

**MAHER HARB**

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**EDUCATION***University of Toronto, Toronto, ON, Canada***Ph.D. in Physics (supervisor, R. J. Dwayne Miller) 2009**

Dissertation: "Electronically Driven Structural Changes of Si Resolved by Femtosecond Electron Diffraction"

*North Carolina A&T State University, Greensboro, NC, USA***M.S. in Electrical Engineering (supervisor, M. Bikdash) 2000**

Thesis: "Fuzzy Inference Systems and their Applications in the Modeling of Wind Turbines"

*American University of Beirut, Beirut, Lebanon***B.E. Electrical Engineering 1997**

Honors: Graduated "with Distinction"

**AWARDS**

- National Research Council Canada postdoctoral fellowship
- Wenner-Gren Foundation postdoctoral fellowship
- Ontario Graduate Scholarship
- Reginald Blyth Fellowship
- Hariri Foundation scholarship

**RESEARCH AND TEACHING EXPERIENCE***Departments of Physics and Materials Science & Engineering 2015 - present*  
*Drexel University, Philadelphia, PA***Assistant professor**

Research Highlights: Conducting research in experimental condensed matter physics, publishing results in peer-reviewed journals, supervising graduate students, and teaching.

Teaching Highlights: PHYS-311 Classical Mechanics I (Winter 2015), PHYS-452/626 Solid State Physics (Fall 2016), PHYS-T380 Modern Optics (Winter 2017) PHY-201 Fundamentals of Physics III (Fall 2017).

*MAX-lab, Lund University, Lund, Sweden 2009 - 2015***NSERC Postdoctoral Fellow**

Research Highlights: Investigated structural dynamics in multilayer graphene, graphite, and amorphous carbon using ultrafast electron diffraction and time resolved x-ray diffraction.

*University of Toronto, Toronto, ON, Canada 2009 - 2009***Postdoctoral Fellow**Research Highlights: Developed a nano-fluidic device that allows *in situ* electron microscopy in the liquid environment.

University of Toronto, Toronto, ON, Canada

2003 - 2008

**Ph.D. Candidate**

Research Highlights: Developed an ultrafast electron diffraction setup and conducted the first study to directly observe non-thermal melting in nano-scale silicon.

North Carolina A&T State University, Greensboro, NC, USA

1998 - 2000

**M.S. Candidate**

Research Highlights: Developed a Fuzzy learning toolbox in MATLAB and used it to model the aerodynamics of auto-furling wind turbines.

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**KEY EXPERTISE**

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|-----------------------------------|-----------------------|--------------------------|
| • Ultrafast Electron diffraction  | • Solid state physics | • Instrument development |
| • Time resolved X-ray diffraction | • Lasers and optics   | • Vacuum technologies    |
| • Ultrafast science               | • Image processing    | • Detection systems      |
| • Lattice dynamics                | • Nanofabrication     | • Electronics            |
|                                   | • Nano/Microfluidics  | • Software development   |

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**RELEVANT INDUSTRIAL & ENTREPRENEURSHIP EXPERIENCE**

Co-founder at Insight Nanofluidics, Toronto, ON

2009 - 2015

Highlights: Co-founded Nanotechnology company based on work in nanofluidics during PhD studies. Provided in-kind support and consulting.

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**REFEREED PUBLICATIONS**

- J. R. Dwyer and **M. Harb**, "Through a window, brightly: A review of selected nanofabricated thin film platforms for spectroscopy, imaging, and detection," *Applied Spectroscopy* 71(9) 2051 (2017).
- **M. Harb**, H. Enquist, A. Jurgilaitis, F. T. Tuyakova, A. N. Obratsov, and J. Larsson, "Phonon-phonon interactions in photoexcited graphite studied by ultrafast electron diffraction", *Phys. Rev. B* 93, 104104 (2016).
- **M. Harb**, H. Enquist, A. Jurgilaitis, F. T. Tuyakova, A. N. Obratsov, and J. Larsson, "Ultrafast dynamics of electron-phonon coupling in highly excited graphite," *Phys. Rev. Lett.* Submitted Oct. 16, (2014).
- A. Jurgilaitis, H. Enquist, B. P. Andreasson, A. I. H. Persson, M. Borg, P. Caroff, K.A. Dick, **M. Harb**, H. Linke, R. Nüske, L. E. Wernersson, and J. Larsson, "Time-resolved x-ray diffraction reveals origin of low thermal conductivity in InSb nanowires," *Nano Letters*, 10.1021/nl403596b (2014).
- A. Jurgilaitis, H. Enquist, **M. Harb**, K.A. Dick, B. M. Borg, R. Nüske, L.-E. Wernersson, and J. Larsson, "Measurements of light absorption efficiency in InSb nanowires," *Structural Dynamics*, 014502 (2014).
- C. Mueller, **M. Harb**, J. R. Dwyer, and R. J. D. Miller, "Nanofluidic Cells with Controlled Pathlength and Liquid Flow for Rapid, High-Resolution In Situ Imaging with Electrons," *J. Phys. Chem. Lett.* 4, 2339 (2013).
- **M. Harb**, C. von Korff-Schmising, H. Enquist, A. Jurgilaitis, I. Maximov, P. V. Shvets, A. N. Obratsov, D. Khakhulin, M. Wulff, and J. Larsson, "The c-axis thermal conductivity of graphite film of nanometer thickness measured by time resolved X-ray diffraction," *Appl. Phys. Lett.* 101, 233108 (2012).

