CURRICULUM VITAE

1/27/20

Dr. Clayton C. Williams
Department of Physics,University of Utah
115 South 1400 East, Rm. 201, Salt Lake City, Utah 84112-0830
Phone: (801) 585-3226, FAX: (801) 581-4801, clayton@physics.utah.edu

EDUCATION:

5/81 - 6/84	Ph.D., Electrical Engineering, Stanford University
9/79 - 5/81	M.S. Electrical Engineering, Stanford University
9/75 - 9/79	Honors B.A., Physics, University of Utah
9/72 - 6/73	Mathematics, Brigham Young University

EXPERIENCE:

9/12-present	Executive Committee / Instrumentation Track Director, Professional Masters of Science and Technology graduate program, U. of Utah
9/08 - 5/09	Visiting Scientist, Agilent Technologies, Santa Clara Laboratory
8/07 – 8/08	Director of Graduate Studies, Department of Physics, U. of Utah
12/98 - 1/03	Director of Graduate Studies, Department of Physics, U. of Utah
1/01 - 12/01	Associate Chair, Department of Physics, University of Utah.
1/98 - present	Professor, Department of Physics, University of Utah.
9/90 - 12/97	Associate Professor, Department of Physics, University of Utah.
3/91 – 2002	Faculty, Center for Biopolymers at Interfaces, University of Utah.
9/84 - 9/90	Research Staff Member, IBM T.J. Watson Research Center
6/84 - 9/84	Post-doc, Stanford University, Dept.of Appl. Phys, Prof. C.F. Quate.
9/79 - 6/84	Graduate student, Stanford University, Elec.Eng., Prof. C.F. Quate.
7/80 -10/80	Summer Intern, IBM T.J. Watson Research Ctr. - Optical Storage
9/78-6/79	Teaching Assistant: Taught and graded for freshman physics lab.
9/76 - 6/79	Undergrad Research Assist., U. of Utah, Physics, Professor F. Luty

Entrepreneurial

2019-present	Founder / owner – LightWorks Metrology, LLC – a startup company which is developing interferometry based Coordinate Measuring Machines and 3D interferometer systems.
2003-present	Founder / owner - Rocky Mountain Nanotechnology, LLC, a company which manufactures Atomic Force Microscopy (AFM) probes for electrical measurements. The probes are sold all over the world to universities, high technology industry researchers and research institutes. The company also specializes in nanoscale

materials characterization by AFM and consulting, reverse engineering measurements and patent infringement analysis.

1/2017-present Entrepreneurial Faculty Scholar, U. of Utah

CONSULTING

2011-2014 – Jackson & Walker LLP, patent consulting, SPM measurements
2010-2011 - Intel Corporation, consulting, device analysis, SPM measurements
2009- 2010 – Orrick, Herrington & Sutcliffe, patent consulting
2008-2009 - Agilent Tech. - consulting on Scanning Microwave Microscope
2006-2007 - ARTIS, consulting on defense related sensor system
2006 - Cooley Godward LLP, consulting, SCM measurements
2005-2006 - White & Case LLP, consulting, SCM measurements
2003-05 - Vinson & Elkins LLP, Coudert Brothers LLP - patent consulting, SCM measurements, expert witness, expert testimony
2003-05 - Vinson & Elkins LLP, patent consulting, SPM measurements
1997-98 - Stanford University, EE Dept., Prof. C. Quate - Nano-lithography Project
1995-96 - Evans and Sutherland, consulting on laser based display
1993 - Fitzpatrick, Cella, Harper & Scinto, consulting on patent interference
1991-92 - Sarcos - consulting on sensor strategies for displacement sensing

HONORS / STATS

Entrepreneurial Faculty Fellow, University of Utah 2017-present
Fellow, American Physical Society (FIAP), 2009.
Semiconductor Research Corporation Inventor Recognition Award, 2005.
Semiconductor Research Corporation Inventor Recognition Award, 2003.
Semiconductor Research Corporation Inventor Recognition Award, 1998.
Associate Editor of the Journal of Vacuum Science and Technology, 2000-2003.
IBM Research Division Award, 1989.
Phi Beta Kappa, Mortar Board, Phi Kappa Phi.
Outstanding Undergraduate Physics Graduate, University of Utah, 1979.

CONFERENCE RESPONSIBILITIES

Co-chair MRS Symposium on Scanning Probe Microscopy, Spring MRS Meeting, San Francisco, 1998.
Organizer of Scanning Probe Microscopy tutorial session at APS March Meeting and MRS Spring Meeting, 1998.
Chairman of SPIE Conference "Scanning Probe Microscopies II" January 17-23, 1993, Los Angeles, CA.
Co-Chair, "Scanning Probe Microscopies Conference within SPIE's International Symposium on Lasers, Sensors and Spectroscopy", January 19-25, 1992, Los Angeles, CA.

FUNDED PROPOSALS:

"Continued Development of UU 3D & 6D Metrology Tools," PI: C.C. Williams, UU Technology Venture Commercialization Seed Fund, $42k, 10/8/18 – 3/15/19.

"Development of Research Experience Based Measurement Laboratory Course," University of Utah Teaching Committee, $7k, 11/8/2017.

"Atomic Scale Lithography at the crystalline diamond surface," PI: C.C. Williams, UU Research Foundation Seed Grant, $35k, 1/1/17-12/31/18.

"Development of a precision 3D fiber interferometer tool," PI: C.C. Williams, Utah Science, Technology and Research Agency (USTAR), University Technology Acceleration Grants (UTAG), $161,730, 1/1/17-1/30/18.

"Development of a 3D Precision Measurement Tool (fiber interferometer)" PI: C.C. Williams, UU Research Foundation (TVC), $58.6k, 8/2/16-7/15/17.

"Room Temperature Single-Spin Tunneling Force Microscopy for Characterization of Paramagnetic Defects in Electronic Materials," PI: C.C. Williams, Army Research Office, $145k (1 year), 8/1/2015 – 11/30/2016.

"Purchase of Matrix Control System with AFM Extension," PI C.C. Williams, U. of Utah Research Instrumentation Fund, $76,918 (2/20/2014)

MRSEC: Next-Generation Materials for Plasmonics and Spintronics, Sr. Investigator – C.C. Williams (IRG2), NSF, 22M / 6 years, 9/15/11-9/14-17.

Atomic Scale Study of Defects in Inter-layer Dielectric Films, PI – C.C. Williams, Semiconductor Research Corporation, $300k/3years, 4/15/12 – 8/31/15.

"Room Temperature Single-Spin Tunneling Force Microscopy for Characterization of Paramagnetic Defects in Electronic Materials," PI: C.C. Williams, Co-PI: C. Boehme, Army Research Office, $325k/3 years, 7/15/2010 - 7/14/2013.

"NSF MRI-R2: Development of a Low Temperature Single Spin Tunneling Force Microscope," PI: C.C. Williams, Co-PI: Boehme, National Science Foundation, $804k/2 years, ($563k NSF, $241k UU required matching funds),3/1/10-2/28/12.

"Atomic resolution imaging and electronic state characterization of single molecules on dielectric surfaces," University of Utah Seed Grant, PI – C.C. Williams, $28k / 2yrs, 1/1/12 – 12/31/13.

"Single Spin" Electron Spin Resonance Microscope, University of Utah Seed Grant, C.C. Williams PI, $31k / 1 year, 10/01/07-9/30/08

“Development of a Dynamic Tunneling Force Microscope for Commercial Applications,” University of Utah Technology Commercialization Project, C.C. Williams PI, $70k / 2.5 years, 07/01/07-10/1/09

“Atomic Scale Study of Traps in high-K Dielectrics,” Semiconductor Research Corporation, $150k / 3 years, 11/01/07-10/31/10, C.C. Williams PI.

“Size-Selected Cluster Deposition and Single Electron Tunneling, Applied to Catalyst Issues,” $401,519 / 3 years, 12/01/05-11/30/08, AFOSR, S. Anderson PI, C.C. Williams, Co-PI.

“Atomic scale characterization of electronic defects in high-k dielectric films,” PI: C.C. Williams, Semiconductor Research Corporation, $300k / 3 years, 10/03-9/06.

“Scanning Capacitance of Solar Cell Devices,” PI: C.C. Williams, National Renewable Energy Lab, $66k, 5/02-5/04.

“Development of a Single Electron Scanning Tunneling Microscope,” PI: C.C. Willliams, $115,509, National Science Foundation, 9/02-9/04.

“Development of a Professional Science Masters of Science and Technology degree program, UU Graduate School, Co-PIs - D. Chapman and R. Reybould, participating faculty, D. Ayers, P. Trombi, H. White and C. Williams, funded 2001, $400k / 3 years.

“Mapping surface potential in mixed lipid and thin polymer films,” Pis: D. Britt (USU) & C.C. Williams, $16k, Center for Biopolymers at Interfaces, 4/02-4/03.

