

Walter O. Krawec

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(Updated September 2020)

Education:

Ph.D. Computer Science

Stevens Institute of Technology, Hoboken NJ

Dissertation: *Semi-Quantum Key Distribution: Protocols, Security Analysis, and New Models*

Graduated May 2015

MA Mathematics

University at Albany (SUNY), Albany NY

Graduated May 2010

BA Mathematics

Mount Saint Mary College, Newburgh NY

Graduated May 2008

Professional Experience:

Assistant Professor of Computer Science & Engineering University of Connecticut , Storrs CT	2017-Present
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Assistant Professor of Computer Science Iona College , New Rochelle NY	2015-2017
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Research Assistant Stevens Institute of Technology , Hoboken NJ	2011-2015
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Instructor University at Albany (SUNY) , Albany NY	2010-2011
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Teaching Assistant University at Albany (SUNY) , Albany NY	2010-2011
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Funding:

External:

- **NSF: FET: Small: Theoretical Foundations and Applications of High Dimensional Quantum Communication**
Principle Investigator, \$317,846 (9/30/20 to 9/29/23)
- **NSF: CIF: Small: Secure Quantum Communication with Limited Resources**
Principle Investigator, \$309,582 (10/1/18 to 9/30/21)
- **Comcast: Development of Experimental Test-Bed for Multi-User Quantum Communication Protocols**
Principle Investigator, \$225,125 (4/1/2019 to 2/29/2020)
- **Comcast: Survey of Practical Quantum Key Distribution Systems**
Principle Investigator, \$27,129 (8/1/18 to 12/31/20)

Internal:

- **University of Connecticut (REP): Analyzing the Security of Quantum Cryptographic Protocols through Classical-Quantum Sampling**
Principle Investigator, \$18,069 (9/1/2019 to 6/1/2020)
- **University of Connecticut: UConn Scholarship Facilitation Fund (SFF)**
Principle Investigator, \$1120.12 (08/18 to 09/18)

Teaching Experience:

University of Connecticut, Storrs CT

2017-Present

- Introduction to Computing for Engineers (Spring 2020)
 - Redesigned course in a “flipped” format
- Introduction to Computer and Network Security (Spring 2019)
- Cryptography (Fall 2017, Fall 2018, Fall 2019)
- Introduction to Quantum Computing (Spring 2018)

Iona College, New Rochelle NY

2015-2017

- Cryptography (Spring 2016, Spring 2017)
- Computer Networking and Network Programming (Spring 2016, Spring 2017)
- Introduction to Robotics (Fall 2017)
- Network Security (Fall 2016)
- Automata and Formal Languages (Fall 2016)
- Computer Science II (Spring 2016, Fall 2016)
- Data Structures and Algorithm Analysis (Fall 2015)
- Programming Languages (Fall 2015)

University at Albany (SUNY), Albany NY

2010-2011

- Algebra and Calculus I (Fall 2010)
- Calculus I (Spring 2011)

Awards:

Robert Crooks Stanley Graduate Fellowship
Stevens Institute of Technology

2014-2015

Invited Talks:

Quantum Key Distribution with Limited Resources.
CICS Seminar. University of Massachusetts, Amherst

Nov. 15, 2019

Quantum Computing – The Final Frontier?
CableLabs Summer Conference

Aug. 5, 2019

Quantum Key Distribution.
Comcast Quantum Computing Working Group

June 8, 2018

Quantum Computing.
University of Connecticut EE-CS Graduate Seminar

Feb. 16, 2018

Semi-Quantum Key Distribution.
University of Connecticut ECE/CSE Security Seminar

Oct. 24, 2017

Security of a Semi-Quantum Key Distribution Protocol.
Security and Quantum Information Group (SQIG) in Instituto de Telecomunicacoes (IT) in Lisbon

Sep. 25, 2017

Publications:

(* Represents a student coauthor.)

