

Rahul Jain

- Position** Associate Professor, Department of Computer Science and Principal Investigator, Centre for Quantum Technologies National University of Singapore
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Homepage: <https://www.comp.nus.edu.sg/~rahul>
- Education** Ph.D. (Computer Science), Tata Institute of Fundamental Research, Mumbai 400005, India, 1998-2003.
B.Tech. (Electrical and Electronics Engineering), Indian Institute of Technology, Mumbai, India, 1993-1997.
- Research Interests** Quantum Computation, Information Theory, Complexity Theory, Communication Complexity, Cryptography.
- Past Professional Experience**
1. Assistant Professor, Department of Computer Science, and Principal Investigator, Centre for Quantum Technologies, National University of Singapore. November 2008 - June 2013.
 2. Visiting Scientist, SIMONS Institute for the Theory of Computing, Berkeley, USA. Spring 2014, Spring 2015.
 3. Visiting Professor, CNRS, Paris. Spring 2015.
 4. Post doctoral research fellow, Computer Science department and Institute for Quantum Computing, University of Waterloo, ON, Canada. May 2006 - October 2008.
 5. Post doctoral research fellow, Computer Science department of University of California at Berkeley, California, USA. September 2004 - April 2006.
 6. Algorithms Consultant, Cadence Design Systems, NOIDA, U.P. India. January 2004 - August 2004.
 7. Software Engineer, Verifone India Private Limited, Bangalore, India. August 1997 - July 1998.
- Awards**
1. Award under the “Vajra” scheme 2017-18 by Government of India (<http://www.vajra-india.in/>).
 2. “Best of 2016” by ACM Computing Reviews for paper number 9 in the refereed conference publications list.
 3. Young Researcher Award, National University of Singapore, 2012.
 4. “Best paper award” at the 42nd ACM Symposium on Theory of Computing (STOC) 2010 for paper number 18 in the refereed conference publications list.
 5. IBM Distinguished Dissertation Award, 2005.
 6. TAA-Sasken Best Thesis Award, 2005-2006.

Academic Service**Editorial Membership**

1. Journal of Computer and System Sciences (JCSS), May 2016 onwards.

Program Committee Membership

1. Annual conference on Quantum Information Processing (QIP), 2018, 2016, 2014.
2. IARCS annual conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS), 2017, 2012.
3. Annual conference on the Theory of Quantum Communications, Computation and Cryptography (TQC), 2018, 2017, 2010.
4. International Colloquium on Automata, Languages and Programming (ICALP), 2016.
5. International Symposium on Theoretical Aspects of Computer Science (STACS), 2016.
6. Annual conference on Theory and Applications of Models of Computation (TAMC), 2016, 2015 (co-Chair), 2013.
7. International Symposium on Algorithms and Computation (ISAAC), 2014.

Grants

1. NRF-ANR (Singapore-France) joint grant “VanQuTe”. Amount SGD 429,600 (co-administered by three PI). Duration 2018-2020.
2. MOE Tier 3 Grant. Amount SGD 295,000. Duration May2013-Apr2018.
3. Young Researcher Award, National University of Singapore. Amount SGD 10,000. Duration May2012-May2015.
4. Centre for Quantum Technologies core grants. Amount SGD 2,500,000. Duration 2009-2022.

Teaching

1. CS3236, “Introduction to Information Theory”, Spring 2018.
2. CS6234, “Advanced Algorithms”, Spring 2012, Spring 2013, Spring 2014, Spring 2016, Spring 2017.
3. CS3230, “Design and Analysis of Algorithms”, Fall 2011, Fall 2012, Fall 2014.
4. CS6209, “Topics in Cryptography”, Spring 2011.
5. CS3231, “Theory of Computation”, Fall 2010, Spring 2010.
6. CS6285, “Foundations of Cryptography”, Spring 2009.
7. QT5198, seminar module offered in the Centre for Quantum Technologies, Spring 2009.
8. CS3230-R, “Design and Analysis of Algorithms-Research”, Spring 2011, Spring 2012, Spring 2013.
9. Linear Algebra, University of Waterloo, Spring 2006.