“Development of a fabrication/calibration process for nanometer scale metallic probe tips for scanning probe microscopy,” PI: C.C. Williams, $70k, University of Utah Research Foundation, 6/03-5/05.

“Nano-electronic device based upon carbon nanotubes,” PI - C.C. Williams, 8/99-8/00, funded by University of Utah Seed Grant Program, $40k.

“Development of New SCM Instrumentation for Ultra-shallow 2D Dopant Profiling,” funded by Semiconductor Research Corporation, $225k, 11/99-10/04.

“Inverse SCM Modeling and Electrical Device Characterization”, PI - C.C. Williams, funded by Semiconductor Research Corporation , 11/97 - 11/00, $170k.

"Quantitative 2D Dopant Diffusion Measurement and Electrical Device Characterization by Scanning Capacitance Microscopy," PI - C.C. Williams, 11/96-11/99, funded by Semiconductor Research Corporation, $185,292.

"Development of a New Scanning Tunneling Probe Microscope with Ultrahigh Charge/Current Detection Sensitivity for Electronic Characterization of Atomic Scale Structures," Principle Investigator - C.C. Williams, Co-PI - Tom Beebe, Jr., 9/96-9/99, $490k ($424k, funded by National Science Foundation, U. of U. matching - $66k).

"Direct Observation of Interfacial Processes - SPM-III," Principle Investigator - V. Hlady, Co-PI - C.C. Williams, 4/96-4/99, funded by National Institute of Health, $570k.

"Proposal to purchase an Electron Beam Lithography System," Principle Investigator - C.C. Williams, 7/96-6/97, $95k, funded by University of Utah, Research Instrumentation Fund Committee, $95k.

"Two-dimensional Semiconductor Dopant Profiling," joint proposal with Digital Instruments, funded by SEMATECH, 8/95-8/98, $312k.

"Near Field Photodetection Optical Microscopy and Spectroscopy," Principle Investigator - C.C. Williams, 6/92-3/96, funded by National Science Foundation, $95k.

Quantitative 2-D Dopant Profiling in VLSI Device Structures by Scanning probe Microscopy," Principle Investigator - C.C. Williams, 9/92-11/96, funded by Semiconductor Research Corporation, $238k.

“Direct Observation of Interfacial Processes” - SFM - II,? PI - V. Hlady, Co-Invest. - C.C. Williams, 4/93-3/96, funded by National Institute of Health, $676k.

“Protein Identification on a Nanometer Scale by Scanning Near-field Optical Absorption Microscopy,” PI - C.C. Williams, 3/96- 3/97, funded by the Center for Biomolecules at Interfaces, U. of Utah, $18k.

"Development of Nanoscale Photodiode Detectors," PI - C.C. Williams, Co-PI - P. Neuzil, 10/95-10/96, funded by Stanford Nanofabrication Facility, $5k.

"Construction of a Scanning Near-field Optical Microscope for High Resolution Fluorescence Imaging," PI - C.C. Williams, 6/94-6/95, funded by Center for Biopolymers at Interfaces, $18.5k.

"A silicon nitride cantilever based near-field scanning optical microscope," PI -C.C. Williams, 6/94-6/95, funded by Park Scientific Instruments, $15k.

"Imaging of "soft" and weakly bound surface molecules with the Scanning Interfacial Force Microscope," PI - C.C. Williams, funded by Center for Biopolymers at Interfaces, University of Utah, $17.5k, 11/93 - 11/94.

"Charge mapping of Contact Lens Materials in Air and under Solution," PI C.C. Williams, 11/92-11/93, $20k, funded by Bausch & Lomb, $20k.

"Charge Mapping of Molecular Structures under Solution,"Principle Investigator - C.C. Williams, 6/92-5/93, funded by Center for Biopolymers at Interfaces, U. of Utah, $17k.

"Quantitative Nanoscale Semiconductor Characterization by Scanning Probe Microscopy," Principle Investigator - C.C. Williams, 11/91-11/92, funded by IBM, $15k.

"Charge Density Mapping of Single Molecules with the Atomic Force Microscope," Principle Investigator - C.C. Williams, Co-investigator - T.P. Beebe, Jr., 6/91-5/92, funded by Center for Biopolymers at Interfaces, University of Utah, $16k.

PATENTS (Issued & applications filed):

17. “Interferometry System and Methods,” C.C. Williams, US patent filed 11/22/2019.

16. “Interferometry System and Associated Methods,” C.C. Williams, US patent 10,514,250 issued 12/24/19 (also nationalized in Europe).

15. “Interferometry System and Associated Methods,” C.C. Williams, US patent 10,422,630, issued 9/24/19.

14. “Method for Height Control for Single Electron and Dynamic Tunneling Force Microscopy,” C.C. Williams and J.P. Johnson inventors, US patent #9,052,337 Issued 6/9/2015.

13. “Measurement of Depth and Energy of Buried Trap States in Dielectric Films by Single Electron Tunneling Force Spectroscopy,” C.C. Williams and J.P. Johnson inventors, US patent 9,052,339, issued 6/9/2015.

12. “Method and apparatus for determining dopant density in semiconductors,” C.C. Williams, US Patent #8,315,819, Issued 11/20/12.

11. “Scanning Probe Characterization of Surfaces,” C.C. Williams and E. Bussmann, US patent #7,420,106, issued 9/2/2008.

10. “Scanning Tunneling Charge Transfer Microscope”, C.C. Williams, US Patent #6,583,412, issued 6/24/2003.

9. “Method for Improving Spatial Resolution and Accuracy in Scanning Probe Microscopy”, C.C. Williams and J.S. McMurray, US Patent #6,210,982, issued 4/3/2001.

8. “Micromachined Probes for Nanometer Scale Measurements and Methods of Making such Probes”, C.C. Williams, R.C. Davis and P. Neusil, US Patent #5,969,345, Issued 10/19/99.

7. “Quantitative 2D Dopant Profile Measurement and Inverse Modeling by Scanning Capacitance Microscopy”, C.C. Williams and Y. Huang, US Patent 5,523,700. Filed 3/95.

6. “Scanning capacitance - voltage microscopy,” J. A. Slinkman, H.K. Wickramasinghe and C.C. Williams, US Patent 5,065,103. Filed 9/91.

5. “Apertureless Near Field Optical Microscope”, H.K. Wickramasinghe and C.C. Williams, US Patent 4,947,034. Filed 4/89.

4. “Particulate Inspection of Fluids using Interferometric Light Measurements,” J.S. Batchelder, D.M. DeCain, M.A. Taubenblatt, H.K. Wickramasinghe and C.C. Williams, US Patent 5,061,070. Filed 4/88.

3. “Particulate Inspection of Fluids using Interferometric Light Measurements,” J.S. Batchelder, D.M. DeCain, M.A. Taubenblatt, H.K. Wickramasinghe and C.C. Williams, European Patent, Filed 4/88.

2. “Scanning Thermal Profiler,” H.K. Wickramasinghe and C.C. Williams, US Patent No. 4,747,698. Filed 4/86.

1. “Methods and Apparatus for Non-Destructive Testing Using Acousto-Optic Laser Probe,” C.C. Williams, US Patent No. 4,666,308. Filed 10/84.

PUBLICATIONS:

2019 M. Teferi1, H. Malissa, Anna B. Morals-Vilches, C. T. Trinh, L. Korte, B. Stannowski, C. C. Williams, C. Boehme, K. Lips, "Close to bandgap open circuit voltages of silicon heterojunction solar cells resolved on the atomic scale," submitted to Nature Energy.

2017

106. K. Ambal, C.C. Williams and C. Boehme, "In situ absolute magnetometry in a UHV scanning probe microscope using conducting polymer-thin film," J. Vac. Sci. Technol. A **35**, 021602 (2017).

2016

105. K. Ambal, P. Rahe, A. Payne, J. Slinkman, C.C. Williams and C. Boehme, "Electrical coupling through individual pairs of phosphorus donor atoms and silicon dangling bonds," Sci. Reports (Nature), (published online, January 13, 2016).

104. "Philipp Rahe, Ryan P. Steele and Clayton C. Williams, "Consecutive Charging of a Molecule-on-Insulator Ensemble Using Single Electron Tunneling Methods," Nano Lett. 16, 911–916 (2016).

2015

103. R. Wang and C.C. Williams, "Dynamic tunneling force microscopy for characterizing electronic trap states in nonconductive surfaces," Rev. Sci. Inst. 86, 093708 (2015)

102. K. Ambal, A. Payne, D.P. Waters, C.C. Williams and C. Boehme, "Spin-Relaxation Dynamics of E' Centers at High Density in SiO2 Thin Films for Single-Spin Tunneling Force Microscopy," Phys. Rev. Appl. 4 024008 (2015).

101. A. Payne, K. Ambal, C. Boehme and C.C. Williams, "An atomic resolution, single-spin magnetic resonance detection concept based upon tunneling force microscopy," Phys. Rev B 91, 195433 (Feb 2015).

