

Curriculum Vitae
Thomas Schenkel

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Research areas

Exploration of spin qubits, materials far from equilibrium, radiation effects, accelerator technology

Experience

- 2019 – present Interim Director, Accelerator Technology and Applied Physics Division (<http://atap.lbl.gov/>), Lawrence Berkeley National Laboratory, Berkeley, CA
- 2013 – present Physicist, Senior Scientist, Accelerator Technology and Applied Physics Division (<http://atap.lbl.gov/>), Lawrence Berkeley National Laboratory
- Deputy Division Director for Technology, ATAP (2017-2018)
 - Program Head, Fusion Science and Ion Beam Technology Program (since 2013), leading a diverse program with research on intense, pulsed ion beams (NDCX-II, BELLA-i), accelerator development, active nuclear interrogation, applied plasma science, radiation effects and explorations of quantum computer architectures, funded by DOE Office of Science, ArpaE, other agencies and companies
- 2009 – 2013 Group Leader, Ion Beam Technology Group, and Deputy Program Head, Fusion Science and Ion Beam Technology Program, LBNL
- 2002 – 2009 Staff Scientist, physicist, Accelerator & Fusion Research Division, LBNL
- PI of quantum computer development projects, leading a multi-disciplinary, multi-institutional team, funded by DOD
- 2000 – 2002 Physicist, Accelerator & Fusion Research Division, LBNL
- Member of the Spallation Neutron Source front end team
 - Established projects in solid state quantum computer development
- 1997 – 2000 Postdoctoral Fellow, Chemistry & Materials Science Department, Lawrence Livermore National Laboratory, Livermore, CA
- Ultrafast electronic excitation of solids, nano-structuring, materials analysis
- 1994 – 1997 Graduate student researcher, Physics & Space Technology Directorate, LLNL
- Ion-solid interaction physics with slow, very highly charged ions

Education

- 1997 Ph.D. Physics, Goethe University, Institute of Nuclear Physics, Frankfurt/M, Germany
1993 Diploma, Physics, Goethe University, Institute of Nuclear Physics, Frankfurt/M

Articles in Nature and Nature family journals

1. A. J. Sigillito, J. Anthony, A. M. Tyryshkin, T. Schenkel, A. A. Houck, S. A. Lyon, "All-electric control of donor nuclear spin qubits in silicon", *Nature Nanotech.* 12, 958 (2017)
2. A. Bienfait, J. J. Pla, Y. Kubo, X. Zhou, M. Stern, C. C. Lo, C. D. Weis, T. Schenkel, D. Vion, D. Esteve, J. J. L. Morton, P. Bertet, "Controlling spin relaxation with a cavity", *Nature* 531, 74 (2016)

3. A. Bienfait, J. J. Pla, Y. Kubo, M. Stern, X. Zhou, C. C. Lo, C. D. Weis, T. Schenkel, M. Thewalt, D. Vion, D. Esteve, B. Julsgaard, K. Mølmer, J. Morton, and P. Bertet, "Reaching the quantum limit of sensitivity in electron spin resonance", *Nature Nanotechnology* 11, 253 (2016)
4. A. M. Tyryshkin, S. Tojo, J. J. L. Morton, H. Riemann, N. V. Abrosimov, P. Becker, H. J. Pohl, T. Schenkel, M. L. W. Thewalt, K. M. Itoh, S. A. Lyon, "Electron spin coherence exceeding seconds in high-purity silicon", *Nature Materials* 11, 143 (2012)
5. G. Fuchs, V. Dobrovitski, D. Toyli, J. Heremans, C. Weis, T. Schenkel, and D. D. Awschalom, "Excited-state spin coherence of a single nitrogen-vacancy centre in diamond", *Nature Physics* 6, 668 (2010)
6. J. J. L. Morton, A. M. Tyryshkin, R. M. Brown, S. Shankar, B. W. Lovett, A. Ardavan, T. Schenkel, E. E. Haller, J. W. Ager, and S. A. Lyon, "Solid state quantum memory using the 31P nuclear spin", *Nature* 455, 1085 (2008)

Articles in Physical Review Letters

1. Dong-Xia Qu, N. E. Teslich, Z. R. Dai, G. F. Chapline, T. Schenkel, S. R. Durham, J. Dubois, "Onset of a Two-Dimensional Superconducting Phase in a Topological-Insulator-Normal-Metal Bi_{1-x}Sb_x/Pt Junction Fabricated by Ion-Beam Techniques", *Phys. Rev. Lett.* 121, 037001 (2018)
2. C. C. Lo, C. D. Weis, J. van Tol, J. Bokor, T. Schenkel, "All electrical nuclear spin polarization of donors in silicon", *Phys. Rev. Lett.*, 110, 057601 (2013)
3. C. C. Lo, V. Lang, R. E. George, J. J. L. Morton, A. M. Tyryshkin, S. A. Lyon, J. Bokor, T. Schenkel, "Electrically detected magnetic resonance of neutral donors interacting with a two-dimensional electron gas", *Phys. Rev. Lett.* 106, 207601 (2011)
4. G. D. Fuchs, V. V. Dobrovitski, R. Hanson, A. Batra, C. D. Weis, T. Schenkel, and D. D. Awschalom, "Excited state spectroscopy using single spin manipulation in diamond", *Phys. Rev. Lett.* 101, 117601 (2008)
5. F. R. Bradbury, A. M. Tyryshkin, G. Sabouret, J. Bokor, T. Schenkel, and S. A. Lyon, "Stark Tuning of Donor Electron Spins in Silicon", *Phys. Rev. Lett.* 97, 176404 (2006)
6. T. Schenkel, A. V. Barnes, T. R. Niedermayr, M. Hattass, M. W. Newman, G. A. Machicoane, J. W. McDonald, A. V. Hamza, and D. H. Schneider, "Deposition of potential energy in solids by slow, highly charged ions", *Phys. Rev. Lett.* 83, 4273 (1999)
7. M. Hattass, T. Schenkel, A. V. Hamza, A. V. Barnes, M. W. Newman, J. W. McDonald, T. R. Niedermayr, G. A. Machicoane, and D. H. Schneider, "Charge Equilibration time of slow, highly charged ions in solids", *Phys. Rev. Lett.* 82, 4795 (1999)
8. T. Schenkel, A. V. Barnes, A. V. Hamza, J. C. Banks, B. L. Doyle, D. H. Schneider: "Synergy of electronic excitation and elastic collision spikes in sputtering of heavy metal oxides", *Phys. Rev. Lett.* 80, 4325 (1998)
9. T. Schenkel, A. V. Hamza, A. V. Barnes, J. C. Banks, B. L. Doyle, D. H. Schneider: "Ablation of GaAs by intense, ultrafast electronic excitation from highly charged ions", *Phys. Rev. Lett.* 81, 2590 (1998)
10. T. Schenkel, M. A. Briere, A. V. Barnes, A. Hamza, K. Bethge, H. Schmidt-Böcking, D. H. Schneider: "Charge State Dependent Energy Loss of Slow Heavy Ions in Solids", *Phys. Rev. Lett.* 79, 2030 (1997)
11. T. Schenkel, M. A. Briere, H. Schmidt-Böcking, K. Bethge, D. H. Schneider, "Electronic Sputtering of Thin Conductors by Neutralization of Slow Highly Charged Ions", *Phys. Rev. Lett.* 78, 2481 (1997)

