Curriculum Vitae
DR. MICHAEL G. MOORE

Address: Department of Physics & Astronomy, 4230 Biomedical Physical Sciences Bldg, Michigan State University, East Lansing, MI 48824
Phone: Office: (517)355-9200 ext.2206, Fax: (740) 593-0433
E-mail: mmoore@pa.msu.edu
Citizenship: USA

EDUCATION:

Ph. D.	Department of Physics, University of Arizona, 1999. Dissertation title: **"Nonlinear Wave-Mixing Between Atomic and Optical Fields"**. Dissertation advisor: Prof. Pierre Meystre.
B. S.	Department of Physics, University of Delaware, 1993. Major: Physics (Honors Program), Minor: Mathematics. Research topic: **Classical and quantum chaos in ion traps**. Research Advisor: Prof. Reinhold Blümel.

SUMMER SCHOOLS ATTENDED :

Les Houches 1999 Summer School Session 72: "Coherent Atomic Matter Waves", Les Houches, France, July 27 - August 27, 1999.

PROFESSIONAL EXPERIENCE:

August 2006-present	Assistant Professor, Department of Physics & Astronomy, Michigan State University. Tenure-Track.
August 2003-August 2006	Assistant Professor, Department of Physics & Astronomy, Ohio University. Tenure-Track.
October 2000-July 2003	Post-Doctoral Fellow, Institute for Theoretical Atomic, Molecular, and Optical Physics (ITAMP), Harvard-Smithsonian Center for Astrophysics. Director: Kate Kirby
January 2000-September 2000	Post-Doctoral Research Associate, Optical Sciences Center, University of Arizona. Supervisor: Pierre Meystre
Spring 1996-December 1999	Graduate Research Associate, Optical Sciences Center, University of Arizona. Supervisor: Pierre Meystre
Fall 1995	Graduate Teaching Assistant, Department of Physics, University of Arizona.
Summer 1992	Undergraduate Research Assistant, Department of Physics, University of Delaware. Supervisor: Reinhold Blümel

AREAS OF RESEARCH (past and present):

Atom optics:

Nonlinear and quantum atom optics • Bose-Einstein condensation and degenerate Fermi gases • matter-wave amplification and superradiance • atom interferometry • matter wave coherence theory• quantum degenerate photoassociation and superchemistry • atom waveguides • atom-atom interactions in confined geometries.

Ion trap physics:

Classical and quantum chaos of two- and three-ions in a Paul trap • higher-order pseudopotential approximations for Paul-trap micromotion • deterministic order to chaos transitions (melting) of Wigner crystals.

HONORS AND AWARDS:

• DAMOP Outstanding Doctoral Thesis Research Award finalist [Division of Atomic Molecular and Optical Physics, American Physical Society](2001).
• ITAMP postdoctoral fellowship (2000).
• NRC postdoctoral fellowship [NIST, declined] (2000).
• NSF International Travel Grant [Les Houches Summer School] (Summer 1999).
• University of Arizona Graduate College Scholarship (Fall 1994).
• University of Arizona Graduate College Fellowship (Fall 1994 to Spring 1995).
• Department of Education Fellowship (Fall 1993 to Spring 1994).
• University of Delaware Honors Program (Fall 1989 to Spring 1993).

TEACHING EXPERIENCE:

• Professor: PHYS852 *Quantum Mechanics II.* [Graduate] Second semester graduate level quantum mechanics. Perturbation theory, scattering theory, identical particles, second-quantization.

• Professor: PHYS851 *Quantum Mechanics I.* [Graduate] Graduate level quantum mechanics. Similar to 441 below.

• Professor: PHYS183 *Physics for Scientists and Engineers I.* [UnderGraduate] Calculus-based introductory physics. Includes Newtonian mechanics and extensions to fluid mechanics and wave motion.

• Professor: PHYS894 *Introduction to Quantum Optics.* [Graduate] Covers quantization of electromagnetic field, atom-field interactions, photon manipulation, quantum theory of open systems, quantum information, and quantum 'paradoxes'.

• Professor: PHYS201 *Introduction to Physics.* [Undergraduate] Algebra and trigonometry-based introductory physics. Covers Newton's Law's, statics, uniform acceleration, rotational dynamics, conservation laws, and fluid dynamics.

