

## MATTHEW D. McCLUSKEY

Department of Physics and Astronomy  
Washington State University (WSU)  
Pullman, WA 99164-2814

Phone: (509) 335-5356  
Fax: (509) 335-7816  
E-mail: mattmcc@wsu.edu  
[www.physics.wsu.edu/research/High-Pressure/matt.htm](http://www.physics.wsu.edu/research/High-Pressure/matt.htm)

### EDUCATION

- B.Sc. Physics, Massachusetts Institute of Technology, 1991
- M.A. Physics, University of California, Berkeley, 1993
- Ph.D. Physics, University of California, Berkeley, 1997

### EXPERIENCE

- Graduate Student Researcher, 6/1993 – 12/1996, University of California, Berkeley and Lawrence Berkeley National Laboratory (LBNL)
- Post-doctoral Research Associate, 1/1997 – 8/1998, Xerox Palo Alto Research Center (PARC)
- WSU, Department of Physics, Assistant Professor, 1998 – 2004
- WSU, Institute for Shock Physics, member, 1998 – present
- WSU, Materials Science Program, 2001 – present
- WSU, Department of Physics, Associate Professor with tenure, 2004 – present
- WSU, Department of Physics and Astronomy, Acting Chair, 2006 – 2007
- WSU, Department of Physics and Astronomy, Chair of Graduate Studies, 2007 – present
- WSU, Materials Science Program, Interim Chair, 2008 – 2009

### DISSERTATION

- **Title:** *Hydrogen Local Vibrational Modes in Semiconductors*
- **Committee:** Eugene Haller (chair), Peter Yu (co-chair), Steven Louie, and Daryl Czhran

### RESEARCH INTERESTS

- Optical and electrical properties of wide-bandgap semiconductors
- Infrared (IR) spectroscopy of hydrogen in semiconductors
- Synthesis and characterization of bulk and nanoscale zinc oxide
- Inorganic and organic semiconductors under hydrostatic pressure
- Optical properties of materials under shock compression
- Optical imaging of neural activity

### PROFESSIONAL SOCIETIES

- American Chemical Society
- American Physical Society
- Materials Research Society

### HONOR SOCIETIES

- Phi Beta Kappa
- Sigma Xi
- Sigma Pi Sigma

## AWARDS

- WSU College of Sciences New Faculty Performance Award (one awarded, 2002)

### Student awards

- Kirill Zhuravlev, WSU College of Sciences Graduate Student Achievement Award (one awarded, 2004)
- Slade Jokela, John P. Hirth Outstanding Graduate Seminar Award for WSU's Physical Chemistry and Materials Science Seminar Program (one awarded, 2005).
- Jennifer Schei, Poncin Scholarship (2006, 2007, 2008)
- Gabriel Hanna, NASA Space Scholarship (2007)
- Marianne Tarun, Golding Family Fellowship (2007)
- Marianne Tarun, John P. Hirth Outstanding Graduate Seminar Award for WSU's Physical Chemistry and Materials Science Seminar Program (one awarded, 2008).

## SERVICE AT WSU

### University

- Materials Science graduate studies committee, 1/01 – 5/05
- Guest Lecturer for WSU Foundation Bay Area alumni reception, San Francisco, 9/26/03
- Future Cougar Day, Seattle, WA, 9/06
- "Getting Connected 2007," orientation and welcome for graduate students, panel member, 8/07
- Presentation on materials research for congressional staff visit, 8/07
- Boeing research collaboration meeting, Seattle, WA, 1/08
- Academic Affairs Program Prioritization (AAPP) Task Force Phase II, 2/08-4/08
- "Getting Connected 2008," orientation and welcome for graduate students, panel member, 8/08
- Interim Chair of Materials Science, 8/08 – 7/09
- Research Infrastructure Committee, 12/08 - present

### College

- Technical Services Advisory Committee, 9/00 – 12/03
- Research Infrastructure Support Committee, 12/03 – 5/04

### Department

- Colloquium Coordinator, spring 2000
- Stephenson Lecture Coordinator (hosted Douglas Osheroff), 9/6/00
- Member, Instructor Search Committee, 9/00 – 3/01
- Colloquium Coordinator, spring 2001
- Member, Experimentalist Search Committee, 11/03 – 5/04
- Member, *Ad hoc* Space Committee, 10/04 – 1/05
- Member, Theory/Astro Search Committee, 9/04 – 5/05
- Member, Graduate Studies Committee, 5/00 – 5/05
- Acting Chair, Department of Physics and Astronomy, 7/06 – 6/07
- Department Accreditation Committee, 10/07 – 12/07
- Chair, Scholarship committee, 7/06 – present
- Chair of Graduate Studies, 7/07 – present
- Research Experiences for Undergraduates (REU) Faculty Coordinator, 2/07 – present

## PROFESSIONAL SERVICE OUTSIDE OF WSU

- Member, National Science Foundation Nanoscale Exploratory Research (NER) panel, February 21-22, 2002
- Session Chair, APS March Meeting 2003 (Session X23, Electronic and Device Structures)
- Participant, APS March Meeting Abstract Sorters' Meeting, December 2003
- Co-organizer, MRS Symposium on Hydrogen in Semiconductors, Spring 2004
- Co-editor, *Mat. Res. Soc. Symp. Proc.* **813**, ed. N.H. Nickel, M.D. McCluskey, and S.B. Zhang (MRS, Pennsylvania, 2004).
- Co-organizer, Focus Topic on Wide-band-gap Semiconductors, APS March Meeting 2004
- Convenor, APS Northwest (APSNW) Meeting 2004
- Member, International Advisory Committee, International Conference on Defects in Semiconductors (ICDS), 2003-5
- Elected member, APSNW Executive Committee, 5/04 – 5/05
- Member, APSNW Program Committee, 11/05 – 5/06
- Member, International Conference on Hydrogen in Materials organizing committee, 2002-6
- Vice chair, Gordon Research Conference on Defects in Semiconductors, 2005-6
- Member, Advisory Committee, University of Idaho DOE-EPSCOR Grant, 2005-7
- Session Chair, APS March Meeting 2008 (Session W19, Dopants and Defects in Semiconductors IV)
- Chair, Gordon Research Conference on Defects in Semiconductors, 2007-8
- External member, PhD Committee, Simon Fraser University, 6/08
- Co-organizer, Focus Topic on Defects in Semiconductors, APS March Meeting 2009

## OUTREACH

- Development of lab exercises for the Nespelem school, on the Collville Indian reservation in northeast Washington, for 8<sup>th</sup> grade class.
- Organized visits by WSU Children's Center (ages: 2-10)
- Mentor for Pullman High School senior science project
- Physics demonstrations at Royal Garrison elementary school
- Physics demonstrations for groups of home-schooled students
- Team Leader, "Kids Judge" neuroscience event, spring 2006.
- Recruiting trip, 2009 Joint Annual Conference of the National Society of Black Physicists and the National Society of Hispanic Physicists
- Advisor, Franklin Elementary Math Club, 2009 – present.