Patents

1. WO2017192834A1, "Wafer-based charged particle accelerator, wafer components, methods, and applications", A. Lal, T. Schenkel, A. Persaud, Q. Ji, P. Seidl, W. Waldron, S. Ardanuc, V. K. B. Kumar, Nov. 2017
2. US 9484176 B2, "Advanced Penning Ion Source", T. Schenkel, Q. Ji, A. Persaud, A. V. Sy,

- Nov. 01, 2016
3. US 9161429 B2, “Compact ion source neutron generator”, T. Schenkel, A. Persaud, R. Kapadia, A. Javey, C. Chang-Hasnain, I. Rangelow, J. Kwan, date of patent: Oct. 13, 2015
 4. US 8709350, “Compact ion acceleration source”, T. Schenkel, A. Persaud, R. Kapadia, A. Javey, April 29, 2014
 5. US 20130087766, “Scalable quantum computer architecture with coupled donor-quantum dot qubits”, T. Schenkel, C. C. Lo, C. Weis, S. Lyon, A. Tyryshkin, J. Bokor, April 11, 2013
 6. US7750297, “Carbon Nanotube Collimator Fabrication and Application”, Lee Chow, Guangyu Chai, Thomas Schenkel, Jul. 6, 2010
 7. US7126139, “Device and method of positionally accurate implantation of individual particles in a substrate surface”, T. Schenkel, I. Rangelow, J. Meijer, Oct. 24, 2006
 8. US6291820, “Highly charged ion secondary ion mass spectrometry”, A. V. Hamza, T. Schenkel, A. V. Barnes, D. H. Schneider, Sept. 18, 2001
 9. US6288394, “Highly charged ion based time of flight emission microscope”, A. V. Barnes, T. Schenkel, A. V. Hamza, D. H. Schneider, and B. L Doyle, Sept. 11, 2001

Teaching

- Lecturer at UC Berkeley, Nuclear Engineering, teaching NE-282, Spring 2018, “Beam physics and Accelerators” (for graduate students)
- Pan American Advanced Study Institute “Ion Nanobeams”, Buenos Aires, Argentina, 02/2006
- supervising (under)-graduate students (physics, nuclear and electrical engineering) since 2000
- guest lectures on topics of quantum computer development, nanotechnology and accelerator technology at UC Berkeley since 2000

Selected Service

- Chair, Fusion Energy Sciences Roundtable on Quantum Information Science, May 2019, <https://science.energy.gov/fes/community-resources/workshop-reports/>
- International Atomic Energy Agency (IAEA), international program advisory committee, radiation effects, 2015-2016
- High Energy Density Science Association, HEDSA, vice-chair, 2015-2016
- Topic editor at the International Conference on Applications of Accelerators in Research and Industry; Focused Ion Beams and Nanotechnology, 21st CAARI, August 2010; Accelerator Technology, 23rd CAARI, August 2014; 24th CAARI, Nov. 2016, 26th CAARI, Aug. 2018
- International scientific advisory committee, International Conference on Atomic Collisions in Solids (ICACS), since 2012
- Chair, International workshop on Silicon Qubits, Berkeley, August 24-25, 2009
- User Executive Committee, The Molecular Foundry, LBNL, member (2007-2010), committee chair and chair of annual users’ meeting (2008)

Selected honors

- Chemistry & Materials Science Directorate Award, Lawrence Livermore National Laboratory, 2000
- Student Prize of the Heraeus Foundation, 1993

Selected invited presentations:

1. “Accessing the dynamics of radiation induced defects in materials”, International Atomic Energy Agency, Technical Meeting on Radiation Effects, Torino, May 2016
2. “Tailoring of materials properties under extreme conditions”, APS March Meeting, Baltimore, March 16, 2016
3. “Local Formation of Nitrogen Vacancy Centers in Diamond by Electronic Excitation”, Material Research Society, Spring Meeting, San Francisco, April 08, 2015

4. “Deterministic doping and the exploration of spin qubits”, Gordon Research Conference on Nanostructure Fabrication, University of New England, Biddeford, ME, July 13-18, 2014,
5. “Formation of quantum computer test structures in silicon and diamond”, International Conference on Applied Atom Optics, Bad Honnef, Germany, July 27-29, 2009
6. “Formation of quantum computer test structures by ion implantation with scanning probe alignment”, 23rd International Conference on Atomic Collisions in Solids, ICACS 23, Phalaborwa, South Africa, August 17-22, 2008
7. “Single atom doping and single atom device development”, 52nd International Conference on Electron, Ion and Photon Beams and Nanofabrication, Portland, OR, May 29, 2008
8. “Ion Implantation with Scanning Probe Alignment”, 15th International Conference on Ion Beam Modification of Materials, IBMM, Taormina, Italy, September 2006
9. “Integration of scanning probes with ion beams and the development of coherent electronic devices”, International Conference on Nanoscience & Nanotechnology, ICONN, Brisbane, Australia, July 2006
10. “Epitaxial integration of spin qubits in silicon”, 14th International Conference on Ion Beam Modification of Materials, IBMM, Monterey, CA, Sept. 2004

General audience articles and features

- “A resonant circuit accelerates spontaneous spin-flip transitions”, J. L. Miller, Physics Today March 2016, P. 16, [link](#)
- “A New Spin on Quantum Computing: Scientists Train Electrons with Microwaves”, Berkeley Lab News, Feb 15, 2016, [link](#)
- C. D. Weis and T. Schenkel, “Single spins in silicon see the light”, Nature 497, 46 (2013)
- Berkeley Lab video glossary “Quantum Computing”, <http://videoglossary.lbl.gov/2009/quantum-computing/>, [link](#)
- “News Bits About Qubits: Scientists Store and Retrieve Data Inside an Atom”, Berkeley Lab News, Oct. 23, 2008
- “A Toolkit for Silicon-based Quantum Computing”, Berkeley Lab News, Oct. 22, 2008, [link](#)
- “Making Quantum Computing Work in Silicon”, Berkeley Lab News, May 30, 2006
- “Aligned implantation via integrated scanning probe”, Materials Today, News, P.10, July 2005
- T. Schenkel, “Reliable Performance”, Nature Materials 4, 799 (2005)
- Lee Gomes, “Quantum Computing may seem too far out, but don’t count on it”, Wall Street Journal, page B1, April 25, 2005

Book chapters

1. M. DeWitt, T. Schenkel, A. Yildiz, “Fluorescence tracking of motor proteins in vitro”, 2014, in “Fluorescent Methods for Molecular Motors”, Pages 211-234, Publisher: Springer Basel
2. T. Schenkel, C. C. Lo, C. D. Weis, J. Bokor, A. M. Tyryshkin, S. A. Lyon, “A spin quantum bit architecture with coupled donors and quantum dots in silicon”, in “Single Atom Nanoelectronics”, Pan Stanford Publishing, ISBN-13: 978-9814316316 (2013), arXiv:1110.2228
3. “Single Ion Implantation”, in “Nanofabrication Handbook”, S. Cabrini and S. Kawata (eds.), Taylor & Francis – CRC Press, ISBN: 978-1-4200-9052-9, P. 340 – 350 (2012)
4. “Surface Analysis with Slow, Highly Charged Ions: TOF-SIMS and the Probing of Nano-environments”, in “Ion Beam Analysis of Surfaces and Interfaces” (Nova, New York, 2003), P. Chakraborty (ed.), P. 267 – 310
5. “Physics at the Electron Beam Ion Trap”, D. H. G. Schneider, J. Steiger, T. Schenkel, and J. R. Crespo Lopez-Urrutia, in “Atomic Physics with Heavy Ions”, H. F. Beyer and V. P. Shevelko (eds.), (Springer, Berlin, 1999), P. 30 - 59