• Professor: PHYS451/551 *Quantum Mechanics.* [Gradate and advanced undergraduate] Introductory quantum mechanics. Topics covered include quantum postulates, Dirac notation, symmetry and conservation laws, one-dimensional scattering, simple-harmonic oscillator, angular-momentum, and hydrogen atom.

• Professor: PHYS498T *Advanced Classical Mechanics*. [Undergraduate] Advanced mechanics Honors Tutorial. Covered calculus of variations, Lagrangian & Hamiltonian mechanics, systems of coupled harmonic oscillators, and introduction to classical field theory.

• Professor: PSC105 *Color, Light, and Sound*. [Undergraduate] Introductory physical science for non-science majors. Department of Physics & Astronomy, Ohio U.

• Guest Lecturer for Prof. Pierre Meystre: *Intro to Quantum Electrodynamics*. Optical Sciences Center, U. Arizona. (Spring 2000).
• Guest Lecturer for Prof. Mikhail Lukin: *Topics in Quantum Optics*. Physics Deptartment, Harvard University. (Fall 2001)
• Laboratory Instructor: *Introductory Electricity and Magnetism*. Department of Physics, University of Arizona. (Fall 1995)

PROFESSIONAL ACTIVITIES :

• Secretary, Theoretical Atomic and Molecular Physics Committee (TAMOC) [2007-present]
• American Physical Society member
• Journal Referee:
Physical Review A
Physical Review E
Physical Review Letters
Journal of Physics B
Physica Scripta
Optics Communications
Journal of Physical Chemistry

REFEREED AND INVITED PUBLICATIONS :

34 K. J. Xu, Y. P. Huang, M. G. Moore, and C. Piermarocchi,"Zeno gates in semiconductor quantum dots", submitted to Phys. Rev. Lett. arXiv:0810.4489

33. Y. P. Huang and M. G. Moore, "Optimized Double-well quantum interferometry with Gaussian squeezed-states", Phys. Rev. Lett. **100**, 250406 (2008).

32. Y. P. Huang and M. G. Moore, "Interaction- and measurement-free Quantum Zeno gates assymptotically on-demand for single-atom and single-photon qubits", Phys. Rev. A **77**, 062332 (2008).*Selected to appear in the APS Virtual Journal of Quantum Information.*

31. Y. P. Huang and M. G. Moore, "On-demand entanglement of atomic qubits via optical interferometry", Phys. Rev. A, **77**, 032349 (2008). *Selected to appear in the APS Virtual Journal of Quantum Information.*

30. M. G. Moore, "Pseudopotential Analog for Zero-Range Photoassociation and Feshbach Resonance", Phys. Rev. Lett. **96** 100401 (2006).

29. Y. P. Huang and M. G. Moore, "Creation, detection, and decoherence of macroscopic quantum superposition states in double-well Bose-Einstein condensates", Phys. Rev. A **73**, 023606 (2006).

28. M. G. Moore, T. Bergeman, and M. Olshanii, "Scattering in tight atom waveguides", J. Phys. IV *France* (2004). Proceedings of Les Houches workshop on Quantum Gases in Low Dimensions.

27. T. Bergeman, M. G. Moore, and M. Olshanii, "Atom-atom scattering in the presence of a cylindrical harmonic potential: Numerical results and extended analytic theory", Phys. Rev. Lett., **91**, 163201 (2003).

26. M. G. Moore and H. Sadeghpour, "Controlling two-species Mott-insulator phases in an optical lattice to form an array of dipolar molecules", Phys. Rev. A, **67**, 041603 (2003).

25. A. Vardi and M. G. Moore, "Directional 'superradiant' collisions: Bosonic amplification of atom pairs emitted from an elongated Bose-Einstein condensate", Phys. Rev. Lett., **89**, 090403 (2002).

24. M. G. Moore and A. Vardi, "Bose-enhanced chemistry: Amplification of selectivity in the dissociation of molecular Bose-Einstein condensates", Phys. Rev. Lett., **88**, 160402 (2002).

23. M. G. Moore and P. Meystre, "Atomic four-wave mixing: Fermions versus Bosons", Phys. Rev. Lett., **86**, 4199 (2001).

22. H. Pu, M. G. Moore, and P. Meystre, "Atomic squeezing and entanglement from Bose-Einstein condensates", *Modern Challenges in Quantum Optics*, ed. by M. Orzag and J. C. Retamal, p.161 (Springer-Verlag, Berlin, 2001).

