

Michael A. Dubson

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EDUCATIONAL RECORD

B.S. in Physics: University of Illinois, Urbana, IL 1978

Ph.D. Condensed Matter Experimental Physics: Cornell University 1984

PROFESSIONAL EXPERIENCE

- Summer, 2008 to Present, Associate Chair for Undergraduate Studies, Dept of Physics, U. Colorado Boulder.
- Summers, 2007 and 2016-2019, faculty at the Boulder campus of The Summer Science Program, (www.ssp.org)
- Oct 2018 to present: Teaching Professor, CU Boulder
- Oct 2000 to Present. Senior Instructor, CU Boulder.
- Jan 1995 to Sept. 2000. Instructor, CU Boulder.
- Sep 1987 to Dec 1994. Assistant Professor of Physics, Michigan State University.
- Sep 1984 to Aug 1987: Postdoctoral Fellow working with Prof. James Garland, Physics Dept., The Ohio State University.
- Mar 1986 to Apr 1987: Consultant for General Motors Research Labs.
- Jun 1980 to Aug 1984: Graduate research assistant, Laboratory of Atomic and Solid State Physics, Cornell U. Thesis work: condensed matter experiment involving NMR and metal-insulator transitions. Thesis advisor: D. F. Holcomb.
- Aug 1978 to May 1980: Teaching assistant in introductory engineering physics courses, Physics Dept., Cornell U.

HONORS

- Graduated Summa Cum Laude, University of Illinois, May 1978.
- IBM Post-doctoral Fellow, 1984-1986.
- ♦ NSF Presidential Young Investigator Award, 1988.
- Boulder Faculty Assembly Excellence in Teaching Award, 2001
- CU Student Organization for Alumni Relations (SOAR) Teacher Recognition Award, 2001
- ♦ CU President's Faculty Excellence Award for Advancing Teaching and Learning through Technology, 2004
- American Association of Physics Teachers Excellence in Undergraduate Education Award, 2006
- CU Parents Association Award, 2007
- CU Best Should Teach Award, 2008
- Member of the Physics Education Technology Project (PhET), which has won national and international awards for best educational software including NSF Visualization Challenge Award (2007) , International Merlot Award for best physics education software (2006), and the Microsoft Education Tech Award (2011).
- Fellow of the American Association of Physics Teachers, 2014
- American Physical Society Excellence in Physics Education Award, 2018

PERSONAL DATA

U.S. citizen; born Feb 13, 1956; married.

SPECIAL SKILLS

Programmer Flash, Java, HTML5, Visual Basic, Python, Mathematica, etc.
Reading and speaking knowledge of French.

Courses taught at CU Boulder:

- ◆ Phys1140 Freshman Laboratory
- Phys2150 Sophomore Laboratory
- Phys1 110/1120 Intro Physics sequence for Engineering and Physics Majors
- ◆ Phys2010/2020 Intro Physics sequence for Life Science Majors
- ◆ Phys3220 Junior-level Quantum Mechanics I
- Phys3310 Junior-level Electricity and Magnetism I
- Phys3320 Junior-level Electricity and Magnetism II
- ◆ Phys4340 Senior-level Solid State Physics
- ◆ Phys4230 Senior-level Statistical Mechanics and Thermodynamics
- ◆ Phys 4430 Senior-level Experimental Laboratory
- Physics X: Non-credit seminar series to prepare graduate students for oral exams
- Physics GRE Preparation Seminar

Activities at CU Boulder:

Textbook author: Modern Physics, 2nd edition by John Taylor, Chris Zafiratos, and Michael Dubson, published Summer 2003. A college sophomore-level text, in use in more than 50 schools nationwide.

Undergraduate curriculum development including:

- ◆ author of several interactive computer simulations, see <http://phet.colorado.edu>
- ◆ development of in-class tutorial activities for Phys3310, 3320, 4230.
- ◆ introduction and promotion of electronic audience feedback in large freshmen courses- now used by more than 17,000 students in more than 150 courses at CU.
- ◆ introduction and management of an Internet-based interactive student homework system called CAPA (Computer-Assisted Physics Assignments) -now used in several freshmen physics
- ◆ introduction and management of the Physics HelpRoom, a centralized facility providing tutoring services for students in freshmen physics courses.
- public outreach (Mr. Wizard Shows, etc), teacher workshops
- ◆ course development/ renovation
- ◆ improved techniques for teaching/managing large freshmen classes

Television Series

Helped write, produce, and starred in "The Convection Connection", a science education series aimed at 5th graders, consisting of ten 5-minute TV segments appearing on KCNC Channel 4 afternoon news, Nov.16-17, 2000. Authored and appeared in half of the segments, co-starring with Larry Green, local weatherman.

