
CONTACT INFORMATION	Assistant Professor of Physics Faculty of Math, Physics, and Computation Schmid College of Science and Technology Chapman University Orange, CA 92866-0429	<i>Office:</i> Hashinger Science Center 110 <i>Phone:</i> +1-714-516-5949 <i>E-mail:</i> dressel@chapman.edu <i>Web:</i> http://www.justindressel.com <i>Citizenship:</i> USA
RESEARCH INTERESTS	<p>Quantum foundations: generalized measurements, contextuality, algebraic methods</p> <p>Quantum information: quantum control, quantum filtering, quantum computing</p> <p>Quantum and classical field theory: relativistic fields, gauge-theory gravitation</p> <p>Mathematical physics: Clifford algebras, von-Neumann algebras, geometric calculus</p> <p>Computer science: functional programming, Bayesian networks, machine learning</p>	
EDUCATION	<p>Ph.D. in Quantum Physics, May 2013</p> <ul style="list-style-type: none"> • University of Rochester, Rochester, New York USA • Adviser: Associate Professor Andrew N. Jordan • Thesis: <i>Indirect Observable Measurement: an Algebraic Approach</i> <p>M.A. in Physics, September 2009</p> <ul style="list-style-type: none"> • University of Rochester, Rochester, New York USA • Adviser: Associate Professor Andrew N. Jordan <p>B.S. in Physics, May 2005</p> <p>B.S. in Mathematics, May 2005</p> <ul style="list-style-type: none"> • New Mexico Institute of Mining and Technology, Socorro, New Mexico USA • <i>Summa cum Laude</i>, With Highest Honors in Physics and Mathematics • Physics Adviser: Associate Professor Kenneth Eack • Mathematics Adviser: Professor Ivan Avramidi 	
ACADEMIC APPOINTMENTS	<p>Assistant Professor of Physics August 2015 to present</p> <p>Faculty of Math, Physics, and Computation Institute for Quantum Studies Chapman University</p> <p>Postdoctoral Scholar September 2013 to August 2015</p> <p>Quantum Computing and Measurement Physics (QCAMP) Group Department of Electrical and Computer Engineering University of California, Riverside</p> <ul style="list-style-type: none"> – Supervisor: Professor Alexander N. Korotkov – Focus: Quantum measurement with superconducting qubits and circuit-QED, designing robust experimental tests of quantum information protocols <p>Visiting Researcher June to August 2013, February 2014, July 2016</p> <p>Quantum Condensed Matter Research Group (QCMRG) Center for Emergent Matter Science (CEMS), RIKEN, Wakoshi, Saitama, Japan</p> <ul style="list-style-type: none"> – Supervisor: Professor Franco Nori – Focus: Classical field interpretations of weak quantum measurement, Clifford algebraic approaches to electromagnetism, orbital and spin angular momentum separation in optical fields 	

RESEARCH
EXPERIENCE

- Since 2009, I have published 31 journal papers, including 1 paper in *Nature* (as a cover-feature), 1 paper in *Reviews of Modern Physics*, 7 papers in *Physical Review Letters*, and 1 paper in *Physics Reports*. These papers currently have over 970 citations (with 319 citations in 2016 alone), including one paper with 205 accumulated citations, yielding an h-index of 16 and i10-index of 21.

My research has spanned a variety of topics, including:

- Foundational theory for the generalized quantum measurements of observables
- Foundational theory that unifies quantum states and quantum observables into conditional parts of the same operational quantum instruments
- Foundational theory for the quantum weak value, and enhancements of weak value methods for sensitive parameter estimation
- Experimental tests of the quantum-to-classical transition using sequential measurements in both entangled optical systems and superconducting qubit systems
- Classical-field and Clifford-algebraic treatments of the the separation of the total angular momentum of light into separately measurable spin and orbital parts
- Practical studies of ancilla quantum bit and microwave resonator methods for implementing generalized measurements in modern quantum computing implementations, with special focus on superconducting systems