2014

100. R. Wang, S.W. King and C.C. Williams, "Atomic scale trap state characterization by dynamic tunneling force microscopy, Appl. Phys. Lett. 105, 052903 (2014).

2013

99. C.C. Williams, "Atomic scale imaging of dielectric point defects," Chapter of book entitled Fundamentals of Picoscience, Taylor and Francis Group, LLC, published 2013.

2011

98. D. W. Winslow and C.C. Williams, "Local density of trap states in SiO_2 and

Si_3N_4 films studied by single electron tunneling force spectscopy," J. Appl. Phys. 110, 114102 (2011).

97. D.W. Winslow, J.P. Johnson and C.C. Williams, "Nanometer scale study of HfO_2 trap states using single electron tunneling force spectroscopy," Appl. Phys. Lett. 98, 172903 (2011).
96. J.P. Johnson, D.W. Winslow and C.C. Williams, "Measurement of depth and energy of buried trap states in dielectric films by Single Electron Tunneling Force Spectroscopy," Appl. Phys. Lett. 98, 052902 (2011).

2010

95. N. Zheng, J.P. Johnson, C.C. Williams and G. Wang, "Electronic characterization of individual monolayer protected Au clusters by single electron tunneling force spectroscopy," Nanotechnology 21, 295708 (2010).

2009

94. J.P. Johnson and C.C. Williams, "Atomic scale imaging and spectroscopy of individual trap states by force detected dynamic tunneling," Nanotechnology 20, 055701 (2009).

2007

93. N. Zheng, C.C. Williams* and E.G. Mishchenko, "A three-dimensional model of single electron tunneling between a conductive probe and a localized electronic state in a dielectric," J. Appl. Phys. 101, 093702 (2007). (selected for publication in Virtual Journal of Nanoscale Science and Technology, 5/14 (2007).

2006

92. E. Bussmann, N. Zheng and C.C. Williams, "Imaging of Localized Electronic States at a non-conducting Surface by Single Electron Tunneling Force Microscopy" Nano Letters, 6 2577 (2006). (also highlighted in the "Research News" section of Materials Today, December, Volume 9 2006).
91. E. Bussmann and C.C. Williams, "Single Electron Tunneling Force Spectroscopy of an Individual Electronic State in a non-conducting Surface," Appl. Phys. Lett. 88, 263108 (2006).

2005

90. E. Bussmann, N. Zheng and C.C. Williams, "Single electron manipulation to and from a silicon dioxide surface by electrostatic force microscopy," Appl. Phys. Lett. 86, 163109 (2005).

2004

89. L. J. Klein and C. C. Williams, "Instability induced tunneling and repeatable charge injection to SiO_2 surfaces by Electrostatic Force Microscopy," J. Appl. Phys. 96, 3328 (2004).
88. E. Bussmann, D.J. Kim, and C.C. Williams, Single electron tunneling to insulator surfaces measured by frequency detection electrostatic force microscopy, Appl. Phys. Lett. 85, 2538 (2004).
87. E. Bussmann and C.C. Williams, "Sub-10 nm lateral spatial resolution in Scanning Capacitance Microscopy achieved with solid platinum probes," Rev. Sci. Inst. 75, 422 (2004).
86. L.J. Klein and C.C. Williams, "Modeling and experimental investigation of cantilever dynamics in force detected single electron tunneling," J. Appl. Phys.

95, 2547 (2004).

85. T. Goodman, E. Bussmann, C.C. Williams, M. Taveras, D. Britt, “Electrostatic Force Microscopy Analysis of Lipid Miscibility in Two-Component Monolayers,”, Langmuir 20, 3684 (2004)

2003

84. “E. Bussmann, L.J. Klein, and C.C. Williams, “Ultra-sharp Platinum Tips for High Resolution in Scanning Capacitance Microscopy, Proceedings of the Seventh International Workshop on: Fabrication, Characterization, and Modeling of Ultra-Shallow Doping Profiles in Semiconductors,” Santa Cruz, California, April 27-May1, p. 207, 2003.

83. E. Bussmann, L.J. Klein and C.C. Williams, “A study of device amplification by double angle beveling for scanning capacitance microscopy,” Proceedings of the Seventh International Workshop on: Fabrication, Characterization, and Modeling of Ultra-Shallow Doping Profiles in Semiconductors,” Santa Cruz, California, April 27-May1, p. 350, 2003.

2002

82. L.J. Klein and C.C. Williams, “Single electron tunneling to insulator surfaces detected by electrostatic force,” Appl. Phys. Lett., 81, 4589 (2002). - (*Article was also selected to appear in the Virtual Journal of Nanoscale Science and Technology, December 16, 2002).

2001

81. L. J. Klein and C.C. Williams, “Single electron tunneling detected by electrostatic force,” Appl. Phys. Lett., 79, 1828 (2001). (*article also appeared in Nature’s Physics Portal web site, September 2001).

80. C.C. Williams, J.S. McMurray and V.V. Zavyalov, “Quantitative characterization and imaging performance evaluation of an improved SCM capacitance sensor for 2D dopant profiling,” Proceedings of the 6th International Workshop on: Fabrication, Characterization and Modelling of Ultra-Shallow Doping Profiles in Semiconductors, Napa Valley, California, April 22-26, p. 199, 2001.

79. R. Davis and C. C. Williams, “An Optical Dipole Model for Photo-detection in the Near-field,” J. Opt. Soc. Am. A **18**, 1543 (2001).

2000

78. V.V. Zavyalov, J.S. McMurray, S.D. Stirling, C.C. Williams and H. Smith, “2D dopant and carrier profiles obtained by Scanning Capacitance Microscopy on an actively biased cross-sectioned MOSFET device,” J. Vac. Sci. Tech. B 18, 549 (2000).

77. V.V. Zavyalov, J.S. McMurray and C.C. Williams, “Noise in Scanning Capacitance Microscopy Measurements, “ J. Vac. Sci. Technol. B 18, 1125 (2000).

76. L.J. Klein, C.C. Williams and J. Kim, “Electron Tunneling Detected by Electrostatic Force,” Appl. Phys. Lett., 77, 3615 (2000).

1999

75. V.V. Zavyalov, J.S. McMurray and C.C. Williams, “A Scanning Capacitance Microscope Methodology for Quantitative Analysis of P-N Junctions,” J. Appl. Phys. **85**(11), 7774 (1999).

74. C.C. Williams, “2D dopant profiling by Scanning Capacitance Microscopy,” Annu. Rev. Mater. Sci. **29**, 471 (1999). **(*Invited)**
73. V.V. Zavyalov, J.S. McMurray, S.D. Stirling, C.C. Williams and H. Smith, “2D dopant and carrier profiles obtained by Scanning Capacitance Microscopy on an actively biased cross-sectioned MOSFET device,” proceedings of the 5th International Workshop of the Measurement, Characterization and Modeling of Ultra-shallow Doping Profiles in Semiconductors, Research Triangle Park, NC March 28-31, (1999).
72. V.V. Zavyalov, J.S. McMurray and C.C. Williams, “Advances in Experimental Technique for Quantitative Two Dimensional Dopant Profiling by Scanning Capacitance Microscopy,” Rev. Sci. Inst., **70** (1), 158 (1999).

1998

71. J.S. McMurray, J. Kim and C.C. Williams, "Direct Comparison of 2-Dimensional Dopant Profiles by Scanning Capacitance Microscopy with TSUPREM4 Process Simulation," J. Vac. Sci. Tech. B. **16**(1), 344 (1998).
70. J. Kim, J. S. McMurray, C. C. Williams, and J. Slinkman, “Two Step Dopant Diffusion Study Performed in Two Dimensions by Scanning Capacitance Microscopy and TSUPREM IV,” J. of Appl. Phys., **84**(3), 1305 (1998).
69. T. Clarysse, M. Caymax, P. De Wolf, T. Trenkler, W. Vandervorst, J. S. McMurray, J. Kim, C.C. Williams, J.G. Clark and G. Neubauer, "Epitaxial Staircase Structure for the Calibration of Electrical Characterization Techniques," J. Vac. Sci. Tech. B **16** (1), 394 (1998).
68. J. Kim, J.S. McMurray, C.C. Williams and J. Slinkman, “2D Dopant diffusion study by Scanning Capacitance Microscopy and TSUPREM4 process simulation,” Characterization and Metrology for UlSI Technology, Eds. D.G. Sieler, A.C. Diebold, W.M. Bullis, J.J. Shaffner, R. McDonald and E.J. Walters, Publisher: American Institute of Physics, Woodbury, NY, USA , p. 720 (1998).
67. J.S. McMurray and C.C. Williams, “Inverse modeling applied to Scanning Capacitance Microscopy for improved spatial resolution and accuracy,” Characterization and Metrology for UlSI Technology, Eds. D.G. Sieler, A.C. Diebold, W.M. Bullis, J.J. Shaffner, R. McDonald and E.J. Walters, Publisher: American Institute of Physics, Woodbury, NY, USA, p. 731 (1998).
66. V.V. Zavyalov, J.S. McMurray and C.C. Williams, “Surface and tip characterization for quantitative 2D dopant profiling by Scanning Capacitance Microscopy,” Characterization and Metrology for UlSI Technology, Eds. D.G. Sieler, A.C. Diebold, W.M. Bullis, J.J. Shaffner, R. McDonald and E.J. Walters, Publisher: American Institute of Physics, Woodbury, NY, USA, p. 731 (1998).
65. V. Ukraintsev, *et al*., “Dopant Characterization Round-Robin Study Performed on Two-dimensional Test Structures Fabricated at Texas Instruments,” Characterization and Metrology for ULSI Technology, Eds. D.G. Seiler, A.C. Diebold, W.M. Bullis, J.J. Shaffner, R. McDonald and E.J. Walters, Publisher: American Institute of Physics, Woodbury, N.Y., USA, p. 741 (1998).

