great variety of applications".

1996 R. W. Wood Prize of the Optical Society of America, "for proposing the concept of Photonic Crystals and electromagnetic band structure engineering".

1993 The W. Streifer Scientific Achievement Award of the IEEE/LEOS, "for contributions to opto-electronics, including the physics of strained-layer lasers and photonic applications of low dimensional structures".

1978 The Adolf Lomb Medal of the Optical Society of America.

1978-79 Alfred P. Sloan Fellow.

1992 Fellow of the Institute of Electrical & Electronics Engineers,
1990 Fellow of the American Physical Society,
1982 Fellow of the Optical Society of America.

UNIVERSITY HONORS:

Ph. d. (honoris causa)	McGill University, Montreal Canada	2018
Honorary Professorship	Nanjing University, China	2015
Ph. d. (honoris causa)	Hong Kong University of Science & Technology	2011
Ph. d. (honoris causa)	KTH, Royal Inst. of Tech., Stockholm, Sweden	2004

SPECIAL HONORS:

Yablonovitch's paper: "Inhibited Spontaneous Emission in Solid-State Physics and Electronics," Phys. Rev. Lett., Vol. 58, 2059 (1987), has over 12,000 citations.
It has the 2nd highest citation count of any paper ever published in Physical Review Letters.

NAMED LECTURESHIPS:

Erwin Schrödinger Distinguished Lecture, Austrian Academy of Sciences, Vienna	May 23, 2019
MIT Energy Initiative IHS Seminar, MIT, Cambridge Massachusetts	Feb. 8, 2017
Paint Branch Lecture, University of Maryland, College Park, Maryland	Oct. 25, 2016
Guptill Lecturer, Dalhousie University, Halifax, Nova Scotia	Oct. 17-18, 2016
Celsius Lecturer, Uppsala University, Sweden	Feb. 18-19, 2016
Nippon Sheet Glass Lecture, UCLA, Los Angeles	Jan. 29, 2016
A.W. Scott Lecturer, University of Cambridge, United Kingdom	May 13-17, 2013
Vincent Meyer Colloquium, Technion, Haifa, Israel	Mar. 26-29, 2012
Cave Memorial Lecture, Queens University, Kingston, Ontario, Canada	Mar. 24, 2011
Edison Lecture, Naval Research Laboratory	Dec. 7, 2010
Herman Haus Lecture, Massachusetts Institute of Technology	April 18, 2007
Walter Schottky Lecture, Aachen University, Germany	July 11, 2006
Morris Loeb Lecturer, Harvard University	April 5-9, 2005
Anson L. Clark Memorial Lecture at Univ. of Texas, Dallas	April 5-6, 2004
Edison Lecture, Notre-Dame University	Mar. 17, 2004
Moore Distinguished Scholar, California Institute of Technology	Sept. 2003-Jun. 2004
Clifford Paterson Lecturer of the Royal Society (London)	May 15-19, 2000

Yablonovitch has contributed **4** different technologies that are used by billions of people every day:

1. Yablonovitch introduced the idea that strained semiconductor lasers could have superior performance due to reduced valence band (hole) effective mass. Today, almost all semiconductor lasers use this concept, including for optical telecommunications, for DVD players, and in the ubiquitous red laser pointers. **In almost every human interaction with the internet, optical telecommunication occurs by strained semiconductor lasers.**

2. In his photovoltaic research, Yablonovitch introduced the 4(n squared) light-trapping factor that is **in worldwide use, for almost all commercial solar panels**. This factor increased the theoretical limits and practical efficiency of solar cells. $4n^2$ is based on statistical mechanics, and is sometimes called the "*Yablonovitch Limit*".

His mantra that "A Great Solar Cell Also Needs to be a Great LED", is the basis of the world record solar cells: single-junction 29.1% efficiency; dual-junction 31.5%; quadruple-junction 38.8% efficiency; all at 1 sun.

3. Yablonovitch is regarded as a Father of the Photonic Bandgap concept, and coined the term "Photonic Crystal". The geometrical structure of the first experimentally realized Photonic Bandgap, is sometimes called "*Yablonovite*".
The broadest use of Photonic Crystals is by Luxtera Inc., (Cisco Systems), whose internal silicon photonic polarization splitter relies upon a two-dimensional Photonic Crystal. These silicon photonic chips provide internal optical communication within the major data centers. **Whoever downloads a web page, or checks their email, is most likely using photonic crystals**.

4. Through his company, Ethertronics Inc., Yablonovitch found a scientific principle to increase cellphone antenna efficiency by approximately 2dB. **Owing to this technological advantage, $>2\times10^9$ antennas were shipped worldwide,** while Yablonovitch was on the Ethertronics Inc., Board of Directors.

In entrepreneurship, Yablonovitch is the Co-Founder of the following science-based companies:

Co-Founder of Ethertronics, Inc. San Diego, CA; antennas for portable electronics:
http://www.ethertronics.com/ 2000-2018, acquired by AVX Inc.
Ethertronics was the major independent cellphone antenna manufacturer.