FUNDING
EXPERIENCE

- Awarded: ARO-LPS Grant Proposal No. 67533-PH-QC (August 2015). Continuous Quantum State Tracking and Error Correction (CQSTEC). I. Siddiqi (UCB), A.N. Korotkov (UCR), A.N. Jordan (UR), J. Dressel (CU). Grant Award No. W911NF-15-1-0496. Subcontract from UCB: \$100,000/yr for 4 years, August 2015 - August 2019.
- Submitted: NSF MRI Proposal 1626648 (January 2017). MRI: Acquisition of a Ti:Sapphire Femtosecond Laser to Investigate Reaction Dynamic and Quantum Metrology. J. LaRue (CU), A. Nilsson (Stockholm U), H. Ogasawara (SLAC), A. Lyon (CU), J. Dressel (CU), C. Kim (CU), C. Owens (CU).

TEACHING
EXPERIENCE

Chapman University, Orange, California USA

Assistant Professor

Spring 2017

- PHYS 101: General Physics I
- PHYS 340: Quantum Information Science
- PHYS 422: Electricity and Magnetism II (Independent Study)

Fall 2016

- PHYS 220: Scientific Computation I
- CS 510: Computing for Scientists

Spring 2016

- PHYS 227: Foundations of Scientific Computing
- PHYS 321: Mechanics II

Fall 2015

- PHYS 107: General Physics for the Life Sciences I
- PHYS 451: Quantum Mechanics (Independent Study)
- CS 510: Computing for Scientists

University of Rochester, Rochester, New York USA

Instructor

Summer 2009

- PHY 114: General Physics II

Tutor for David T. Kearns Center

January 2010 to May 2012

- PHY 113: General Physics I. (Spring 2010)
- PHY 121: Mechanics. (Spring 2012, Fall 2011, Spring 2011)
- PHY 122: Electricity and Magnetism. (Fall 2011, Spring 2011)

Teaching Assistant

September 2007 to August 2009

- Workshop Facilitator for PHY 143: Honors Waves and Modern Physics (Spring 2008)
- Workshop Facilitator for PHY 113: General Physics I (Fall 2007)

SERVICE

Conference Organizer

- *American Physical Society (APS) March Meeting 2017* (March 2017).
Focus Session: *Continuous Quantum Measurements and Quantum Foundations*.
Co-organizer: J. Dressel (CU), K. Murch (WU).
New Orleans Convention Center, New Orleans LA, March 2017.
- *Concepts and Paradoxes in a Quantum Universe* (June 2016).
Co-organizers: Y. Aharonov (CU), L. Hardy (PI), J. Dressel (CU), J. Tollaksen (CU), M. Leifer (CU).
Workshop: June 1-19, Conference: June 20-24.
Perimeter Institute for Theoretical Physics, Waterloo, Ontario, Canada, June 2016.

Journal Referee

- *Science*
- *Nature Communications*
- *Physical Review Letters*
- *Physical Review X*
- *Physical Review A*
- *Physical Review B*
- *Journal of Physics A: Mathematical and Theoretical*
- *Scientific Reports*
- *New Journal of Physics*
- *Foundations of Physics*
- *Quantum Studies: Mathematics and Foundations*
- *Physics Letters A*
- *Optics Letters*
- *Annals of Physics*
- *Atoms*

Public Outreach

Fall 2015

- Academic Minute radio program
How quantum physics makes your digital photos grainy
Chapman University

Summer 2010, Summer 2011

- Rochester Scholars summer course for volunteer high school students:
Unexplained Quantum Phenomena Revealed
Guest lecturer, technical assistant for optical demonstrations
University of Rochester

Prospective student recruitment

Fall 2016

- Discover Chapman Day
Chapman University
Tesla Coil Band Performance
- Tesla Coil Plasma Speaker: Wireless Energy Demo

Fall 2015

- Discover Chapman Day
Chapman University

Fall 2008 to Fall 2012

- Graduate student weekend reception and outreach, guest lectures
University of Rochester

Conference photographer

March 2012, June 2013

- Coherence and Quantum Optics (CQO) X
Quantum Information and Measurement (QIM) Conference, 2013
University of Rochester, Rochester, NY (2013)
- Northeast Modern Language Association (NEMLA) Conference, 2012
Rochester Conference Center, Rochester, NY (2012)

