Boulat A. Bash

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Education

2015 **Ph. D. (Computer Science)**, *University of Massachusetts*, Amherst, Massachusetts.
Advisors: Don Towsley and Dennis Goeckel
Thesis: Fundamental Limits of Covert Communications *(won outstanding doctoral dissertation award)*

2008 **M. S. (Computer Science)**, *University of Massachusetts*, Amherst, Massachusetts.

2001 **A. B. (Economics), *cum laude***, *Dartmouth College*, Hanover, New Hampshire.

Employment

2018– **Assistant Professor**, *Electrical & Computer Engineering Department*, University of Arizona, Tucson, Arizona.

2015–2018 **Scientist**, *Quantum Information Processing Group*, Raytheon BBN Technologies, Cambridge, Massachusetts.

2005–2015 **Research Assistant**, *College of Information and Computer Sciences*, University of Massachusetts, Amherst, Massachusetts.

2004–2005 **Research Associate**, *Computer Science Department*, Boston University, Boston, Massachusetts.

2000–2002 **Analyst**, *Quantitative Strategies Group, Asset Management Division*, Goldman, Sachs & Co., New York, New York.

Awards

2016 Winner, Raytheon Space and Airborne Systems (SAS) Excellence in Engineering and Technology Award for the theoretical and experimental work on covert communication

2015 Honorable Mention, NSA Best Scientific Cybersecurity Paper Competition, for "Quantum-secure Covert Communication on Bosonic Channels" (journal ref. [8])

2015 Winner, University of Massachusetts School of Computer Science Outstanding Doctoral Dissertation Award

2015 University of Massachusetts nominee for the ACM Doctoral Dissertation Award

2001 Student Speaker Award, Francis Ouimet Scholarship Fund

Research Interests

I am broadly interested in applications of classical and quantum information theory to practical problems of reliability and security. Specifically, I study the fundamental limits of communications and sensing with signals that are mathematically provable to be secure against adversaries that are restricted only by the laws of quantum mechanics, and push towards these limits by engineering experimental and prototype systems. A lot of my work is on covert, or low probability of detection/intercept (LPD/LPI) systems. I collaborate closely with experts in radio and optical systems engineering. While most of my work focuses on electronic systems, I am also keenly interested in applications of information-theoretic approaches to securing biomechanical and very large distributed computing systems.

Invited Talks

- *Hiding Signals in Noise: Fundamental Limits of Covert Communication and Sensing.* University of Arizona, Tucson, College of Optical Sciences Colloquium, November 30, 2017
- *Quantum-secure Covert Communication on Bosonic Channels.* Science of Security Quarterly Lablet Meeting, Laurel MD, November 2, 2016

Journal Publications

[11] Christos N. Gagatsos, **Boulat A. Bash**, Animesh Datta, Zheshen Zhang, and Saikat Guha. "Covert sensing using floodlight illumination". In: *Phys. Rev. A* 99 (6 June 2019), p. 062321. DOI: 10.1103/PhysRevA.99.062321. eprint: `arXiv:1812.10743[quant-ph]`.

[10] Azadeh Sheikholeslami, Majid Ghaderi, Donald Towsley, **Boulat A. Bash**, Saikat Guha, and Dennis Goeckel. "Multi-Hop Routing in Covert Wireless Networks". In: *IEEE Trans. Wireless Commun.* 17.6 (June 2018), pp. 3656–3669. DOI: 10.1109/TWC.2018.2812881. eprint: `arXiv:1803.04100[cs.NI]`.

[9] Ramin Soltani, Dennis Goeckel, Don Towsley, **Boulat A. Bash**, and Saikat Guha. "Covert Wireless Communication with Artificial Noise Generation". In: *IEEE Trans. Wireless Commun.* 17.11 (Nov. 2018), pp. 7252–7267. DOI: 10.1109/TWC.2018.2865946. eprint: `arXiv:1610.00384[cs.IT]`.

[8] Christos N. Gagatsos, **Boulat A. Bash**, Saikat Guha, and Animesh Datta. "Bounding the quantum limits of precision for phase estimation with loss and thermal noise". In: *Phys. Rev. A* 96 (6 Dec. 2017), p. 062306. DOI: 10.1103/PhysRevA.96.062306. eprint: `arXiv:1701.05518[quant-ph]`.

[7] Tamara V. Sobers, **Boulat A. Bash**, Saikat Guha, Don Towsley, and Dennis Goeckel. "Covert Communication in the Presence of an Uninformed Jammer". In: *IEEE Trans. Wireless Commun.* 16.9 (Sept. 2017), pp. 6193–6206. DOI: 10.1109/TWC.2017.2720736.