Co-Founder of Luxtera, Inc. Carlsbad, CA; nano-photonic integration in foundry Silicon:
http://www.luxtera.com/ 2001-2018, acquired by Cisco Systems, Inc.
Luxtera is the Global Leader in Silicon Photonics, shipping the most Silicon Photonics chips.

Co-Founder of Luminescent, Inc. Palo Alto, CA; a photolithography software company:
http://www.luminescent.com/ 2002-2012, acquired by KLA Tencor.
Luminescent provided the first successful use of sophisticated Mathematical Optimization for the design of the Photo-masks used in semiconductor manufacturing. This was the beginning of Inverse Electromagnetic Design. Since 2008 this has been employed for DRAM's, Flash memory, and for Intel micro-processors.

Co-Founder of Alta Devices, Inc. Santa Clara, CA; thin film GaAs solar cells:
2008-2014, acquired by Hanergy Inc.
Alta Devices holds the world record for solar cell efficiency, single junction 29.1%; dual-junction 31.5%; all at 1 sun, based on Yablonovitch's mantra "A Great Solar Cell Also Needs to be a Great LED".

PATENTS:

1. “Hybrid Solar System Has Heat Transfer And Storage System Which Is Integrated With Hybrid Solar Collector, And Includes Solid Particle Laden Gas As Thermal Media To Simultaneously Generate And Store High Temperature Dispatchable Heat”, (with D. Cygan, H. Abbasi, A. Kozlov, R. Winston), U.S. Patent No. 2018358528-A1, (Dec. 13, 2018.)
2. “Nano-Fabricated Plasmonic Optical Transformer”, (with H. Choo, S. Cabrini, P.J. Schuck, X. Liang,) U.S. Patent No. 9,052,450 (Jun. 9, 2015).
3. “Probes for Multi-Dimensional Spectroscopic Imaging, and Methods of Fabrication Thereof”, (with A. Weber-Bargioni, S. Cabrini, W. Bao, M. Melli, and P.J. Schuck) U.S. Patent No. 8,984,661 (Mar. 17, 2015).
4. “Shielded Spiral Sheet Antenna Structure and Method”, (with L. Declos and S. Rowson), U. S. Patent No. 6,677,915 (January 13, 2004).
5. “Magnetic Dipole Antenna Structure and Method”, (with L. Declos and S. Rowson), U. S. Patent No. 6,567,053 (May 20, 2003).
6. “Circuit and Method for Eliminating Surface Currents on Metals”, (with D. Sievenpiper), U. S. Patent No. 6,262,495 (July 17, 2001).
7. “Patterning Method for Epitaxial Lift-off Processing,” (with T. J. Gmitter) U. S. Patent No. 5,201,996 (Apr. 13, 1993).
8. “Optical Reflector Structure, Device, Method of Fabrication, and Communications Method,” U. S. Patent No. 5,172,267 (Dec. 15, 1992).
9. “Arsenic Sulfide Surface Passivation of III-V Semiconductors,” (with B. G. Bagley and T. J. Gmitter) U. S. Patent No. 4,920,078 (Apr. 27, 1990).
10. “Passivation of Indium Gallium Arsenide Surfaces,” (with T. J. Gmitter), U. S. Patent No. 4,843,037 (June 27, 1989).
11. “Method of Making a DH Laser With Strained Layers by MBE,” U. S. Patent No. 4,804,639 (Feb. 14, 1989).
12. “Method for Lifting-Off Epitaxial Films” (with T. J. Gmitter), U. S. Patent No. 4,846,931 (July 11, 1989).
13. “Lift-off and Subsequent Bonding of Epitaxial Films,” (with T. J. Gmitter) U. S. Patent No. 4,883,561 (Nov. 28, 1989).
14. “Passivation of Gallium Arsenide Surfaces,” (with T. J. Gmitter and C. J. Sandroff), U. S. Patent No. 4,751,200 (June 14, 1988).
15. “Method for Producing an Electronically Passivated Surface on Crystalline Silicon Using a Fluorination Treatment and an Organic Overlayer, Using Hydrogen Fluoride,” (with H. W. Deckman and B. R. Weinberger), U. S. Patent No. 4,608,097 (Aug. 26, 1986).
16. “Method for Making Optically Enhanced Thin Film Photovoltaic Device Using Lithographically Defined Random Surfaces,” (with H. W. Deckman, H. Witzke, and C. Wronski), U. S. Patent No. 4,554,727 (Nov. 26, 1985).
17. “Inverted Optically Enhanced Solar Cell,” U. S. Patent No. 4,525,593 (June 25, 1985).
18. “Short Laser Pulse Generation by Gas Breakdown Switching and Highly Selective Spectral Filtering,” (with J. Goldhar), U. S. Patent No. 3,979,694 (Sept. 7, 1976).