PROFESSIONAL
EXPERIENCE

National Radio Astronomy Observatory, Socorro, New Mexico USA

Software Engineer

June 2005 to August 2007

Atacama Large Millimeter Array (ALMA) project:

- Integration, Test, and Support (ITS) subsystem: reorganized and maintained the CVS repository for the primary codebase; debugged and integrated software written in C, C++, Java, Python, and Bash by seven different subsystems; technical support for software running at five separate international sites
- Systems architect for large distributed diskless network: helped design, install on site, and maintain a distributed network for managing telescopes; implemented automated (linux) software synchronization in Python and Bash, still in production use in six international locations

SOFTWARE SKILLS

Programming Languages:

- Fluent: Mathematica, Python, Julia, Haskell, Bash, L^AT_EX, C
- Familiar: OCaml, Scheme, Julia, Lisp, Java, Clojure, R, C++, D, Matlab

Version Control:

- Distributed: Git, Mercurial, Darcs
- Centralized: CVS, SVN, RCS

AWARDS AND
CERTIFICATES

University of Rochester

- David T. Kearns Center, Certificate of Gratitude, 2012
- Agnes M. and George Messersmith Fellowship, 2011–2013
- Certificate in Teaching of College Physics, 2010
- American Association of Physics Teachers (AAPT) Award, 2008
- Department of Education GAANN Fellowship, 2007–2012

National Radio Astronomy Observatory

- Star Award, 2007

New Mexico Institute of Mining and Technology

- Abraham and Esther Brooke Award for Excellence in Physics, 2004

JOURNAL
PUBLICATIONS

31. *Rapid Estimation of drifting parameters in continuously measured quantum systems.*
Cortez, L., Chantasri, A., García-Pintos, L.P., Dressel, J., and Jordan, A.N.
Physical Review A **95**, 012314 (2017).
30. *Experimental demonstration of direct path state characterization by strongly measuring weak values in a matter-wave interferometer.*
Denkmayr, T., Geppert, H., Lemmel, H., Waegell, M., Dressel, J., Hasegawa, Y. and Sponar, S.
Physical Review Letters **118**, 010402 (2017).

29. *Probing quantumness with joint continuous measurements of non-commuting qubit observables.*
García-Pintos, L.P., and Dressel, J.
Physical Review A **94**, 062119 (2016).
28. *Measuring a transmon qubit in circuit QED: dressed squeezed states.*
Khezri, M., Dressel, J., and Korotkov, A.N.
Physical Review A **94**, 012347 (2016).
27. *Preserving entanglement during weak measurement demonstrated with a violation of the Bell-Leggett-Garg inequality.*
White, T.C., Mutus, J.Y., Dressel, J., Kelly, J., Barends, R., Jeffrey, E., Sank, D., Megrant, A., Campbell, B., Chen, Y., Chen, Z., Chiaro, B., Dunsworth, A., Hoi, I.-C., Neill, C., O'Malley, P.J.J., Roushan, P., Vainsencher, A., Wenner, J., Korotkov, A.N., and Martinis, J.M.
Nature Partner Journals: Quantum Information **2**, 15022 (2016).
26. *Qubit measurement error from coupling with a detuned neighbor in circuit QED.*
Khezri, M., Dressel, J., and Korotkov, A.N.
Physical Review A **92**, 052306 (2015).
25. *Spacetime algebra as a powerful tool for electromagnetism.*
Dressel, J., Bliokh, K.Y., and Nori, F.
Physics Reports **589**, 1–71 (2015).
24. *Power-Recycled Weak-Value-Based Metrology.*
Lyons, K., Dressel, J., Jordan, A.N., Howell, J.C., and Kwiat, P.G.
Physical Review Letters **114**, 170801 (2015).
23. *Weak Values as Interference Phenomena.*
Dressel, J.
Physical Review A **91**, 032116 (2015).
22. *Violating the Modified Helstrom Bound with Nonprojective Measurements.*
Dressel, J., Brun, T.A., and Korotkov, A.N.
Physical Review A **91**, 040301(R) (2015).
21. *Heisenberg scaling with weak measurement: A quantum state discrimination point of view.*
Jordan, A.N., Tollaksen, J., Troupe, J.E., Dressel, J., and Aharonov, Y.
Quantum Studies: Mathematics and Foundations **2**, 5–15 (2015).
20. *Conservation of the spin and orbital angular momenta in electromagnetism.*
Bliokh, K.Y., Dressel, J., and Nori, F.
New Journal of Physics **16**, 093037 (2014).
19. *Implementing generalized measurements with superconducting qubits.*
Dressel, J., Brun, T.A., and Korotkov, A.N.
Physical Review A **90**, 032302 (2014).
18. *Mapping the optimal route between two quantum states.*
Weber, S.J., Chantasri, A., Dressel, J., Jordan, A.N., Murch, K.W., and Siddiqi, I.
Nature **511**, 570–573 (2014).
17. *Entanglement-assisted weak value amplification.*
Pang, S., Dressel, J., and Brun, T.A.
Physical Review Letters **113**, 030401 (2014).

