

## John Harris Miller, Jr.: Curriculum Vitae (3-page Summary)

### Research Highlights (since 2009):

- Quantum nucleation of vortex-antivortex pairs in superconductors.
- Dynamics of charge and spin density waves (up to 340 K in NbS<sub>3</sub>); Soliton tunneling model.
- Real-time electrophoresis; Studies of mitochondrial electron transport chain.
- Model of ATP synthase rotary biological motor; Electromagnetic probes of biological motors & enzymes.

### Employment History:

2006 – present: Professor of Physics, University of Houston  
 1995-2006: Associate Professor of Physics, University of Houston  
 1994-2003: Adjunct Assistant Professor of Pediatric Cardiology, Baylor College of Medicine  
 1994-present: Project Leader, HTS Device Applications Lab, Texas Center for Superconductivity  
 1989-1995: Assistant Professor of Physics, University of Houston  
 1986-1989: Assistant Professor of Physics, University of North Carolina at Chapel Hill  
 1985-1986: IBM Postdoctoral Fellow, University of Illinois at Urbana-Champaign  
 1980-1985: Graduate Research Assistant, University of Illinois at Urbana-Champaign  
 Summer 1988: Resident Visitor, Bell Communications Research Laboratories  
 Summer 1980: Electronic Design Engineer, Magnavox Government and Industrial Division  
 1977-1980: Electrical Engineering Coop, Kodak Apparatus Division

### Education:

1985: Ph.D., Electrical Engineering, University of Illinois at Urbana-Champaign.  
 1983: M.S., Electrical Engineering, University of Illinois at Urbana-Champaign.  
 1980: B.S., Electrical Engineering, Northwestern University.

### Ph.D. Thesis (Experimental):

*Quantum Tunneling of Charge-Density Waves in Quasi-One-Dimensional Conductors*, May 1985. Thesis advisors: John R. Tucker and two-time Nobel laureate John Bardeen. Miller Ph.D. thesis is included in the John Bardeen Archives at the University of Illinois at Urbana-Champaign.

### Other Experience and Professional Memberships (since 2009):

Member: American Physical Society: Divisions of Condensed Matter & Biological Physics, Topical Group on Quantum Information; Biophysical Society  
NIH Study Section: ZRG1 SBIB-V (58), PAR-11-020 & -021, Technologies for Healthy Independent Living (May 2011).  
NIH Study Section: ZRG1 BST-M (58) R, RFA OD-09-003, Challenge Grants Panel 4 (2009).  
Session chair: International School & Workshop on Electronic Crystals, Cargèse, Corsica, France, Aug. 15- 27, 2011.  
Session co-chair: Platform C, Oxidative Phosphorylation and Mitochondrial Metabolism, Biophysical Society 53<sup>rd</sup> Annual Meeting, Boston, Massachusetts, February 28 – March 4, 2009.

### Refereed Publications (Since 2009, reverse chronological order):

1. *Quantum mechanisms of density wave transport*. J. H. Miller, Jr. and A. I. Wijesinghe, *Physica B: Condensed Matter*, vol. **407** (no. 11), pp. 1734-1736 (2012).
2. *Rapid morphological characterization of isolated mitochondria using Brownian motion*. Akilan Palanisami, Jie Fang, Thomas W. Lowder, Hawley Kunz, and John H. Miller, Jr., *Analytical Methods*, vol. **4**, pp. 513-521 (2012).
3. *Correlated Quantum Transport of Density Wave Electrons*. J. H. Miller, Jr., A. I. Wijesinghe, Z. Tang, and A. M. Guloy, *Physical Review Letters*, vol. **108** (no. 3) p. 036404, 5 pages + supplemental material (2012).
4. *Reduction of electrode polarization capacitance in low-frequency impedance spectroscopy by using mesh electrodes*. D. Padmaraj, J. H. Miller Jr., J. Wosik, W. Zagozdzon-Wosik, *Biosensors & Bioelectronics*, vol. **29** (1), pp. 13-17 (2011).
5. *Quantum Decay of the 'False Vacuum' and Pair Creation of Soliton Domain Walls*. J. H. Miller, Jr., *Advances in Quantum Theory*, G. Jaeger, A. Khrennikov, et al., editors, AIP Conference Proceedings, vol. **1327**, pp. 434-438 (2011).
6. *Quantum dynamical phase transition in the soliton nucleation model of density wave transport*. J. H. Miller, Jr., *Journal of Physics: Conference Series*, vol. **273**, pp. 012007: 1-4 (2011).
7. *Nonlinear Impedance of Whole Cells Near an Electrode as a Probe of Mitochondrial Activity*. Akilan Palanisami, George T. Mercier, Jie Fang, and John H. Miller, Jr., *Biosensors*, vol. **1**, pp. 46–57 (2011).
8. *Simultaneous sizing and electrophoretic mobility measurement of sub-micron particles using Brownian motion*. Akilan Palanisami and John H. Miller, Jr., *Electrophoresis*, vol. **31**, pp. 3613–3618 (2010).

