RYAN CHRISTOPHER TOONEN, PH.D.

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EDUCATION

Ph.D. Electrical Engineering September 2007
University of Wisconsin–Madison
Dissertation Topic: The Transport Properties of a Three-Terminal Quantum Dot
Primary Area of Study: Applied Physics / Solid State Device Physics
Secondary Area of Study: Electromagnetic Fields and Waves
Minor: Physics

M.A. Physics May 2007
University of Wisconsin–Madison
Course-Option Degree with Emphasis on Condensed Matter Physics
Passed Qualifier Examination at the Ph.D. Level

M.S. Electrical Engineering August 2005
University of Wisconsin–Madison
Course-Option Degree with Emphasis on Solid State Device Physics

B.S. Electrical Engineering August 2002
University of Wisconsin–Madison
Specialization: Electronic Devices, Microelectronics and Integrated Circuits

B.S. Applied Mathematics, Engineering & Physics May 1999
University of Wisconsin–Madison
Thesis Topic: Plasma Atomic-Emission Spectroscopy

SCIENCE AND ENGINEERING POSITIONS

Assistant Professor August 2013–Present
University of Akron
Akron, OH

- Served as the principle investigator of the Zip Electronic Nanotechnologies Laboratory (ZEN-Lab), which is focused on investigating microwave-frequency properties of nanoelectronic devices and sensor applications of nanostructured materials.
- Served as the advisor for five graduate students (with one Ph.D. granted and one in progress)
- Served as independent studies advisor for three undergraduate students.
- Developed original graduate and undergraduate courses pertaining to the subjects of *Nanoelectronics*, *Microwave Electronics*, and *Electronic Properties of Materials, Devices and Nanostructures*.
- Taught core graduate coursework in *Optical Electronics and Photonic Devices*.
- Taught core undergraduate coursework in *Physical Electronics* and *Electronic Design*.
- Served as a Senior Design Project advisor.
- Served as a mentor for outreach programs including: the UA Women in Engineering Program's Summer Experience in Engineering (See UA) Summer Camp and the National Center for Education and Research on Corrosion and Materials Performance High School Summer Corrosion Research Academy (NCERCAMP CRA)
- Served as chair of the Non-Curricular Activities Committee.
- Served on College of Engineering Dean Search Committee.
- Served on ECE Graduate Admission and Retention, Promotion and Tenure Policy Committees.
- Received competitive, external funding from the National Science Foundation.

Research Electrical Engineer (Promoted from Postdoctoral Research Associate)
May 2008–August 2013
U.S. Army Research Laboratory
Aberdeen Proving Ground, MD

- Served as the primary principle investigator on three ARL-sponsored basic research efforts focused on: a comparative study of the electrical properties of ferroic materials nanostructured in one, two, and three dimensions; the fabrication of nano-structured varactors for enabling enhanced mobile communication in harsh environments; and an integrated materials solution for enabling the wireless detection of micro-defects in aging and battle-worn aircraft.
- Served as a co-principle-investigator on two ARL-sponsored basic research efforts focused on: carbon nanotube / indium tin oxide hybrid thin films for implementation in transparent electronics; and nano-templated oxide arrays for universal, shape-compliant sensor architectures.
- Served as a major technical contributor on two ARL-sponsored basic research efforts focused on: reducing power loss in barium strontium titanate varactors by mitigating oxygen vacancies with ultra-violet assisted processing; and investigating complex oxide based metamaterials for tera-Hertz signal processing electronics.
- Managed all technical activities of an ARL / NASA collaboration sponsored by the U.S. Special Operations Command. Project focused on the development novel thin film technology for agile communication applications.
- Managed applied research activities of an ARL / industry-partner collaboration sponsored by the MIT Institute for Soldier Nanotechnologies (ISN). Project focused on the application of carbon nanotube based materials for the realization of transparent antennas.
- Performed integrated materials research involving a multidisciplinary approach with a focus on electronic materials, solid state devices, nanotechnology, materials integration and process science, and electrical (DC through microwave) characterization.
- Researched and developed novel applications of complex oxide, multiferroic, semiconductor, and metal thin films grown via Physical Vapor Deposition (PVD), Metal Organic Spin Deposition (MOSD), and Metal Organic Chemical Vapor Deposition (MOCVD).
- Processed micro- and nano-electronic devices using RF / DC sputtering, e-beam evaporation, wet and dry etching, and lithography techniques (including: optical, deep UV, and electron beam methods).
- Designed, fabricated, characterized, and performed experimental and modeling analysis of microwave test structures based on complex oxide, multiferroic, semiconductor, and metal thin films.
- Characterized novel materials and test structures at cryogenic and military temperature ranges in the presence of externally applied electric and magnetic fields.
- Mentored several ARL interns including: two Ph.D. candidates (from the University of Connecticut and the University of Michigan), two undergraduates (from the University of the Virgin Islands), and two high school students (Science and Engineering Apprenticeship Program).