1997

64. T. Clarysse, M. Caymax, P. De Wolf, T. Trenkler, W. Vandervorst, J. S. McMurray, J. Kim, C.C. Williams, J.G. Clark and G. Neubauer, "Epitaxial

Staircase Structure for the Calibration of Electrical Characterization Techniques," Proceedings of Fourth International Workshop on the measurement, characterization and modeling of ultra-shallow doping profiles in semiconductors, Research Triangle Park, NC, April 6-9, p.30.1 (1997).

63. J.S. McMurray, J. Kim and C.C. Williams, "Quantitative measurement of two-dimensional dopant profile by cross-sectional scanning capacitance microscopy," J. Vac. Sci. Tech. B15, 1011 (1997).
62. J.S. McMurray, J. Kim and C.C. Williams, "Direct Comparison of 2-Dimensional Dopant Profiles by Scanning Capacitance Microscopy with TSUPREM4 Process Simulation," Fourth International Workshop on the measurement, characterization and modeling of ultra-shallow doping profiles in semiconductors, Research Triangle Park, NC, April 6-9, p.54.1 (1997).
61. R. Alvis, C.C. Williams, J. McMurray and J. Kim, "Scanning Capacitance Microscopy: Emerging Metrology Tool for Quantitative Two-Dimensional Dopant Profiling," Future Fab International, p.345 (1997).
60. C.J. Kang, C.K. Kim, Y. Kuk, K.M. Mang, J.K. Lee, K.S. Suh and C.C. Williams, "Depth dependent carrier density profile by scanning capacitance microscopy," Appl. Phys. Lett, 71, 1546 (1997).
59. J-K. Leong, C.C. Williams and J.M. Olson, "Evidence of Internal Fields in Two-variant Ordered $GaInP_2$ by Near-field Scanning Optical Microscopy," Phys. Rev. B, 56, 1472 (1997).

1996

58. J-K. Leong, C.C. Williams, J.M. Olson and S. Froyen, "Evidence for Internal Electric Fields in Two Variant Ordered GaInP Obtained by Scanning Capacitance Microscopy," Appl. Phys. Lett. 69, 4081 (1996).
57. R.C. Davis and C.C. Williams, "Nanometer Scale Absorption Spectroscopy by Near-field Photodetection Optical Microscopy," Appl. Phys. Lett., 69(9) 1179 (1996).
56. J-K. Leong, J. McMurray, C.C. Williams and G.B. Stringfellow, "Spatial Mapping of Ordered and Disordered Domains of GaInP by Near-field Scanning Optical Microscopy and Scanning Capacitance Microscopy," J. Vac. Sci. Technol. B, 14(4) 3113 (1996).
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Capacitance Microscopy," International Electron Devices Meeting, San Francisco, CA, Dec 9-12, (1990).

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1989

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14. D.W. Abraham, C.C. Williams, and H.K. Wickramasinghe, "High-resolution Force Microscopy of In-plane Magnetization," Journal of Microscopy, Vol. 152, (1988).
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1987

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1986

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10. C.C. Williams and H.K. Wickramasinghe, "High Resolution Thermal Microscopy," 1986 IEEE Ultrasonics Symposium Proceedings, Vol. 1, 393-398 (1986).

(*Invited)

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8. C.C. Williams and H.K. Wickramasinghe, "Scanning Thermal Profiler," Microcircuit Engineering 5, North-Holland, 509-513, (1986).

1985

7. C.C. Williams, "High Resolution Photothermal Laser Probe," IEEE Transactions on Sonics and Ultrasonics, Vol. SU-32, 365 (1985).

1984

6. C.C. Williams, "High Resolution Photoacoustic and Photothermal Imaging," Ph.D. Thesis, Stanford University, June (1984).
5. C.C. Williams, "High Resolution Photothermal Laser Probe," Appl. Phys. Lett., 44(12), 15 June (1984).

1983

4 C.C. Williams, "High Resolution Acousto-optic Laser Probe," 1983 IEEE Ultrasonics Proceeding, 951 (1983).
3. V.B. Jipson and C.C. Williams, "Two Dimensional Modeling of an Optical Disk Readout," Appl. Opt., 22, 2202-2209 (1983).

1981

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1980

1. Fritz Luty and C.C. Williams, "Raman and Infrared Studies of Dilute Graphite Particles Produced Chemically inside of Alkali-Halide Crystals," Proceedings of the International Conference on Small Particles and Clusters, Switzerland (1980).

PRESENTATIONS:

2018

Gongqi Yu and C.C. Williams, “Dangling bond states at the diamond surface characterized by Dynamic Tunneling Force Microscopy,” Four Corners APS Meeting, Salt Lake City, 10/12/18

G. Laicher and C.C. Williams, “A Research Experience Based Measurement Laboratory Course,” American Association of Physics Teachers (AAPT) Summer Meeting, Washington DC, 7/28/18-8/1/18.

2017

P. Rahe, R.P. Steele and C.C. Williams, “Consecutive Charging of a Molecule-on-Insulator Ensemble Using Single Electron Tunnelling Methods, “DPG-Frühjahrstagung

Meeting, Dresden, Germany, 3/19/17-3/24/17.

2016

K. Ambal, A. Payne, P. Rahe, J. Slinkman, C.C. Williams and C. Boehme, “Imaging and Spectroscopy of Individual Paramagnetic Electronic States on the Atomic Scale,” Gordon Research Conference on Defects in Semiconductors, Colby-Sawyer College, New London, New Hamshire, 8/14/16-8/19/16.

K. Ambal, P. Rahe, A. Payne, J. Slinkman, C.C. Williams and C. Boehme, “Electrical detection and imaging of individual phosphorus and silicon-dangling bond states at the crystalline silicon to silicon dioxide interface, APS March Meeting, Baltimore, MD, 3/14/16-3/18/16.

2015

R. Wang, S. King and C.C. Williams, “Atomic Scale Study of Trap States in Low-K Dielectric Films Studied by Dynamic Tunneling Force Microscopy,” MRS Spring Meeting, San Francisco, California, April 6-10 2015

R. Wang, S. King and C.C. Williams, “Atomic Scale Study of the Effect of Electrical Stress in a Low-k Dielectric Film,” MRS Spring Meeting, San Francisco, California, April 6-10, 2015

P. Rahe, R.P. Steele, C.C. Williams, “Charge trapping after electron tunnelling into a molecule-on-insulator system,” 18th International Conference on non-contact Atomic Force Microscopy, Cassis, France, Sept. 7-11, 2015.

N. Anderson, K. Ambal, A. Payne, C. Boehme and C.C. Williams, “RF and Magnetic Field Generation System for Atomic Scale Magnetic Resonance, National Conference on Undergraduate Research, Eastern Washington University, Spokane, Washington, April 16-18, 2015.

K. Ambal, A. Payne, C. C. Williams and C. Boehme, “Development of a Spin-Selection Rule based Single-Electron Spin Resonance Microscope,” 57th Annual Rocky Mountain Conference on Magnetic Resonance, Snowbird, Utah, July 25-30, 2015.

2014

R. Wang, S. King and C.C. Williams, “3D mapping and energy measurement of trap states in inter-layer dielectric films by Dynamic Tunneling Force Microscopy,” APS March Meeting, Denver, Colorado, March 3-7, 2014.

P. Rahe, R.P. Steele and C.C. Williams, “Ferrocenes on calcite: Single-electron tunneling at room temperature,” APS March Meeting, Denver, Colorado, March 3-7, 2014.

K. Ambal, P. Rahe, C.C. Williams and C. Boehme, “Angstrom resolved imaging of charge percolation through the interface between phosphorous doped crystalline silicon and silicon dioxide,” APS March Meeting, Denver, Colorado, March 3-7, 2014.

R. Wang, S. King and C.C. Williams, “Atomic scale study of trap states in inter-layer dielectric films by dynamic tunneling force microscopy,” MRS Spring Meeting, San Francisco, California, April 2014.

2013

A. Payne, K. Ambal, C. Boehme and C.C. Williams, “Towards performing electron spin resonance measurements with a single spin at room temperature,” APS March Meeting, Baltimore, Maryland, March 18, 2013.