- M. Gao, H. J.-R., R. R. Cooney, J. Stampe, M. de Jong, **M. Harb**, G. Sciaini, G. Moriena, and R. J. D. Miller, "Full characterization of RF compressed femtosecond electron pulses using ponderomotive scattering," Optics Express 20, 12048 (2012).
- R. Nüske, A. Jurgilaitis, H. Enquist, **M. Harb**, Y. Fang, U. Håkanson, and J. Larsson, "Transforming graphite to nanoscale diamonds by a femtosecond laser pulse," Appl. Phys. Lett. 100, 043102 (2012).
- **M. Harb**, A. Jurgilaitis, H. Enquist, R. Nüske, C. v. Korff Schmisin, J. Gaudin, S. L. Johnson, C. J. Milne, P. Beaud, E. Vorobeva, A. Caviezel, S. O. Mariager, G. Ingold, and J. Larsson, "Picosecond Dynamics of Laser-Induced Strain in Graphite," Phys. Rev. B 84, 045035 (2011).
- R. Nüske, A. Jurgilaitis, H. Enquist, S. D. Farahani, J. Gaudin, L. Guerin, **M. Harb**, C. v. K. Schmisin, M. Störmer, M. Wulff, and J. Larsson, "Picosecond time-resolved x-ray reflectivity of a laser-heated amorphous carbon thin film," Appl. Phys. Lett. 98, 101909 (2011).
- R. J. D. Miller, R. Ernstorfer, **M. Harb**, M. Gao, C. T. Hebeisen, H. Jean-Ruel, C. Lu, G. Moriena, and G. Sciaini, "Making the molecular movie': first frames," Acta Cryst. A 66, 137 (2010).
- **M. Harb**, W. Peng, G. Sciaini, C. T. Hebeisen, R. Ernstorfer, M. A. Eriksson, M. G. Lagally, S. G. Kruglik, and R. J. D. Miller, "Excitation of longitudinal and transverse coherent acoustic phonons in nanometer free-standing films of (001) Si," Phys. Rev. B 79, 094301 (2009).
- G. Sciaini, **M. Harb**, S. G. Kruglik, T. Payer, C. T. Hebeisen, F.-J. M. zu Heringdorf, M. Yamaguchi, M. H. von Hoegen, R. Ernstorfer, and R. J. D. Miller, "Electronic acceleration of atomic motions and disordering in bismuth," Nature 458, 56 (2009).
- R. Ernstorfer, **M. Harb**, C. T. Hebeisen, G. Sciaini, T. Dartigalongue, and R. J. D. Miller, "Experimental Evidence for Electronic Bond Hardening in Gold," Science 323, 5917 (2009).
- **M. Harb**, R. Ernstorfer, C. T. Hebeisen, G. Sciaini, W. Peng, T. Dartigalongue, M. A. Eriksson, M. G. Lagally, S. G. Kruglik, and R. J. D. Miller, "Electronically Driven Structure Changes of Si Captured by Femtosecond Electron Diffraction," Phys. Rev. Lett. 100, 155504 (2008).
- **M. Harb**, W. Peng, G. Sciaini, C. T. Hebeisen, M. A. Eriksson, M. G. Lagally, S. G. Kruglik, and R. J. D. Miller, "Electronically Driven Structural Dynamics of Si Resolved by Femtosecond Electron Diffraction," Springer Series in Chemical Physics 92, 158 (2008).
- R. Ernstorfer, **M. Harb**, C.T. Hebeisen, G. Sciaini, T. Dartigalongue, I. Rajkovic, M. Ligges, D. von der Linde, Th. Payer, M. Horn-von-Hoegen, F.-J. Meyer zu, Heringdorf, S. Kruglik, and R.J.D. Miller, "Atomic View of the Photoinduced Collapse of Gold and Bismuth," Springer Series in Chemical Physics 92, 113 (2008).
- C. T. Hebeisen, G. Sciaini, **M. Harb**, R. Ernstorfer, S. G. Kruglik, and R. J. D. Miller, "Direct Visualization of Electron Emission from a Surface under Intense Laser Illumination," Springer Series in Chemical Physics 92, 693 (2008).
- C. T. Hebeisen, G. Sciaini, **M. Harb**, R. Ernstorfer, T. Dartigalongue, S. G. Kruglik, and R. J. D. Miller, "Grating enhanced ponderomotive scattering for visualization and full characterization of femtosecond electron pulses," Optics Express 16, 3334 (2008).
- J. R. Dwyer, R. E. Jordan, C. T. Hebeisen, **M. Harb**, R. Ernstorfer, T.