## REFEREEING

- *American Journal of Physics*
- *Applied Physics Letters*
- Environmental Molecular Sciences Laboratory / Pacific Northwest National Laboratory (EMSL/PNNL)
- *Journal of Applied Physics*
- *Journal of Chemical Physics*
- *Journal of Crystal Growth*
- *Journal of the Electrochemical Society*
- *Journal of Physical Chemistry*
- *Journal of Physics D: Applied Physics*
- *Journal of Vacuum Science and Technology B*
- *Materials Today*
- *Nanotechnology*

- *Nature*
- *Nature Materials*
- National Science Foundation
- Natural Sciences and Engineering Research Council of Canada
- *Organic Electronics*
- Petroleum Research Fund
- *Physical Review B*
- *Physical Review Letters*
- *Semiconductor Science and Technology*
- Stanford Synchrotron Radiation Laboratory
- *Superlattices and Microstructures*
- Tenure application (1)
- *Thin Solid Films*
- United States – Israel Binational Science Foundation (BSF)

## PUBLICATIONS

### Summary

- Authored or co-authored over 80 peer-reviewed publications, including 3 *Physical Review Letters* and an invited review article featured on the cover of *Journal of Applied Physics* (April 15, 2000).
- Top citations (15 Dec 2008, ISI Web of Knowledge):
  - Gotz *et al.*, "Local vibrational modes of the Mg-H acceptor complex in GaN," *Appl. Phys. Lett.* **69**, 3725 (1996), cited 126 times.
  - Shan *et al.*, "Optical properties of  $\text{In}_x\text{Ga}_{1-x}\text{N}$  alloys grown by metalorganic chemical vapor deposition," *J. Appl. Phys.* **84**, 4452 (1998), cited 85 times.
  - McCluskey *et al.*, "Phase separation in InGaN/GaN multiple quantum wells," *Appl. Phys. Lett.* **72**, 1730 (1998), cited 127 times.
  - McCluskey *et al.*, "Large band gap bowing of  $\text{In}_x\text{Ga}_{1-x}\text{N}$  alloys," *Appl. Phys. Lett.* **72**, 2725 (1998), cited 138 times.
  - McCluskey *et al.*, "Metastability of oxygen donors in AlGaIn," *Phys. Rev. Lett.* **80**, 4008 (1998), cited 78 times.
  - McCluskey *et al.*, "Infrared spectroscopy of hydrogen in ZnO," *Appl. Phys. Lett.* **81**, 3807 (2002), cited 77 times.

### Journals and Conference Proceedings (peer-reviewed unless noted otherwise)

1994

1. M.D. McCluskey, E.E. Haller, J. Walker, and N.M. Johnson, "Spectroscopy of hydrogen-related complexes in GaP:Zn," *Appl. Phys. Lett.* **65**, 2191-2 (1994).

1995

2. J.W. Ager III, W. Walukiewicz, M.D. McCluskey, M.A. Plano, and M.I. Landstrass, "Fano interference of the Raman phonon in heavily boron-doped diamond films grown by chemical vapor deposition," *Appl. Phys. Lett.* **66**, 616-8 (1995).
3. M.D. McCluskey, E.E. Haller, J. Walker, and N.M. Johnson, "Vibrational spectroscopy of group II acceptor - hydrogen complexes in GaP," *Phys. Rev. B* **52**, 11859-64 (1995).

1996

4. M.D. McCluskey, E.E. Haller, F.X. Zach, and E.D. Bourret-Courchesne, "Vibrational spectroscopy of arsenic-hydrogen complexes in ZnSe," *Appl. Phys. Lett.* **68**, 3476-8 (1996).
5. M.D. McCluskey, E.E. Haller, W. Walukiewicz, and P. Becla, "Hydrogen passivation of Se and Te in AlSb," *Phys. Rev. B* **53**, 16297-301 (1996).
6. M.D. McCluskey, L. Hsu, L. Wang, and E.E. Haller, "Infrared absorption of solid nitrogen at high pressures," *Phys. Rev. B* **54**, 8962-4 (1996).

7. W. Götz, N.M. Johnson, D.P. Bour, M.D. McCluskey, and E.E. Haller, "Local vibrational modes of the Mg-H acceptor complex in GaN," *Appl. Phys. Lett.* **69**, 3725-7 (1996).

1997

8. M.D. McCluskey, E.E. Haller, J. Walker, N.M. Johnson, J. Vetterhöffer, J. Weber, T.B. Joyce, and R.C. Newman, "Local vibrational modes in GaAs under hydrostatic pressure," *Phys. Rev. B* **56**, 6404-7 (1997).

9. M.D. McCluskey and E.E. Haller, "Interstitial oxygen in silicon under hydrostatic pressure," *Phys. Rev. B* **56**, 9520-3 (1997).

10. M.D. McCluskey, E.E. Haller, W. Walukiewicz, and P. Becla, "Resonant interaction between local vibrational modes and extended lattice phonons in AlSb," *Mat. Sci. Forum* **258-263**, 1247-52 (1997).

11. W. Götz, M.D. McCluskey, N.M. Johnson, and D.P. Bour, "Spectroscopic identification of the acceptor-hydrogen complex in Mg-doped GaN grown by MOCVD," *Mat. Res. Soc. Symp. Proc.* **468**, 117 (1997).

1998

12. M.D. McCluskey, N.M. Johnson, C.G. Van de Walle, D.P. Bour, M. Kneissl, and W. Walukiewicz, "Metastability of oxygen donors in AlGaIn," *Phys. Rev. Lett.* **80**, 4008-11 (1998).

13. M.D. McCluskey, E.E. Haller, W. Walukiewicz, and P. Becla, "Anti-crossing behavior of local vibrational modes in AlSb," *Solid State Commun.* **106**, 587-90 (1998).