[6] **Boulat A. Bash**, Dennis Goeckel, and Don Towsley. "Covert Communication Gains From Adversary's Ignorance of Transmission Time". In: *IEEE Trans. Wireless Commun.* 15.12 (Dec. 2016), pp. 8394–8405. DOI: 10.1109/TWC.2016.2614502.

[5] Dennis Goeckel, **Bash A. Bash**, Saikat Guha, and Don Towsley. "Covert Communications when the Warden Does Not Know the Background Noise Power". In: *IEEE Commun. Lett.* 20.2 (Feb. 2016), pp. 236–239. DOI: 10.1109/LCOMM.2015.2507594.

[4] **Boulat A. Bash**, Andrei H. Gheorghe, Monika Patel, Jonathan L. Habif, Dennis Goeckel, Don Towsley, and Saikat Guha. "Quantum-secure covert communication on bosonic channels". In: *Nat. Commun.* 6 (Oct. 2015). DOI: 10.1038/NCOMMS9626.

[3] **Boulat A. Bash**, Dennis Goeckel, Saikat Guha, and Don Towsley. "Hiding Information in Noise: Fundamental Limits of Covert Wireless Communication". In: *IEEE Commun. Mag.* 53.12 (2015). DOI: 10.1109/MCOM.2015.7355562. eprint: arXiv:1506.00066[cs.IT].

[2] **Boulat A. Bash**, Dennis Goeckel, and Don Towsley. "Asymptotic Optimality of Equal Power Allocation for Linear Estimation of WSS Random Processes". In: *IEEE Wireless Communications Letters* 2.3 (2013), pp. 247–250. DOI: 10.1109/WCL.2013.020513.120908.

[1] **Boulat A. Bash**, Dennis Goeckel, and Don Towsley. "Limits of Reliable Communication with Low Probability of Detection on AWGN Channels". In: *IEEE J. Select. Areas Commun.* 31.9 (Sept. 2013), pp. 1921–1930. DOI: 10.1109/JSAC.2013.130923. eprint: arXiv:1202.6423[cs.IT].

Conference Publications

[16] **Boulat A. Bash**, Christos Gagatsos, and Saikat Guha. "Fundamental limits of discrete-modulation quantum-secure covert optical communication". In: *Proc. Central Eur. Workshop Quantum Opt. (CEWQO)*. June 2019.

[15] Christos N. Gagatsos, **Boulat A. Bash**, Animesh Datta, Zheshen Zhang, and Saikat Guha. "Covert sensing using floodlight illumination". In: *Proc. Conf. Lasers Electro-Opt. (CLEO)*. San Jose, CA, USA: Opt. Soc. Amer., May 2019, FF1F.7.

[14] Dennis Goeckel, Azadeh Sheikholeslami, Tamara Sobers, **Boulat A. Bash**, Don Towsley, and Saikat Guha. "Covert Communications in a Dynamic Interference Environment". In: *Proc. IEEE Int. Workshop Signal Process. Advances Wireless Commun. (SPAWC)*. Kalamata, Greece, June 2018.

[13] **Boulat A. Bash**, Christos N. Gagatsos, Animesh Datta, and Saikat Guha. "Fundamental limits of quantum-secure covert optical sensing". In: *Proc. IEEE Int. Symp. Inform. Theory (ISIT)*. Aachen, Germany, June 2017. eprint: arXiv:1701.06206[quant-ph].

[12] Dennis Goeckel, **Boulat A. Bash**, Azadeh Sheikholeslami, Saikat Guha, and Don Towsley. "Covert Active Sensing of Linear Systems". In: *Proc. Asilomar Conf. Signals Syst. Comput.* Pacific Grove, CA, USA, Nov. 2017.

[11] Tamara V. Sobers, **Boulat A. Bash**, Saikat Guha, Don Towsley, and Dennis Goeckel. "Covert Communications on Continuous-Time Channels in the Presence of Jamming". In: *Asilomar Conf. Signals Syst. Comput.* Pacific Grove, CA, USA, Nov. 2017.

[10] Azadeh Sheikholeslami, **Boulat A. Bash**, Donald Towsley, Dennis Goeckel, and Saikat Guha. "Covert Communication over Classical-Quantum Channels". In: *Proc. IEEE Int. Symp. Inform. Theory (ISIT)*. Barcelona, Spain, July 2016. eprint: `arXiv:1601.06826[quant-ph]`.

[9] Tamara V. Sobers, **Boulat A. Bash**, Dennis Goeckel, Saikat Guha, and Don Towsley. "Covert communication with the help of an uninformed jammer achieves positive rate". In: *Asilomar Conf. Signals Syst. Comput.* Pacific Grove, CA, USA, Nov. 2015, pp. 625–629.