16. *Colloquium: Understanding Quantum Weak Values: Basics and Applications.*
Dressel, J., Malik, M., Miatto, F.M., Jordan, A.N., and Boyd, R.W.
Reviews of Modern Physics **86**, 307 (2014).
15. *Avoiding Loopholes with Hybrid Bell-Leggett-Garg Inequalities.*
Dressel, J., and Korotkov, A.N.
Physical Review A **89**, 012125 (2014).
14. *Classical Field Approach to Quantum Weak Measurements.*
Dressel, J., Bliokh, K.Y., and Nori, F.
Physical Review Letters **112**, 110407 (2014).
13. *Certainty in Heisenberg's uncertainty principle: Revisiting definitions for estimation errors and disturbance.*
Dressel, J., and Nori, F.
Physical Review A **89**, 022106 (2014).
12. *Action principle for continuous quantum measurement.*
Chantrasi, A., Dressel, J., and Jordan, A.N.
Physical Review A **88**, 042110 (2013).
11. *Strengthening weak value amplification with recycled photons.*
Dressel, J., Lyons, K., Graham, T.M., Kwiat, P.G., and Jordan, A.N.
Physical Review A **88**, 023821 (2013).
10. *Quantum instruments as a foundation for both states and observables.*
Dressel, J., and Jordan, A.N.
Physical Review A **88**, 022107 (2013).
9. *Corrigendum: Sufficient conditions for uniqueness of the weak value.*
Dressel, J., and Jordan, A.N.
Journal of Physics A: Mathematical and Theoretical **46**, 029501 (2012).
8. *Weak Values are Universal in Von Neumann Measurements.*
Dressel, J., and Jordan, A.N.
Physical Review Letters **109**, 230402 (2012).
7. *Contextual-value approach to the generalized measurement of observables.*
Dressel, J., and Jordan, A.N.
Physical Review A **85**, 022123 (2012).
6. *Measuring which-path information with coupled electronic Mach-Zehnder interferometers.*
Dressel, J., Choi, Y., and Jordan, A.N.
Physical Review B **85**, 045320 (2012).
5. *Significance of the imaginary part of the weak value.*
Dressel, J., and Jordan, A.N.
Physical Review A **85**, 012107 (2012).
4. *Sufficient conditions for uniqueness of the weak value.*
Dressel, J., and Jordan, A.N.
Journal of Physics A: Mathematical and Theoretical **45**, 015304 (2012).
3. *Experimental Violation of Two-Party Leggett-Garg Inequalities with Semi-weak Measurements.*
Dressel, J., Broadbent, C.J., Howell, J.C., and Jordan, A.N.
Physical Review Letters **106**, 040402 (2011).

2. *Contextual Values of Observables in Quantum Measurements.*
Dressel, J., Agarwal, S., and Jordan, A.N.
Physical Review Letters **104**, 240401 (2010).

1. *Gravitational Redshift and Deflection of Slow Light.*
Dressel, J., Howell, J.C., Rajeev, S., and Jordan, A.N.
Physical Review A **79**, 013834 (2009).