PUBLICATIONS LIST:

1. Yablonovitch, E., Bloembergen, N., Wynne, J.J. "Dispersion of the Nonlinear Optical Susceptibility in n-InSb," Phys. Rev. B, Vol. 3(6), pp. 2060-2062, March 1971.
2. Yablonovitch, E. "Optical Dielectric Strength of Alkali-Halide Crystals Obtained by Laser-Induced Breakdown," Appl. Phys. Lett., Vol. 19(11), pp. 495-497, December 1971.
3. Yablonovitch, E., Flytzanis, C., Bloembergen, N. "Anisotropic Interference of Three-Wave and Double Two-Wave Frequency Mixing in GaAs," Phys. Rev. Lett., Vol. 29(13), pp. 865-868, September 1972.
4. Yablonovitch, E., Bloembergen, N. "Avalanche Ionization and the Limiting Diameter of Filaments Induced by Light Pulses in Transparent Media," Phys. Rev. Lett., Vol. 29(14), pp. 907-910, October 1972.
5. Yablonovitch, E. "Nonlinear Optics with the CO_2 Laser," PhD. Thesis, Harvard University, Division of Engineering and Applied Physics (1972).
6. Fradin, D.W., Yablonovitch, E., Bass, M. "Confirmation of an Electron Avalanche Causing Laser-induced Bulk Damage at 1.06um," Appl. Optics, Vol. 12(4), pp. 700-709, April 1973.
7. Yablonovitch, E., Goldman, L.; Richfield, D.; and Bloembergen N., "Studies in Laser safety of new high-output systems. II. TEA CO_2 laser impacts," (Optics and Laser Technology, vol.5, (no.2), p.58-9, April 1973.
8. Yablonovitch, E. "Similarity Principles for Laser-Induced Breakdown in Gases," Appl. Phys. Lett., Vol. 23(3), pp. 121-122, August 1973.
9. Yablonovitch, E. "Spectral Broadening in the Light Transmitted through a Rapidly Growing Plasma," Phys. Rev. Lett., Vol. 31(14), pp. 877-879, October 1973.
10. L. Goldman, E. Yablonovitch, N. Bloembergen, D. Richfield, "Studies in Laser Safety of New High Output Systems, 2. TEA CO_2 Laser Impacts", Optics and Laser Technology, vol. 5, p. 58-59, (1973).
11. Yablonovitch, E. "Self-Phase Modulation of Light in a Laser-Breakdown Plasma," Phys. Rev. Lett., Vol. 32(20), pp. 1101-1104, May 1974.
12. Yablonovitch, E. "Self-Phase Modulation and Short-Pulse Generation from Laser-Breakdown Plasmas," Phys. Rev. A, Vol. 10(5), pp. 1888-1895, November 1974.
13. Yablonovitch, E., Goldhar, J. "Short CO_2 Laser Pulse Generation by Optical Free Induction Decay," Appl. Phys. Lett., Vol. 25(10), pp. 580-582, November 1974.
14. Kwok, H-S., Yablonovitch, E. "CO_2 Oscillator-Pulse Shaper-Amplifier System Producing 0.1 J in a 500 psec Laser Pulse," Rev. Sci. Instrum., Vol. 46(7), pp. 814-816, July 1975.
15. Yablonovitch, E. "Generation of a Short Optical Pulse of Arbitrary Shape and Phase Variation," IEEE J. Quantum Electron., Vol. QE-11, pp. 789-791, September 1975.
16. Yablonovitch, E. "Plasma Resonance in the X-Ray Emission from Gaseous Laser Targets," Phys. Rev. Lett., Vol. 35(20), pp. 1346-1349, November 1975.
17. Kwok, H.S., Yablonovitch, E. "Electrical Triggering of an Optical Breakdown Plasma with Subnanosecond Jitter," Appl. Phys. Lett., Vol. 27(11), pp. 583-585, December 1975.
18. Kolodner, P., Yablonovitch, E. "Proof of the Resonant Acceleration Mechanism for Fast Electrons in Gaseous Laser Targets," Phys. Rev. Lett., Vol. 37(26), pp. 1754-1757, December 1976.

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20. Kolodner, P., Winterfeld, C., Yablonovitch, E. "Molecular Dissociation of SF6 by Ultra-Short CO_2 Laser Pulses," Optics Commun., Vol. 20(1), pp. 119-122, January 1977.
21. Kwok, H.S., Yablonovitch, E. "30-psec CO_2 Laser Pulses Generated by Optical Free Induction Decay," Appl. Phys. Lett., Vol. 30(3), pp. 158-160, February 1977.
22. Black, J., Yablonovitch, E. "Avalanche Initiating Electron Produced by Laser-Induced Tunneling," IEEE J. of Quantum Electron., pp. 117-119, April 1977.
23. Kwok, H.S., Yablonovitch, E. "A Simple Self-Triggered Plasma Shutter," Optics Commun., Vol. 21(2), pp. 252-254, May 1977.
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