Postdoctoral Research Associate September 2007–May 2008
National Institute of Standards and Technology
Boulder, CO

- Supported by the University of Colorado's Professional Research Experience Program.
- Researched and developed novel applications of superconductors and Josephson junctions based on sputtered $MoSi_2$ / SiO_2 thin film heterostructures.
- Designed and constructed analog, digital and RF / microwave electronics for biasing and interfacing with superconducting integrated circuits.
- Responsible for analyzing nonlinear aspects of the Johnson noise thermometry system.
- Supported team efforts which led to an electronic re-definition of the Boltzmann constant (acknowledgment in *Metrologia* **48**, 142 (2011)).

Graduate Student Research Assistant September 2003–September 2007
Laboratory for Molecular-Scale Engineering
University of Wisconsin–Madison

- Supported by funding from National Science Foundation.
- Researched novel applications of $Al_{x-1}Ga_xAs$ / GaAs heterostructures grown via Molecular Beam Epitaxy (MBE).
- Developed original experiments for quantum computing hardware research.
- Designed, fabricated, and characterized experimental cryogenic mesoscopic devices.
- Created original RF / microwave (X- and Ku-band) measurement instrumentation.
- Designed and fabricated custom machined parts and signal conditioning circuits for interfacing room temperature electronics with sub-Kelvin cryostats.
- Mentored undergraduate students participating in research projects for independent studies credit.

Visiting Researcher June 2003–August 2003
Center for NanoScience
Ludwig-Maximilians-Universität (Munich, Bavaria, Germany)

- Designed and fabricated gate-defined quantum dots from $Al_{x-1}Ga_xAs$ / GaAs heterostructures.
- Developed proficiency using optical and Scanning Electron Microscope (SEM) lithography.

Integrated Circuit Design Engineer (Promoted from IC Engineering Intern) June 2001–Dec. 2002
Zentrum Mikroelektronik Dresden AG (ZMD Reining, Inc.)
Madison, Wisconsin

- Promoted from position of IC Engineering Intern (August 2002).
- Worked with a small team to develop sensor-interface Application Specific ICs (ASICs) with high-yield manufacturability.
- Designed mixed-signal IC blocks including: band-gap references, bias generators, low-power operational amplifiers, and analog multiplexers.
- Developed proficiency using Cadence Software Systems.

Technical Publications Engineer November 1999–May 2000
GE Medical Systems (via Ad Interim staffing agency)
New Berlin, Wisconsin

- Temporary contracted position via Ad Interim staffing agency.
- Worked with a small team to produce Computed Tomography (CT) system field manuals.

Student Hourly Researcher May 1996–July 1999
Pegasus Toroidal Experiment
University of Wisconsin–Madison

- Researched plasma atomic-emission spectroscopy for the Pegasus Toroidal Experiment.
- Designed and constructed ultra high vacuum systems.
- Designed and constructed instrumentation electronics.
- Implemented electro-optical systems.
- Programmed data analysis code.

GRANTS, AWARDS, AND NOMINATIONS

Competitive External Funding Available to Universities

FY2016–'19	NSF Collaborative Research Award for Multiferroic Antennas (co-P.I.): $306k (to UA); $130k (Toonen allocation)

Awards, Nominations, and Other Grants

FY2020	Concurrent Technologies Corp./DoD (Congressional Earmark Funding): $56k
FY2018	2018 NASA Glenn Research Center Faculty Fellowship Program Award, $14k
2018	Cash Award from U. S. Army Research Laboratory for Superior Accomplishment, $450

