

Biographical sketch for Jeff Tollaksen

Director, Institute for Quantum Studies, Professor of Physics, Chapman University

I. PROFESSIONAL PREPARATION

1987 B.S. Massachusetts Institute of Technology (physics)
1994 M.A. Boston University (theoretical physics)
2002 Ph.D. Boston University (theoretical physics); Principal thesis advisor: Yakir Aharonov

II. APPOINTMENTS AND WORK EXPERIENCE

3/2012- Present Founder and co-Director, Institute for Quantum Studies, Chapman University

starting 8/2012 Full Professor, Schmid College of Science and Technology, Chapman University

6/2008- Present Founder and Director, Center for Quantum Studies, Chapman University

6/2010- present Head of Physics Faculty, Chapman University

8/2008-2010 Associate Professor and Founding Chair, Department of Physics, Computational Science and Engineering, Chapman University

2006-8/2008 Founder and Director, Center for Quantum Studies, George Mason University

2006-8/2008 Assistant Professor, College of Science, George Mason University

2004-2006 Assistant Professor, School of Computational Sciences, George Mason University

2003-2004 Research Assistant Professor, School of Computational Sciences, George Mason University

III. RESEARCH ACTIVITIES

a. Grants

- 1) Principal Investigator: Tollaksen, Research Investigator Gulian: Office for Naval Research, "Instrumentation for Proper Characterization of Novel Superconducting Candidate Materials," \$486,524.62, 6/1/12-5/30/14.
- 2) Principal Investigator: Tollaksen, Research Investigator Gulian: Office for Naval Research, "Investigation of Sulfur-Substituted Strontium Ruthenates," \$465,000, February 1, 2012-January 30, 2015.
- 3) Principal Investigator: Tollaksen, co-investigator Gulian: Office for Naval Research, "Stimulated Brillouin and Raman scattering for fiber-optic digital data transfer," \$356,659, October 2008-September 2011.

- 4) Principal Investigator: Tollaksen; National Institute of Standards and Technology, "Applying foundational concepts in quantum mechanics to quantum information, computing, and measurement," initially \$900,000, 2007-2008.
- 5) Principal Investigator: Tollaksen; Naval Research Laboratory, "Slow Light Technology," \$65,000, 2006-2008.
- 6) Principal Investigator: **Tollaksen**, co-Investigators include Paul Davies, Brian Greene, Yakir Aharonov, Menas Kafatos, etc., CTNS-Stars, "Subjective experience as a window on foundational physics, \$100,000.
- 7) Principal Investigator: Office for Naval Research, conference "Entanglement beyond the optical regime," \$50,000, December 2009-December 2010.
- 8) Principal Investigator: Tollaksen, Research Investigator Gulian: Office for Naval Research, "Development of fiber-optics 4K cryo-cooler," \$450,000, October 2009-September 2012.
- 9) Principal Investigator: \$20,000, CTNS-Stars, co-Investigators include Paul Davies, Yakir Aharonov, Menas Kafatos, etc., CTNS-Stars, "Time and Reality: New Insights from Weak Measurements and Non-locality".
- 10) Principal Investigator: Office of Naval Research, "Quantum computation and communication and amplification of weak signals using weak measurements," (shared with Univ. of South Carolina, total grant size \$179,929).
- 11) Principal Investigator: Templeton Foundation, "Probing Quantum Reality and Quantum Computing with New Measurements," 2003-2006, \$25,000.