14. M.D. McCluskey, L.T. Romano, B.S. Krusor, D.P. Bour, and S. Brennan, "Phase separation in InGaIn/GaN multiple quantum wells," *Appl. Phys. Lett.* **72**, 1730-2 (1998).

15. M.D. McCluskey, C.G. Van de Walle, C.P. Master, L.T. Romano, and N.M. Johnson, "Large band-gap bowing of  $\text{In}_x\text{Ga}_{1-x}\text{N}$  alloys," *Appl. Phys. Lett.* **72**, 2725-6 (1998).

16. M.D. McCluskey, L.T. Romano, B.S. Krusor, N.M. Johnson, T. Suski, and J. Jun, "Interdiffusion of In and Ga in InGaIn/GaN quantum wells," *Appl. Phys. Lett.* **73**, 1281-3 (1998).

17. L.T. Romano, M.D. McCluskey, B.S. Krusor, D.P. Bour, C. Chua, S. Brennan, and K.M. Yu, "Phase separation in annealed InGaIn/GaN multiple quantum wells," *J. Crystal Growth* **189/190**, 33-36 (1998).

18. D.P. Bour, M. Kneissl, L.T. Romano, M.D. McCluskey, *et al.*, "Characteristics of InGaIn/AlGaIn multiple-quantum-well laser diodes," *IEEE Journ. Select. Top. Quant. Electr.* **4**, 498-504 (1998).

19. W. Shan, P. Perlin, J.W. Ager III, W. Walukiewicz, E.E. Haller, M.D. McCluskey, N.M. Johnson, and D.P. Bour, "Pressure dependence of optical transitions in  $\text{In}_{0.15}\text{Ga}_{0.85}\text{N}$  multiple quantum wells," *Phys. Rev. B* **58**, R10191-4 (1998).

20. W. Shan, P. Perlin, W. Walukiewicz, E.E. Haller, B.D. Little, J.J. Song, M.D. McCluskey, N.M. Johnson, Z.C. Feng, M. Schurman, and R.A. Stall, "Optical properties of  $\text{In}_x\text{Ga}_{1-x}\text{N}$  alloys grown by metalorganic chemical vapor deposition," *J. Appl. Phys.* **84**, 4452-8 (1998).

21. W. Shan, P. Perlin, J.W. Ager III, W. Walukiewicz, E.E. Haller, M.D. McCluskey, N.M. Johnson, and D.P. Bour, "Comparison study of photoluminescence from InGaIn/GaN multiple quantum wells and InGaIn epitaxial layers under large hydrostatic pressure," *Appl. Phys. Lett.* **73**, 1613-5 (1998).

22. L.T. Romano, B.S. Krusor, M.D. McCluskey, D.P. Bour, and K. Nakua, "Structural and optical properties of pseudomorphic  $\text{In}_x\text{Ga}_{1-x}\text{N}$  alloys," *Appl. Phys. Lett.* **73**, 1757-9 (1998).

23. L.T. Romano, D. Hofstetter, M.D. McCluskey, D.P. Bour, and M. Kneissl, "Structural and optical properties of epitaxially overgrown third-order gratings for InGaN/GaN-based distributed feedback lasers," *Appl. Phys. Lett.* **73**, 2706-8 (1998).
24. M.D. McCluskey, L.T. Romano, B.S. Krusor, and D.P. Bour, "Phase separation in InGaN/GaN multiple quantum wells," *Mat. Rec. Soc. Symp. Proc.* **482**, 985-9 (1998).
25. E.E. Haller and M.D. McCluskey, "Infrared optical studies of semiconductors at large hydrostatic pressures," *Mat. Res. Soc. Symp. Proc.* **499**, 371 (1998).
26. M.D. McCluskey, "Hydrogen local vibrational modes in compound semiconductors," *Mat. Res. Soc. Symp. Proc.* **513**, 217-28 (1998).
27. M.D. McCluskey, N.M. Johnson, C.G. Van de Walle, and D.P. Bour, "Evidence for oxygen DX centers in AlGaIn," *Mat. Rec. Soc. Symp. Proc.* **512**, 531-6 (1998).

1999

28. H. Navarro-Contreras, F. de Anda-Salazar, J. Olvera-Hernandez, L. Hsu, M.D. McCluskey, and E.E. Haller, "Shallow to deep transformation of Se donors in GaSb under hydrostatic pressure," *Phys. Rev. B* **59**, 8003-7 (1999).
29. M.D. McCluskey and N.M. Johnson, "Hydrogen in compound semiconductors," *J. Vacuum Sci. Tech. A* **17**, 2188-93 (1999).
30. M.D. McCluskey, C.G. Van de Walle, N.M. Johnson, D.P. Bour, and M. Kneissl, "DX centers in AlGaIn," *Int. J. Mod. Phys. B* **13**, 1363-78 (1999).
31. C.G. Van de Walle, M.D. McCluskey, C.P. Master, L.T. Romano, and N.M. Johnson, "Large and composition-dependent band gap bowing in  $\text{In}_x\text{Ga}_{1-x}\text{N}$ ," *Mater. Sci. Engin. B* **59**, 274-8 (1999).
32. D.P. Bour, M. Kneissl, D. Hofstetter, L.T. Romano, M. McCluskey, C.G. Van de Walle, B.S. Krusor, C. Dunnrowicz, R. Donaldson, J. Walker, and N.M. Johnson, "MOCVD growth and characterization of AlGaInN multiple quantum well heterostructures and laser diodes," *Mater. Sci. Engin. B* **59**, 33-8 (1999).
33. L.T. Romano, M.D. McCluskey, C.G. Van de Walle, J.E. Northrup, D.P. Bour, M. Kneissl, T. Suski, and J. Jun, "Phase separation in InGaN multiple quantum wells annealed at high nitrogen pressures," *Appl. Phys. Lett.* **75**, 3950-2 (1999).
34. C.G. Van de Walle, J. Neugebauer, C. Stampfl, M.D. McCluskey, and N.M. Johnson, "Defects and defect reactions in semiconductor nitrides," *Acta Physica Polonica A* **96**, 613 (1999).
35. C.G. Van de Walle, C. Stampfl, J. Neugebauer, and M.D. McCluskey, "Doping of AlGaIn alloys," *MRS Internet J. Nitride Semicond. Res.* **4S1**, G10.4 (1999).
36. M.D. McCluskey, L.T. Romano, B.S. Krusor, D. Hofstetter, N.M. Johnson, T. Suski, and J. Jun, "Disordering of InGaN/GaN superlattices after high-pressure annealing," *MRS Internet J. Nitride Semicond. Res.* **4S1**, G3.42 (1999).
37. W. Shan, J.W. Ager III, W. Walukiewicz, E.E. Haller, M.D. McCluskey, N.M. Johnson, and D.P. Bour, "Pressure dependence of optical transitions in InGaN/GaN multiple quantum wells," *MRS Internet J. Nitride Semicond. Res.* **4S1**, G3.15 (1999).