Member of American Association of Physics Teachers

RECENT RESEARCH GRANTS:

NSF "Expanding PhET Interactive Science Simulations to Grades 4-8: A Research-based Approach." PI: Katherine Perkins. Co-PI's are Dan Schwartz (Stanford), Dubson, N. Podalefsky (PhET post-doc). \$1,997,695, 09/01/10-01/31/13.

NSF "Developing Research-Based Tutorials in Upper-division Electricity and Magnetism" PI is Steven Pollock; co-PI's are Perkins, Dubson, and Beale. \$530,906, 01/01/11-12/31/13.

"Collaborative Research: A comparative Study of Escaping Atmospheres using AEOS/HiVIS", PI: N Schneider, Senior Personnel: M Dubson. \$101K 07/15/2008 - 06/30/2010.

NSF CCLI Grant "Using a Research-based Approach to Reform Upper-division Quantum I and E&M I" PI: K Perkins. Co-Pis: ND Finkelstein, J Cumalat, M Dubson, S Pollock. \$150K, 01/01/08 - 12/31/09

American Physical Society, "Colorado PhysTEC" Total award \$298,642 (renewable), 7/1/04 to 6/30/07, ND Finkelstein (PI), M Dubson (Co-PI), Valerie Otero (Co-PI), SJ Pollock (Co-PI).

NSF, "Implementing Tutorials Sustainably: Restructuring Undergraduate Recitations and Laboratories in Introductory Physics" total award \$199,611 total award, 7/1/04 - 6/30/06, ND Finkelstein (PI), M Dubson (CoPI), SJ Pollock (Co-PI).

PUBLICATIONS IN REFERRED JOURNALS

1. "Metal-insulator transition **in** the compensated sodium bronze, $\text{Na}_{1-x}\text{TaW}_{1-y}\text{O}_3$ ", M.A. Dubson and D.F. Holcomb, Phys.Rev.B **32**, 1955 (1985).
2. "Measurement of the Ruderman-Kittel interaction in tungsten", M.A. Dubson, Phys.Rev.B **32**, 3485 (1985).
3. "Measurement of the conductivity exponent in two-dimensional percolating networks: square lattice vs. random-void continuum" , M.A. Dubson and J.C. Garland, Phys.Rev.B **32**, 7621 (1985).
4. "An NMR study of the metal-insulator transition in $\text{Na}_x\text{Ta}_y\text{W}_{1-y}\text{O}_3$, M .A.D ubson and D.F.Holcomb, Phys.Rev.B **34**, 25 (1986).
5. "Measurement of Fluctuation-Enhanced Conductivity Above T_c in Y-Ba-Cu-O", M.A. Dubson, J.J. Calabrese, S.T. Herbert, D.C. Harris, BR. Patton, and J.C. Garland, Berkeley Workshop on Novel Mechanisms of Superconductivity, Berkeley, CA, June 22-26, 1987.