K. Ambal, A. Payne, D.P. Waters, C. Williams and C. Boehme, “Synthesis and Physical Characterization of think silicon dioxide layers with very high densities of E’ centers,” APS March Meeting, Baltimore, Maryland, March 18, 2013.

2012

D.W. Winslow and C.C. Williams, “Creation of Electron Trap States in Silicon Dioxide By Local Electron Injection,” APS March Meeting, Boston, Massachusetts, February 28, 2012.

2011

D.W. Winslow, J.P. Johnson and C.C. Williams, “Charge Injection and Relaxation in HfO_2 Films Measured by Single Electron Tunneling Force Spectroscopy,” APS March Meeting, Dallas, Texas, March 23, 2011.

D.W. Winslow, J.P. Johnson and C.C. Williams, “Detection of Individual Dielectric Trap States Using Single Electron Tunneling Force Spectroscopy,” APS March Meeting, Dallas, Texas, March 23, 2011.

C.C. Williams, “Atomic Scale Exploration of Electronic States with Single Electrons,” ECE Graduate Seminar, U. of Utah, Oct 7, 2011 (**Invited**).

C.C. Williams, “Atomic Scale Exploration of Electronic States with Single Electrons,” Brigham Young University, Department of Physics Colloquium, February 1, 2011. (**Invited**)

2010

C.C. Williams, “Atomic scale study of traps in high-K dielectric films,” Semiconductor Research Corporation Webinar, October 13, 2010 (Invited).

C.C. Williams, “Atomic scale study of traps in high-K dielectric films, GRC Digital CMOS Technologies and Memory Technologies Review , Yale University, May 12, 2010.

2009

J.P. Johnson and C.C. Williams, “3D Imaging and Spectroscopy of Electron Trap States in high-K films by Force Detected Tunneling,” MRS Fall Meeting, Boston, Massachusetts, Nov. 30-Dec 4, 2009.

J.P. Johson, D. Winslow and C.C. Williams,”3D Imaging of Electron Traps States in non-conducting Films using Force Microscopy,” NanoUtah Conference, Salt Lake City, Utah, October 16, 2009.

C.C. Williams, “Exploring Non-conducting Surfaces with Single Electrons by Force Detected Tunneling,” Department of Physics, University of Osnabruck, Germany, March 20, 2009 **(Invited)**.

C.C. Williams, “Exploring Surfaces with Single Electrons using Force Detected Tunneling Microscopy / Spectroscopy,” Department of Physics, University of Duisburg-Essen, Germany, March 9, 2009 **(Invited).**

J.P. Johnson, D. Winslow and C.C. Williams, “3D Imaging & Spectroscopy of Individual Trap States in Dielectric Films by Force Detected Tunneling Microscopy/Spectroscopy,” MRS Spring Meeting, San Francisco, CA, April 13-17, 2009

J.P. Johnson and C.C. Williams, “Independent determination of depth and energy of electronic trap states in dielectric films by Dynamic Tunneling Force Microscopy,” APS March Meeting, Pittsburg, PA, March 16-20, 2009

C.C. Williams, “Atomic Scale Study of Traps in High-K Dielectrics,” Semiconductor Research Corporation Webinar, February 4, 2009 **(Invited).**

C.C. Williams, “Dynamic Tunneling Force Microscopy, Imaging and Spectroscopy with Single Electrons,” T.J. Watson Research Ctr, Yorktown Heights, NY, January 30, 2009 **(Invited).**

2008

J.P. Johnson and C.C. Williams, “Atomic scale imaging of electronic defect states in SiO2 and HfSiOx dielectric films by Dynamic Tunneling Force Microscopy (DTFM),” MRS Spring Meeting, San Francisco, CA, March 24-28, 2008

N. Zheng, J.P. Johnson, C.C. Williams and G. Wang, “Direct Measurement of Electronic States of Monolayer Protected Clusters by Single Electron Tunneling Force Spectroscopy,” International Conference on Nanoscience and Technology, Keystone Colorado, July 20-25, 2008.

J.P. Johnson, D. Winslow and C.C. Williams, “Dynamic Tunneling Force Microscopy – 3D imaging of electronic states in non-conducting dielectric surfaces with sub-nanometer spatial resolution,” International Conference on Nanoscience and Technology, Keystone Colorado, July 20-25, 2008.

C.C. Williams, “Addressing Atomic Scale Electronic States with Single Electrons,” Department of Metallurgy, Univ. of Utah, Feb. 20, 2008 **(invited)**

J.P. Johnson and C.C. Williams, “Atomic Scale Imaging and Spectroscopy of individual Dielectric Trap States by Single Electron Tunneling Microscopy,” PCSI 35, Santa Fe, New Mexico, Jan 13-17, 2008.

2007

N. Zheng, J.P. Johnson, G. Wang and C.C. Williams, "Energy Spectra of Individual Gold Monolayer Protected Clusters Measured by Single Electron Tunneling Force Microscopy," presented at March APS Meeting, Denver, Colorado, March 5-9, 2007.

J.P. Johnson, N. Zheng and C.C. Williams, "Imaging of electronc defect states in SiO2 and HfSiOx films with sub-nanometer spatial resolution by two-way Single Electron Tunneling Force Microscopy, presented at March APS Meeting, Denver, Colorado, March 5-9, 2007.

C.C. Williams, "Addressing Atomic Scale Electronic States with Single Electrons," presented at Micron Technology, Inc, March 23, 2007 **(*Invited)**

C.C. Williams, “Addressing Atomic Scale Electronic States with Single Electrons," presented at Asylum Research, Santa Barbara, California, April 26, 2007 **(*Invited)**

C.C. Williams, "Addressing Atomic Scale Electronic States with Single Electrons," presented at Agilent Technologies, May 24, 2007 **(*Invited)**

C.C. Williams, "Addressing Atomic Scale Electronic States with Single Electrons," presented to the Semiconductor Research Corporation (Electronic Conference), Jan. 10, 2007. **(*Invited)**

C.C. Williams, "Addressing Atomic Scale Electronic States with Single Electrons," Physics Department, Vanderbilt University, October 3, 2007. **(*Invited)**

C.C. Williams, “Addressing Individual Electronic States with Single Electrons,” presentation to Semiconductor Research Corporation, Electronic Conference, to researchers of member companies (IBM, Freescale, Intel, etc), Jan 10, 2007. **(Invited*)**

2006

C.C. Williams, “Single Electron Tunneling Force Microscopy” at the International Conference on Nanoscience and Technology in Basel, Switzerland, July 30 -August 4, 2006. **(invited*)**

N. Zheng, G. Wang, E. Bussmann and C.C. Williams, “Single electron tunneling force spectroscopy of electronic states in non-conducting surfaces,” MRS Spring Meeting, San Fransisco, California, 2006

C.C. Williams, E. Bussmann and N. Zheng, “Oxide Films Imaged on a Nanometer-Scale by Single Electron Tunneling Force Microscopy,” APS March Meeting, Baltimore MD (2006)

N. Zheng, G.L. Wang, E. Bussmann and C.C. Williams, “Single-electron tunneling force spectroscopy of electronic states in nonconducting surfaces,’ APS March Meeting, Baltimore, MD (2006).

2005

E. Bussmann and C.C. Williams “Localized Single-Electron Tunneling Spectroscopy Measurements on SiO_2,“ APS March Meeting, Los Angelos, California, 2005

E. Bussmann and C.C. Williams,“ Single electron manipulation and imaging by Electrostatic Force Microscopy,”, APS March Meeting, Los Angelos, California, 2005

C.C. Williams and E. Bussmann, “Single electron manipulation and spectroscopy by force detected vacuum tunneling to individual electronic states,”, MRS Fall Meeting, Boston, Mass, Nov. 27 – Dec. 2, 2005.

2004

N. Zheng and C.C. Williams, “Scanning Capacitance Microscopy measurements on solar cell devices, , APS Four Corners Meeting, Four Corners Meeting, Albuquerque, New Mexico, October 15,16 2004.

E. Bussman, D.J. Kim, B. Armstrong and C.C. Williams, “Measurements and modeling of single electron tunneling to interface states in SiO2 and HfO2 detected by electrostatic force, March APS Meeting, 2004.

2003

L.J. Klein and C.C. Williams. “Modeling and experimental investigation of cantilever dynamics in force detected single electron tunneling,” March APS Meeting, 2003.

L.J. Klein and C.C. Williams, “Single electron tunneling to an insulator surface detected by electrostatic force,” March APS Meeting, 2003.

C.C. Williams, “Development of New Instrumentation for Ultrashallow 2D dopant profiling,” SRC/FEP Modeling and Simulation Review, University of Washington, Seattle, Washington, May 5, 2003.

2002

C.C. Williams and L.J. Klein, “Manipulating Single Electrons at the surface of SiO2,” APS 4 Corners Meeting, Salt Lake City, Utah, October 4-5, 2002 **(*Invited)**

L.J. Klein and C.C. Williams, “Single electron tunneling to insulator surfaces by Scanning Probe Microscopy,” March APS Meeting, 2002.