Supervision

1. Graduate students:
 - (a) Naresh B. Goud and Srijita Kundu (2017 onwards).
 - (b) Anurag Anshu (2013 onwards). Recipient of Deans Graduate Research Excellence Award 2017.
 - (c) Priyanka Mukhopadhyay (2013 onwards).
 - (d) Penghui Yao (2009-2013). Recipient of Research Achievement Award, 2012. Assistant Professor, Nanjing Univesity, China, 2018 onwards. Postdoctoral researcher at CWI, Amsterdam, Netherlands; at IQC, University of Waterloo, Canada and “Hartree Postdoctoral Fellow” at University of Maryland.
 - (e) Attila Pereszlényi (2010-2015). Postdoctoral researcher at CNRS, Paris.
2. Undergraduate students: Venkatesan Harish (2017-18), Utkarsh Jain (2017-18), Eric Siu Zi Feng (2017-18), Vu Dinh Quang Dat (2017-18), Zhou Jun (2012-13).
3. Around fifteen interns from various IITs and other institutes in India.

Organization

1. Workshop on Quantum Algorithms and Complexity Theory. Member local organizing committee. Singapore. February-March 2018.
2. The 17th Asian Quantum Information Science Conference (AQIS). Member local organizing committee. Singapore. September 2017.
3. IMS workshop on Semidefinite and Matrix Methods for Optimization and Communication. Member local organizing committee. Singapore. January-February 2016.
4. Shannon Centenary Symposium. Member local organizing committee. Singapore. May 2016.
5. The 12th Annual Conference on Theory and Applications of Models of Computation (TAMC). Member local organizing committee. Singapore. May 2015.
6. The 9th Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC). Member local organizing committee. Singapore. May 2014.
7. 14th Annual Workshop on Quantum Information Processing (QIP). Member local organizing committee. Singapore. January 2011.
8. Workshop on Quantum Algorithms and Complexity Theory. Member local organizing committee. Singapore. November 2008.

**Selected in-
vited talks**

1. Bombay Information Theory Seminar. Mumbai, India. January 2018.
2. Conference on “Quantum Information Theory”. The Henri Poincaré Institute. Paris, France. December 2017.
3. BIRS workshop on “Communication Complexity and Applications, II”. Canada. March 2017.

Selected invited talks

4. Workshop on “Perspectives on Complexity Theory and Cryptography”. National Mathematics Initiative (NMI), Indian Institute of Science (IISc), Bangalore, India. January, 2017.
5. International workshop on Trustworthy Quantum Information. China. July 2016.
6. IEEE Information Theory Workshop (ITW). South Korea. October 2015.
7. BIRS workshop on “Communication Complexity and Applications, I”. Canada. August 2014.
8. Satellite meeting on “Quantum Correlation and its application in communication and cryptography”, Indian Statistical Institute (ISI), Kolkata. September, 2013.
9. ELC Tokyo Complexity Workshop. Japan. March 2013.
10. Workshop on “Recent progress in quantum algorithms”. Institute of Quantum Computing (IQC), University of Waterloo, Canada. April 2012.
11. The 2nd Annual Mysore Park Workshop in Theoretical Computer. India. May 2011.
12. Annual conference on Quantum Information Processing (QIP). Switzerland. January 2010.
13. Microsoft Research. India. May 2009.
14. The 6th Regional Seminar of the ICT-Asia Programme. Thailand. February 2009.
15. Workshop on “Quantum Information Processing”, Institute of Quantum Computing, University of Waterloo, Canada, November, 2003.
16. Workshop on “Quantum Information Processing”, Centrum voor Wiskunde en Informatica (CWI), Amsterdam, Netherlands, June, 2003.

Service and Outreach

1. International Judge for the Singapore International Mathematics Challenge. Singapore. May 2016.
2. Member of the Department Evaluation Committee (DEC) for Promotion and Tenure (P&T), 2016.
3. Member of the IT Committee at the Centre for Quantum Technologies, NUS, January 2009 onward.
4. Member of the Academic Committee at the Centre for Quantum Technologies, NUS, January 2009 onward.
5. Participant and speaker at the SoC-Vietnam Workshop. Vietnam. 2012.
6. Participant in NUS Openhouse, 2010-2017.