Review articles

1. S. Henderson, ..., T. Schenkel, ..., et al., “The Spallation Neutron Source accelerator system

- design”, Nucl. Instr. Meth. A 763, 610 (2014)
2. W. J. Moberly Chan, D. P. Adams, M. J. Aziz, G. Hobler, T. Schenkel, "Fundamentals of Focused Ion Beam Nanostructural Processing", MRS Bulletin Vol. 32 (5), 424 (2007)
 3. T. Schenkel, A. Persaud, S. J. Park, J. Nilsson, J. Bokor, J. A. Liddle, R. Keller, D. H. Schneider, D. W. Cheng, and D. E. Humphries, "Solid state quantum computer development in silicon with single ion implantation", J. Appl. Phys. (Applied Physics Review) 94, 7017 (2003)
 4. T. Schenkel, A. V. Hamza, A. V. Barnes, and D. H. Schneider, "Interaction of slow, very highly charged ions with surfaces", Prog. Surf. Science 61, 23 (1999)

Articles (h-index: 29, web of science; 33, Google scholar)

1. Dong-Xia Qu, N. E. Teslich, Z. R. Dai, G. F. Chapline, T. Schenkel, S. R. Durham, J. Dubois, "Onset of a Two-Dimensional Superconducting Phase in a Topological-Insulator-Normal-Metal Bi_{1-x}Sbx/Pt Junction Fabricated by Ion-Beam Techniques", Phys. Rev. Lett. 121, 037001 (2018)
2. F. Treffert, Q. Ji, P. A. Seidl, A. Persaud, B. Ludewigt, J. J. Barnard, A. Friedman, D. P. Grote, E. P. Gilson, I. D. Kaganovich, A. Stepanov, M. Roth, T. Schenkel, "Design and implementation of a Thomson parabola for fluence dependent energy-loss measurements at the Neutralized Drift Compression eXperiment", Rev. Sci. Instr. 89, 103302 (2018)
3. P.A. Seidl, A. Persaud, W. Ghiorso, Q. Ji, W.L. Waldron, A. Lal, K.B. Vinayakumar, T. Schenkel, "Source-to-accelerator quadrupole matching section for a compact linear accelerator", Rev. Sci. Instr. 89, 053302 (2018),
4. Anton D. Stepanov, Erik P. Gilson, Igor D. Kaganovich, Peter A. Seidl, Arun Persaud, Qing Ji, Thomas Schenkel, Alex Friedman, John J. Barnard, David P. Grote, "Optimizing Beam Transport in Rapidly Compressing Beams on the Neutralized Drift Compression Experiment – II", arXiv:1711.00539, Matter and Radiation at Extremes 3, 78 (2018)
5. Lake, R. E., A. Mueller, H. Pan, A. Persaud, B. A. Ludewigt, V. Z. Kresin, A. M. Minor, P. A. Seidl, and T. Schenkel. 2017. "Patterned Electron Beam Exposures of YBCO – Towards Local Control of Doping." Physics Procedia 90, 381–84 (2018),
6. B. A. Ludewigt, P.A. Seidl, A. Persaud, Q. Ji, S. Steinke, S.S. Bulanov, K. Nakamura, W.P. Leemans, T. Schenkel, E.S. Bielejec, A. Friedman, D.P. Grote, and J.J. Barnard, "Short Intense Ion Pulses for Radiation Effects Research Using NDCX-II and BELLA-i", Journal of Radiation Effects, research and Engineering (JRERE) V 36, 96 (2018), available upon request
7. J. J. Barnard and T. Schenkel, "Modeling of intense pulsed ion beam heated masked targets for extreme materials characterization", J. of Appl. Phys. 122, 195901 (2017)
8. S. Probst, A. Bienfait, P. Campagne-Ibarcq, J. J. Pla, B. Albanese, J. F. D. Barbosa, J. F. Da Silva, T. Schenkel, D. Vion, D. Esteve, K. Molmer, J. J. L. Morton, R. Heeres, P. Bertet, "Inductive-detection electron-spin resonance spectroscopy with 65 spins/root Hz sensitivity", Appl. Phys. Lett. 111, 202604 (2017)
9. A. Bienfait, P. Campagne-Ibarcq, A. H. Kiilerich, X. Zhou, S. Probst, J. J. Pla, T. Schenkel, D. Vion, D. Esteve, J. J. L. Morton, K. Moelmer, P. Bertet, "Magnetic Resonance with Squeezed Microwaves", Phys. Rev. X 7, 041011 (2017)
10. A. J. Sigillito, J. Anthony, A. M. Tyryshkin, T. Schenkel, A. A. Houck, S. A. Lyon, "All-electric control of donor nuclear spin qubits in silicon", Nature Nanotech. 12, 958 (2017)
11. J.J. Pla, A. Bienfait, G. Pica, J. Mansir, F.A. Mohiyaddin, A. Morello, T. Schenkel, B.W. Lovett, J.J.L. Morton, P. Bertet, "Strain-induced nuclear quadrupole splittings in silicon devices", Phys. Rev. Applied 9, 044014 (2018)
12. A. T. Asfaw, A. J. Sigillito, A. M. Tyryshkin, T. Schenkel, S. A. Lyon, "Multi-frequency spin manipulation using rapidly tunable superconducting coplanar waveguide microresonators", Appl. Phys. Lett. 111, 032601 (2017)
13. P.A. Seidl, Q. Ji, A. Persaud, E. Feinberg, B. Ludewigt, M. Silverman, A. Sulyman, W.L. Waldron, T. Schenkel, J.J. Barnard, A. Friedman, D.P. Grote, E.P. Gilson, I.D. Kaganovich, A.D. Stepanov, F. Treffert, M. Zimmer, "Irradiation of Materials with Short, Intense Ion