L.J. Klein and C.C. Williams, “Dynamic electrical response of thin dieletric films measured by electrostatic force microscopy,” March APS Meeting, 2002.

2001

C.C. Williams, “Single electron tunneling, Department of Mechanical Engineering, U. of Utah, March 29, 2001

C.C. Williams, “Single electron tunneling,” Department of Physics, Utah State University, 2001.

C.C. Williams, J.S. McMurray and V.V. Zavyalov, “Quantitative characterization and imaging performance evaluation of an improved SCM capacitance sensor for 2D dopant profiling,**”** 6th International Workshop on: Fabrication, Characterization, and Modelling of Ultra-Shallow Doping Profiles in Semiconductors, Napa Valley, California, April 22-26, 2001.

C.C. Williams, J.S. McMurray and V.V. Zavyalov, “Capacitance sensor analysis and improvement for Scanning Capacitance Microscopy, “ APS March Meeting, 2001.

L.J. Klein and C.C. Williams, “Electron tunneling events detected by Electrostatic Force,” APS March Meeting, 2001.

2000

C.C. Williams, “Electrostatic Force and Scanning Capacitance Microscopy,” Invited Plenary talk at the 2nd Congress on Forces and Tunneling 2000, Santiago de Compostela, Spain (September 22-25, 2000). **(*Invited)**

Jeff McMurray and C.C. Williams, “Quantitative Scanning Capacitance Microscopy Analysis of an Ultra-Shallow pn Junction, SEMATECH 2d Dopant Profiling Working Group, NIST, Gaithersburg, MD, June 29, 2000.

C.C. Williams, “Electrostatic Force and Scanning Capacitance Microscopy, “ Plenary talk at the 2nd Congress on Forces and Tunneling 2000, Santiago de Compostela, Spain, September 22-25, 2000. **(*Invited)**

J.S. McMurray, V.V. Zavyalov and C.C. Williams, “Noise in Scanning Capacitance Microscopy Measurements,” 2000 International Conference on Characterization and Metrology for ULSI Technology, Gaithersburg, MD, June 26-29, 2000.

J.S. McMurray, V.V. Zavyalov and C.C. Williams, “Quantitative Scanning Capacitance Microscopy Analysis of an Ultra-Shallow pn Junction,” 2000 International Conference on Characterization and Metrology for ULSI Technology, Gaithersburg, MD, June 26-29, 2000.

J.S. McMurray and C.C. Williams, “Quantitative Scanning Capacitance Microscopy Analysis of an Ultra-Shallow pn Junction, SEMATECH 2d Dopant Profiling Working Group, NIST, Gaithersburg, MD, June 29, 2000.

L. Klein and C.C. Williams, “New Scanning Probe Method Detects Electron Tunneling by Electrostatic Force,” March APS meeting, Minneapolis, MN, March 20-24, 2000.

V.V. Zavyalov, J.S. McMurray, S.D. Stirling, C.C. Williams and P.A. Ronsheim, “Quantitative Scanning capacitance Microscopy Analysis of an Ultra-shallow pn Junction,” March APS meeting, Minneapolis, MN, March 20-24, 2000.

1999

C.C. Williams, “Characterization of Electronic Materials and Devices by Scanning Probe Microscopy,” 46th International Symposium of the American Vacuum Society, Seattle, Wash., October 25-29, 1999.**(*Invited)**

V.V. Zavyalov, J.S. McMurray and C.C. Williams, “Quantitative p-n junction delineation by Scanning Capacitance Microscopy,” Fifth International Workshop on the Measurement, Characterization and Modeling of Ultra-shallow Doping Profiles in Semiconductors, Research Triangle Park, NC, March 28-31, 1999.

V.V. Zavyalov, J.S. McMurray and C.C. Williams, “2D Dopant and Carrier Profiles Obtained by Scanning Capacitance Microscopy on an Actively Biased Cross-sectioned MOSFET device,” Fifth International Workshop on the Measurement, Characterization and Modeling of Ultra-shallow Doping Profiles in Semiconductors, Research Triangle Park, NC, March 28-31, 1999.

J.S. McMurray, V.V. Zavyalov and C.C. Williams, “A Method for Quantitative pn Junction Delineation by Scanning Capacitance Microscopy,” March APS meeting, Atlanta, GA, March 20-26, 1999.

V.V. Zavyalov, J.S. McMurray and C.C. Williams, “Two-dimensional Carrier Profiles Obtained by Scanning Capacitance Microscopy,” March APS meeting, Atlanta, GA, March 20-26, 1999.

J. Kim, L. Klein and C.C. Williams, “Observation of Fixed Charges on the Silicon Dioxide Surface with Electrostatic Force Microscopy,” March APS meeting, Atlanta, GA, March 20-26, 1999.

L. Klein, J. Kim and C.C. Williams, “Single-electron Charge Decay Studied with UHV-EFM,” March APS meeting, Atlanta, GA, March 20-26, 1999.

J.S. McMurray, V.V. Zavyalov, C.C. Williams and P. Ronsheim, “Direct Comparison of Ultra-shallow Dopant Profiles Obtained by Scanning Capacitance Microscopy and Secondary Ion Mass Spectrometry,” March APS meeting, Atlanta, GA, March 20-26, 1999.

C.C. Williams, “Nanometer Scale Electronic Measurements of Semiconductor Surfaces by Scanning Capacitance Microscopy,” Physics colloquium, Brigham Young University, February 10, 1999.

C.C. Williams, “Nanometer scale Electronic Measurements of Semiconductor Surfaces by Scanning Capacitance Microscopy,” Physics colloquium, Brigham Young University, Feb 10, 1999 **(*Invited)**.

1998

C.C. Williams, “Recent advances in Scanning Capacitance Microscopy,” 45th International Symposium of the American Vacuum Society, Baltimore, Maryland, November 2-6, 1998 **(*Invited).**

C. C. Williams, “Electrostatic Characterization of Surfaces & Interfaces by Scanning Probe Microscopy,” Engineering Foundation Conference “Surface Characterization of Adsorption and Interfacial Reactions - II,” Kona, Hawaii, January 11-18, 1998 **(*Invited)**.

C.C. Williams, “Observation of Ordering-Induced Electric Fields in GaInP//bsb/2//esb/ by Scanning Capacitance and Near-field Optical Microscopy,” Electronic Materials Conference, June 22, 1998, Charlottesville, VA **(*Invited)**.

C.C. Williams, “Nanometer Scale Electronic Measurements by Scanning Probe Microscopy,” APS 4 corners meeting, Brigham Young University, Oct. 16, 1998 **(*Invited)**.

C.C. Williams, tutorial on “Scanning Capacitance Microscopy,” at the International Reliability Physics Symposium, Reno, Nevada, March 30-April 2, 1998 **(*Invited)**.

C.C. Williams, “Update on SCM Work at the University of Utah,” SEMATECH Analytical

Managers Working Group on 2D Dopant profiling, Intel, Santa Clara, CA, Dec. 9-10, 1998 **(*Invited)**.

1997

C.C. Williams, "Recent Developments in Optical and Electronic Surface Characterization by Scanning Probe Microscopy," Canadian Association of Physicists Congress (annual meeting for Canadian Physicisits), Calgary, Canada, June 8-11, 1997 **(*Invited)**.

C.C. Williams, "Quantitative Comparison of 2D Dopant Profiles obtained by Scanning Capacitance Microscopy and TCAD Process Simulation," Spring MRS Meeting, San Francisco, CA. , March 31-April 1, 1997 **(*Invited)**.

C.C. Williams, “Status of Capacitance to Dopant Concentration Conversion”, Utah SCM Project Presentation given at SEMATECH 2D Dopant Profiling Status and Strategy Meeting, Austin, Texas, Nov. 18, 1997.

C.C. Williams, “2D Dopant Diffusion Measurement and Electrical Device Characterization by Scanning Capacitance Microscopy,” presentation given at Semiconductor Research Corporation Contract Review, University of Texas Austin, Austin, Texas, July 8-10, 1997.

C.C. Williams, "Nanometer scale characterization of semiconductor surfaces with new and old Scanning Probe Microscopies," presented at Physics colloquium, Utah State University, Logan, UT, February 20, 1997 **(*Invited)**.

C.C. Williams, “Status of Capacitance to Dopant Concentration Conversion”, Utah SCM Project Presentation given at 2D Dopant Profiling Status and Strategy Meeting, Austin, Texas, Nov. 18, 1997.

C.C. Williams, “2D Dopant Diffusion Measurement and Electrical Device Characterization by Scanning Capacitance Microscopy,” presentation given at Semiconductor Research Corporation Contract Review, University of Texas Austin, Austin, Texas, July 8-10, 1997.

J.K. Leong, C.C. Williams and J.M. Olson, "Evidence for internal electric fields in two-variant ordered GaInP obtained by Scanning capacitance and near-field optical microscopy," presented at 1997 APS March Meeting, Kansas City, Mo.