FY2018	NSF I-Corps Sites Program Award for Sports Spectator Beacon, $2.5k
FY2017	2017 NASA Glenn Research Center Faculty Fellowship Program Award, $14k
FY2017	2017 Firestone Research Initiative Fellowship Award: $10k
FY2014	NSF I-Corps Sites Program Award for Wireless Corrosivity Sensor, $2.5k
2013	2012 Army Research and Development Achievement (RDA) Award for Outstanding Technical Achievement
FY2012–'13	Directors Research Initiative Grant for Physics of Nano-Oxides (Lead P.I.): $500k
FY2011	WMRD Innovation Grant for Nanostructured Varactors (Lead P.I.): $250k
FY2010–'11	Directors Research Initiative Grant for Novel Transponders (Lead P.I.): $240k
FY2010–'11	Directors Research Initiative Grant for Oxide Nanorod Growth (co-P.I.): $240k
FY2010	Directors Research Initiative Grant for Transparent Conductors (co-P.I.): $120k
2009	Top Three FY08 ARL DRI Award (Major Technical Contributor on Project)
2012	Individual Nomination for ARL Science Award by Branch Chief, Dr. J.P. Singh
2012	Team Nomination for Army R&D Award (competed at directorate level)
2011	Individual Nomination for ARL Science Award by Branch Chief, Dr. J.P. Singh

MEMBERSHIPS & ACTIVITIES

Institute for Electrical and Electronics Engineers Student Member (2006–2007), Member (2008–pres.) Active Member of the IEEE Technical Committee MTT-13: Microwave Control Materials and Devices (http://tc13.mtt-tcc.org/), Organizer of MTT-13 Student Design Contest (2017)

American Physical Society Student Member (2004–2007), Member (2008, 2012–present)

SPIE: *the International Society for Optics and Photonics* Member (2018–present)

American Society for Engineering Education Member (2017–2018)

Madison Committee on Foreign Relations Member (2007)

Volunteer Work
Monitoring Volunteer for Eastern Box Turtle Telemetry Program at the Anita C. Leight Estuary Ctr (2010)

PUBLICATION LIST

Journal Papers

[1] Michael Gasper, Ryan Toonen, Nicholas C. Varaljay, Robert R. Romanofsky, and Félix A. Miranda "Thermoelectric Graphene Nano-Constrictions as Detectors of Microwave Signals," *IEEE Transactions on Nanotechnology*, (accepted for publication on August 11, 2019).

[2] Nitin Parsa, Michael R. Gasper, Ryan C. Toonen, Mathew P. Ivill and Samuel G. Hirsch, "Microwave Power Detection Using Ferroelectric Thin Film Varactors," *Integrated Ferroelectrics*, **192(1)**, 1-9, (2018). DOI: 10.1080/10584587.2018.1521656.

[3] Nitin Parsa, Michael R. Gasper, Blake C. Amacher, and Ryan C. Toonen. "Millimeter-Wave Faraday Rotation from Ferromagnetic Nanowires," *IEEE Transactions on Nanotechnology*, (early online access, 2018), DOI: 10.1109/TNANO.2018.2874956.

[4] Nitin Parsa and Ryan C. Toonen, "Ferromagnetic Nanowires for Nonreciprocal Millimeter-Wave Applications," *IEEE Nanotechnology Magazine*, **12(4)**, 28-35 (2018), DOI: 10.1109/MNANO.2018.2869234.

[5] N. Parsa, R. C. Toonen, F. Peng, and M. Cakmak, "Voltage-Controlled, Nonreciprocal Millimeter-Wave Propagation From Magnetoelastic Membranes Infused With Aligned Nickel Microparticles," *IEEE Transactions on Magnetics*, **65(9)**, 3278-3284 (2017), DOI: 10.1109/TMAG.2018.2866156.

[6] M. R. Gasper, R. C. Toonen, S. G. Hirsch, M. P. Ivill, H. Richter, and R. Sivarajan, "Radio Frequency Carbon Nanotube Thin-Film Bolometer," *IEEE Transactions on Microwave Theory and Techniques*, **65(9)**, 3278-3284 (2017). DOI:10.1109/TMTT.2017.2677444.

[7] R. R. Romanofsky and R. C. Toonen, "Past, present and future of ferroelectric and multiferroic thin films for array antennas," *Multidim. Syst. Sign. Process*. **29(2)**, 475-487 (2018). First online: 26 Sept. 2016. DOI:10.1007/s11045-016-0449-5.