- 6.** "Non-ohmic dissipative regime in the superconducting transition of polycrystalline YBCO" M.A.Dubson, S.T.Herbert, J.J.Calabrese, D.C.Harris, BR.Patton, and J.C.Garland, Phys.Rev.Lett. **60**, 1061 (1988). See also, "Reply to a comment" M.A.Dubson et al., Phys.Rev.Lett. **61**, 1260 (1988).
- 7.** "Measurement of the fourth moment of the current distribution in two-dimensional random resistor networks", M.A.Dubson, Y.C.Hui, M.B.Weissman, and J.C.Garland, Phys. Rev. B **39**, 6807 (1989).
- 8.** "Conductance of a plane containing random cuts", Jan Tobochnik, M.A.Dubson, M.L.Wilson, and M.F.Thorpe, Phys.Rev.A **40**, 5370 (1989).
- 9.** "Giant discrete resistance fluctuations observed in normal-metal tunnel junctions", X.Jiang, M.A.Dubson, and J.C.Garland, Phys. Rev.B **42**, 5427 (1990).
- 10.** "Coalescence and percolation in thin metal films", X.Yu, P.M.Duxbury, G.Jeffers, and M.A.Dubson, Phys.Rev.B **44**, 13163 (1991).
- 11.** "Simple, variable-temperature scanning tunneling microscope", M.A.Dubson and Jeeseong Hwang, Rev. Sci. Instrum. **63**, 3 643 (1992).
- 12.** "The critical current of *AgNBCO* random bulk composites", J.J.Calabrese, M.A.Dubson, and J.C.Garland, J.Appl.Phys. **72**, 2958 (1992).
- 13.** "Atomically flat gold films grown on hot glass", Jeeseong Hwang and M.A.Dubson, J.Appl.Phys. **72**, 1852 (1992).
- 14.** "Digital images from your old SEM", M.A.Dubson and Qifu Zhu, Rev. Sci. Instrum. **63**, 4461 (1992).
- 15.** "Linear decay of islands on metal surfaces", M.A.Dubson, Martine Kalke, and Jeeseong Hwang, Phys.Rev.B **47**, 10044 (1993).
- 16.** "Annealed percolation: precise determination of exponents in a correlated percolation problem", David Wollman, M.A.Dubson, and Qifu Zhu, Phys.Rev.B **48**, 3713 (1993).
- 17.** "Profile decay by surface diffusion at low temperature", M.A.Dubson and G.Jeffers, Phys. Rev. B **49**, 8347 (1994)
- 18.** "The island-to-percolation transition during growth of metal films", G.Jeffers, M.A.Dubson, and P.M.Duxbury, J.Appl.Phys. **75**, 5016 (1994).
- 19.** "High-temperature scanning tunneling microscope with a novel sample heater and interchangeable scan heads", Lowell I. McCann, Richard M. Smalley, and M.A. Dubson, Rev. Sci. Instrum. **65**, 2519 (1994).

- 20.** "Substrate inhomogeneity and the growth morphology of thin films", P.M.Duxbury, M.A.Dubson, X.Yu, and G.Jeffers, *Europhys. Lett.* 26, 601 (1995).
- 21.** "Photon-by-photon post-processing correction of pointing errors in an orbiting satellite", M.A.Dubson, N.M.Schneider, and S.N.Osterman, *SPIE Proceedings Vol. 5899, Optics for EUV, X-Ray, and Gamma-Ray Astronomy II* (2005).
- 22.** "Evaluating a model of research-based practices for teacher preparation in a physics department: Colorado PhysTEC", N.Finkelstein, C.Turpen, S.Pollock, M.Dubson, S.Iona, C.Keller, and V.Otero, *AIP Physics Education Research Conference Proceedings, AIP Proceedings 818*, 3 (2005).
- 23.** "PhET: Interactive Simulations for Teaching and Learning Physics", Katherine Perkins, Wendy Adams, Michael Dubson, Noah Finkelstein, Sam Reid, Carl Wieman, and Ron LeMaster, *Physics Teacher* **44**(1), 18 (2006).
- 24.** "New instrument for measuring student beliefs about physics and learning physics: The Colorado Learning Attitudes about Science Survey", W. K. Adams, K. K. Perkins, N. S. Podolefsky, M. Dubson, N. D. Finkelstein, and C. E. Wieman, *Phys. Rev. ST Phys.Educ.Res.* **2**, 010101 (2006).
- 25.** "3 or 4 Golden Rules of Lecture", M.Dubson, *Phys. Teach.* 45, 252 (2007).
- 26.** "Research-based Practices For Effective Clicker Use" C.Keller, N.Finkelstein, K.Perkins, S.Pollock, C.Turpen, and M.Dubson, *Proceedings of the 2007 Physics Education Research Conference, AIP Press. Melville NY, 951, 128-131, (2007).* [Refereed conference proceedings.]
- 27.** "A Study of Educational Simulations Part I - Engagement and Learning", W. K. Adams, S. Reid, R. LeMaster, S. B. McKagan, K. K. Perkins, M. Dubson and C. E. Wieman, *Journal of Interactive Learning Research*, 19(3), 397-419, July 2008.
- 28.** "A Study of Educational Simulations Part II - Interface Design", W. K. Adams, S. Reid, R. LeMaster, S. B. McKagan, K. K. Perkins, M. Dubson and C. E. Wieman, *Journal of Interactive Learning Research*, 19(4), 551-577, October 2008.
- 29.** "Developing and researching PhET simulations for teaching quantum mechanics", S.B.McKagan, K.Perkins, M.Dubson, C.Malley, S.Reid, R.LeMaster, and C.E.Wieman, *Amer. J. Phys.* 76, 406 (2008).
- 30.** "Developing and researching PhET simulations for teaching quantum mechanics", S.B.McKagan, K.Perkins, M.Dubson, C.Malley, S.Reid, R.LeMaster, and C.E.Wieman, *Amer. J. Phys.* 76, 406 (2008).