Peer-Reviewed Journal and Conference Papers:

1. S. Han, W.O. Krawec, and F. Miao. A Game Theoretic Security Framework for Quantum Cryptography: Performance Analysis and Application. To appear: *Quantum Information Processing*.
2. O. Amer*, W.O. Krawec., and B. Wang. Efficient Routing for Quantum Key Distribution Networks. To appear: *Proc. IEEE Quantum Computing and Engineering (QCE) 2020*. pre-print available online: arXiv:2005.12404
3. H. Iqbal* and W.O. Krawec. High-Dimensional Semi-Quantum Cryptography. To appear: *IEEE Transactions on Quantum Engineering*. pre-print available online: arXiv:1907.11340
4. O. Amer* and W.O. Krawec. Finite Key Analysis of the Extended B92 Protocol. To appear:

- Proc. *IEEE International Symposium on Information Theory (ISIT)* 2020. pre-print available online: arXiv:2001.05940
5. Tang, Z., Qin, Y., Jiang, Z., Krawec, W. O., & Zhang, P. (2020). Quantum-Secure Microgrid. To Appear: *IEEE Transactions on Power Systems*. arXiv preprint arXiv:2001.02301.
 6. W.O. Krawec. A New High-Dimensional Quantum Entropic Uncertainty Relation with Applications. To appear: Proc. *IEEE International Symposium on Information Theory (ISIT)* 2020. pre-print available online: arXiv:2005.04773
 7. W.O. Krawec and S.A. Markelon*. A Semi-Quantum Extended B92 Protocol and its Analysis. Proc. SPIE 11391, Quantum Information Science, Sensing, and Computation XII, 113910G (24 April 2020)
 8. H. Iqbal* and W.O. Krawec. Semi-Quantum Cryptography. *Quantum Information Processing* (2020) 19 (3), 97. pre-print available online: arXiv:1910.05368
 9. W.O. Krawec. Quantum Sampling and Entropic Uncertainty. *Quantum Information Processing* (2019) 18 (12), 368. pre-print available online: arXiv:1804.08788
 10. W.O. Krawec. Multi-mediated semi-quantum key distribution. In 2019 *IEEE Globecom Workshops (GC Wkshps)* (pp. 1-6). IEEE.
 11. O. Amer* and W.O. Krawec. Semi-Quantum Key Distribution with High Quantum Noise Tolerance. *Physical Review A* 100 (2) 022319. pre-print available online: arXiv:1812.04144 (2019)
 12. A. Gagliano*, W.O. Krawec, and H. Iqbal*. From Classical to Semi-Quantum Secure Communication. To appear: Proc. *IEEE International Symposium on Information Theory (ISIT)* 2019. pre-print available online: arXiv:1901.01611
 13. W.O. Krawec, S. Picek, and D. Jakobovic. Evolutionary Algorithms for the Design of Quantum Protocols. In *Applications of Evolutionary Computation (EvoApplications)* 2019. Lecture Notes in Computer Science, vol. 11454, Springer.
 14. W.O. Krawec and E. Geiss*. Semi-Quantum Key Distribution with Limited Measurement Capabilities. *Proc. International Symposium on Information Theory and Its Applications (ISITA)*, Singapore, 2018, pp. 462-466
 15. C. Vlachou, W.O. Krawec, P. Mateus, N. Paunkovic, and A. Souto. Quantum Key Distribution with Quantum Walks. *Quantum Information Processing* (2018) 17:288.
 16. W.O. Krawec and F. Miao. Game Theoretic Security Framework for Quantum Key Distribution. *International Conference on Decision and Game Theory for Security*. Springer, pp. 38-58. (2018)
 17. W.O. Krawec. Key-Rate Bound of a Semi-Quantum Protocol Using an Entropic Uncertainty Relation. To appear: *IEEE International Symposium on Information Theory (ISIT)* 2018.
 18. W. O. Krawec and S. A. Markelon*. Genetic Algorithm to Study Practical Quantum Adversaries. *Proc. ACM GECCO 2018*. pp. 1270-1277. (2018)
 19. W. O. Krawec. Practical Security of Semi-Quantum Key Distribution. *Proc. SPIE Quantum Information Science, Sensing, and Computation X. Vol. 10660* (2018).
 20. W.O. Krawec, M.G. Nelson*, E.P. Geiss*. Automatic Generation of Optimal Quantum Key

Distribution Protocols. *Proc. ACM GECCO 2017, Berlin (2017)*. pp. 1153-1160.