T. Clarysse, M. Caymax, P. De Wolf, T. Trenkler, W. Vandervorst, J. S. McMurray, J. Kim, C.C. Williams, J.G. Clark and G. Neubauer, "Epitaxial Staircase Structure for the Calibration of Electrical Characterization Techniques," Fourth International Workshop on the measurement, characterization and modeling of ultra-shallow doping profiles in semiconductors, Research Triangle Park, NC, April 6-9, 1997.

J.S. McMurray, J. Kim and C.C. Williams, "Direct Comparison of 2-Dimensional Dopant Profiles by Scanning Capacitance Microscopy with TSUPREM4 Process Simulation," Fourth International Workshop on the measurement, characterization and modeling of ultra-shallow doping profiles in semiconductors, Research Triangle Park, NC, April 6-9, 1997.

C.C. Williams, "Nanometer Scale Characterization of Semiconductor Surfaces with New and Old Scanning Probe Microscopies," Colloquium at Utah State University, Logan, UT, February 11, 1997 **(*Invited)**.

1996

C.C. Williams, "Recent Developments in Scanning Probe Microscopy for Optical and Electronic Characterization of Surfaces," talk given at 1996 APS March Meeting, St. Louis, Mo, March 18-22, 1996. **(*Invited)**.

C.C. Williams, "2D SCM dopant profiling," Semiconductor Research Corp., Annual Contract Review, University of Texas, Austin, TX, July 17, 1996.

C.C. Williams, "Electronic Characterization of Semiconductor Surfaces by Scanning Probe Microscopy," presented at the 23rd Conference on the Physics and Chemistry of Semiconductor Interfaces, La Jolla, CA, January 21-25, 1996 **(*Invited)**.

1995

C.C. Williams, "Nanometer Scale Semiconductor Surface Characterization by Scanning Probe Microscopy," presented at MRS 1995 Fall Meeting, Boston, MA, November 27-December 1, 1995 **(*Invited)**.

R.C. Davis, C.C. Williams and P. Neuzil, "A Micromachined Sub-micrometer Photodiode for Scanning Probe Microscopy," presented at Transducers 95 / Eurosensors IX, Stockholm, Sweden, June 25-29, 1995.

Y. Leng and C.C. Williams, "Rectification of AC Bias in Kelvin Probe Force Microscopy Observed on Semiconductor Surfaces," presented at the APS March Meeting, San Jose, CA, March 20-24, 1995.

Y. Huang and C.C. Williams, "Quantitative 2-dimensional Profile Measurements on Si Cross-sectioned Surfaces by Scanning Capacitance Microscopy," presented at the APS March Meeting, San Jose, CA, March 20-24, 1995.

R.C. Davis, and C.C. Williams, "Photodiode Probe for Near-field Optical Microscopy: Probe Sample Interaction," presented at the APS March Meeting, San Jose, CA, March 20-24, 1995.

C.C. Williams, "Scanning Capacitance Microscopy - Carrier Density Mapping/Dopant

Profiling," presented to Department of Electronic Engineering, Chinese University of Hong Kong, Hong Kong, China, April 26, 1995, **(*Invited)**.

C.C. Williams, "Electrostatic Force Microscopy - Charge mapping and dielectric imaging," presented to Department of Electronic Engineering, Chinese University of Hong Kong, Hong Kong, China, April 27, 1995, **(*Invited)**.

C.C. Williams, "Kevlin Probe Force Microscopy - Semiconductor surface/interface characterization," presented to Department of Electronic Engineering, Chinese University of Hong Kong, Hong Kong, China, May 2, 1995, **(*Invited)**.

C.C. Williams, "Near-field Photodetection Optical Microscopy (NPOM) - A new approach to surface chemical/molecular identification on a nanometer scale," presented to Department of Electronic Engineering, Chinese University of Hong Kong, Hong Kong, China, May 4, 1995, **(*Invited)**.

A. DiCarlo and C.C. Williams, "Electrostatic Force Measurement and Imaging under solution," presented at the 69th Colloid & Surface Science Symposium, University of Utah, Salt Lake City, UT, June 11-14, 1995.

Y. Huang, C.C. Williams and H. Smith, "Direct comparison of Cross-sectional SCM Dopant Profile and Vertical SIMS Profiles," presented at the 3rd International Workshop on the Measurement and Characterization of Ultra-shallow Doping Profiles in Semiconductors, MCNC, North Carolina, March 20-22, 1995.

G. Neubauer, A. Erickson, C.C. Williams, J. Kopanski, M. Rodgers and D. Adderton, "2D- Scanning Capacitance Microscopy Measurements of Cross-Sectioned VLSI Devices," presented at the 3rd International Workshop on the Measurement and Characterization of Ultra-shallow Doping Profiles in Semiconductors, MCNC, North Carolina, March 20-22, 1995.

C.C. Williams, "Electronic Characterization of Semiconductor Surfaces by Scanning Probe Microscopy," presented at the Eight International Conference on Scanning Tunneling Microscopy/Spectroscopy and Related Techniques (STM'95), Snowmass Village, CO, July 23-28, 1995. **(*Invited)**.

Y. Huang, C.C. Williams and M.A. Wendman, "Quantitative Carrier Density Mapping of Abrupt Dopant Profiles in Si by Cross-sectional Scanning Capacitance Microscopy (SCM)," presented at the 42nd National Symposium of the American Vacuum Society, Minneapolis, MN, October 16-20, 1995.

R.C. Davis, C.C. Williams and P. Neuzil, "Near-field Photodetection Optical Microscopy (NPOM) on a Sub-100 Nanometer Scale," presented at the 42nd National Symposium of the American Vacuum Society, Minneapolis, MN, October 16-20, 1995.

C.C. Williams, "Electronic Characterization of Surfaces by Scanning Probe Microscopy," presented at Kodak Research, Rochester, NY, October 18, 1995. **(*Invited)**.

C.C. Williams, "Surface Characterization by Scanning Probe Microscopy," presented at 3M, St. Paul, MN, June 26, 1995. **(*Invited)**.

1994

R.C. Davis and C.C. Williams, "Localized photodiode for Near-Field Photodetection Optical Microscopy," 41st National Symposium of The American Vacuum Society, Denver, CO. October 24-28, 1994.

Y. Huang and C.C. Williams, "Quantitative Dopant Profile Measurements on Si by Scanning Capacitance Microscopy," 41st National Symposium of the American Vacuum Society, Denver, CO, October 24-28, 1994.

Y. Leng, Y.J. Huang, C.C. Williams, L.C. Su, and G.B. Stringfellow, "Observation of Atomic Ordering in GaInP by Scanning ProbeMicroscopy," 41st National Symposium of the American Vacuum Society, Denver, CO, October 24-28, 1994.

C.C. Williams, "Quantitative 2D Dopant Profiling by SCM," Intel Corporation, August 15, 1994.

C.C. Williams, "Quantitative Dopant Profiling by SCM," University of Manitoba, Winnipeg, Canada, July 28, 1994. **(*Invited)**.

C.C. Williams, "Quantitative 2D Dopant Profiling by SCM, Massachusetts SCOE and SOI and Novel Process Technologies Review, Cambridge, MA, May 31-June 3, 1994.

L.C. Su, I.H. Ho, G.B. Stringfellow, Y. Leng, and C.C. Williams, "Effect of Substrate Misorientation on Ordering in GaInP," Spring MRS Meeting, San Francisco, CA, April 1994.

Y. Huang and C.C. Williams, "Quantitative Inversion of Scanning Probe C-V Data for 2D Density Dopant Profiling," Workshop on Industrial Applications of Scanned Probe Microscopy, National Institute of Standards and Technology, Gaithersburg, MD, March 24-25, 1994. **(*Invited)**.

Y. Leng, L.C. Su, G.B. Stringfellow, and C.C. Williams, "Observation of Ordering in GaInP by Electrostatic Force Microscope," presented at APS meeting, March 21-25, 1994.

C.C. Williams, "Interfacial Charge Mapping with the EFM," Engineering Foundation Conference: Surface Characterization of Adsorption and Interfacial Reactions, Kona, Hawaii, January 9-14, 1994. **(*Invited)**.

1993

C.C. Williams, "Quantitative 2D Dopant Profiling by Scanning Probe Microscopy," SEMATECH TCAD Steering Committee Meeting, September 22-23, 1993. **(*Invited)**.

C.C. Williams, "2D Dopant Profiling," Submicron Physics and Chemistry Group, Digital Equipment Corporation, Hudson, Massachusetts, June 4, 1993. **(*Invited)**.

C.C. Williams and Y. Huang, "Quantitative 2-D Dopant Profiling of VLSI Structures by Scanning Probe Microscopy," Semiconductor Research Corporation MIT Joint Contract Review, Cambridge, MA, June 2-4, 1993.