- pulses at NDCX-II”, *Lasers and Particle, Beams* 35, 373 (2017)
14. A. Persaud, P. A. Seidl, Q. Ji, E. Feinberg, W. L. Waldron, T. Schenkel, S. Ardanuc, K. B. Vinayakumar, A. Lal, “Staging of RF-accelerating units in a MEMS-based ion accelerator”, arXiv:1702.00460, *Physics Procedia* 90, 2017, Pages 136-142
 15. A. Persaud, Q. Ji, E. Feinberg, P. A. Seidl, W. L. Waldron, A. Lal, K. B. Vinayakumar, S. Ardanuc, D. A. Hammer, and T. Schenkel, ”A compact linear accelerator based on a scalable micro-electromechanical-system RF-structure”, *Rev. Sci. Instr.* 88, 063304 (2017)
 16. Q. Ji, C. J. Lin, C. Tindall, M. Garcia-Sciveres, T. Schenkel, B. A. Ludewigt, “Coincidence measurements of He-3 and neutrons from a compact D-D neutron generator”, *Rev. Sci. Instr.* 88, 056105 (2017)
 17. B. C. Rose, C. D. Weis, A. M. Tyryshkin, T. Schenkel, S. A. Lyon, “Spin Coherence and 14-N ESEEM Effects of Nitrogen-Vacancy Centers in Diamond with X-band Pulsed ESR”, *Diamond and related Materials* 72, 32 (2017)
 18. A. Koniges, W. Liu, S. Lidia, T. Schenkel, J. Barnard, A. Friedman, D. Eder, A. Fisher, N. Masters, “Numerical Modeling of Complex Targets for High-Energy- Density Experiments with Ion Beams and other Drivers”, *J. Phys.: Conf. Series* 688 (2016) 012053
 19. A. Bienfait, J. J. Pla, Y. Kubo, X. Zhou, M. Stern, C. C. Lo, C. D. Weis, T. Schenkel, D. Vion, D. Esteve, J. J. L. Morton, and P. Bertet, “Controlling spin relaxation with a cavity”, *Nature* 531 ,74 (2016)
 20. G. Pica, B. W. Lovett, R. N. Bhatt, T. Schenkel, S. A. Lyon, “Surface code architecture for donors and dots in silicon with imprecise and non-uniform qubit couplings”, *Phys. Rev. B* 93, 035306 (2016)
 21. P. A. Seidl, J. J. Barnard, R. C. Davidson, A. Friedman, E. P. Gilson, D. Grote, Q. Ji, I. D. Kaganovich, A. Persaud, W. L. Waldron, T. Schenkel, “Short-Pulse, Compressed Ion Beams at the Neutralized Drift Compression Experiment”, *Journal of Physics, Conference Series* 717, 012079 (2016)
 22. A. Bienfait, J. J. Pla, Y. Kubo, M. Stern, X. Zhou, C. C. Lo, C. D. Weis, T. Schenkel, M. Thewalt, D. Vion, D. Esteve, B. Julsgaard, K. Mølmer, J. Morton, and P. Bertet, “Reaching the quantum limit of sensitivity in electron spin resonance”, *Nature Nanotechnology* 11, 253 (2016)
 23. Q. Ji, P. A. Seidl, W. L. Waldron, J. H. Takakuwa, A. Friedman, D. P. Grote, A. Persaud, J. J. Barnard, and T. Schenkel, “Development and testing of a pulsed helium ion source for probing materials and warm dense matter studies”, *Rev. Sci. Instr.* 87, 02B707 (2016)
 24. P. A. Seidl, W. G. Greenway, S. M. Lidia, A. Persaud, M. Stettler, J. H. Takakuwa, W. L. Waldron, T. Schenkel, J. J. Barnard, A. Friedman, D. P. Grote, R. C. Davidson, E. P. Gilson, I. D. Kaganovich, “Short intense ion pulses for materials and warm dense matter research”, *Nucl. Instr. Meth. A* 800, 98 (2015), arXiv:1506.05839
 25. A. Persaud, J. J. Barnard, H. Guo, P. Hosemann, S. Lidia, A. M. Minor, P. A. Seidl, and T. Schenkel, “Accessing defect dynamics using intense, nanosecond pulsed ion beams”, *Physics Procedia* 66, 604 (2015), arXiv:1409.2565
 26. T. Schenkel, C. D. Weis, C. C. Lo, A. Persaud, I. Chakarov, D. H. Schneider, and J. Bokor, “Deterministic Doping and the Exploration of Spin Qubits”, *Proceedings of the XII International Symposium on Electron Beam Ion Sources and Traps*, AIP Conf. Proc. 1640, 124 (2015)
 27. J. Schwartz, S. Aloni, D. F. Ogletree, M. Tomut, M. Bender, D. Severin, C. Trautmann, I. W. Rangelow, and T. Schenkel, “Local formation of nitrogen-vacancy centers in diamond by swift heavy ions”, *J. Appl. Phys.* 116, 214107 (2014)
 28. Hua Guo, Arun Persaud, Steve Lidia, Andrew M. Minor, P. Hosemann, Peter A. Seidl, and Thomas Schenkel, “Dynamic investigation of defects induced by short, high current pulses of high energy lithium ions”, *Mater. Res. Soc. Symp. Proc. Vol. 1712*, DOI: 10.1557/opl.2014.856
 29. Saleem G. Rao, Altaf Karim, Julian Schwartz, Natania Antler, Thomas Schenkel, and Irfan Siddiqi, Directed Assembly of Nanodiamond Nitrogen-Vacancy Centers on a Chemically

- Modified Patterned Surface”, ACS Appl. Mater. Interfaces 6, 12893 (2014)
30. A. R. Schmidt, E. Henry, C. C. Lo, Y.-T. Wang, H. Li, L. Greenman, O. Namaan, T. Schenkel, K. B. Whaley, J. Bokor, E. Yablonovitch, and I. Siddiqi, “A prototype silicon double quantum dot with dispersive microwave readout”, J. Appl. Phys. 116, 044503 (2014)
 31. C. C. Lo, S. Simmons, R. Lo Nardo, C. D. Weis, A. M. Tyryshkin, J. Meijer, D. Rogalla, S. A. Lyon, J. Bokor, T. Schenkel, J. J. L. Morton, “Stark shift and field ionization of arsenic donors in ^{28}Si -SOI structures”, Appl. Phys. Lett. 104, 193502 (2014), arXiv:1401.6885
 32. T. Schenkel, S. M. Lidia, C. D. Weis, W. L. Waldron, J. Schwartz, A. M. Minor, P. Hosemann, J. W. Kwan, “Towards pump-probe experiments of defect dynamics with short ion beam pulses”, Nucl. Instr. Meth. B 315, 350, (2013), <http://arxiv.org/abs/1211.6385>
 33. C. C. Lo, C. D. Weis, J. van Tol, J. Bokor, T. Schenkel and J. J. L. Morton, “Spins in silicon MOSFETs: Electron spin relaxation and hyperpolarization of nuclear spins”, Proceedings of SPIE Vol. 8813, 2X-1, Spintronics VI, 2013
 34. T. N. Makgatoa, E. Sideras-Haddad, S. Shrivastava, T. Schenkel, R. Ritter, G. Kowarik, F. Aumayr, J. Crespo López-Urrutia, S. Bernitt, C. Beilmann, R. Ginzler, “Highly charged ion impact induced nanodefects in diamond”, Nucl. Instr. Meth. B 314, 135 (2013)
 35. A. Sy, Q. Ji, A. Persaud, B. A. Ludewigt and T. Schenkel, “Ion Source and Beam Guiding Studies for an Associate Particle Imaging Neutron Generator”, in: Applications of Accelerator in Research and Industry, AIP Conf. Proc. 1525, 123 (2013)
 36. O. Waldmann, A. Persaud, R. Kapadia, K. Takei, F. I. Allen, A. Javey, T. Schenkel, “Effects of palladium coating on field-emission properties of carbon nanofibers in a hydrogen plasma”, Thin Solid Films 534, 488 (2013)
 37. C. C. Lo, C. D. Weis, J. van Tol, J. Bokor, T. Schenkel, “All electrical nuclear spin polarization of donors in silicon”, Phys. Rev. Lett., 110, 057601 (2013)
 38. M. Ilg, C. D. Weis, J. Schwartz, A. Persaud, Q. Ji, C. C. Lo, J. Bokor, A. Hegyi, E. Guliyev, I. W. Rangelow, T. Schenkel, “Improved single ion implantation with scanning probe alignment”, J. Vac. Sci. Techn. B 30, 06FD04 (2012)
 39. C. D. Weis, C. C. Lo, V. Lang, A. M. Tyryshkin, R. E. George, K. M. Yu, J. Bokor, S. A. Lyon, J. J. L. Morton, T. Schenkel, “Electrical activation and electron spin resonance measurements of implanted bismuth in isotopically enriched silicon-28”, Appl. Phys. Lett. 100, 172104 (2012)
 40. J. Schwartz, S. Aloni, D. F. Ogletree and T. Schenkel, “Effects of low-energy electron irradiation on formation of nitrogen–vacancy centers in single-crystal diamond”, New J. Phys. 14, 043024 (2012)
 41. Q. Ji, J. Staples, A. Sy, T. Schenkel, and D. Li, “Research and development of H⁻ ion source and low energy beam transport for a kaon-neutrino factory”, Rev. Sci. Instr. 83, 02BA718 (2012)
 42. A. Sy, Q. Ji, A. Persaud, O. Waldmann, and T. Schenkel, “Novel methods for improvement of a Penning ion source for neutron generator applications”, Rev. Sci. Instr. 83, 02B309 (2012)
 43. A. Persaud, O. Waldmann, R. Kapadia, K. Takei, A. Javey, and Thomas Schenkel, “A compact neutron generator using a field ionization source”, Rev. Sci. Instr. 83, 02B312 (2012)
 44. C. C. Lo, F. R. Bradbury, A. M. Tyryshkin, C. D. Weis, J. Bokor, T. Schenkel, and S. A. Lyon, “Suppression of microwave rectification effects in electrically detected magnetic resonance measurements”, Appl. Phys. Lett. 100, 063510 (2012)
 45. A. M. Tyryshkin, S. Tojo, J. J. L. Morton, H. Riemann, N. V. Abrosimov, P. Becker, H. J. Pohl, T. Schenkel, M. L. W. Thewalt, K. M. Itoh, S. A. Lyon, “Electron spin coherence exceeding seconds in high-purity silicon”, Nature Materials 11, 143 (2012)
 46. C. C. Lo, V. Lang, R. E. George, J. J. L. Morton, A. M. Tyryshkin, S. A. Lyon, J. Bokor, T. Schenkel, “Electrically detected magnetic resonance of neutral donors interacting with a two-dimensional electron gas”, Phys. Rev. Lett. 106, 207601 (2011)