9. *Nonlinear dielectric spectroscopy for label-free detection of respiratory activity in whole cells.* G. T. Mercier, A. Palanisami, & J. H. Miller, Jr., *Biosensors & Bioelectronics*, vol. **25**, pp. 2107-2114 (2010).
10. *Harmonic Analysis of Neuronal Membranes and Tissue using SQUIDS.* James R. Claycomb, Quoc Tran, Vijayanand Vajrala, and John H. Miller, Jr., *IEEE Transactions on Applied Superconductivity*, vol. **19**, no. 3, pp. 839-843 (2009).
11. *Intrinsic Electromagnetic Noise in Living Cells in Vitro and its Spectroscopy,* M. H. S. Bukhari, J. H. Miller Jr. and Z. H. Shah, *J. Basic & Applied Sciences*, vol. **5**, no. 2, 65-71, (2009).
12. *A Weak Current Amperometric Technique in Physiological and Bioelectromagnetic Measurements,* M. H. S. Bukhari, J. H. Miller Jr. and Z. H. Shah, *Pak. J. Sci. Ind. Res.*, Vol. **52**(2), 91-99 (2009).
13. *Physical mechanisms of biological molecular motors.* John H. Miller, Jr., Vijayanand Vajrala, Hans L. Infante, James R. Claycomb, Akilan Palanisami, Jie Fang, and George T. Mercier, *Physica B*, vol. **404**, 503-506 (2009).