2000

38. M.D. McCluskey, "Local vibrational modes of impurities in semiconductors," *J. Appl. Phys. (Appl. Phys. Rev.)* **87**, 3593-3617 (2000). Invited review article, featured on cover.

2001

39. M.D. McCluskey, K.K. Zhuravlev, B.R. Davidson, and R.C. Newman, "Pressure dependence of local vibrational modes in InP," *Phys. Rev. B* **63**, 125202:1-4 (2001).

40. K.K. Zhuravlev and M.D. McCluskey, "Flattening of organic molecules under pressure," *J. Chem. Phys.* **114**, 5465-7 (2001).

41. M.D. McCluskey, K.K. Zhuravlev, B.R. Davidson, and R.C. Newman, "Acceptor-hydrogen complexes in semiconductors under pressure," *Physica B* **308-310**, 780-3 (2001).

2002

42. M.D. McCluskey, E.E. Haller, and P. Becla, "Carbon acceptors and carbon-hydrogen complexes in AlSb," *Phys. Rev. B* **65**, 045201:1-4 (2002).

43. M.D. McCluskey and K.K. Zhuravlev, "N<sub>2</sub> and CO<sub>2</sub> vibrational modes in solid nitrogen under pressure," *J. Chem. Phys.* **116**, 1607-12 (2002).

44. M.D. McCluskey, Y.M. Gupta, C.G. Van de Walle, D.P. Bour, M. Kneissl, and N.M. Johnson, "Band gap changes of GaN shocked to 13 GPa," *Appl. Phys. Lett.* **80**, 1912-4 (2002).

45. M.D. McCluskey, S.J. Jokela, K.K. Zhuravlev, P.J. Simpson, and K.G. Lynn, "Infrared spectroscopy of hydrogen in ZnO," *Appl. Phys. Lett.* **81**, 3807-9 (2002).

46. K.K. Zhuravlev, and M.D. McCluskey, "Infrared spectroscopy of biphenyl under hydrostatic pressure," *J. Chem. Phys.* **117**, 3748-52 (2002).

47. M.D. McCluskey, D.I. Grover, and K.K. Zhuravlev, "Infrared spectroscopy of bis(4-nitrophenyl) disulfide grown on a Pb layer," *Chem. Lett.*, **2002**, No. 11, 1138-9 (2002).

48. M.D. McCluskey, K.K. Zhuravlev, M. Kneissl, W. Wong, D. Treat, S. Limpijumngong, C.G. Van de Walle, and N.M. Johnson, "Vibrational spectroscopy of GaN:Mg under pressure," *Mat. Res. Soc. Symp. Proc.* **693**, 12.4 (2002).

49. H.Y. Peng, M.D. McCluskey, Y.M. Gupta, M. Kneissl, and N.M. Johnson, "Band gap shift of GaN under uniaxial strain compression," *Mat. Res. Soc. Symp. Proc.* **693**, 111.49 (2002).

2003

50. L. Hsu, M.D. McCluskey, and J.L. Lindstrom, "Resonant interaction between localized and extended vibrational modes in Si:<sup>18</sup>O under pressure," *Phys. Rev. Lett.* **90**, 095505:1-4 (2003).

51. L. Hsu, M.D. McCluskey, and E.E. Haller, "Pressure dependence of donor excitation spectra in AlSb," *Phys. Rev. B* **67**, 035209:1-8 (2003).

52. H.Y. Peng, M.D. McCluskey, Y.M. Gupta, M. Kneissl, and N.M. Johnson, "The Franz-Keldysh effect in shocked GaN:Mg," *Appl. Phys. Lett.* **82**, 2085-7 (2003).

53. M.D. McCluskey, C.G. Van de Walle, L.T. Romano, B.S. Krusor, and N.M. Johnson, "Effect of composition on the band gap of strained In<sub>x</sub>Ga<sub>1-x</sub>N alloys," *J. Appl. Phys.* **93**, 4340-2 (2003).

54. M.D. McCluskey, L. Hsu, and J.L. Lindström, "Interaction between localized and extended modes of oxygen in silicon," *Physica B* **340-342**, 514-7 (2003).
55. S.J. Jokela, M.D. McCluskey, and K.G. Lynn, "Infrared spectroscopy of hydrogen in annealed zinc oxide," *Physica B* **340-342**, 221-4 (2003).
56. B. Pajot, B. Clerjaud, and M.D. McCluskey, "Isotope effects in the electronic spectra of singly ionized S<sup>+</sup> and Se<sup>+</sup> donors in silicon," *Physica B* **340-342**, 760-4 (2003).
57. M.D. McCluskey, "Local vibrational mode spectroscopy of hydrogen in compound semiconductors," in *Hydrogen in Materials and Vacuum Systems*, AIP Conf. Proc. **671**, 49-54 (2003).

#### 2004

58. K.K. Zhuravlev, and M.D. McCluskey, "Conformation of p-terphenyl under hydrostatic pressure," *J. Chem. Phys.* **120**, 1841-5 (2004).
59. L. Hsu and M.D. McCluskey, "Vibrational studies and resonant interaction between localized and extended modes in Si:O under pressure," *Mod. Phys. Lett. B* **18**, 1013-28 (2004).
60. B. Pajot, B. Clerjaud, and M.D. McCluskey, "Isotope effects in the electronic spectrum of S<sup>+</sup> and Se<sup>+</sup> in silicon," *Phys. Rev. B* **69**, 085210:1-7 (2004).
61. M.D. McCluskey, "Pressure tuning of localized and extended vibrational modes in Si:O," *Phys. Stat. Sol. (b)* **241**, 3300-05 (2004).
62. M.D. McCluskey and S.J. Jokela, "Infrared spectroscopy of hydrogen in ZnO," in *Hydrogen in Semiconductors*, edited by N.H. Nickel, M.D. McCluskey, and S.B. Zhang (*Mat. Res. Soc. Symp. Proc.* **813**, Warrendale, PA, 2004), H3.2.