47. J. Schwartz, P. Michaelides, C. D. Weis, and T. Schenkel, "In situ optimization of co-implantation and substrate temperature conditions for nitrogen-vacancy center formation in single-crystal diamonds", *New J. Physics* 13, 035022 (2011), Focus Issue on Diamond-Based Photonics and Spintronics
48. V. Lang, C. C. Lo, R. E. George, S. A. Lyon, J. Bokor, T. Schenkel, A. Ardavan, and J. J. L. Morton, "Electrically detected magnetic resonance in a W-band microwave cavity", *Rev. Sci. Instr.* 82, 034704 (2011)
49. A. Persaud, I. Allen, M. R. Dickinson, T. Schenkel, R. Kapadia, K. Takei, A. Javey, "Development of a Compact Neutron Source based on Field Ionization Processes", *J. Vac. Sci. Technol. B* 29, 02B107 (2011)
50. L. J. Bond, J. W. Griffin, K. M. Denslow, R. V. Harris, T. Schenkel, A. Persaud, G. E. Dale, A. Sood, J. T. Rutledge, S. Kovaleski and F. Keel, "Nuclear Source Replacement in Petrochemical Well-Logging", *SEG Expanded Abstracts* 29, 518 (2010); doi:10.1190/1.3513833
51. D. M. Toyli, C. D. Weis, G. D. Fuchs, T. Schenkel, and D. D. Awschalom, "Chip-scale nanofabrication of single spins and spin arrays in diamond", *NanoLetters* 10, 3168 (2010)
52. G. Fuchs, V. Dobrovitski, D. Toyli, J. Heremans, C. Weis, T. Schenkel, and D. D. Awschalom, "Excited-state spin coherence of a single nitrogen-vacancy centre in diamond", *Nature Physics* 6, 668 (2010)
53. C. C. Lo, A. Persaud, S. Dhuey, D. Olynick, F. Borondics, M. C. Martin, Hans. A. Bechtel, J. Bokor, and T. Schenkel, "Device fabrication and transport measurements of FinFets built with 28-SOI wafers towards donor qubits in silicon", *Semicond. Sci. Technol.* 24, 105022 (2009)
54. T. Schenkel, C. C. Lo, C. D. Weis, A. Schuh, A. Persaud, and J. Bokor, "Critical issues in the formation of quantum computer test structures by ion implantation", *Nucl. Instr. Meth. B* 267, 2563 (2009)
55. E. Sideras-Haddad, T. Schenkel, S. Shrivastava, T. Makgato, A. Batra, C. D. Weis, A. Persaud, R. Erasmus, and B. Mwakikunga, "Possible diamond-like nanoscale structures induced by slow highly-charged ions on graphite (HOPG)", *Nucl. Instr. Meth. B* 267, 2774 (2009)
56. C. D. Weis, A. Schuh, A. Batra, A. Persaud, I. W. Rangelow, J. Bokor, C. C. Lo, S. Cabrini, D. Olynick, S. Duhey, and T. Schenkel, "Mapping of ion beam induced current changes in FinFETs", *Nucl. Instr. Meth. B* 267, 1222 (2009)
57. C. D. Weis, A. Schuh, A. Batra, A. Persaud, I. W. Rangelow, J. Bokor, C. C. Lo, S. Cabrini, E. Sideras-Haddad, G. D. Fuchs, R. Hanson, D. D. Awschalom, and T. Schenkel, "Single-atom doping for quantum device development in diamond and silicon", *J. Vac. Sci. Techn. B* 26, 2596 (2008)
58. M. Sarovar, K. C. Young, T. Schenkel, K. B. Whaley, "Quantum non-demolition measurements of single donor spins in semiconductors", *Phys. Rev. B* 78, 245302 (2008)
59. J. J. L. Morton, A. M. Tyryshkin, R. M. Brown, S. Shankar, B. W. Lovett, A. Ardavan, T. Schenkel, E. E. Haller, J. W. Ager, S. A. Lyon, "Solid state quantum memory using the ^{31}P nuclear spin", *Nature* 455, 1085 (2008)
60. G. D. Fuchs, V. V. Dobrovitski, R. Hanson, A. Batra, C. D. Weis, T. Schenkel, and D. D. Awschalom, "Excited state spectroscopy using single spin manipulation in diamond", *Phys. Rev. Lett.* 101, 117601 (2008)
61. W. J. Moberly Chan, D. P. Adams, M. J. Aziz, G. Hobler, T. Schenkel, "Fundamentals of Focused Ion Beam Nanostructural Processing: Below, At, and Above the Surface", *Materials Research Society, MRS Bulletin* 32, 424 (2007)
62. C. C. Lo, J. Bokor, T. Schenkel, J. He, A. M. Tyryshkin, and S.A. Lyon, "Spin-Dependent Scattering off Neutral Antimony Donors in ^{28}Si Field-Effect Transistors", *Appl. Phys. Lett.* 91, 242106 (2007)