**Conference Presentations** (Since 2010, selected, reverse chronological order):

1. *The impact of electric and magnetic fields on charge density wave and soliton order parameters,* J. H. Miller, Jr. & A. I. Wijesinghe, Electronic States & Phases Induced by Electric & Optical Impacts (IMPACT 2012), Orsay, France, September 10–14, 2012.
2. *Correlated Quantum Transport of Electrons up to 360 K,* J. H. Miller, Jr. and A. I. Wijesinghe, Gordon Research Conference on Correlated Electron Systems, Correlations and Topology in Electron Systems, Mount Holyoke College, South Hadley, Massachusetts, June 24–29, 2012.
3. *Quantum Nucleation of Charge and Flux Solitons.* J. H. Miller, Jr., A. I. Wijesinghe, Z. Tang, & A. M. Guloy, International School & Workshop on Electronic Crystals, Cargèse, Corsica, France, August 15 – 27, 2011
4. *RF-intermodulation distortion technique to investigate nonlinear signatures of bio-chemical systems.* R. Pande, W. Z.-Wosik, L. Xie, K. Nesteruk, & J. Wosik, Graduate Research Conference, Houston, Texas, March 29, 2011.
5. *Time-Correlated Soliton Tunneling in Density Waves.* J. H. Miller, Jr., A. I. Wijesinghe, Z. Tang, & A. M. Guloy, 2011 March Meeting of the American Physical Society, Dallas, Texas. Abstract in: *Bulletin of the American Physical Society*, APS March Mtg. 2011, vol. **56**, no. 1, 2011, March 21 - 25, 2011.
6. *Dielectric sensors for measuring membrane potential.* K. Rajapakshe, A. Wijesinghe, J. Fang, W. Widger, & J. Miller, 2011 March Meeting of the American Physical Society, Dallas, Texas. Abstract in: *Bulletin of the American Physical Society*, APS March Mtg. 2011, vol. **56**, no. 1, 2011, March 21 - 25, 2011.
7. *Probing the Membrane Potential of Liposomes with Impedance Spectroscopy.* K. I. Rajapakshe, A. I. Wijesinghe, J. Fang, W. R. Widger, & J. H. Miller, Biophys. Society 55th Annual Mtg., Baltimore, Maryland, March 5 – 9, 2011.
8. *Quantum dynamical phase transitions in the quantum nucleation model of density wave transport.* J. H. Miller, Jr., International Conference on Strongly Correlated Electron Systems (SCES 2010), Santa Fe, New Mexico, USA, June 27 – July 2, 2010.
9. *Quantum decay of the “false vacuum” in the soliton tunneling model of density wave dynamics.* John H. Miller, Jr., 12<sup>th</sup> International Conference on Advances in Quantum Theory (AQT 2010), Växjö, Sweden, June 14-17, 2010.
10. *Biophysical processes in diabetes and metabolism.* John H. Miller, Jr., Sladjana Maric, and Jarek Wosik, Keystone Symposium on Diabetes, Whistler, British Columbia, Canada, April 12 -17, 2010.
11. *Torque generation mechanism of ATP synthase.* John Miller, Sladjana Maric, M. Scoppa, and M. S. Cheung, American Physical Society Meeting, Portland, Oregon, March 15-19, 2010.
12. *Electric field driven torque in ATP synthase,* John H. Miller, Jr., S. Maric, H. L. Infante, M. Scoppa, M. S. Cheung, and J. R. Claycomb, Biophysical Society 54<sup>th</sup> Annual Meeting, San Francisco, California, February 20-24, 2010.

**Invited Talks (Since August 2011):**

1. *Quantum Nucleation of Charge and Flux Solitons.* J. H. Miller, Jr., A. I. Wijesinghe, Z. Tang, & A. M. Guloy, International School & Workshop on Electronic Crystals, Cargèse, Corsica, France, Aug. 15 – 27, 2011.
2. *Superconductivity and Other Macroscopic Quantum Phenomena,* John H. Miller, Jr., XIV Simposio Internacional de Física (SIF-14), Monterrey Institute of Technology & Higher Education, Monterrey, Mexico, Feb. 23–25, 2012.
3. *Quantum Transport of an Electron Fluid up to 360 K,* John H. Miller, Jr., Correlated UH Chemistry Physical Division Seminar, University of Houston, Houston, Texas, May 2, 2012.
4. *Correlated Quantum Transport of Electrons up to 360 K,* John H. Miller, Jr., TcSUH Bi-Weekly Seminar, University of Houston, Houston, Texas, June 8, 2012.
5. *Correlated Quantum Transport of Electrons up to 360 K,* John H. Miller, Jr., The Institute for Biocomplexity and Informatics and The Institute for Quantum Information Science, University of Calgary, Calgary, Alberta, Canada, June 21, 2012.