[8] **Boulat A. Bash**, Dennis Goeckel, and Don Towsley. "LPD Communication when the Warden Does Not Know When". In: *Proc. IEEE Int. Symp. Inform. Theory (ISIT)*. Honolulu, HI, July 2014. eprint: `arXiv:1403.1013[cs.IT]`.

[7] Ramin Soltani, **Boulat A. Bash**, Dennis Goeckel, Saikat Guha, and Don Towsley. "Covert Single-hop Communication in a Wireless Network with Distributed Artificial Noise Generation". In: *Proc. Conf. Commun. Control Comp. (Allerton)*. Monticello, IL, USA, Oct. 2014. eprint: `arXiv:1610.00384[cs.IT]`.

[6] **Boulat A. Bash**, Saikat Guha, Dennis Goeckel, and Don Towsley. "Quantum Noise Limited Communication with Low Probability of Detection". In: *Proc. IEEE Int. Symp. Inform. Theory (ISIT)*. Istanbul, Turkey, July 2013.

[5] **Boulat A. Bash**, Dennis Goeckel, and Don Towsley. "Square Root Law for Communication with Low Probability of Detection on AWGN Channels". In: *Proc. IEEE Int. Symp. Inform. Theory (ISIT)*. Cambridge, MA, July 2012.

[4] **Boulat A. Bash**, Dennis Goeckel, and Don Towsley. "Clustering in Cooperative Networks". In: *Proc. IEEE Int. Conf. Comput. Commun. (INFOCOM) Mini-conference*. Shanghai, China, Apr. 2011.

[3] **Boulat A. Bash**. "Informed Detour Selection Helps Reliability". In: *Proc. IEEE Global Internet Symp. (GIS)*. Rio de Janeiro, Brasil, Apr. 2009, pp. 1–6.

[2] **Boulat A. Bash** and Peter J. Desnoyers. "Exact Distributed Voronoi Cell Computation in Sensor Networks". In: *Proc. ACM Int. Confi. Inform. Process. Sensor Networks (IPSN)*. Cambridge, Massachusetts, USA, 2007, pp. 236–243.

[1] **Boulat A. Bash**, John W. Byers, and Jeffrey Considine. "Uniform Random Sampling in Sensor Networks". In: *Proc. Int. Workshop Data Manage. Sensor Networks (DMSN)*. Toronto, Canada, Aug. 2004.

Patents

[1] **Boulat A. Bash** and Saikat Guha. "Covert Sensor". U.S. App. 10/274,587. Apr. 2019.

Technical Reports and Work in Submission

[3] Michael S. Bullock, Christos N. Gagatsos, Saikat Guha, and **Boulat A. Bash**. *Fundamental limits of quantum-secure covert communication over bosonic channels*. arXiv:1907.04228. 2019.

[2] **Boulat A. Bash**, Nivedita Chandrasekaran, Jeffrey H. Shapiro, and Saikat Guha. *Quantum Key Distribution Using Multiple Gaussian Focused Beams*. arXiv:1604.08582 [quant-ph]. 2016.

[1] **Boulat A. Bash**. *Post-IPO Flipping and Turnover: Predictive Factors for Long-Run Returns*. Social Sci. Res. Network work. paper 623502. May 2001.

Teaching

Fall 2019 **Introduction to Communications**, *UA ECE 340A*.

Spring 2019 **Introduction to Communications**, *UA ECE 340A*.

Spring 2011 **Wireless Network Security: Information-Theoretic vs. Cryptographic Approaches**, *UMass CMPSCI 691WS/ECE 691WS*, www-net.cs.umass.edu/cs691ws/.

Memberships and Professional Activities

Since 2006 Member, Institute of Electrical and Electronics Engineers (IEEE)

Since 2006 Member, Association for Computing Machinery (ACM)

Reviewer:
- IEEE Transactions on Information Theory
- IEEE Transactions on Wireless Communications
- IEEE/ACM Transactions on Networking
- IEEE International Symposium on Information Theory (ISIT)
- IEEE Journal on Selected Areas of Communications (JSAC)
- IEEE Access
- IEEE Transactions on Information Forensics & Security
- ACM Transactions on Sensor Networks (TOSN)
- ACM SIGMOBILE Mobile Computing and Communications Review (MC^2R)
- IEEE International Conference on Computer Communications (INFOCOM)
- ACM Symposium on Parallelism in Algorithms and Architectures (SPAA)
- International Conference on Distributed Computing in Sensor Systems (DCOSS)

Miscellaneous

- Hobbies:
  - Running and hiking;

- Watching spectator sports: baseball, ice hockey, gridiron and association football, college basketball;
- Traveling and exploring the US National Parks System.