63. A. Batra, C. D. Weis, J. Reijonen, A. Persaud, S. Cabrini, C. C. Lo, J. Bokor and T. Schenkel, "Detection of low energy single ion impacts in micron scale transistors at room temperature", *Appl. Phys. Lett.* 91, 193502 (2007)
64. S. J. Robinson, C. L. Perkins, T. C. Shen, J. R. Tucker, T. Schenkel, X. W. Wang, and T. P. Ma, "Low-temperature charge transport in Ga-acceptor nanowires implanted by focused-ion beams", *Appl. Phys. Lett.* 91, 122105 (2007)
65. G. Chai, H. Heinrich, L. Chow, and T. Schenkel, "Electron transport through single carbon nanotubes", *Appl. Phys. Lett.* 91, 103101 (2007)
66. D. Schneider, J. McDonald, B. Zielbauer, D. Ursescu, U. Spillmann, T. Stoelker, T. Kuehl, T. Schenkel, G. Andler, E. Lindroth, and R. Schuch, "Electromagnetically confined plasma target for interaction studies with intense laser fields", *Nucl. Instr. Meth. B* 261, 239 (2007)
67. E. Sideras-Haddad, T. Schenkel, D. B. Rebuli, A. Persaud, S. Shrivastava, D. H. Schneider, B. Mwakikunga, "Electron emission and defect formation in the interaction of slow, highly charged ions with diamond surfaces", *Nucl. Instr. Meth. B* 256, 464 (2007)
68. A. M. Tyryshkin, S. A. Lyon, T. Schenkel, J. Bokor, J. Chu, W. Jantasch, F. Schäffler, J. L. Truitt, S. N. Coppersmith, and M. A. Eriksson, "Electron Spin Coherence in Silicon", *Physica E* 35, 257 (2006)
69. A. Persaud, K. Ivanova, Y. Sarov, Tzv. Ivanov, B. E. Volland, I. W. Rangelow, N. Nikolov, T. Schenkel, V. Djakov, D. W. K. Jenkins, J. Meijer, T. Vogel, "Micromachined piezoresistive proximal probe with integrated bimorph actuator for aligned single ion implantation", *J. Vac. Sci. Technol. B* 24, 3148 (2006)
70. F. R. Bradbury, A. M. Tyryshkin, G. Sabouret, J. Bokor, T. Schenkel, and S. A. Lyon, "Stark Tuning of Donor Electron Spins in Silicon", cond-mat/0603324, *Phys. Rev. Lett.* 97, 176404 (2006)
71. T. Schenkel, A. M. Tyryshkin, R. deSousa, K. B. Whaley, J. Bokor, J. A. Liddle, A. Persaud, J. Shangkuan, I. Chakarov, and S. A. Lyon, "Electrical activation and spin coherence of ultra low dose antimony implants in silicon", cond-mat-0507318, *Appl. Phys. Lett.* 88, 112101 (2006)
72. T. Schenkel, J. A. Liddle, J. Bokor, A. Persaud, S. J. Park, J. Shangkuan, C. C. Lo, S. Kwon, S. A. Lyon, A. M. Tyryshkin, I. W. Rangelow, Y. Sarov, D. H. Schneider, J. Ager, and R. de Sousa, "Strategies for integration of donor electron spin qubits", *Microelectr. Engin.* 83, 1814 (2006)
73. F. I. Allen, A. Persaud, S. J. Park, A. Minor, M. Sakurai, D. H. Schneider, and T. Schenkel, "Transport of Multiply and Highly Charged Ions through Nanoscale Apertures in Silicon Nitride Membranes", *Nucl. Instr. Meth. B* 244, 323 (2006)
74. A. Persaud, J. A. Liddle, J. Bokor, T. Ivanov, I. Rangelow, and T. Schenkel, "Ion implantation with scanning probe alignment", *J. Vac. Sci. Technol. B*, 23, 2798 (2005)
75. A. Persaud, S. J. Park, J. A. Liddle, J. Bokor, I. W. Rangelow, and T. Schenkel, "Integration of scanning probes and ion beams", *NanoLetters* 5, 1087 (2005)
76. A. Persaud, S. J. Park, J. A. Liddle, I. W. Rangelow, J. Bokor, R. Keller, F. I. Allen, D. H. Schneider, T. Schenkel, "Quantum Computer Development with Single Ion Implantation", *Quantum Information Processing, Special Issue: Experimental Aspects of Quantum Computing*, V 3, 233 (2004)
77. S. J. Park, J. A. Liddle, A. Persaud, F. I. Allen, J. Bokor, and T. Schenkel, "Formation of 15 nm scale Coulomb blockade structures in silicon by electron beam lithography with a bi-layer resist process", *J. Vac. Sci. Technol. B* 22, 3115 (2004)
78. T. C. Shen, J. S. Kline, T. Schenkel, S. J. Robinson, S. Y. Ji, C. Yang, R. R. Du, and J. R. Tucker, "Nanoscale electronics based on two-dimensional dopant patterns in silicon", *J. Vac. Sci. Technol. B* 22, 3182 (2004)
79. A. Persaud, F. I. Allen, T. Schenkel, I. W. Rangelow, F. Gicquel, Tzv. Ivanov, K. Ivanova, S. J. Park, J. A. Liddle, and J. Bokor, "Single Ion Implantation with Scanning Probe Alignment", *J. Vac. Sci. Technol. B*, 22, 2992 (2004)