#### 2005

63. M.A. Scarpulla, B.L. Cardozo, R. Farshchi, W.M. Hlaing Oo, M.D. McCluskey, K.M. Yu, and O.D. Dubon, "Ferromagnetism in Ga<sub>1-x</sub>Mn<sub>x</sub>P: evidence for inter-Mn exchange mediated by localized holes within a detached impurity band," *Phys. Rev. Lett.* **95**, 207204:1-4 (2005).
64. H.Y. Peng, M.D. McCluskey, Y.M. Gupta, M. Kneissl, and N.M. Johnson, "Shock-induced band-gap shift in GaN: Anisotropy of the deformation potentials," *Phys. Rev. B* **71**, 115207:1-5 (2005).
65. W.M. Hlaing Oo, M.D. McCluskey, A.D. Lalonde, and M.G. Norton, "Infrared spectroscopy of ZnO nanoparticles containing CO<sub>2</sub> impurities," *Appl. Phys. Lett.* **86**, 073111:1-3 (2005).
66. S.J. Jokela and M.D. McCluskey, "Structure and stability of O-H donors in ZnO from high-pressure and infrared spectroscopy," *Phys. Rev. B* **72**, 113201:1-4 (2005).
67. M.D. McCluskey and S.J. Jokela, "Hydrogen donors in zinc oxide," in *Proceedings of the NATO Advanced Workshop on Zinc Oxide*, edited by N. Nickel and E. Terukov, NATO Science Series II, Vol. **194**, p. 125-32 (2005).
68. M.D. McCluskey, S.J. Jokela, and W.M. Hlaing Oo, "Hydrogen donors in zinc oxide," in *Semiconductor Defect Engineering—Materials, Synthetic Structures and Devices*, edited by S. Ashok, J. Chevallier, B.L. Sopori, M. Tabe, and P. Kiesel (*Mater. Res. Soc. Symp. Proc.* **864**, Warrendale, PA, 2005), E10.4.
69. W.M. Hlaing Oo and M.D. McCluskey, "Infrared spectroscopy of impurities in ZnO nanoparticles," in *Semiconductor Defect Engineering—Materials, Synthetic Structures and Devices*, edited by S. Ashok, J.

Chevallier, B.L. Sopori, M. Tabe, and P. Kiesel (Mater. Res. Soc. Symp. Proc. **864**, Warrendale, PA , 2005), E4.40.

2006

70. M.D. McCluskey, S.J. Jokela, and W.M. Hlaing Oo, "Hydrogen in bulk and nanoscale ZnO," *Physica B* **376-377**, 690-3 (2006).

71. J. Huso, J.L. Morrison, H. Hoeck, X.-B. Chen, L. Bergman, S.J. Jokela, M.D. McCluskey, and T. Zheleva, "Pressure response of the ultraviolet photoluminescence of ZnO and MgZnO nanocrystallites," *Appl. Phys. Lett.* **89**, 171909:1-3 (2006).

2007

72. W.M. Hlaing Oo, M.D. McCluskey, J. Huso, and L. Bergman, "Infrared and Raman spectroscopy of ZnO nanoparticles annealed in hydrogen," *J. Appl. Phys.* **102**, 043529:1-5 (2007).

(Featured in *Virtual Journal of Nanoscale Science & Technology*, September 10, 2007, Volume 16, Issue 11.)

73. M.D. McCluskey, J.J. Sable, A.J. Foust, G. Gratton, and D.M Rector, "Recording invertebrate nerve activation with modulated light changes," *Applied Optics* **46**, 1866-71 (2007).

74. P. Grivickas, M.D. McCluskey, and Y.M. Gupta, "Indirect band-gap transitions in GaP shocked along the [100], [110], and [111] axes," *Phys. Rev. B* **75**, 235207:1-8 (2007).

75. S.J. Jokela and M.D. McCluskey, "Hydrogen complexes in ZnO grown by chemical vapor transport," *Physica B* **401-2**, 395-8 (2007).

76. M.D. McCluskey and S.J. Jokela, "Sources of n-type conductivity in ZnO," *Physica B* **401-2**, 355-7 (2007).

77. S.J. Jokela and M.D. McCluskey, "Unambiguous identification of nitrogen-hydrogen complexes in zinc oxide," *Phys. Rev. B* **76**, 193201:1-4 (2007).

78. M.D. McCluskey, B.D. Riley, A.M. Perenchio, and M. Knoblauch, "Confocal microscopy of water under static pressure," *Shock Compression of Condensed Matter – 2007, AIP Conference Proceedings* **955**, ed. M. Elert, M.D. Furnish, R. Chau, N. Holmes, and J. Nguyen, p. 1109-12 (2007).

2008

79. Jennifer L. Schei, Matthew D. McCluskey, Amanda J. Foust, Xin-Cheng Yao, and David M. Rector, "Action potential propagation imaged with high temporal resolution near-infrared video microscopy and polarized light," *NeuroImage* **40**, 1034-43 (2008).

80. P. Grivickas, M.D. McCluskey, and Y.M. Gupta, "Band-gap luminescence of GaP:S shock compressed to 5 GPa," *Appl. Phys. Lett.* **92**, 142104:1-3 (2008).

81. W.M. Hlaing Oo, M.D. McCluskey, Y.P. He and Y.P. Zhao, "Strong Fano resonance of oxygen-hydrogen bonds on oblique angle deposited Mg nanoblades," *Appl. Phys. Lett.* **92**, 183112:1-3 (2008).

82. M.D. McCluskey, "Local vibrational modes of impurities in silicon," in the Proceedings of the 5<sup>th</sup> International Symposium on Advanced Science and Technology of Silicon Materials (JSPS Si Symposium), Nov. 10-14, 2008, Kona, Hawaii (not peer-reviewed).