JOURNAL
SUBMISSIONS

2. *Arrow of Time for Continuous Quantum Measurements.*
Dressel, J., Chantasri, A., Jordan, A.N., and Korotkov, A.N.
arXiv:1610.03818

1. *Confined Contextuality in Neutron Interferometry: Observing the Quantum Pigeonhole Effect.*
Waegell, M., Denkmayr, T., Geppert, H., Ebner, D., Jenke, T., Hasegawa, Y., Sponar, S., Dressel, J., and Tollaksen, J.
arXiv:1609.06046

PAPERS IN
PREPARATION

6. *Past observable dynamics of a continuously monitored quantum bit.*
García-Pintos, L.P., Dressel, J.

5. *State dragging using the quantum Zeno effect.*
Hacohen-Gourgy, S., Martin, L., García-Pintos, L.P., Dressel, J., and Siddiqi, I.

4. *Linear feedback stabilization of a continuously monitored qubit.*
Chantasri, A., Patti, T., Dressel, J., and Jordan, A.N.

3. *The quasiprobability behind the out-of-time-ordered correlator.*
Halpern, N.Y., Swingle, B., and Dressel, J.

2. *Delayed choice Lorentz rotations of a quantum bit.*
Dressel, J., and Nori, F.

1. *How zero light intensity can exert a nonzero force on a charged particle.*
Aharonov, Y., Dressel, J., and Tollaksen, J.

CONFERENCE
PRESENTATIONS

38. *What does a continuously monitored qubit readout really show?.*
American Physical Society (APS): March Meeting 2017.
New Orleans Center, New Orleans LA, March 2017.

37. *State dragging using the quantum Zeno effect.*
American Physical Society (APS): March Meeting 2017.
New Orleans Center, New Orleans LA, March 2017.

36. *Probing quantumness with joint continuous measurements of non-commuting qubit observables.*
American Physical Society (APS): March Meeting 2017.
New Orleans Center, New Orleans LA, March 2017.

35. *Linear feedback stabilization of a continuously monitored qubit.*
American Physical Society (APS): March Meeting 2017.
New Orleans Center, New Orleans LA, March 2017.

34. *Arrow of time for repeated and continuous quantum measurement.*
American Physical Society (APS): March Meeting 2017.
New Orleans Center, New Orleans LA, March 2017.
33. *Weak and continuous measurements with superconducting qubits.*
Invited Talk: CEMS, RIKEN 2016.
CEMS, RIKEN, Wako-shi, Saitama, Japan, July 2016.
32. *Experimental violation of a Bell-Leggett-Garg inequality using weak measurements.*
Invited Talk: CEMS, RIKEN 2016.
CEMS, RIKEN, Wako-shi, Saitama, Japan, July 2016.
31. *Weak and continuous measurements with superconducting qubits.*
Concepts and Paradoxes in a Quantum Universe, Conference.
Perimeter Institute of Theoretical Physics, Waterloo, Ontario, Canada, June 2016.
30. *Delayed Choice Lorentz Rotations.*
Concepts and Paradoxes in a Quantum Universe, Workshop.
Perimeter Institute of Theoretical Physics, Waterloo, Ontario, Canada, June 2016.
29. *Continuous Transmon Measurements: Filtering and Parameter Determination.*
Army Research Office (ARO) On-site Grant Review Meeting.
University of California, Berkeley, Berkeley CA, May 2016.
28. *Sagnac Sensing Weak Value Amplification: Technical feasibility analysis.*
DRS Technical Review Meeting.
Teleconference with slides, April 2016.
27. *How zero-intensity light can exert a non-zero force on a charged particle.*
American Physical Society (APS): March Meeting 2016.
Baltimore Convention Center, Baltimore MD, March 2016.
26. *Experimental violation of a Bell-Leggett-Garg inequality using weak measurements.*
Invited Talk: Math, Physics, and Computation (MPC) Seminar.
Chapman University, Orange, CA, December 2015.
25. *Experimental violation of a Bell-Leggett-Garg inequality using weak measurements.*
Invited Talk: International Conference on Quantum Foundations (ICQF) 2015.
National Institute of Technology, Patna, Bihar, India, December 2015.
24. *Entanglement-assisted weak measurement.*
American Physical Society (APS): March Meeting 2015.
San Antonio Convention Center, San Antonio TX, March 2015.
23. *Entanglement-assisted weak measurement.*
American Physical Society (APS): March Meeting 2015.
San Antonio Convention Center, San Antonio TX, March 2015.
22. *Violating the Modified Helstrom Bound with Nonprojective Measurements.*
American Physical Society (APS): March Meeting 2015.
San Antonio Convention Center, San Antonio TX, March 2015.
21. *Experimental violation of a Bell-Leggett-Garg inequality using weak measurements, Part II: The Violation.*
American Physical Society (APS): March Meeting 2015.
San Antonio Convention Center, San Antonio TX, March 2015.