Y. Huang and C.C. Williams, "Nanometer Scale C-V Measurement by Scanning Probe C-V Microscopy," Second International Workshop on the Measurement and Characterization of Ultra-Shallow Doping Profiles in Semiconductors, MCNC, Research Triangle. Park, NC, March 23-25, 1993. **(*Invited)**.

Y. Huang, C.C. Williams, and J. Slinkman, "Quantitative Dopant Density Measurements on a Nanometer Scale by Scanning Capacitance Microscopy," APS March Meeting, March 22-26, 1993.

Y. Leng and C.C. Williams, "FEP and Modified FEP Surface Charge Study Using Electrostatic Scanning Force Microscope," APS March Meeting, March 22-26, 1993.

D.R. Busath, R.C. Davis, and C.C. Williams, "Near-field photodetection optical microscopy (NPOM): a novel probe for sub-wavelength optical characterization," Scanning Probe Microscopies II, OE/LASE '93, Los Angeles, CA, January 18-19, 1993.

Y. Leng and C.C. Williams, "Atomic Force Microscopy charge mapping of molecular systems," Scanning Probe Microscopies II, OE/Lase '93, Los Angeles, CA, January 18-19, 1993.

C.C. Williams, "Applications of Atomic Force Microscopy to Molecular Systems," Biomedical Optics '93, Los Angeles, CA, January 17-18, 1993. **(*Invited)**.

1992

J. Xu, R. Moller, K. Lauger, K. Dransfeld, and C.C. Williams, "On the Energy Dissipation in Field Emission and Tunneling Microscopy," Nato-ARW Conference: Manipulation of Atoms under High Fields and Temperatures: Applications, Lyon, France, July 6-10, 1992.

C.C. Williams, "Toward Quantitative Semiconductor Characterization by Scanning Probe Microscopy," Gordon Research Conference Non-Destructive Evaluation, Oxnard, CA, January 20-25, 1992. **(*Invited)**.

1991

C.C. Williams, "Scanning Chemical Potential Microscopy," Institut fur Physik, University of Konstanz, Konstanz, Germany, August 20, 1991. **(*Invited)**.

C.C. Williams, "Impurity Dopant Measurements in Semiconductors," Institut fur Physik, University of Konstanz, Konstanz, Germany, August 20, 1991. **(*Invited)**.

J. Tansock and C.C. Williams, ?Force Measurement with a Piezoelectric Cantilever in Scanning Force Microscope," STM'91 Conference, Interlaken, Switzerland, August 12-16, 1991.

Measurement in Semiconductors by Scanning Force Microscopy," STM'91 Conference, Interlaken, Switzerland, August 12-16, 1991.

K.S. Mak and C.C. Williams, "Nanoscale Semiconductor Impurity Characterization by Scanned Probe Microscopy." SPIE Scanning Microscopy Instrumentation, San Diego, CA, July 22-23, 1991. **(*Invited)**.

K.S. Mak and C.C. Williams, "Nanoscale Semiconductor Impurity Characterization by Scanned Probe Microscopy," SPIE International Symposium on Optical Applied Science and Engineering, San Diego, CA, July 21-26, 1991. **(*Invited)**.
C.C. Williams, "Scanning Capacitance Microscopy," American Physical Society March Meeting, March 18-22, Cincinnati, OH, March 18-22, 1991. **(*Invited**).

C.C. Williams and H.K. Wickramasinghe, "Atomic Scale Chemical Differentiation by the Scanning Chemical Potential Microscope," SPIE OE/LASE '91, Los Angeles, CA, January 20-25, 1991. **(*Invited)**.

C.C. Williams, J. Slinkman, D.W. Abraham and H.K. Wickramasinghe, "Nanoscale Surface Characterization by Scanning Capacitance Microscopy," Engineering Foundation Conference "Scanned Probe Microscopies: STM and Beyond," Santa Barbara, CA, January 6-11, 1991. **(*Invited)**.

1990
J. Slinkman, C.C. Williams, D.W. Abraham, and H.K. Wickramasinghe, "Lateral Dopant Profiling in MOS Structures on an 100 NM Scale using Scanning Capacitance Microscopy," International Electron Devices Meeting, San Francisco, CA, December 9-12, 1990.

C.C. Williams and H.K. Wickramasinghe, "Scanning Chemical Potential Microscope: A New Technique for Atomic Scale Surface Investigation," 5th International Conference on Scanning Tunneling Microscopy/Spectroscopy and First International Conference on Nanometer Scale and Technology, Baltimore, MD, July 23-27, 1990.

D.W. Abraham, C.C. Williams, J. Slinkman, and H.K. Wickramasinghe, "Lateral Dopant Profiling in Semiconductors by AFM Using Capacitive Detection," STM'90/Nano I

Meeting, Baltimore, MD, July 23-27, 1990.

J. Slinkman, C.C. Williams, and H.K. Wickramasinghe, "Lateral Dopant Profiling in Silicon by Scanning Capacitance Microscopy," Scanning Microscopy 1990 Meeting, Bethesda, MD, May 5-10, 1990. **(*Invited)**.

1989

H.K. Wickramasinghe, J. Weaver, and C.C. Williams, "Phonons and Scanning Tunneling Microscopy," 3rd International Conference on Phonon Physics, Heidelberg, Germany, August, 1989. **(*Invited)**.

C.C. Williams, J. Slinkman, W.P. Hough, and H.K. Wickramasinghe, "Two Dimensional Lateral Dopant Profiling on a 100 Nanometer Scale by Near Field Capacitance Microscopy," 4th International Conference on Scanning Tunneling Microscopy/Spectroscopy, Oarai, Japan, July 9-14, 1989.

C.C. Williams and H.K. Wickramasinghe, "Thermal and Photothermal Imaging with High Spatial and Temperature Resolution and Future Prospects," 1989 Microprocess Conference, Kobe, Japan, July 3-5, 1989. **(*Invited)**.

J. Slinkman and C.C. Williams, "Nondestructive Lateral Dopant Profiling on a 200 Nanometer Scale by Scanning Capacitance Microscopy," Review of Progress in Quantitative NDE, Brunswick, ME, July, 1989. **(*Invited)**.

1988

C.C. Williams and H.K. Wickramasinghe, "Thermal and Photothermal Imaging of 100 Nanometer Structures," American Vacuum Society Meeting, Atlanta, GA, October 3-7, 1988. **(*Invited)**.

C.C. Williams and H.K. Wickramasinghe, "Thermal and Photothermal Imaging on a Sub 100 Nanometer Scale," SPIE Meeting on Scanning Microscopy Technologies and Applications, Los Angeles, CA, January 13-15, 1988. **(*Invited)**.

1987

C.C. Williams and M. Wei, "Fiber Optic Ranging System for Stage Position Control," ASTL Symposium, East Fishkill, NY, November 9-11, 1987.

C.C. Williams and H.K. Wickramasinghe, "Photothermal Imaging with Sub-100 Nanometer Spatial Resolution," 5th International Topical Meeting on Photoacoustic and Photothermal Phenomena, Heidelberg, Germany, July 27-30, 1987. **(*Invited)**.

Y. Martin, C.C. Williams, and H.K. Wickramasinghe, "Tip-Techniques for Microcharacterization of Material," Scanning Electron Microscopy, Inc., Quebec, Canada, May 1987. **(*Invited**).

1986
C.C. Williams and H.K. Wickramasinghe, "High Resolution Thermal Microscopy," IEEE Ultrasonics Symposium, Williamsburg, VA, November 17-19, 1986.

C.C. Williams and H.K. Wickramasinghe, "Absolute Laser Ranging with Micron Precision," American Society of Precision Engineering Conference, Dallas, TX, November 4-7, 1986. **(*Invited)**.

C.C. Williams and H.K. Wickramasinghe, "Scanning Thermal Profiler," Microcircuit Engineering 86 Conference, Interlaken, Switzerland, September 22-25, 1986.

C.C. Williams, "Measurement Techniques in Micro-Metrology, "Manufacturing Technology Institute, Thornwood, N.Y., July 17, Manufacturing Technology Institute, Thornwood, NY, July 17, 1986.

1984
C.C. Williams, "Thin Film Characterization with Optical Resolution Using 1 GHz Thermal Waves," IEEE Ultrasonics Symposium, Dallas, TX, 1984.

1983
C.C. Williams, "High Resolution Acousto-Optic Laser Probe," IEEE Ultrasonics Symposium, Atlanta, GA, October 31-November 2, 1983.

1982
C.C. Williams and C.F. Quate, "Photoacoustic Imaging of Thin Films," IEEE Trans. Sonics Ultrasonics, San Diego, CA, October 27-29, 1982.

1981
C.F. Quate and C.C. Williams, "Photoacoustic and Acoustic Imaging at High Frequencies," IEEE Ultrasonics Symposium, Chicago, IL, October 14-16, 1981.

R.C. Bray, C.F. Quate, and C.C. Williams, "Opto/Acoustic Microscopy," 2nd International Topical Meeting on Photoacoustic Spectroscopy, Berkeley, CA, June 22-25, 1981.