- Dartigalongue, and R. J. D. Miller, "Femtosecond electron diffraction: an atomic perspective of condensed phase dynamics," J. Modern Optics 54, 905 (2007).
- J. R. Dwyer, R. E. Jordan, C. T. Hebeisen, **M. Harb**, R. Ernstorfer, T. Dartigalongue, and R. J. D. Miller, "Experimental basics for femtosecond electron diffraction studies," J. Modern Optics 54, 923 (2007).
  - C. T. Hebeisen, R. Ernstorfer, **M. Harb**, T. Dartigalongue, R. E. Jordan, and R. J. D. Miller, "Femtosecond electron pulse characterization using laser ponderomotive scattering," Optics Letters 31, 3517 (2006).
  - **M. Harb**, R. Ernstorfer, T. Dartigalongue, C. T. Hebeisen, R. E. Jordan, and R. J. D. Miller, "Carrier Relaxation and Lattice Heating Dynamics in Silicon Revealed by Femtosecond Electron Diffraction," J. Phys. Chem. B 110, 25308 (2006).
  - R. Ernstorfer, **M. Harb**, C. T. Hebeisen, T. Dartigalongue, R. E. Jordan, L. Zhu, and R. J. D. Miller, "Femtosecond Electron Diffraction Study on the Heating and Melting Dynamics of Gold," Springer Series in Chemical Physics 88, 755 (2006).
  - C.T. Hebeisen, R. Ernstorfer, **M. Harb**, T. Dartigalongue, R.E. Jordan, L. Zhu, and R.J.D. Miller, "Characterization of ultrashort electron pulses," Springer Series in Chemical Physics 88, 758 (2006).
  - A. Paarmann, D. Kraemer, M. L. Cowan, N. Huse, **M. Harb**, B. D. Bruner, J. R. Dwyer, E. T. J. Nibbering, T. Elsaesser, and R. J. D. Miller, "2D-IR Photon Echo Spectroscopy of Liquid H<sub>2</sub>O - Combination of Novel Nanofluidics and Diffractive Optics Deciphers Ultrafast Structural Dynamics," Springer Series in Chemical Physics 88, 335 (2006).
  - J. R. Dwyer, C. T. Hebeisen, R. Ernstorfer, **M. Harb**, V. Deyirmenjian, R. E. Jordan, and R. J. D. Miller, "Femtosecond Electron Diffraction: 'Making the Molecular Movie'," Phil. Trans. R. Soc. A 364, 741 (2006).

## SELECTED CONFERENCE ABSTRACTS

- **M. Harb**, R. Ernstorfer, C. T. Hebeisen, G. Sciaini, T. Dartigalongue, and R. J. D. Miller, "Non-Thermal Collapse of the Silicon Lattice Observed by Femtosecond Electron Diffraction," The eleventh Frontiers of Electron Microscopy in Materials Science Conference, Sonoma, CA (2007).
- **M. Harb**, and M. Bikdash, "A fuzzy model of wind turbine aerodynamics learned from Yawdyn data", Artificial Neural Networks in Engineering (ANNIE), Nov. 7-10, Rolla, Mo, (1999).
- **M. Harb**, M. Bikdash, and A. Homaifar, "Generating contiguous training data for inverse-learning control", the American Control Conference (1999).