c. Publications

- 1) Y. Aharonov, F. Colombo, S. Nussinov, I. Sabadiniy, D.C. Struppa, J. Tollaksen, "Superoscillations in $SO(3)$ " to appear in Proceedings of the Royal Society A.
- 2) Y. Aharonov, F. Colombo, I. Sabadiniy, D.C. Struppa, **J. Tollaksen**, "On some operators associated to superoscillations," *Complex Analysis and Operator Theory*, in press.
- 3) Y. Aharonov, F. Colomboy, I. Sabadiniy, D.C. Struppa, J. Tollaksen, "On the Cauchy problem for the Schroedinger equation with superoscillatory initial data," *Journal-Mathematiques-Pures-Appliques* in press.
- 4) Nussinov, S., Tollaksen, J., "Extreme sub-radiance: can quantum effects generate dramatically longer atomic lifetimes?", *Foundations of Physics*, DOI 10.1007/s10701-012-9663-7, June 8, 2012.
- 5) Aharonov, Y., Popescu, S., **Tollaksen, J.**, "Consistent treatments of quantum mechanics," *Physics Today*, October, 2011.
- 6) T. Kaufherr, Y. Aharonov, S. Nussinov, S. Popescu, and **J. Tollaksen**, "Dynamical features of interference phenomena in the presence of entanglement," *Physical Review A*, 83, 052127 (2011).
- 7) Aharonov, Y., Popescu, S., **Tollaksen, J.**, Reply letter for "A time-symmetric formulation of quantum mechanics," Feature Story for *Physics Today*, May 2011.
- 8) **Tollaksen, J.**, "Pre and post-selection, weak measurements and the flow of time in quantum mechanics," Proceedings of the International Conference on Advances in Quantum Theory, ed.: G. Jaeger, A. Khrennikov, M. Schlosshauer, G. Weihs, AIP Conference Proceedings Volume 1327, 978-0-7354-0882-1, Pages: 240-268 (2011).

- 9) Aharonov, Y., Colombo, F., Sabadini, I., Struppa, D.C., **Tollaksen, J.**, “Some mathematical properties of superoscillations,” *Journal of Physics A: Mathematical and Theoretical* 44 (2011) 365304.
- 10) Yakir Aharonov, Alonso Botero, Shmuel Nussinov, Sandu Popescu, Jeff **Tollaksen** “On the classical limit of quantum optics,” accepted to *Nature Physics* (2011) (pending minor revisions).
- 11) Aharonov, Y., Popescu, S., **Tollaksen, J.**, "A time-symmetric formulation of quantum mechanics," Feature Story for *Physics Today*, November 2010.
- 12) Tollaksen, J., “Time-symmetry, weak measurements and dynamical non-locality in quantum mechanics,” in press, American Physical Society proceedings for the “75 years of entanglement” conference, *Journal of Physics: Conf.*, 2011 (in press).
- 13) Tollaksen, J., “Dynamical quantum non-locality,” Proceedings of the International Conference on Advances in Quantum Theory, ed.: G. Jaeger, A. Khrennikov, M. Schlosshauer, G. Weihs, AIP Conference Proceedings Volume 1327, 978-0-7354-0882-1, Pages: 269-288 (2011).
- 14) **Tollaksen, J.**, Aharonov, Y., Casher, A., Kaufherr, T., Nussinov, S., “Quantum interference experiments, modular variables and weak measurements,” *New Journal of Physics*, **12** (2010) 013023 (novel theoretical predictions made in this paper have been verified experimentally).
- 15) Aharonov, Y., **Tollaksen, J.**, “New insights on Time-Symmetry in Quantum Mechanics,” in VISIONS OF DISCOVERY: New Light on Physics, Cosmology And Consciousness, ed. R. Y. Chiao, M. L. Cohen, A. J. Leggett, W. D. Phillips, and C. L. Harper, Jr. Cambridge: Cambridge University Press, 2010.
- 16) **Tollaksen, J.** and Aharonov, Y “Deterministic Operators, Weak Measurements and Interference Phenomenon” *Journal of Physics: Conf.*, 196 012006 (2009) Institute of Physics.
- 17) Aharonov, Y., Popescu, S., **Tollaksen, J.** Vaidman, L. *Physical Review A*, “Multiple-time states and multiple-time measurements in quantum mechanics,” **79**, 052110 (2009).
- 18) Nussinov, S, **Tollaksen, J.** *Physical Review D*, “Color transparency in Q.C.D. and post-selection in quantum mechanics,” **78**, 036007 (2008).
- 19) **Tollaksen, J.**, Gray, J.E., “Memory, contextuality, instrumentality, and quantum mechanics,” Quantum Information and Computation VI, Proceedings of SPIE Volume: 6976, pp. 69760R-69760R-11 (2008), editor(s): Eric J. Donkor; Andrew R. Pirich; Howard E. Brandt.
- 20) Gray, J.E., **Tollaksen, J.**, “The Aharonov-Vaidman formula, its justification, and implications for signal enhancement,” Quantum Information and Computation VI, Proceedings of SPIE Volume: 6976, pp. 69760S-69760S-11 (2008), editor(s): Eric J. Donkor; Andrew R. Pirich; Howard E. Brandt.
- 21) **Tollaksen, J.**, “Pre- and post-selection, weak values, and contextuality” in *Journal of Physics A: Mathematical and General*, Institute of Physics, **40** (2007) 9033-9066.
- 22) **Tollaksen, J.** “Robust Weak Measurements on Finite Samples,” *Journal of Physics: Conf.*, **70**, (2007), Institute of Physics, 012014 (featured in O. Hosten, P. Kwiat, *Science*, “Observation of the Spin Hall Effect of Light via Weak Measurements,” **319**, 787 (2008) which was featured in K. J. Resch, *Science*, “Amplifying a Tiny Optical Effect,” **319**, 733 (2008), both of which were featured in *Physics Today* , April 2008, C. Day, “Light exhibits a spin Hall effect,” Volume 61, Issue 4, pp. 8-96, see also Popescu, S. “Weak measurements just got stronger,” *Physics* 2, 32 (2009) “.