[8] Richard X. Fu, Ryan C. Toonen, Samuel G. Hirsch, Mathew P. Ivill, Melanie W. Cole, and Kenneth E. Strawhecker, "Fabrication of self-aligned, nanoscale, complex oxide varactors," *J. Micro/Nanolith. MEMS MOEMS.* **14(1)**, 013508 (2015). DOI: 10.1117/1.JMM.14.1.013508.

[9] Ryan C. Toonen and M. W. Cole, "Third-order electric-field-induced dipolar resonances from patterned barium-strontium-titanate thin-films," *Appl. Phys. Lett.* **100**, 222908 (2012).

[10] M. W. Cole, R. C. Toonen, M. Ivill, S. G. Hirsch, E. Ngo, and C. Hubbard, "Ultraviolet assisted processing: A unique approach to mitigate oxygen vacancies and attain low loss highly tunable Ba0.60Sr0.40TiO3 thin films," *J. Appl. Phys.* **110**, 124105 (2011).

[11] M. W. Cole, R. C. Toonen, S. G. Hirsch, M. Ivill, E. Ngo, C. Hubbard, S. Ramanathan, and A. Podpirka, "An Elegant Post-Growth Process Science Protocol to Improve the Material Properties of Complex Oxide Thin Films for Tunable Device Applications," *Integrated Ferroelectrics* **126**, 34 (2011).

[12] R. X. Fu, R. C. Toonen, E. H. Ngo, M. W. Cole, S. G. Hirsch, M. P. Ivill, and C. W. Hubbard, "Pb(Zr,Ti)O3 (PZT) Thin Film Sensors for Fully-Integrated, Passive Telemetric Transponders," *Sensors & Transducers J.* **11**, 34 (2011).

[13] M. W. Cole, R. C. Toonen, S. G. Hirsch, E. Ngo, R. R. Romanofsky, F. Van Keuls, C. Hubbard, M. Ivill, and D. Demaree, "Ba0.60Sr0.40TiO3 Thin Films for Microwave Phase Shifter Devices: The Influence of Crystallization Temperature on the Electric Field Dependent Phase Shift Response," *Integr. Ferroelectrics: Int. J.* **111**, 1, 68 (2009).

[14] C. V. Weiss, M. B. Okatan, S. P. Alpay, M. W. Cole, E. Ngo, and R. C. Toonen, "Compositionally Graded Ferroelectric Multilayers for Frequency Agile Tunable Devices," *J. Mater. Sci.* **44**, 5364 (2009).

[15] C. V. Weiss, M. W. Cole, S. P. Alpay, E. Ngo, R. C. Toonen, S. G. Hirsch, J. D. Demaree, and C. Hubbard, "Dielectric Response of Variable Thickness Ba0.6Sr0.4TiO3 Films for Property-Specific Device Applications," *Integrated Ferroelectrics* **100**, 36 (2008).

[16] R. C. Toonen and S. P. Benz, "Nonlinear behavior of electronic components characterized with precision multitones from a Josephson arbitrary waveform synthesizer," *IEEE Trans. Appl. Supercond.* **19**, 715 (2009).

[17] R. C. Toonen, C. C. Haselby and R. H. Blick, "An Ultra-Wideband Cross-Correlation Radiometer for Mesoscopic Experiments," *IEEE Trans. Instrum. Meas.* **57**, 2874 (2008).

[18] H. Qin, N. Shaji, N. E. Merrill, H. S. Kim, R. C. Toonen, R. H. Blick, M. M. Roberts, D. E. Savage, M. G. Lagally, G. Celler, "Formation of microtubes from strained SiGe/Si heterostructures," *New J. Phys.* **7**, 241 (2005).

[19] M. Prada, R. C. Toonen, R. H. Blick, and P. Harrison, "Electron-Nuclear Spin Interaction in Triple Quantum Dots Systems," *Nanotechnology* **16(5)**, S266 (2005).

Conference Proceedings

[1] Michael Gasper, Ryan Toonen, Nicholas C. Varaljay, Robert R. Romanofsky, and Félix A. Miranda "Nanoscale Fabrication of Microwave Detectors from Commercially-Available CVD-Grown Monolayer Graphene," *2018 IEEE 13th Nanotechnology Materials and Devices Conference (NMDC)*, Portland, OR, 1-4 (2018). DOI: 10.1109/NMDC.2018.8605826.