### Submitted manuscripts

1. W.M. Hlaing Oo, L.V. Saraf, M.H. Engelhard, V. Shutthanandan, L. Bergman, J. Huso, and M.D. McCluskey, "Suppression of conductivity in Mn-Doped ZnO Thin Films," *J. Appl. Phys.* (in press).
2. P. Grivickas, M.D. McCluskey, Y. Zhang, J. F. Geisz, and Y.M. Gupta, "Bound exciton luminescence in shock compressed GaP:S and GaP:N," *J. Appl. Phys.* (submitted).
3. G.J. Hanna and M.D. McCluskey, "Measuring the volume of a fluid in a diamond anvil cell using a confocal microscope," *Applied Optics* (submitted).
4. J. Huso, J.L. Morrison, E. Casey, H. Hoeck, C. Walker, L. Bergman, W.M. Hlaing Oo, and M.D. McCluskey, "Optical transitions and multiphonon scattering of Cu-doped ZnO ceramics," *Appl. Phys. Lett.* (submitted).
5. M.D. McCluskey, "Resonant interaction between hydrogen vibrational modes in AlSb:Se," *Phys. Rev. Lett.* (submitted).

### Book chapters

- M.D. McCluskey, and E.E. Haller, "Vibrational spectroscopy of hydrogen in III-V and II-VI semiconductors," in Semiconductors in Semimetals **61**, ed. N.H. Nickel (Academic Press, 1999), Ch. 9.
- S.J. Jokela and M.D. McCluskey, in Zinc Oxide, the Future material for Electronics: A Comprehensive Review, ed. F. Selim (Research Signpost, India), to be published.

### Edited Volumes

*Hydrogen in Semiconductors*, edited by N.H. Nickel, M.D. McCluskey, and S.B. Zhang (*Mat. Res. Soc. Symp. Proc.* **813**, Warrendale, PA, 2004).

## PRESENTATIONS

1. "Hydrogen in Compound Semiconductors," American Vacuum Society Symposium 1998, Baltimore (invited).
2. "Local Vibrational Modes Under Pressure," Gordon Research Conference on Point and Line Defects in Semiconductors 1998, New London, New Hampshire (invited).
3. "Hydrogen Local Vibrational Modes in Compound Semiconductors," Materials Research Society Spring Meeting 1998, San Francisco (invited).
4. "Recent Discoveries Involving Hydrogen in Compound Semiconductors," American Physical Society Meeting 1998, Los Angeles (invited).
5. "Phase separation in InGaN quantum wells," American Physical Society Northwest Meeting 1999, Vancouver.
6. "Pressure Dependence of Local Vibrational Modes in InP:C,H," Gordon Research Conference on Point and Line Defects in Semiconductors 2000, New London, New Hampshire.
7. "Band gap of GaN under shock compression," American Physical Society March Meeting 2000, Minneapolis.
8. "Planarization of polyphenyls under hydrostatic pressure," American Physical Society March Meeting 2001, Seattle (K.K. Zhuravlev).
9. "Hydrogen local vibrational modes in InP under pressure," American Physical Society March Meeting 2001, Seattle.
10. "Flattening of organic molecules under pressure," American Physical Society Northwest Meeting 2001, Seattle.
11. "Optical absorption in shocked GaN," American Physical Society Shock Compression of Condensed Matter Meeting 2001, Atlanta (H.Y. Peng).
12. "Acceptor-hydrogen complexes in semiconductors under pressure," International Conference on Defects in Semiconductors 2001 (ICDS-21), Giessen, Germany.
13. "Vibrational spectroscopy of GaN:Mg under pressure," Materials Research Society Fall Meeting 2001, Boston.
14. "Infrared spectroscopy of GaN:Mg,H under pressure," Gordon Research Conference on Point and Line Defects in Semiconductors 2002, New London, New Hampshire.
15. "Local vibrational mode spectroscopy of hydrogen in compound semiconductors," 2002, International Workshop on Hydrogen in Materials and Vacuum Systems, Jefferson Lab, Newport News, Virginia (invited).
16. "Structural changes in biphenyl and p-terphenyl under hydrostatic pressure," American Physical Society March Meeting 2003, Austin (Kirill Zhuravlev).
17. "Vibrational spectroscopy of hydrogen donors in zinc oxide," American Physical Society March Meeting 2003, Austin.
18. "Local vibrational mode spectroscopy," International Conference on Defects in Semiconductors 2003 (ICDS-22), Aarhus, Denmark (invited tutorial).

19. "Interaction between localized and extended modes of oxygen in silicon," International Conference on Defects in Semiconductors 2003 (ICDS-22), Aarhus, Denmark.
20. "Vibrational spectroscopy of hydrogen donors in zinc oxide", International Conference on Defects in Semiconductors 2003 (ICDS-22), Aarhus, Denmark ([Slade Jokela](#)).
21. "The effect of piezoelectric fields on the optical absorption of shocked GaN," American Physical Society Shock Compression of Condensed Matter Meeting 2003, Portland.
22. "Determination of the deformation potentials of GaN using shock wave compression," American Physical Society Shock Compression of Condensed Matter Meeting 2003, Portland.
23. "Hydrogen donors in zinc oxide," Gordon Research Conference on Defects in Semiconductors 2004, New London, New Hampshire ([invited](#)).
24. "Hydrogen donors in zinc oxide," NATO Workshop on Zinc Oxide, St. Petersburg, Russia, 2004 ([invited](#)).
25. "Structure and stability of hydrogen complexes in ZnO," American Physical Society March Meeting 2004, Montreal.
26. "Infrared spectroscopy of hydrogen in ZnO," Materials Research Society Spring Meeting 2004, San Francisco.
27. "Pressure tuning of resonant interaction between localized and extended vibrational modes in Si:O," High Pressure Semiconductor Physics 2004 (HPSP-XI), Berkeley ([invited](#)).
28. "Instability of hydrogen as a donor in zinc oxide," American Physical Society Northwest Meeting 2004, Moscow/Pullman ([invited](#), [Slade Jokela](#)).
29. "Ultrafast carrier dynamics in AlSb," American Physical Society Northwest Meeting 2004, Moscow/Pullman (poster, [Win Maw Hlaing Oo](#)).
30. "Hydrogen donors in zinc oxide," Materials Research Society Spring Meeting 2005, San Francisco ([invited](#)).
31. "Hydrogen donors in zinc oxide," American Physical Society Northwest Meeting 2005, Victoria, BC.
32. "Hydrogen donors in zinc oxide," International Conference on Defects in Semiconductors 2005 (ICDS-23), Awaji Island, Japan.
33. "Action potentials in invertebrate nerves studied by modulated light changes," Optical Society of America Biomedical Optics Topical Meeting 2006, Ft. Lauderdale (poster).
34. "Infrared and Raman spectroscopy of ZnO nanoparticles," American Physical Society Northwest Meeting 2006, University of Puget Sound ([invited](#), [Win Maw Hlaing Oo](#)).
35. "Structure and stability of H donors in ZnO," Gordon Research Conference on Defects in Semiconductors 2006, New London, NH ([invited](#), [Slade Jokela](#)).
36. "Zinc oxide – a material for energy applications," American Physical Society Northwest meeting, 2007, Pocatello ([invited](#)).
37. "Confocal microscopy of water under static pressure," American Physical Society Shock Compression of Condensed Matter meeting 2007, Hawaii (poster).