80. J. W. McDonald, A. V. Hamza, M. W. Newman, J.P. Holder, D. H. G. Schneider and T. Schenkel, "Surface charge compensation for a highly charged ion emission microscope", *Ultramicroscopy* 101, 225 (2004)
81. S.-J. Park, A. Persaud, J. A. Liddle, J. Nilsson, J. Bokor, D. H. Schneider, I. Rangelow and T. Schenkel, "Processing Issues in Top-Down Approaches to Quantum Computer Development in Silicon", *Microelectronic Engineering* 73-74, 695 (2004)
82. T. Schenkel, I. W. Rangelow, R. Keller, S. J. Park, J. Nilsson, A. Persaud, V. R. Radmilovic, P. Grabiec, D. H. Schneider, J. A. Liddle, and J. Bokor, "Open questions in electronic sputtering of solids by slow highly charged ions with respect to applications in single ion implantation", *Nucl. Instr. Meth. B* 219-220, 200 (2004)
83. P. Grabiec, J. Radojewski, M. Zaborowski, K. Domanski, T. Schenkel, and I. W. Rangelow, "Batch fabricated scanning near field optical microscope/atomic force microscopy microprobe integrated with piezoresistive cantilever beam with highly reproducible focused ion beam micromachined aperture", *J. Vac. Sci. Tech. B* 22, 16 (2004)
84. T. Schenkel, V. Radmilovic, E. A. Stach, S.-J. Park and A. Persaud, "Formation of a Few Nanometer Wide Holes in Membranes with a Dual Beam Focused Ion Beam System", *J. Vac. Sci. Technol. B* 21, 2720 (2003)
85. R. Pedrak, Tzv. Ivanov, K. Ivanova, T. Gotszalk, N. Abedinov, and I. W. Rangelow, K. Edinger, E. Tomerov, T. Schenkel, and P. Hudek, "Micromachined atomic force microscopy sensor with integrated piezoresistive sensor and thermal bimorph actuator for high-speed tapping-mode atomic force microscopy phase-imaging in higher eigenmodes", *J. Vac. Sci. Technol. B* 21, 3102 (2003)
86. T. Schenkel, and K. J. Wu, "Probing nano-environments of peptide molecules on solid surfaces by highly charged ion secondary ion mass spectrometry", *Internatl. J. Mass Spec.* 229, 47 (2003)
87. A. V. Hamza, M. W. Neumann, P. A. Thielen, H. W. H. Lee, T. Schenkel, J. W. McDonald and D. H. Schneider, "Exciton Dispersion in Silicon Nanostructures Formed by Intense, Ultrafast Electronic Excitation", *Applied Physics A* 76, 313 (2003)
88. T. Schenkel, A. Persaud, S. J. Park, J. Meijer, J. R. Kingsley, J. W. McDonald, J. P. Holder, J. Bokor and D. H. Schneider, "Single Ion Implantation for Solid State Quantum Computer Development", *J. Vac. Sci. Technol. B* 20, 2819 (2002)
89. T. Schenkel, J. Reijonen, A. Persaud, A. Kraemer, K. N. Leung, R. A. Gough, W. A. Barletta and E. A. Blakely, "A focused heavy-ion beam system for high-LET studies of cells", *Radiation Res.* 158, 368 (2002)
90. R. Thomae, R. Gough, R. Keller, K. N. Leung, T. Schenkel, A. Aleksandrov, M. P. Stockli, R. Welton, "Beam measurements on the H⁻ source and low energy beam transport system for the Spallation Neutron Source system for the Spallation Neutron Source", *Rev. Sci. Instr.* 73, 2016 (2002)
91. V. K. Liechtenstein, T. M. Ivkova, E. D. Olshanski, R. Repnow, J. Levin, R. Hellborg, P. Persson, T. Schenkel, "Advances in targetry with thin diamond-like carbon foils", *Nucl. Instr. Meth. A* 480, 185 (2002)
92. A. Machicoane, T. Schenkel, T. R. Niedermayr, M. W. Newmann, A. V. Hamza, A. V. Barnes, J. W. McDonald, J. A. Tanis, and D. H. Schneider, "Internal dielectronic excitation in highly charged ions colliding with surfaces", *Phys. Rev. A* 65, 042903 (2002)
93. T. Schenkel, A. Persaud, A. Kraemer, J. W. McDonald, J. P. Holder, A. V. Hamza, and D. H. Schneider, "Extraction of Highly Charged Ions from the Electron Beam Ion Trap at LBNL for Applications in Surface Analysis and Materials Science", *Rev. Sci. Instr.* 73, 663 (2002)
94. T. Schenkel, J. W. Staples, R. W. Thomae, J. Reijonen, R. A. Gough, K. N. Leung, and R. Keller, "Plasma ignition schemes for the SNS radio-frequency driven H⁻ source", *Rev. Sci. Instr.* 73, 1017 (2002)
95. R. F. Welton, M. P. Stockli, Y. Yang, M. Janney, R. Keller, R. W. Thomae, T. Schenkel, S. Shukla, "Ion source antenna development for the spallation neutron source", *Rev. Sci. Instr.* 73, 1008 (2002)

96. R. Keller, D. Cheng, R. DiGennaro, R. A. Gough, J. Greer, K. N. Leung, A. Ratti, J. Reijonen, R. W. Thomae, T. Schenkel, J. W. Staples, and R. Yord, "Ion source and low-energy beam transport issues with the front-end system for the spallation neutron source", *Rev. Sci. Instr.* 73, 914 (2002)
97. T. Schenkel, J. Meijer, A. Persaud, J. W. McDonald, J. P. Holder, and D. H. Schneider, "Single ion implantation for solid state quantum computer development", *Proceedings of SPIE V 4656*, 10 (2002)
98. A. V. Hamza, M. W. Newman, P. A. Thielen, H. W. Lee, T. Schenkel, J. W. McDonald, D. H. Schneider, "Light-emitting nanostructures formed by intense, ultrafast electronic excitation in silicon (100)", *Appl. Phys. Lett.* 81, 2973 (2001)
99. T. Schenkel, A. V. Hamza, M. W. Newman, G. A. Machicoane, J. W. McDonald, D. H. Schneider, K. J. Wu, and V. Kh. Liechtenstein, "Transport of hollow atoms through thin dielectric foils", *Physica Scripta T92*, 208 (2001)
100. T. Schenkel, A. Krämer, K. N. Leung, A. V. Hamza, J. W. McDonald, and D. H. Schneider, "Highly Charged Ion Secondary Ion Mass Spectrometry (HCI-SIMS): Towards metrology solutions for sub-100 nm Technology nodes", *Proceedings of SPIE V 4468*, 35 (2001)
101. J. W. McDonald, T. Schenkel, M. W. Newman, G. Overturf, H. Gregg, T. R. Niedermayr, A. V. Barnes, D. H. G. Schneider, I. A. Mowat, "Effects of Radiation on 1,3,5-Triamino-2,4,6-Trinitrobenzene (TATB) Studied by Time-of-Flight Secondary Ion Mass Spectrometry", *J. Energetic Materials V 19/2-3*, 101 (2001)
102. B. L. Doyle, D. S. Walsh, S. N. Renfrow, G. Vizkelethy, T. Schenkel, and A. V. Hamza, "Nuclear Emission Microscopies", *Nucl. Instr. Meth. B 181*, 199 (2001)
103. T. Schlathoelter, M. W. Newman, T. R. Niedermayr, G. A. Machicoane, J. W. McDonald, T. Schenkel, R. Hoekstra, and A. V. Hamza, "Hydrogenated carbon clusters produced by highly charged ion impact on solid C₈₄", *European Physical Journal D 12*, 323 (2000)
104. T. Schenkel, T. Schlathoelter, M. W. Newman, G. A. Machiocane, J. W. McDonald, and A. V. Hamza, "Influence of hydrogen on the stability of positively charged silicon dioxide clusters", *Journal of Chemical Physics 113*, 2419 (2000)
105. A. V. Hamza, A. V. Barnes, E. Magee, M. Newman, T. Schenkel, J. W. McDonald, and D. H. Schneider, "Highly charged ion based time-of-flight emission microscope", *Rev. Sci. Instr.* 71, 2077 (2000)
106. T. Schenkel, M. W. Newman, T. R. Niedermayr, G. A. Machicoane, J. W. McDonald, A. V. Barnes, A. V. Hamza, J. C. Banks, B. L. Doyle, K. J. Wu, "Electronic sputtering of solids by slow, highly charged ions: Fundamentals and Applications", *Nucl. Instr. and Methods in Phys. Research B 161-163*, 65 (2000)
107. T. Schenkel, A. V. Barnes, T. R. Niedermayr, M. Hattass, M. W. Newman, G. A. Machicoane, J. W. McDonald, A. V. Hamza, and D. H. Schneider, "Deposition of potential energy in solids by slow, highly charged ions", *Phys. Rev. Lett.* 83, 4273 (1999)
108. T. Schenkel, K. J. Wu, H. Li, M. W. Newman, A. V. Barnes, and A. V. Hamza, "Analysis of sub-micron Cu-Ta-SiO₂ structures by highly charged ion SIMS", *J. Vac. Sci. Technol. B 17*, 2331 (1999)
109. M. Hattass, T. Schenkel, A. V. Hamza, A. V. Barnes, M. W. Newman, J. W. McDonald, T. R. Niedermayr, G. A. Machicoane, and D. H. Schneider, "Charge Equilibration time of slow, highly charged ions in solids", *Phys. Rev. Lett.* 82, 4795 (1999)
110. T. Schenkel, A. V. Hamza, A. V. Barnes, M. W. Newman, T., Niedermayr, M. Hattass, J. W. McDonald, D. H. Schneider, K. J. Wu, R. W. Odom, "Surface analysis by highly charged ion based secondary ion mass spectrometry", *Phys. Scripta T80*, 73 (1999)
111. A. V. Hamza, T. Schenkel, A. V. Barnes, "Dependence of cluster ion emission from uranium oxide surfaces on the charge state of the incident slow highly charged ion", *Europ. Phys. J. D 6*, 83 (1999)
112. A. V. Hamza, T. Schenkel, A. V. Barnes, D. H. Schneider, "Secondary ion coincidence in highly charged ion based secondary ion mass spectrometry for process characterization", *J. Vac. Sci. Technol. A 17*, 303 (1999)