[2] Nitin Parsa, Michael R. Gasper,Venkata Sai Praneeth Karempudi, Ryan C. Toonen, "Magnetic Field Dependence of Non-Reciprocal Propagation of Millimeter-Waves Through Arrays of Ferromagnetic Nanowires," *2018 IEEE 13th Nanotechnology Materials and Devices Conference (NMDC)*, Portland, OR, 1-4 (2018). DOI: 10.1109/NMDC.2018.8605890.

[3] (Invited Conference Paper) Ryan C. Toonen, Michael R. Gasper, Nitin Parsa, Venkata Sai Praneeth Karempudi, Blake Amacher, Colleen E. Treacy, Ramesh Sivarajan, Nicholas C. Varaljay, Robert R. Romanofsky, Félix A. Miranda, "Microwave bolometers based on carbon nanotube thin films and CVD-grown graphene," *Proc. SPIE 10656, Image Sensing Technologies: Materials, Devices, Systems, and Applications V*, 106560G (14 May 2018). DOI: 10.1117/12.2305107.

[4] Nitin Parsa, Nathaniel Hawk, Michael Gasper, and Ryan Toonen, "Millimeter-Wave Faraday Rotation from Ferromagnetic Nanowires," *2017 IEEE 17th International Conference on Nanotechnology (IEEE-NANO)*, Pittsburgh, PA, 749-751 (2017). DOI: 10.1109/NANO.2017.8117375.

[5] Nathaniel A. Hawk, Jutta Luettmer-Strathmann, and Ryan C. Toonen, "Simulations of Electromagnetic Propagation through Nanowire Arrays of Varying Geometric Arrangements," *2017 IEEE 17th International Conference on Nanotechnology (IEEE-NANO)*, Pittsburgh, PA, 603-606 (2017). DOI: 10.1109/NANO.2017.8117421.

[6] Michael R. Gasper, Nitin Parsa, and Ryan C. Toonen, "Microwave Power Detection with Gated Graphene," *2017 IEEE 17th International Conference on Nanotechnology (IEEE-NANO)*, Pittsburgh, PA, 118-120 (2017). DOI: 10.1109/NANO.2017.8117376.

[7] N. Parsa, N. Hawk, M. R. Gasper, R. C. Toonen and Fang Peng, "Apparatus for characterizing millimeter-wave propagation through magnetoelastic multiferroic materials," 2017 *Cognitive Communications for Aerospace Applications Workshop (CCAA)*, Cleveland, OH, 1-4 (2017). DOI: 10.1109/CCAAW.2017.8001875.

[8] S. M. Sakhamuri, S. P. K. Gummadi, R. C. Toonen and O. R. Camacho, "Corrosivity sensor based on metallic nanowires," *2016 IEEE SENSORS*, Orlando, FL, (2016). DOI: 10.1109/ICSENS.2016.7808857.

[9] Nitin Parsa, Michael Gasper, Ryan Toonen, Mathew Ivill and Samuel Hirsch, "Microwave Power Detection from an Anharmonic Dipolar Resonance," in *Proceedings of the 2016 IEEE MTT-S International Microwave Symposium*, San Francisco, CA (2016). DOI: 10.1109/MWSYM.2016.7540114.

[10] Michael Gasper, Ryan Toonen, Samuel Hirsch, Mathew Ivill, Henning Richter, and Ramesh Sivarajan, "Uncooled Radio Frequency Bolometer based on Carbon Nanotube Thin Films," in *Proceedings of the 2016 IEEE MTT-S International Microwave Symposium*, San Francisco, CA, (2016). DOI: 10.1109/MWSYM.2016.7540291.

[11] R. C. Toonen, E. H. Ngo, M. W. Cole, S. G. Hirsch, M. P. Ivill, C. W. Hubbard, and R. X. Fu, "Tunable Split-Ring Resonator Devices for Compact, Frequency-Selective, Back-Scatter Transponders," *27th Army Science Conf. Proc.* NP-12 (December 2010).

[12] M. W. Cole, E. Ngo, A. Podpirka, S. Ramanathan, M. Ivill, R. C. Toonen, S. G. Hirsch, and C. Hubbard, "Improved Material Properties of Complex Oxide Thin Films for Application in Phased Array Antennas," *ASCE Conference Proceedings* **366**, 328 (2010).

[13] R. C. Toonen, et al., "Measurements of Correlated Conductances and Noise Fluctuations from 3-Lead Quantum Dots," *AIP Conference Proceedings* **780**, 472 (2005).