- 23) **Tollaksen, J.**, "Novel Relationships between Super-oscillations, Weak Values, and Modular Variables," *Journal of Physics: Conf*, **70**, (2007), Institute of Physics, 012014.
- 24) **Tollaksen, J.** "Quantum properties that are extended in time," Quantum Information and Computation V, Ed by E Donkor, A Pirich, H Brandt, Proc of SPIE Vol. 6573 (SPIE, Bellingham, WA, 2007), CID 6573-35.
- 25) **Tollaksen, J**, Ghoshal, D "Weak Measurements, Weak Values and Entanglement," Quantum Information and Computation V, Ed by E Donkor, A Pirich, H Brandt, Proc of SPIE Vol. 6573 (SPIE, Bellingham, WA, 2007), CID 6573-36.
- 26) **Tollaksen, J** "Non-statistical weak measurements," Quantum Information and Computation V, Ed by E Donkor, A Pirich, H Brandt, Proc of SPIE Vol. 6573 (SPIE, Bellingham, WA, 2007), CID 6573-33.
- 27) **Tollaksen, J.**, "Pre- and post-selection, weak values, and contextuality" in *Journal of Physics Conf*, Institute of Physics, **70** (2007) 012014.
- 28) **Tollaksen J.**, Ghoshal, D., "NP problems, post-selection and weak measurements," in Quantum Information and Computation IV, edited by Eric J. Donkor, Andrew R. Pirich, Howard E. Brandt, Proceedings of SPIE Vol. 6244 (SPIE, Bellingham, WA, 2006) 62440S.
- 29) Aharonov Y, Botero A, Popescu S, Reznik B, **Tollaksen J**, "Revisiting Hardy's paradox: counterfactual statements, real measurements, entanglement and weak values," *Physics Letters A* 301 (3-4): 130-138, 2001. This novel effect has been verified in several independent experiments which have or will be featured in popular science journals including Scientific American (Japan), New Scientist "They said it couldn't be done but now we can see inside the quantum world," The Economist, The Wall Street journal, etc.
- 30) **Tollaksen, J.** "New Insights from Quantum Theory on Time, Consciousness, and Reality," M.I.T. Press, eds. S. Hameroff, A. Kaszniak, and A. Scott.
- 31) Aharonov Y, Massar S, Popescu S, **Tollaksen J**, Vaidman L, "Adiabatic measurements on metastable systems," *Physical Review Letters*, 77 (6): 983-987, 1996.

Under consideration

- 32) Gray, J.E., Tollaksen, J., "Weak value amplification and generalized implications for signal enhancement," submitted to *Physical Review A*.
- 33) Gray, J, Tollaksen, J, "The Notion of a Random Gauge and its Interpretation," submitted to *Physics Letters A*.
- 34) Gulian, A., et al "Superconducting Antenna for Gravitational Wave Radiation: Part 1. The Concept", Annalen der Physik, under consideration.