21. J. Heurich, H. Pu, M. G. Moore, and P. Meystre, "Instabilities and self-oscillations in atomic four-wave mixing", Phys. Rev. A., **63**, 033605 (2001).

20. J. Zapata, A. M. Guzman, M. G. Moore, and P. Meystre, "Gravity-induced Wannier-Stark ladder in an optical lattice", Phys. Rev. A, **63**, 023607 (2001).

19. M. G. Moore and P. Meystre, "Parametric amplification of coupled atomic and optical fields", *Coherence in Light-Matter Interaction*, ed. by H. J. Carmichael, R. J. Glauber, and M. O. Scully, p.116 (Springer Verlag, Berlin, 2001).

18. M. G. Moore and P. Meystre, "Generating entangled atom-photon pairs from Bose-Einstein condensates", Phys. Rev. Lett. **85**, 5026 (2000).

17. E. V. Goldstein, M. G. Moore, H. Pu, and P. Meystre, "Eliminating the mean-field shift in multicomponent Bose-Einstein condensates", Phys. Rev. Lett. **85**, 5030 (2000).

16. J. Heurich, M. G. Moore and P. Meystre, "Cavity atom optics and the 'free atom laser"', Optics Commun. **179**, 549 (2000)

15. E. V. Goldstein, M. G. Moore, O. Zobay, and P. Meystre, "Nonlinear optics of matter waves", *Advances in Laser Physics*, ed. by V. S. Letokhov and P. Meystre, (Gordon & Breach, 2000).

14. E. V. Goldstein, M. G. Moore and P. Meystre, "Nonlinear manipulation and control of matter waves", Laser Physics **10**, 8 (2000).

13. M. G. Moore and P. Meystre, "Theory of superradiant scattering of laser light from Bose-Einstein condensates", Phys. Rev. Lett. **83**, 5202 (1999).

12. M. G. Moore, O. Zobay, and P. Meystre, "Quantum optics of a Bose-Einstein condensate coupled to a quantized light field", Phys. Rev. A **59**, 1491 (1999).

11. M. G. Moore and P. Meystre, "Optical control and entanglement of atomic Schrödinger fields", Phys. Rev. A **59**, R1754 (1999).

10. M. G. Moore and P. Meystre, "Effects of atomic diffraction on the collective atomic recoil laser", Phys. Rev. A **58**, 3248 (1998).

9. M. G. Moore and P. Meystre, "Monte Carlo investigation of an atom laser with a modulated quasi-one-dimensional cavity", J. Mod. Optics **44**, 1815 (1997).

8. M. G. Moore and P. Meystre, "Dipole-dipole selection rules for an atom laser cavity", Phys. Rev. A **56**, 2989 (1997).

7. A. M. Guzman, M. Moore, and P. Meystre, "Theory of a coherent atomic beam generator", Phys. Rev. A **53**, 977 (1996).

6. M. G. Moore and R. Blümel, "Prediction of deterministic melting regions of two and three laser cooled ions in a Paul trap", Phys. Scripta **T59**, 434 (1995), and *Trapped Charged Particles and Related Fundamental Physics, Proceedings of Nobel Symposium 91*, ed. by I. Bergström, C. Carlberg, and R. Schuch, (Physica Scripta, The Royal Swedish Academy of Sciences, Stockholm; and World Scientific Publishing, Singapore; 1995).

5. M. G. Moore and R. Blümel, "An improved pseudo potential for the two-ion Paul trap", Phys. Scripta **T59**, 429 (1995), and *Trapped Charged Particles and Related Fundamental Physics, Proceedings of Nobel Symposium 91*, ed. by I. Bergström, C. Carlberg, and R. Schuch, (Physica Scripta, The Royal Swedish Academy of Sciences, Stockholm; and World Scientific Publishing, Singapore; 1995).

4. M. G. Moore and R. Blümel, "Prediction of an alignment transition region of two-ion crystals in a Paul trap", Phys. Rev. A **50**, R4453 (1994).

3. M. Moore and R. Blümel, "Quantum manifestations of order and chaos in the Paul trap", Phys. Rev. A **48**, 3082 (1993).

2. J. W. Emmert, M. Moore, and R. Blümel, "Prediction of a deterministic melting transition of two-ion crystals in a Paul trap", Phys. Rev. A **48** , R1757 (1993).