Awarded Patents

[1] Toonen, Ryan C., Mathew P. Ivill, and Melanie W. Cole. 2014. "Pyroelectric Device." U. S. Patent No. 10,043,964 B2. 7 August 2018.

[2] Toonen, Ryan C., Mathew P. Ivill, and Melanie W. Cole. 2014. "Nano Structured Paraelectric or Superparaelectric Varactors for Agile Electronic Systems." U. S. Patent No. 9,666,729. 30 May 2017.

[3] Toonen, Ryan Christopher. 2013. "Optically Transparent, Radio Frequency, Planar Transmission Lines." U. S. Patent No. 9,356,331. 31 May 2016.

ARL Reports

[1] Samuel G. Hirsch, Ryan C. Toonen, Eric H. Ngo, Mathew P. Ivill, and M. W. Cole, "A Study on Reactive Ion Etching of Barium Strontium Titanate Films Using Mixtures of Argon (Ar), Carbon Tetrafluoride (CF_4), and Sulfur Hexafluoride (SF_6)," ARL-TR-6979 (July 2014).

[2] Richard X. Fu, Ryan C. Toonen, Samuel G. Hirsch, Mathew P. Ivill, and Melanie W. Cole, "Films, Needles, and Particles: A Comparative Study on the Ferroic Properties of Complex Oxides Nano-Structured in One, Two, and Three Dimensions (Final Report)," ARL-MR-0868 (March 2014).

[3] Ryan C. Toonen, Julia B. Doggett, S. Gary Hirsch, Mathew P. Ivill, Eric H. Ngo, Clifford W. Hubbard, Henning Richter, and Ramesh Sivarajan, "Evaluation of Carbon Nanotube Thin Films for Optically Transparent Microwave Applications Using On-Wafer Probing of Corbino-Disc Test Structures," ARL-TR-6362 (March 2013).

[4] Julia B. Doggett and Ryan C. Toonen, "On the Performance of Carbon Nanotubes in Extreme Conditions and in the Presence of Microwaves," ARL-MR-0836 (January 2013).

[5] Eddie Elburn and Ryan C. Toonen, "Acoustic Nondestructive Evaluation of Aircraft Paneling Using Piezoelectric Sensors," ARL-MR-834 (December 2012).

[6] R. C. Toonen, S. G. Hirsch, R. X. Fu, M. P. Ivill, and M. W. Cole, "A Fully Integrated Materials Framework for Enabling the Wireless Detection of Micro-defects in Aging and Battle-worn Structures (Final Report)," ARL-MR-0822 (May 2012).

[7] Mathew Ivill, Eric Ngo, S. Gary Hirsch, Melanie W. Cole, Ryan C. Toonen, and Clifford Hubbard, "Development of Nanotemplated Oxide Arrays for Universal, Shape-compliant Sensor Architectures (Final Report)," ARL-MR-0823 (May 2012).

[8] M. W. Cole, R. C. Toonen, M. Ivill, S. G. Hirsch, E. Ngo, and G. Mallick, "An Enabling Materials Technology to Enhance Transparent Electrode Conductivity for Realization of Covert Transparent Target Tracking and Locating Antenna/Radar Systems," ARL-TR-5583 (June 2011).

[9] M. Ivill, E. Ngo, S. Gary Hirsch, M. W. Cole, R. C. Toonen, and C. W. Hubbard, "Development of Nanotemplated Oxide Arrays for Universal, Shape-compliant Sensor Architectures (Year 1)," ARL-MR-0784 (June 2011).

[10] R. C. Toonen, R. X. Fu, M. P. Ivill, S. G. Hirsch, M. W. Cole, and T. S. Zheleva, "A Fully Integrated Materials Framework for Enabling the Wireless Detection of Micro-defects in Aging and Battle-worn Structures (Year 1)," ARL-MR-0775 (April 2011).

[11] M. W. Cole, E. Ngo, R. Tan, R. C. Toonen, S. G. Hirsch, M. Ivill, C. Hubbard, and T. Anthony. "A Lowcost Materials Processing Solution for Achieving Low Insertion Loss, Affordable Tunable Devices for Next Generation On-The-Move Communications Systems-Part II", ARL-TR-5227 (June 2010).

Dissertation

Ryan Christopher Toonen, "The transport properties of a three-terminal quantum dot," Ph.D. dissertation, University of Wisconsin – Madison, 2007.