38. "Hydrogen-related complexes in ZnO," International Conference on Defects in Semiconductors 2007 (ICDS-24), Albuquerque ([invited](#)).
39. "Magnetic and optical properties of ferromagnetic ZnO nanoclusters," Physical Behavior of Materials DOE-BES Contractors Meeting 2008, Virginia (poster).
40. "Nitrogen-hydrogen complexes in ZnO: A possible route toward p-type conductivity," American Physical Society March Meeting 2008, New Orleans.
41. "Hydrogen in bulk and nanoscale zinc oxide," UC Santa Barbara Workshop on Frontiers in Complex Oxides, 2008 ([invited](#)).
42. "Nitrogen-hydrogen complexes in zinc oxide", Gordon Research Conference on Defects in Semiconductors 2008, New London, NH (poster, [Slade Jokela](#)).
43. "Infrared spectroscopy of copper in ZnO nanoparticles", Gordon Research Conference on Defects in Semiconductors 2008, New London, NH (poster, [Win Maw Hlaing Oo](#)).
44. "An investigation of substitutional hydrogen in ZnO", Gordon Research Conference on Defects in Semiconductors 2008, New London, NH (poster, [Marianne Tarun](#)).
45. "Nitrogen-hydrogen complexes in zinc oxide", AVS Northwest Meeting 2008, PNNL (poster, [Slade Jokela](#)).
46. "Infrared spectroscopy of copper in ZnO nanoparticles", AVS Northwest Meeting 2008, PNNL (poster, [Win Maw Hlaing Oo](#)).
47. "Local vibrational modes of impurities in silicon," 5<sup>th</sup> International Symposium on Advanced Science and Technology of Silicon Materials (JSPS Si Symposium), 2008, Kona, Hawaii ([invited](#)).
48. "Nitrogen doping of bulk ZnO grown by chemical vapor transport," American Physical Society March Meeting 2009, Pittsburgh.
49. "NSF REU / DoD ASSURE Site: Extreme Matter," American Physical Society March Meeting 2009, Pittsburgh.
50. "Dopants in bulk and nanoscale ZnO," Materials Research Society Spring Meeting 2009, San Francisco ([invited](#)).
51. "Defects in bulk ZnO," Materials Research Society Spring Meeting 2009, San Francisco ([invited](#)).

## **COLLOQUIA**

1. Xerox PARC, Electronic Materials Laboratory, 3/12/98
2. WSU, Physics, 1/26/99
3. WSU, Physical Chemistry and Materials Science, 9/10/99
4. Pacific Northwest National Laboratory, 4/17/00
5. WSU, Institute for Shock Physics, 11/2/00
6. University of Montana, 2/2/01
7. Boise State University, 1/25/01

8. WSU, Physics, 10/23/01
9. University of Montana, 12/10/01
10. Montana State University, 3/21/02
11. Boise State University, 11/22/02
12. Lawrence Livermore National Laboratory, 12/10/02
13. WSU, Physics and Astronomy, 9/6/03
14. University of Georgia, Physics, 10/13/05.
15. UC Santa Barbara, Materials Science, 2/17/06
16. Rensselaer Polytechnic Institute, Physics, 11/15/06
17. University at Albany, College of Nanoscale Science and Engineering, 11/17/06
18. WSU, Physics and Astronomy, 10/30/07
19. Simon Fraser University, 6/20/08
20. WSU, Physics and Astronomy, 9/9/08
21. Walla Walla University, 10/9/08

## EXTERNAL FUNDING

Title	Agency	Period and budget
Hydrogen in Compound Semiconductors	NSF	5/15/99 – 4/30/02 \$150,000
Hydrogen in Compound Semiconductors (REU supplement)	NSF	5/16/99 – 4/30/02 \$3,500
Infrared spectroscopy of conjugated molecules under hydrostatic pressure	ACS-PRF	1/1/02 – 8/31/04 \$35,000
Local vibrational spectroscopy of impurities in semiconductors (renewal)	NSF	5/16/02 – 5/15/06 \$360,720
Infrared spectroscopy of conjugated molecules under pressure – supplement	ACS-PRF	5/16/03 – 8/31/03 \$8,000
Local vibrational spectroscopy of impurities in semiconductors (REU supplement)	NSF	8/16/03 – 8/16/04 \$6,750
Optical and structural properties of wide bandgap semiconductors under extreme conditions (PI: Bergman, co-PI: McCluskey)	ACS-PRF	9/1/04 – 8/31/06 \$80,000 (WSU: \$40,000)
Development of a new infrared detector material	WTC	7/1/04 – 5/31/05 \$24,000
Integrated nanoscale metal hydride – catalyst architectures for hydrogen storage (PI: Zhao, co-PIs: Zhang, McCluskey)	DOE	8/16/05 – 8/15/08 \$900,000 (WSU: \$120,000)
Near infrared optical brain imaging of sleep (PI: Rector, co-PIs: Belenky, McCluskey)	MJ Murdock Charitable Trust	6/1/05 – 5/31/06 \$50,000
Local vibrational spectroscopy of impurities in semiconductors (REU supplement)	NSF	8/16/05 – 5/16/06 \$10,500
2006 Defects in Semiconductors Gordon Conference; New London, NH; July 2-7, 2006 (submitted through GRC)	NSF	4/1/06 – 3/31/07 \$5,000
REU Site: Extreme Matter	NSF-PHY	5/16/07 – 5/15/10 \$240,000
New theoretical, technical, and experimental approaches to brain organization of sleep and performance (PI: Belenky, co-PIs: Krueger, Rector, Van Dongen, LaRue, McCluskey)	WM Keck Foundation	7/1/06 – 6/30/09 \$1,494,057