20. *Experimental violation of a Bell-Leggett-Garg inequality using weak measurements, Part I: Avoiding loopholes.*
American Physical Society (APS): March Meeting 2015.
San Antonio Convention Center, San Antonio TX, March 2015.
19. *Mapping the Optimal Route Between Two Quantum States.*
Riverside Postdoctoral Association, Inaugural Symposium 2014.
University of California, Riverside, Riverside CA, September 2014.
18. *Violating the modified Helstrom bound.*
Workshop Talk: UCSB Meeting 2014.
University of California: Santa Barbara, Santa Barbara CA, September 2014.
17. *Implementing generalized measurements.*
Workshop Talk: UCSB Meeting 2014.
University of California: Santa Barbara, Santa Barbara CA, September 2014.
16. *Optimal routes through quantum phase space.*
Workshop Talk: UCSB Meeting 2014.
University of California: Santa Barbara, Santa Barbara CA, September 2014.
15. *Avoiding Loopholes with Hybrid Bell-Leggett-Garg Inequalities.*
American Physical Society (APS): March Meeting 2014.
Denver Convention Center, Denver CO, March 2014.
14. *Enhancing Weak Value Amplification.*
Invited Talk: UCB 2014.
University of California, Berkeley CA, January 2014.
13. *An Action Principle for Continuous Quantum Measurements.*
Invited Talk: USC 2013.
University of Southern California, Los Angeles CA, November 2013.
12. *Weak Measurements, Weak Values, and Bell-Leggett-Garg Inequalities.*
Workshop Talk: UCSB Meeting 2013.
University of California: Santa Barbara, Santa Barbara CA, September 2013.
11. *Weakly Measuring Observables with Generalized Eigenvalues.*
Invited Talk: CEMS, RIKEN 2013.
CEMS, RIKEN, Wako-shi, Saitama Japan, July 2013.
10. *Weak Values are Universal in von Neumann Measurements.*
American Physical Society (APS): March Meeting 2013.
Baltimore Convention Center, Baltimore MD, March 2013.
9. *Grounding generalized measurements in the laboratory.*
Optical Society of America (OSA): Frontiers in Optics (FiO) 2012.
Rochester Convention Center, Rochester NY, October 2012.
8. *Weak values need not be weak.*
Cross Borders Workshop (XBW) XIV.
McGill University, Montreal Quebec, Canada, June 2012.
7. *Contextual Values: Going beyond the eigenvalues of an observable.*
Cross Borders Workshop (XBW) XIII.
University of Rochester, Rochester NY, June 2011.

6. *Experimental Violation of Two-Party Leggett-Garg Inequalities with Semi-weak Measurements.*
American Physical Society (APS): March Meeting 2011.
Dallas Convention Center, Dallas TX, March 2011.
5. *Quantum measurement with Mach-Zehnder Interferometers.*
American Physical Society (APS): March Meeting 2011.
Dallas Convention Center, Dallas TX, March 2011.
4. *Quantum Strangeness: or, How I learned to stop worrying and love Weak Values.*
University of Rochester Prospective Physics Weekend.
University of Rochester, Rochester NY, February 2011.
3. *Experimental Violation of Two-Party Leggett-Garg Inequalities with Semi-weak Measurements.*
Optical Society of America (OSA): Frontiers in Optics (FiO) 2010.
Rochester Convention Center, Rochester NY, October 2010.
2. *Weak Value Inequalities as a Test of Hidden Variable Theories.*
Symposium on Quantum Control and Quantum Entanglement.
University of Rochester, Rochester NY, October 2009.
1. *Gravitational Redshift and Deflection of Slow Light.*
American Physical Society (APS): March Meeting 2009.
Pittsburgh Convention Center, Pittsburgh PA, March 2009.