1. M. Moore and R. Blümel, "Quantum manifestations of order and chaos in the Paul trap", *Proceedings of the Third Drexel Symposia on Quantum Nonintegrability*, ed. by D. H. Feng and Y. M. Yaun, (Gordon and Breach, New York, 1992).

INVITED CONFERENCE/WORKSHOP TALKS :

19. "Optimized Double-Well Quantum Interferometry with Gaussian Squeezed States", Workshop on Nuclei and Mesoscopic Physics. WNMP07, NSCL, East Lansing (October 20-22, 2007).

18. "Quantum Computation: is decoherence always bad?", Midwest-Great Lakes Workshop on Condensed Matter Physics, Wayne State University, Detroit (August 23, 2007).

17. "A generalized approach to interaction- and measurement-free quantum logic gates based on the quantum Zeno effect", joint ITAMP and CUA workshop on Hybrid Approaches to Scalable Quantum Information Processing, ITAMP, Cambridge, MA (May 24-26, 2007).

16. "Nonlinear wave-mixing: Bosons vs. Fermions", Princeton-TAMU Symposium on Quantum Mechanics, Informatics and Control", Princeton NJ (April 6-7, 2007).

15. "A pseudo-potential analog for atom-molecule coupling", Workshop on Quantum Dynamics of Ultracold Few-Body Systems, Cuernavaca, Mexico (March 12-30, 2007).

14. "Scattering in tight atomic waveguides and confinement induced resonances", ITAMP workshop on Quantum Degenerate Gases n Low-Dimensionality, Cambridge (October 4-6, 2004).

13. "Atom-atom correlations in Ultracold Atomic Systems", Great Lakes Photonics Symposium, Cleveland (June 2004).

12. "Confinement Induced Resonances in Tight Atomic Waveguides", Cambridge Area Atomic, Molecular and Optical Physics Open House, Cambridge (April 2003).

11. "Multi-channel scattering in tight atomic waveguides", 11th International Laser Physics Workshop (LPHYS02), Bratislava, Republic of Slovakia (July 2002).

10. "Nonlinear and quantum atom optics", New Laser Scientist Workshop, OSA/DLS2001, Long Beach (October 2001).

9. "Matter-wave amplification and superradiant scattering in Bosonic and Fermionic degenerate atomic gases", 10th International Workshop on Laser Physics, Moscow (July 2001).

8. "Nonlinear wave-mixing between atomic and optical fields", DAMOP 01, Outstanding Doctoral Thesis Award session, London, Ontario (May 2001).

7. "Four-wave mixing phenomena in degenerate Bosonic and Fermionic atomic gases", invited session on Quantum Atom Optics, DAMOP 01, London, Ontario (May 2001).

6. "Generating entangled atom-photon pairs", 31st Winter Colloquium on the Physics of Quantum Electronics, Snowbird, Utah (January 2001).

5. "Atomic four-wave mixing: fermions vs. bosons", Joint US-Japan seminar on Coherent Quantum Systems, Newport, Rhode Island (September 2000)

4. "Atomic four-wave mixing: fermions vs. bosons", ONR and TAMU Workshop on Quantum Optics, Jackson Hole, Wyoming (July 2000)

3. "Density independent phase evolution of multicomponent condensates", 30th Winter Colloquium on the Physics of Quantum Electronics, Snowbird, Utah (January 2000).

2. "The collective atomic recoil laser: Dynamically coupled coherent Maxwell and Schrödinger fields", ONR and TAMU Workshop on Quantum Optics, Jackson Hole, Wyoming (July 1998).

1. "Atom laser scheme based on dipole-dipole selection rules", ARO Workshop on Atom Lasers, Tucson, Arizona (1997).

INVITED SEMINARS/COLLOQUIA :

20 "Taming quantum fluctuations with atoms and photons", Michigan State University, Physics Department CMP seminar (February 4, 2008).

19 "Quantum interferometry with ultracold atoms", University of Michigan, Physics Department AMO/CMP seminar (October 2, 2007).

18 "Quantum computation and the role of decoherence", Wayne State University, Physics Department Colloquium, Detroit (September 20,2007).

17 "Squeezed state interferometry with double-well condensates", Kirchhoff-Institute for Experimental Physics AMO seminar, Heidelberg (July, 2007).

16 "Nonlinear optics with Fermionic matter waves", Princeton University, joint MAE seminar with Marlan Scully (TAMU/princeton) and Randy Hulet (Rice), Princeton NJ (May 1, 2007).