113. T. Schenkel, A. V. Hamza, A. V. Barnes, J. C. Banks, B. L. Doyle, D. H. Schneider: "Ablation of GaAs by intense, ultrafast electronic excitation from highly charged ions", *Phys. Rev. Lett.* 81, 2590 (1998)
114. T. Schenkel, A. V. Barnes, A. V. Hamza, J. C. Banks, B. L. Doyle, D. H. Schneider: "Synergy of electronic excitation and elastic collision spikes in sputtering of heavy metal oxides", *Phys. Rev. Lett.* 80, 4325 (1998)
115. T. Schenkel, M. Schneider, M. Hattass, M. W. Newman, A. V. Barnes, A. V. Hamza, D. H. Schneider, R. L. Cicero, C. E. D. Chidsey, "Electronic desorption of alkyl monolayers from silicon by very highly charged ions", *J. Vac. Sci. Technol. B* 16, 3298 (1998)
116. T. Schenkel, A. V. Hamza, A. V. Barnes, D. H. Schneider: "Cluster ion emission in the interaction of slow highly charged ions with surfaces", *Europ. Phys. Journal D* 1, 297 (1998)
117. T. Schenkel, A. V. Hamza, A. V. Barnes, D. H. Schneider, D. S. Walsh, B. L. Doyle: "Analysis of B-SiO₂ films by highly charged ion based time-of-flight secondary ion mass spectrometry, standard secondary ion mass spectrometry and elastic recoil detection", *J. Vac. Sci. Technol. A* 16, 1384 (1998)
118. T. Schenkel, M. A. Briere, A. V. Barnes, A. Hamza, K. Bethge, H. Schmidt-Böcking, D. H. Schneider: "Charge State Dependent Energy Loss of Slow Heavy Ions in Solids", *Phys. Rev. Lett.* 79, 2030 (1997)
119. T. Schenkel, M. A. Briere, H. Schmidt-Böcking, K. Bethge, D. H. Schneider, "Electronic Sputtering of Thin Conductors by Neutralization of Slow Highly Charged Ions", *Phys. Rev. Lett.* 78, 2481 (1997)
120. T. Schenkel, A. Hamza, A. V. Barnes, D. H. Schneider: "Energy loss of slow, highly charged ions in solids", *Phys. Rev. A* 56, 1701R (1997)
121. T. Schenkel, A. V. Barnes, M. A. Briere, A. Hamza, A. Schach von Wittenau, D. Schneider: "Emission of Secondary Particles from Metals and Insulators at Impact of Slow Highly Charged Ions", *Nucl. Instr. and Meth. B* 125, 153 (1997)
122. T. Schenkel, M. A. Briere, H. Schmidt-Böcking, K. Bethge, D. Schneider: "Electronic Sputtering and Desorption Effects in TOF-SIMS Studies Using Slow Highly Charged Ions like Au⁶⁹⁺", *Materials Science Forum*, Vol. 248-249, 413 (1997)
123. M. A. Briere, T. Schenkel, P. Bauer, A. Arnau, D. Schneider: "Non-equilibrium Energy Loss for Very Highly Charged Ions in Insulators", *Physica Scripta T73*, 324 (1997)
124. M. A. Briere, T. Schenkel, D. Schneider: "Super TOF Secondary Ion Mass Spectroscopy Using Very Highly Charged Primary Ions up to Th⁷⁰⁺", *Proceedings of SIMS X*, (Wiley, New York, 1996)
125. T. Schenkel, H. Hebert, J. Meyer, R. Michelmann, K. Bethge: "Channeling Charged Particle Activation Analysis of light Impurities in Semiconductors", *Nucl. Instr. Meth. B* 89, 79 (1994)
126. H. Hebert, T. Schenkel, J. Meyer, R. Michelmann, K. Bethge: "Localization of Oxygen in Gallium Arsenide by Channeling-Nuclear Reaction Analysis", *Nucl. Instr. Meth. B* 89, 95 (1994)

Selected reports and conference proceedings

1. K. B. Vinayakumar, A. Persaud, P. A. Seidl, Q. Ji, W. L. Waldron, T. Schenkel, S. Ardanuc, A. Lal, "Waferscale Electrostatic Quadrupole Array for Multiple Ion Beam Manipulation", *IEEE, MEMS 2018*, Belfast, Northern Ireland, UK, 21-25 January 2018, <https://ieeexplore.ieee.org/document/8346681/>
2. P. A. Seidl, Q. Ji, A. Persaud, E. Feinberg, B. Ludewigt, M. Silverman, A. Sulyman, W. L. Waldron, T. Schenkel, J. J. Barnard, A. Friedman, D. P. Grote, E. P. Gilson, I. D. Kaganovich, A. Stepanov, F. Treffert, M. Zimmer, *Recent Experiments At Ndcx-II: Irradiation Of Materials Using Short, Intense Ion Beams*, arXiv:1610.05253
3. Q. Ji, D. Grote, J. Staples, T. Schenkel, A. Lambert, D. Li, "Beam dynamics studies of H⁻ beam chopping in a LEBT for Project X", *Proceedings of the 52nd International Committee*

for Future Accelerators "Advanced Beam Dynamics Workshop on High-Intensity and High-Brightness Hadron Beams", Beijing, Sept. 2012, THO3B04

4. D. Li, M. Hoff, Q. Ji, A. Lambert, T. Schenkel, J. Staples, S. Virostek, S. Nagaitsev, G. Romanov, L. Prost, A. Shemyakin, "Progress of the front-end system development for Project X at LBNL", Proceedings of the International Particle Accelerator Conference, New Orleans, May 2012
5. "Evaluation of Non-Nuclear Techniques for Well Logging: Technology Evaluation", L. J. Bond, R. V. Harris, K. M. Denslow, T. L. Moran, J. W. Griffin, D. M. Sheen, G. E. Dale and T. Schenkel, Report to DOE, PNNL-19867, 2010
6. J. Staples, T. Schenkel, "High-efficiency matching network for RF-driven ion sources", Proceedings of the 2001 Particle Accelerator Conference, IEEE 3, 2108 (2001)
7. "Novel Approaches to Surface Analysis and Materials Engineering Using Highly Charged Ions", A. Hamza, T. Schenkel, A. Barnes and D. Schneider, LLNL, UCRL-ID-137449, 2000