31. "Faculty Disagreement about the Teaching of Quantum Mechanics", M. Dubson, S. Goldhaber, S. Pollock, and K. Perkins, *PERC Proceedings: Ann Arbor* (2009). [Refereed conference proceedings.]
32. "Transforming Upper-Division Quantum Mechanics: Learning Goals and Assessment", S. Goldhaber, S. Pollock, M. Dubson, P. Beale and K. Perkins. *PERC Proceedings: Ann Arbor* (2009).
33. "The use of concept test and peer instruction in upper-division physics", SJ .Pollock, S.V.Chasteen, M.Dubson, and K.Perkins. *PERC Proceedings: Portland* (2010).
34. "Research-based Materials and Assessments for Upper-Division Electrodynamics", C.Baily, M.Dubson, and S.Pollock. *PERC Proceedings: Philadelphia* (2012).
35. "Developing Tutorials for Advanced Physics Students: Processes and Lessons Learned" Charles Baily, Michael Dubson, and Steven J. Pollock, *PERC Proceedings: Portland* (2013).
36. "Apples vs. Oranges: Comparison of Student Performance in a MOOC vs. a Brick-and-Mortar Course" Michael Dubson, Ed Johnsen , David Lieberman, Jack Olsen, and Noah Finkelstein, *PERC Proceedings: Minneapolis* (2014).

OTHER PUBLICATIONS:

Textbook:

Modern Physics for Scientists and Engineers, 2nd edition by John Taylor, Chris Zafiratos, and Michael Dubson, (2003). A college sophomore-level text, in use in more than 50 schools nationwide.

Recent Book reviews:

The Theoretical Minimum: What You Need to Know to Start Doing Physics, Michael Dubson *Am. J. Phys.* **82**, 174 (2014).

Feynman's Tips on Physics (2nd ed.), Michael Dubson *Am. J. Phys.* **82**, 175 (2014).

SELECTED RECENT PRESENTATIONS AT PROFESSIONAL MEETINGS:

I have given my talk on MOOCs as an **invited talk** several times in the last two years. The title of the presentation is "Apples and Oranges: Comparison of Student Performance in a MOOC vs. a Brick-and-Mortar Course". My invited presentations include:

- Plenary talk: AAPT Physics Education Research Conference, Minneapolis, July 2014
- Annual Spring Conference of the German Physical Society (DPG), Berlin, Germany, March 18, 2015.
- Plenary Talk: 20th International Conference on Multimedia in Physics Teaching and Learning, Munich, Germany, Sept 10, 2015. <http://www.en.didaktik.physik.uni-muenchen.de/mptl/invitedspeakers/index.html>
- AAPT Summer meeting, College Park, Maryland, July 27, 2015.
- APS March Meeting, March 2016
- CU Physics Department Colloquium, Sept 2016

"Do Good Students have Good Homework Habits?", Bryan Kaufman and Michael Dubson, presented at AAPT Summer Meeting, Ann Arbor MI, July 2009.

Invited Talk: "Clicker use in upper-division physics courses" Michael Dubson, APS March Meeting, New Orleans LA, Mar. 2008.

Invited Talk: "Three or Four Golden Rules of Lecture" Michael Dubson, AAPT Summer Meeting, Syracuse NY, Aug. 2006.

"Sharp Telescope Images with Video Astronomy: An Undergraduate Laboratory" Michael Dubson, poster presented at AAPT Summer Meeting, Salt Lake City, UT, Aug. 2005.

"Logistics of a Secondary Implementation of the Washington Tutorials", Michael Dubson, Steven Pollock, and Noah Finkelstein, presented at AAPT Summer Meeting, Salt Lake City, UT, Aug. 2005.

"Photon-by-photon post-processing correction of pointing errors in an orbiting satellite", M.A.Dubson, N.M.Schneider, and S.N.Ostein an, presented at SPIE Annual Summer meeting, San Diego, CA, July, 2005.