21. W.O. Krawec. Quantum Key Distribution with Mismatched Measurements over Arbitrary Channels. *Quantum Information & Computation*. Vol 17, No. 3 and 4, pages 209-241. (2017) Available online: arXiv:1608.07728
22. W.O. Krawec. An Improved Asymptotic Key Rate Bound for a Mediated Semi-Quantum Key Distribution Protocol. *Quantum Information & Computation*. Vol. 16, No. 9 and 10, pages 813-834 (2016). Available online: arXiv:1509.04797
23. W.O. Krawec. An Asymptotic Analysis of a Three State Quantum Cryptographic Protocol. *Proc. IEEE International Symposium on Information Theory (ISIT), Barcelona 2016*. Pages 2489 – 2493 (2016). Available online: arXiv:1601.00185
24. W.O. Krawec. Security of a Semi-Quantum Protocol where Reflections Contribute to the Secret Key. *Quantum Information Processing*, 15 (5), 2067-2090 (2016). Available online: arXiv:1510.07181
25. W.O. Krawec. A Genetic Algorithm to Analyze the Security of Quantum Cryptographic Protocols. *Proc. IEEE CEC 2016 (Vancouver Canada)*. Pages 2098-2105. (2016)
26. W.O. Krawec. Security Proof of a Semi-Quantum Key Distribution Protocol. *Proc. IEEE International Symposium on Information Theory (ISIT), Hong Kong 2015*. Pages 686-690 (2015). Available online: arXiv:1412.0282
27. W.O. Krawec. Mediated Semi-Quantum Key Distribution. *Physical Review A*, 91 032323 (2015). Available online: arXiv:1411.6024
28. W.O. Krawec. History Dependent Quantum Walk on the Cycle with an Unbalanced Coin. *Physica A: Statistical Mechanics and its Applications*, 428, pages 319-331 (2015). Available online: arXiv:1411.6298
29. W.O. Krawec. n-Player Impartial Combinatorial Games with Random Players. *Theoretical Computer Science*, 569, pages 1-12 (2015).
30. W.O. Krawec. Restricted Attacks on Semi-Quantum Key Distribution Protocols. *Quantum Information Processing*, 13 (11), pages 2417-2436 (2014)
31. W.O. Krawec. On the Application of Quantum Decision Theory to Artificial Life. *Proc. IEEE CEC*, pages 3323-3330, Cancun Mexico (2013)
32. W.O. Krawec. Regarding Modular Multiplicative Graphs. *Graph Theory Notes of NY LXIV*, pages 45-48. (2013)
33. W.O. Krawec. On the Emergent Behaviors of a Robot Controlled by a Real-Time Evolving Neural Network. *Proc. Of the 13th International Conference on the Simulation and Synthesis of Living Systems (ALife 13)*, pages 364-371, East Lansing MI. (2012)
34. W.O. Krawec. Modular Multiplicative Graphs. *Ars Combinatoria*. Vol. 124, pages 33-40
35. W.O. Krawec. Analyzing n-Player Impartial Games. *International Journal of Game Theory*, 41 (2) pages 345-367 (2012)

Posters and Poster Papers (Peer-Reviewed):