15 "Teleportation of atomic qubits via optical interferometry", Miami University of Ohio, Physics Department Seminar, Oxford OH (November 1, 2006).

14 "Nonlinear and Quantum Atom Optics", Purdue University, Condensed Matter Seminar, West Lafayette IN (April 28, 2006).

13 "Nonlinear and Quantum Atom Optics", Michigan State University, Institute for Quantum Science Seminar, East Lansing MI (April 12, 2006).

12. "Deterministic, long-distance teleportation of atomic qubits via optical interferometry", LANL Quantum Institute, Visitor Symposia, Los Alamos, NM (February 9, 2006).

11. "Atom molecule coupling in ultracold atomic systems", Ohio University, Physics Department Colloquium, Athens, OH (April 2003).

10. "Atom molecule coupling in ultracold atomic systems", SUNY Stony Brook, Department of Physics AMO seminar, Stony Brook, NY (April 2003)

9. "Quantum atom optics: Novel interaction phenomena with ultracold atoms ", University of Delaware, Dept. of Physics & Astronomy AMO seminar, Newark, DE (February 2003).

8. "Quantum atom optics: Novel interaction phenomena with ultracold atoms", Rice University, Physics & Astronomy Dept. Colloquium, Houston, TX (February 2003).

7. "Quantum Atom Optics", University of Michigan, Dept. of Physics CM/AMO seminar, Ann Arbor, MI (January 2003).

6. "Nonlinear and quantum atom optics", UC Berkeley, Physics Dept. AMO Seminar, Berkeley , CA(October 2001).

5. "Nonlinear and quantum atom optics", University of Southern California (USC), Physics Dept. Colloquium, Los Angeles, CA (October 2001).

4. "Directionality and the generation of squeezed matter waves from atomic and molecular BECs", MIT, Center for Ultracold Atoms Seminar, Cambridge, MA (September 2001).

3. "Scattering laser light from quantum degenerate Bose and Fermi gases", Wesleyan University, Physics Dept. Colloquium, Middletown, CT (February 2001).

2. "Scattering laser light from Bose Einstein condensates and degenerate Fermi gases", ITAMP, Atomic and Molecular Physics Seminar, Cambridge, MA (November 2000)

1. "Superradiant scattering of laser light from Bose-Einstein condensates", NIST, atomic physics seminar, Gaithersburg, MD (December 1999).

CONTRIBUTED CONFERENCE/WORKSHOP PRESENTATIONS :

12. "Optimized quantum interferometry in a double-well BEC", INTERF08, Levico Terme (Trento), Italy (April 3-5, 2008).

11. "Interaction- and measurement-free quantum information processing with single-atom and/or single-photon qubits", DAMOP 2007, Calgary, Canada (June 9, 2007).

10. "Measuring and unknown phase with quantum-limited precision using nonlinear beamsplitters", talk by Y. P. Huang DAMOP 2007, Calgary, Canada (June 9, 2007).

9. "Scattering in a cylindrical harmonic potential", (poster) ICAP 2002, Cambridge, MA (2002).

8. "Multi-channel scattering in tight atomic wave-guides", (poster) FANO Memorial Symposium, Cambridge, MA (2002).

7. "Directional squeezed atomic matter waves from elongated Bose-Einstein condensates", DAMOP 02, Williamsburg, VA (2002).

6. "Matter-wave superradiance", (poster) ERATO Workshop, Tucson, AZ (1999).

5. "Nonlinear wave mixing between atomic and optical fields", Les Houches Summer School on Coherent Atomic Matter Waves, Les Houches, France (1999).

4. "Quantum entanglement and control of coherence between a condensate and an optical field", APS Centennial Meeting/DAMOP 99, Atlanta, GA (1999).

3. "Matter wave optics theory of the collective atomic recoil laser", DAMOP 98, Santa Fe, NM (1998).

2. "An atom laser scheme based on a modulated quasi-one-dimensional cavity", CLEO/QELS, Anaheim, CA (1997).

1. "Nonlinear dynamics of two and three ions in the Paul Trap", (poster) Nobel Symposium 91: Trapped Charged Particles and Related Fundamental Physics, Lysekil, Sweden (1994).

EXTERNAL FUNDING:

1. NSF Atomic Theory Grant: "Quantum Information Processing and Interferometry Based on Coupled Matter-Light Systems". awarded **$150k** as sole PI 8/15/07-8/15/09.