"Should a Fortran-savvy educator learn Java, Flash, both, or neither?", M.Dubson. Presented at AAPT Summer Meeting, Sacramento, CA, Aug. 2004.

"The Physics Education Technology Project: Web-based interactive simulations to support student learning", Wendy Adams, Katherine Perkins, Noah Finkelstein, Ron LeMaster, Sam Reid, Michael Dubson, and Carl Wieman. Presented by W.Adams at the APS Meeting, Denver, in April 04.

Invited Talk: "Clickers in Large Lecture Classes" M.Dubson, American Astronomical Society, Denver, June 2004.

Invited talk: "Clickers: An Overview of Clicker Technology, Costs, Applications, and Results" M.Dubson, Doug Duncan, Frank and Susan Kowalski, Teaching with Technology Conference, CU campus, Aug. 2004.

"Research-Based Design Features of Web-Based Interactive Simulations", Wendy Adams, Kathy Perkins, Noah Finkelstein, Ron LeMaster, Sam Reid, Michael Dubson, Noah Pdolesky, and Carl Wieman. Poster presented by W.Adams, AAPT meeting, Sacramento Aug 2004.

"The Design and Validation of the Colorado Learning Attitudes about Science Survey" W. K. Adams, K. K. Perkins, M. Dubson, N.D. Finkelstein and C. E. Wieman. Physics Education Research Conference (PERC) proceedings, Aug 2004.

Research Activities at Michigan State University (1987-1994)

26 contributed talks given by me or my students at APS meetings ('82 to '94). 2 invited talks at major conferences. 37 seminars and colloquia given while on the faculty at MSU ('88-'94)

Thesis Advisor for 3 Ph.D. students:

- Jeesong Hwang, 1993
"STM study of surface diffusion and dislocation motion in atomically flat gold films."
- Qifu Zhu, 1994
"Resistance imaging a scanning electron microscope."
- George Jeffers, 1994
"The island-to-percolation transition during growth of metal films."

In addition, while at MSU, I supervised research projects by 7 other graduate students and 8 undergraduate students. One of the undergraduates, David Wollman, won an NSF graduate fellowship on the basis of his undergraduate work with me.

Grant Support while at Michigan State U.

NATIONAL SCIENCE FOUNDATION

3-year, \$270,000 grant, 6/1/94-5/31/97. Project Title: Growth and Instability of thin metal films and small metal structures. Co-PI Prof. P.M.Duxbury. (Award declined 12/1/94.)

PETROLEUM RESEARCH FUND

3-year, \$75,000 grant, 6/1/93-8/31 /96. Project title: Growth and morphology of thin metal films.

TEXAS INSTRUMENTS

I-year, \$25,000 grant, 9/1/93-9/1/94 (possibility of renewal). Project title: Development of a new probe of resistance variations in metal circuit lines.

MSU All-Universily Research Initiation Grant

1-year, \$10,000 grant, 7/1/93-6/30/94. Project title: A new probe of resistance variations in thin metal lines.

National Science Foundation

Presidential Young Investigator Award, 7/1/88-5/30/94, \$257,000.

MSU Center for Fundamental Materials Research

Support for several 1-year proposals over the years 1988-1994, totaling \$133,500.

Ford Scientific Research Labs

2-year, \$17,500 grant, 1990-1992, matching award for NSF-PYL

COURSES TAUGHT WHILE AT MICHIGAN STATE UNIVERSITY (1987-1994)

Physics 183, freshman introductory calculus-based mechanics. Physics

297, Introductory lab - mechanics.

Physics 391, Introductory calculus-based modern physics

Physics 439, Advanced lab - physical optics.

Physics 496, Senior level solid state physics.

Astronomy 217, Introductory astronomy for science majors.

Also, in the Spring of '93, in addition to regular teaching duties, I and three of my colleagues taught a non-credit lecture course covering experimental techniques in condensed matter physics.

REFERENCES:

Prof. John Cumalat (current Chair), Prof. Paul Beale (past Chair), Michael Ritzwoller (future Chair), Prof. Steven Pollock, and Prof. Noah Finkelstein, Physics Department, University of Colorado at Boulder

Prof. Nicholas Schneider, Department of Astrophysical and Planetary Sciences, University of Colorado at Boulder