36. F. Massa, P. Yadav, A. Moqanaki, W. O. Krawec, P. Mateus, N. Paunkovic, A. Souto, P. Walther. Experimental semi-quantum key distribution with classical users. *International Conference on Quantum Cryptography (QCrypt)* 2020.
37. W.O. Krawec. Quantum Sampling and Entropic Uncertainty, with Applications. *9th International Conference on Quantum Cryptography (Qcrypt)* 2019, Montreal Canada.
38. C. Vlachou, W.O. Krawec, P. Mateus, N. Paunkovic and A. Souto Quantum Walks and Quantum Key Distribution. *9th International Conference on Quantum Cryptography (Qcrypt)* 2019, Montreal Canada.
39. W.O. Krawec. Mismatched Measurements and Quantum Key Distribution. *6th International Conference on Quantum Cryptography (QCrypt)* 2016, Washington D.C.
40. W.O. Krawec. An Algorithm for Evolving Multiple Quantum Operators for Arbitrary Quantum Computational Problems. *Proc. ACM GECCO (Companion)* 2014, Vancouver Canada, pages 59-60
41. W.O. Krawec. Minimal Variable Quantum Decision Makers for Robotic Control. *Proc. ACM GECCO (Companion)* 2014, Vancouver Canada, pages 33-34
42. W.O. Krawec. Using Evolutionary Techniques to Analyze the Security of Quantum Key Distribution Protocols. *Proc. ACM GECCO (Companion)* 2014, Vancouver Canada, pages 171-172

Theses:

43. W.O. Krawec. Semi-Quantum Key Distribution: Protocols, Security Analysis, and New Models. Ph.D. Thesis, Stevens Institute of Technology, Hoboken NJ, May 2015
44. W.O. Krawec. Analyzing n-Player Impartial Games. MA Thesis, University at Albany (SUNY), Albany NY, May 2010

Abstracts:

45. W.O. Krawec. Security in the Semi-Quantum Setting. Presented at the AMS/MAA Joint Math Meetings, San Antonio TX, January 2015

Manuscripts:

46. W.O. Krawec. Simulating Quantum Algorithms with Q-Prog.
47. M. Daven and W.O. Krawec. Three-legged Spiders with Even Edge Count are Harmonious

Other (Not Peer-Reviewed) Articles:

48. W.O. Krawec. Evolutionary Robotics (Parts I and II). *Circuit Cellar Ink*. November-December 2015.
49. W.O. Krawec. Experiments in Developmental Robotics (Parts I and II). *Circuit Cellar Ink*. September-October 2013

50. W.O. Krawec. Creating an HC11 OS. *Dr. Dobbs Journal*. December 2008
51. W.O. Krawec. Programming the Pocket PC. *Nuts & Volts Magazine*. June 2006
52. W.O. Krawec. Palm Programming: An Introduction. *Nuts & Volts Magazine*. October 2004
53. W.O. Krawec. An HC11 File Manager. *Circuit Cellar Online*. April-May 2001

Professional Service:

I have served as reviewer for the following journals and conferences:

- *Nature Physics*
- *Quantum Information & Computation*
- *SIAM Reviews (SIREV)*
- *Entropy*
- *New Journal of Physics*
- *IEEE International Symposium on Information Theory (ISIT)*
- *Quantum Information Processing*
- *Theoretical Computer Science*
- *Discrete Mathematics*
- *Discrete Applied Mathematics*
- *Scientific Reports*

I am also a reviewer for the *AMS Mathematical Reviews* and serve on NSF panels.

Students:

PhD:

1. Omar Amer (Fall 2018 – present)
2. Hasan Iqbal (Fall 2018 – present)
3. Minwoo Bae (Fall 2018 – present)

Undergraduate:

1. Julia Guskind (2019-present)
2. Keegan Yao (2019-present)
3. Calvin Roth (2019)
4. Allison Gagliano (2018)
5. Alex Masi (2018)
6. Omar Amer (Honor's Student, Spring 2018)
7. Sam Markelon (2017-2020)
8. Michael Nelson (Honor's Student, 2017)
9. Eric Geiss (2016-2017)