**Research Grants (since 2009):**

- J. H. Miller, Jr. (PI), “Correlated Electron Transport in Condensed Matter & Biological Systems,” Texas Center for Superconductivity at the University of Houston. 9/1/2012 – 8/31/2013, \$70,000.
- J. H. Miller, Jr. (PI), “Physics & Applications of High- $T_c$  Superconducting Films & Sensing Devices,” Texas Center for Superconductivity at the University of Houston. 9/1/2011 – 8/31/2012, \$70,000.
- J. H. Miller, Jr. (PI), “Noninvasive Sensors of Metabolic Activity,” NIH – NCI/NHLBI and NSF (joint program). Co-investigators: W. R. Widger, Ph.D. (UH), D. J. Hamilton, M.D. (Methodist Hospital), Richard J. Robbins, M.D. (Methodist Hospital). 9/1/2007 – 8/31/2011, \$623,425.
- J. H. Miller, Jr. (PI), “ARRA – Noninvasive Sensors of Metabolic Activity,” NIH-NCI ARRA supplement. Co-investigator: Jarek Wosik, Ph.D., (UH – ECE), 9/1/2009 – 7/31/2011, \$181,800.
- J. H. Miller, Jr. (PI) and Wanda Z.-Wosik (co-I), “Physical Mechanisms of Biological Rotary Motors.” Norman Hackerman Advanced Research Program (NHARP), \$120,000, 5/1/2008 – 12/31/2010.
- John H. Miller, Jr. (PI) “Dielectric Spectroscopy of Chemical and Biological Systems,” Robert A. Welch Foundation, June 1, 2007 – May 31, 2010, \$180,000.
- John H. Miller, Jr. (PI), “Electromagnetic Sensors for Biomedical Applications,” Texas Center for Superconductivity at the University of Houston (TcSUH), 9/1/2009 – 8/31/2010, \$90,000.

**Courses taught (since 2009):**

Physics 1301, 1302: Introductory General Physics Sequence, (Algebra-based).

Physics 3315, Modern Physics I, Including relativity and introductory quantum mechanics.

Physics 3316, Modern Physics II, Quantum mechanics & related topics.

Physics 1321-1322 course sequence, Calculus-based physics for engineering majors.

**Postdoctoral Scholars and Graduate Students Supervised (since 2009):**

**Postdoctoral Fellows**

Akilan Palanisami, Wellman Center for Photomedicine, Massachusetts General Hospital; George T. (“Skip”) Mercier.

**Graduate Students**

**Current:** Asanga Iroshan Wijesinghe, Slajdana Maric, Rooplekha Mitra, Diana Brown.

**Previous:** Kimal Rajapakshe, Jie Fang, Vector Seismic Data Processing, Inc., Houston, Texas; Divya Pajmaran (E.C.E. student supported by J. Miller & W. Z.- Wosik), Intel Corporation, Rio Rancho, New Mexico; Hans L. Infante, HISD special programs teacher for Spanish-speaking students; Vijayanand Vajrala, currently in India.

**Recent Ph.D. Dissertations:**

“Development of Nonlinear Bioimpedance Technique with Tests on Photosynthetic Organelles,” Jie Fang, Aug. 31, 2010.

“Probing Membrane Potential of Biological Cells Using Dielectric Spectroscopy: Tests on Liposome Suspensions,” Kimal Rajapakshe, August 31, 2012.

**Service to the Department and College (since 2009)**

Physics Department committee memberships: Personnel Committee; Chairman, Medical & Biological Physics Faculty Search Committee; Nano-science faculty search committee,\* executive committee, undergraduate studies committee, biophysics search committee,\* machine shop committee, awards committee, colloquium committee, graduate studies committee. Scattering faculty search committee. Hosted several recruits. \*Played important role in hiring 4 new UH faculty members: 3 in Physics and 1 in Chemistry.

**Service to the University (since 2009)**

Chairman, TcSUH Research Committee; UH Faculty Senate, Committee on Community & Government Relations.

**Service to the Scientific Committee (since 2009)**

NIH Study Section: ZRG1 SBIB-V (58), FOA PAR-11-020 & -021, Technologies for Healthy Independent Living (R01 & R21) (2011).

Session chair: International School & Workshop on Electronic Crystals (ECRYS-2011), Cargèse, Corsica, France, August 15 – 27, 2011.

Session Co-Chair: Biophysical Society Meeting, Platform C, Oxidative Phosphorylation and Mitochondrial Metabolism, Biophysical Society 53<sup>rd</sup> Annual Meeting, Boston, Massachusetts, February 28 – March 4, 2009.

NIH Study Section: ZRG1 BST-M (58) R, RFA OD-09-003, Challenge Grants Panel 4 (2009).

Session co-chair: Platform C, Oxidative Phosphorylation and Mitochondrial Metabolism, Biophysical Society 53<sup>rd</sup> Annual Meeting, Boston, Massachusetts, February 28 – March 4, 2009.