

Lee A. Weinstein

Energy Researcher & STEM Educator

41 Belmont St., Apt. 26
Somerville, MA 02143
(415) 342-2282
leeweinstein@gmail.com
www.laweinstein.com

Massachusetts Institute of Technology

Sept. 2017 PhD in Mechanical Engineering GPA: 5.00/5.00
Sept. 2013 MS in Mechanical Engineering GPA: 5.00/5.00

University of California, Berkeley

May 2011 BS in Mechanical Engineering GPA: 3.97/4.00

Research Experience

2015 – Present **Solar-Thermal Aerogel Receiver – MIT**

I am part of a team developing a novel solar-thermal aerogel receiver, which achieves efficient solar to thermal conversion using transparent silica aerogel. I am modeling system performance as well as fabricating and characterizing experimental prototypes of the receiver.

2016 – Present **Determining Performance Limit of Spectral Selectivity – MIT**

I am attempting to determine the limit of performance enhancement possible using spectral selectivity (e.g., in solar thermal systems) for physically realizable surfaces. In this work, limits are set by the Kramers-Kronig relations in conjunction with selected physical constraints.

2014 – Present **Hybrid PV-Thermal Solar Receiver – MIT**

I helped design a spectrum-splitting hybrid PV and thermal solar receiver, and developed an integrated model spanning the receiver sub-components to predict overall system performance.

- 2012 – 2015 **Macroscale Optical Cavity for Solar Receivers – MIT**
- I designed an optical cavity to reduce radiative losses from solar receivers. As part of this project, I programmed a ray tracing code to predict cavity performance and experimentally demonstrated reduced thermal losses from a receiver at elevated temperature. I also used ray tracing to show an improvement in absorption of photovoltaic cells with the cavity.
- 2011 – 2015 **Solar Thermoelectric Generator (STEG) – MIT**
- I helped design an improved efficiency STEG using optical concentration and modeled the device efficiency using heat transfer analysis. I tested a prototype STEG with integrated thermal storage.
- 2010 – 2011 **Energy scavenger from fluid flow – UC Berkeley**
- I helped develop a piezoelectric energy scavenger for use in HVAC ducts. My work on the project improved power output from 3 μ W to 2 mW, or approximately 700x increased performance. I modeled the fluid dynamics and solid mechanics of the system to optimize design, prototyped a variety of designs and completed performance and fatigue testing on prototypes.

Educational Experience

- 2017 – Present **Science Quiz Writer – Brilliant.org**
- I develop curriculum for brilliant.org, which provides online STEM education. I am currently creating lessons on renewable energy, designing them to be broadly accessible without sacrificing technical accuracy.
- 2014 – 2017 **Mentor – MITxplore**
- As a mentor for MITxplore (mitxplore.org) I worked with about ten 4th – 6th grade students per semester during weekly math outreach sessions. I also developed lessons to make complex math topics accessible and engaging for young students.
- Spring 2016 **Teaching Assistant – 2.55: Advanced Heat and Mass Transfer**
- I was a teaching assistant for course 2.55 (graduate level heat transfer) at MIT. I organized and led recitation sessions, office hours and exam review. I earned an overall rating of 6.8/7 on my course evaluations in this position.

Publications

1. K. McEnaney, L. Weinstein, D. Kraemer, H. Ghasemi and G. Chen. "Aerogel-based solar thermal receivers." *Nano Energy*, **40**, 180-186, 2017.
2. D. Kraemer, Q. Jie, K. McEnaney, F. Cao, W. Liu, L.A. Weinstein, J. Loomis, Z. Ren and G. Chen. "Concentrating solar thermoelectric generators with a peak efficiency of 7.4%" *Nature Energy*, **1**, 16153, 2016.
3. S.V. Boriskina, L.A. Weinstein, J.K. Tong, W.C. Hsu and G. Chen. "Hybrid Optical-Thermal Antennas for Enhanced Light Focusing and Local Temperature Control." *ACS Photonics*, **3** (9), 1714-1722, 2016.
4. L.A. Weinstein, J. Loomis, B. Bhatia, D.M. Bierman, E.N. Wang and G. Chen. "Concentrating Solar Power." *Chemical Reviews*, **115** (23), 12797-12838, 2015.
5. J. Loomis, L. Weinstein, S.V. Boriskina, X. Huang, V. Chiloyan and G. Chen. "Diverging polygon-based modeling (DPBM) of concentrated solar flux distributions." *Solar Energy*, **122**, 24-35, 2015.
6. L.A. Weinstein, W.C. Hsu, S. Yerci, S.V. Boriskina, G. Chen, "Enhanced absorption of thin-film photovoltaic cells using an optical cavity," *Journal of Optics*, **17** (5), 055901, 2015.
7. L. Weinstein, D. Kraemer, K. McEnaney, G. Chen, "Optical cavity for improved performance of solar receivers in solar-thermal systems," *Solar Energy*, **108**, 69-79, 2014.
8. L.A. Weinstein, K. McEnaney, G. Chen, "Modeling of thin-film solar thermoelectric generators," *Journal of Applied Physics*, **113** (16), 164504, 2013.
9. L.A. Weinstein, M.R. Cacan, P.M. So, P.K. Wright, "Vortex shedding induced energy harvesting from piezoelectric materials in heating, ventilation and air conditioning flows," *Smart Materials and Structures*, **21** (4), 045003, 2012.
10. J. Bakhshi, L. Weinstein, K.S. Poksay, B. Nishinaga, D.E. Bredesen, R.V. Rao, "Coupling endoplasmic reticulum stress to the cell death program in mouse melanoma cells: effect of curcumin," *Apoptosis*, **13** (7), 904-914, 2008.