**EXTERNAL FUNDING, continued**

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<b>Title</b>	<b>Agency</b>	<b>Period and budget</b>
Vibrational spectroscopy of defects in zinc oxide	NSF-DMR	5/16/07 – 5/15/10 \$415,993
Magnetic and optical properties of ferromagnetic ZnO nanoclusters (co-PIs: Bergman, Qiang)	DOE-BES	8/1/07 – 7/31/10 \$372,948 (WSU: \$147,682)
2008 Defects in Semiconductors Gordon Conference; New London, NH; August 3-8, 2008 (submitted through GRC)	NSF-DMR	4/1/08 – 3/31/09 \$6,000
Defects in Semiconductors Gordon Conference; New London, NH; August 3-8, 2008 (submitted through GRC)	AFOSR	4/1/08-3/31/09 \$5,000
Polymer light-emitting diodes for high efficiency aircraft cabin lighting (PI: McCluskey, co-PI: Jen)	Boeing	5/1/08 – 4/30/10 \$190,000 (estimate) (WSU: \$95,000)
The WSU high-performance computing center (PI: Tomsovic, co-PIs: Cooper, McCluskey, Worthey)	MJ Murdock Charitable Trust	4/1/09 – 3/31/10 \$499,000 (pending)

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## COURSES TAUGHT

Semester/Year	Course #	Course Title	Credit Hours	Enrollment (estimate)
Spring 1999	201	Classical Physics	4	35
Spring 2000	590	Seminar	1	20
Spring 2000	201	Classical Physics	4	70
Fall 2000	201	Classical Physics	4	130
Spring 2001	590	Seminar	1	20
Spring 2001	463	Intro. Solid State	3	15
Fall 2001	410	Electronics	3	10
Spring 2002	463	Intro. Solid State	3	20
Spring 2002	Mat Sci 571*	Surfaces	3	25
Spring 2002	515*	Optoelectronics Lab	3	15
Fall 2002	410	Electronics	3	10
Spring 2003	463	Intro. Solid State	3	20
Spring 2003	Mat Sci 571*	Surfaces	3	25
Spring 2003	515*	Optoelectronics Lab	3	15
Fall 2003	410	Electronics	3	5
Spring 2004	463	Intro. Solid State	3	29
Spring 2004	515**	Optoelectronics Lab	3	9
Fall 2004	410	Electronics	3	10
Spring 2005	463	Intro. Solid State	3	12
Spring 2005	515**	Optoelectronics Lab	3	9
Fall 2006	304	Modern Physics II	3	11
Spring 2007	Mat Sci 571*	Surfaces	3	25
Fall 2007	304	Modern Physics II	3	22
Spring 2008	Mat Sci 571*	Surfaces	3	15
Fall 2008	304	Modern Physics II	3	15
Spring 2009	Mat Sci 571*	Surfaces	3	15

\* Team-taught course

\*\* Team-taught course, head instructor

## INSTRUCTIONAL INNOVATIONS

- *The Physics of the Titanic*, a lecture that examines the sinking of the *RMS Titanic* from a physicist's point of view.
- In-class exercise where the students worked out problems involving crystal structures and presented the results to the class.
- "Ten Easy Questions." Students were assigned qualitative questions and presented the answers to the class. The questions were central to solid state physics, and served to identify and remedy conceptual misunderstandings.
- Thermal conductivity hands-on demonstration.

## UNDERGRADUATE RESEARCH SUPERVISION

Brooke Bafus (1999), Tyler Cumby (2001), Daniel Grover (2001), Lance Culnane (2003), Ben Horton (2004-5), Amy Perenchio (2005), Andrew Ulrich (2005-6), Katie Epperson (2007), Martha Roseberry (2007), Heather Ploeg (2008), Bobbie Riley (2006-8)

## THESIS COMMITTEES CHAIRED

Name of Student	Thesis Title	Anticipated Degree/Year	Completed Degree/year
Kirill Zhuravlev	Infrared spectroscopy of conjugated organic molecules under high pressure		Ph.D. 2004 (Physics)
Slade Jokela	Stability and structure of hydrogen defects in zinc oxide		Ph.D. 2006 (Mat Sci.)
Win Maw Hlaing Oo	Vibrational spectroscopy of defects in nanoscale ZnO		Ph.D. 2007 (Mat. Sci.)
Gabriel Hanna	Confocal microscopy of materials under pressure	Ph.D. 2009 (Physics)	
Jennifer Schei	Optical changes in neural tissue	Ph.D. 2010 (Physics)	Non-thesis M.S. 2008 (Physics)
Marianne Tarun	Growth and doping of zinc oxide	Ph.D. 2011 (Mat. Sci.)	
Samuel Teklemichael	Defects in ZnO nanoparticles	Ph.D. 2012 (Physics)	

## THESIS COMMITTEE SERVICE (not including those listed above)

Year	Number of M.S.	Number of Ph.D.
1999	0	1
2000	1	1
2001	6	3
2002	5	6
2003	4	6
2004	8	5
2005	0	7
2006	1	8
2007	4	9
2008	1	6

## POSTDOCTORAL SUPERVISION

<b>Name of postdoc</b>	<b>Project</b>	<b>Years</b>
Dr. Hongying Peng	Shock compression of gallium nitride (co-supervised with Prof. Y.M. Gupta)	2001-2003
Dr. Win Maw Hlaing Oo	Dopants in ZnO nanoparticles	2007-
Dr. Slade Jokela	Growth and characterization of bulk ZnO	2008-

## **PRESS CITATIONS / QUOTATIONS**

*Physics faculty member receives \$150,000 NSF grant*, Spectrum, 1999/2000.

*Neuro, Micro, Opto*, Washington State Magazine, Spring 2006  
(<http://washington-state-magazine.wsu.edu/stories/2006/February/sleepmain-3.html>)

*WSU researchers work on hydrogen energy*, The Daily Evergreen, 9/25/2006  
(<http://www.dailyevergreen.com/story/18961>)

*Hydrogen gets promiscuous*, Chemistry World, 12/4/2006  
(<http://www.rsc.org/chemistryworld/News/2006/December/04120603.asp>)

## **VIDEOS**

*Watermelon versus liquid nitrogen*, 2007  
(<http://www.youtube.com/watch?v=szBafBoN2nY>)

*Ice VI*, 2008  
(<http://www.youtube.com/watch?v=VLuQoNhVv3U>)