Published Conference Proceedings

1. L.A. Weinstein, D.M. Bierman, E.N. Wang and G. Chen, "Directional selectivity as an alternative to concentration for high efficiency solar thermal systems," TFESC-12752, ASTFE Thermal and Fluid Engineering Summer Conference, August 9-12, 2015, New York City, NY

Conference Presentations

1. L. Weinstein, T. Cooper, S. Yang, B. Bhatia, L. Zhao, E. Strobach, G. Ni, S. Boriskina, E. Wang and G. Chen, "On-sun demonstration of a Solar-Thermal Aerogel Receiver (STAR)," MRS-ES09.10.05, MRS Fall Meeting, November 26 - December 1, 2017, Boston, MA.
2. L.A. Weinstein, V. Chiloyan, T.A. Cooper, S.V. Boriskina and G. Chen, "Limit to the spectral selectivity of a passive radiative surface based on the Kramers-Kronig relations," HT2017-4837, ASME Summer Heat Transfer Conference, July 9 - 12, 2017, Seattle, WA.
3. L. Weinstein, V. Chiloyan, S. Boriskina and G. Chen, "Limit on the Performance of Spectrally Selective Surfaces for Solar Applications," MRS-NM4.6.04, MRS Fall Meeting, November 27 - December 2, 2016, Boston, MA
4. L. Weinstein, S. Fay, C. Douglas, C. Jiang, A. Hosoi and C. Clanet, "Dribbling as a Particle-Particle Interaction," Sports Physics, June 8 - June 10, 2016, Paris, France
5. L. Weinstein, S. Yang, L. Zhao, B. Bhatia, E. Strobach, D. Bierman, T. Cooper, L. Meroueh, S.B. Boriskina, E.N. Wang and G. Chen, "A Solar-Thermal Aerogel Receiver (STAR) for Cost-Effective Electricity Generation," MRS-EE3.1.08, MRS Spring Meeting, March 28 - April 1, 2016, Phoenix, AZ
6. L. Weinstein, J. Loomis, X. Huang, S. Yang, L. Zhao, Y. Huang, F. Cao, T. Sun, B. Bhatia, D. Bierman, E. Strobach, W.C. Hsu, G. Ni, L. Tang, S. Boriskina, Z. Ren, E. Wang and G. Chen, "Hybrid PV and Thermal Solar Receiver Using Silica Aerogel and Thin-Film Multi-Layer Spectral Splitting," MRS-OO11.02, MRS Fall Meeting, November 29 - December 4, 2015, Boston, MA
7. K. McEnaney, D. Kraemer, L.A. Weinstein, Q. Jie, W.S. Liu, F. Cao, Z. Ren and G. Chen, "Demonstrated high efficiency of concentrating solar thermoelectric generators," MRS-CC8.01, MRS Fall Meeting, November 30 - December 5, 2014, Boston, MA
8. L.A. Weinstein, W.C. Hsu, S. Boriskina and G. Chen, "External Cavity for Enhanced Absorption in Thin-Film Photovoltaics", ES-FuelCell2014-6865, ASME International Conference on Energy Sustainability, June 30 - July 2, 2014, Boston, MA
9. L.A. Weinstein, D. Kraemer, K. McEnaney and G. Chen, "Angularly dependent emissivity using optical cavities", IMECE2013-64894, ASME International Conference and Exhibition, November 15 - 21, 2013, San Diego, CA

Patents

1. G. Chen, E.N. Wang, S.V. Boriskina, L.A. Weinstein, S. Yang, B. Bhatia, L. Zhao, E.M. Strobach, T.A. Cooper, D.M. Bierman, X. Huang, J. Loomis. Solar Thermal Aerogel Receiver, Application #: US 62/299,090
2. G. Chen, E.N. Wang, S.V. Boriskina, K. McEnaney, H. Ghasemi, S. Yerci, A. Lenert, S. Yang, N. Miljkovic, L.A. Weinstein, D. Bierman. Internally-Heated Thermal and Externally-Cool Photovoltaic Cascade Solar Energy System for Full Solar Spectrum Utilization, Application #: US 14/464,103
3. S. Boriskina, D. Kraemer, K. McEnaney, L.A. Weinstein, G. Chen. Solar power conversion system with directionally-and spectrally-selective properties based on a reflective cavity, Application #: US 13/972,261

Selected Leadership and Service

2013 – 2017	Webmaster, MITxplore, MIT
2014 – 2017	Graduate Member at Large, Intramural Executive Board, MIT
2015 – 2017	Member, DAPER Advisory Board, MIT
2015	Intramural Chair, Graduate Association of Mechanical Engineers, MIT
2014	President, Graduate Association of Mechanical Engineers, MIT
2012	Orientation Chair, Graduate Association of Mechanical Engineers, MIT
2010 – 2011	Student Relations Officer, Tau Beta Pi, UC Berkeley
Spring 2011	Student Relations Chair, Pi Tau Sigma, UC Berkeley

Awards and Honors

2017	Harold J. Pettegrove Award
2015	MIT Mechanical Engineering Research Exhibition – Audience Choice Award
2011 – 2012	Warren M. Rohsenow Fellowship recipient
2011, 2012	National Science Foundation GRFP Honorable Mention
Spring 2011	Pi Tau Sigma – Officer of the Semester
2007 – 2011	Regents' and Chancellor's Scholar