Journal publications

1. Mika Göös, Rahul Jain and Thomas Watson. “Extension complexity of independent set polytopes.” *SIAM Journal of Computing (SICOMP)*, Volume 47, Issue 1, pp. 241269, February 2018.
2. Anurag Anshu, Rahul Jain and Naqeeb Ahmad Warsi. “A generalized quantum Slepian-Wolf.” *IEEE Transactions of Information Theory (IEEE-TIT)*, Volume: 64, Issue: 3, March 2018. Contributed talk at the 17th Asian Quantum Information Science Conference (AQIS) 2017.
3. Anurag Anshu, Rahul Jain and Naqeeb Ahmad Warsi. “A one-shot achievability result for quantum state redistribution.” *IEEE Transactions of Information Theory (IEEE-TIT)*, Volume: 64, Issue: 3, March 2018. Contributed talk at the 21st Annual Conference on Quantum Information Processing (QIP) 2018.
4. Anurag Anshu, Vamsi Krishna Devabathini and Rahul Jain. “Quantum communication using coherent rejection sampling.” *Physical Review Letters (PRL)*, Vol. 119, Issue 12 - 22 September 2017.
5. Rahul Jain, Zhaohui Wei, Penghui Yao and Shengyu Zhang. “Multipartite quantum correlation and communication.” *Computational Complexity (CC)*, Volume 26 Issue 1, pp. 199-228, March 2017.
6. Anurag Anshu, Rahul Jain, Priyanka Mukhopadhyay, Ala Shayeghi and Penghui Yao. “New one shot quantum protocols with application to communication complexity.” *IEEE Transactions of Information Theory (IEEE-TIT)*, Volume: 62, Issue: 12, Dec. 2016.
7. Gábor Braun, Rahul Jain, Troy Lee, Sebastian Pokutta. “Information-theoretic approximations of the nonnegative rank.” *Computational Complexity (CC)*, pp. 1-51, 2016.
8. Christopher Perry, Rahul Jain and Jonathan Oppenheim. “Communication tasks with infinite quantum-classical separation.” *Phys. Rev. Lett. (PRL)* 115, 030504, July 2015.
9. Rahul Jain. “New strong direct product results in communication complexity.” *Journal of the ACM (JACM)*, volume 62 Issue 3, Article No. 20, June 2015.
10. Rahul Jain and Ashwin Nayak. “The space complexity of recognizing well-parenthesized expression.” *IEEE Transactions on Information Theory (IEEE-TIT)*, vol. 60:10, pp.1-23, 2014.
11. Somshubhro Bandyopadhyay, Rahul Jain, Jonathan Oppenheim and Christopher Perry. “Conclusive exclusion of quantum states.” *Physical Review A. (PRA)* vol. 89(2), pp. 22336-22349, 2014. Contributed talk at the 13th Asian Quantum Information Science Conference (AQIS) 2013.
12. Rahul Jain, Yaoyun Shi, Zhaohui Wei and Shengyu Zhang. “Efficient protocols for generating bipartite classical distributions and quantum states.” *IEEE Transactions on Information Theory (IEEE-TIT)*, vol. 59(8), pp. 5171-5178, 2013.
13. Rahul Jain and Ashwin Nayak. “Short proofs of the quantum Substate Theorem.” *IEEE Transactions on Information Theory (IEEE-TIT)*, Volume: 58(6), pp. 3664-3669, 2012.

Journal publications

14. Rahul Jain. “Resource requirements of private quantum channels and consequence for oblivious remote state preparation.” *Journal of Cryptology (JoC)*, Volume 25, Issue 1, pp. 1-13, 2012.
15. Rahul Jain and Shengyu Zhang. “The influence lower bound via query elimination.” *Theory of Computation (ToC)*, Volume 7, Article 10 pp. 147-153, 2011.
16. Prahladh Harsha, Rahul Jain, David McAllester and Jaikumar Radhakrishnan. “The communication complexity of correlation.” *IEEE Transactions on Information Theory (IEEE-TIT)*, 56(1), pp. 438-449, 2010.
17. Rahul Jain, Hartmut Klauck and Miklos Santha. “Optimal direct sum results for deterministic and randomized decision tree complexity.” *Information Processing Letter (IPL)*, 110 (2010), pp. 893-897.
18. Rahul Jain, Zhengfeng Ji, Sarvagya Upadhyay and John Watrous. “QIP = PSPACE.” Invited to the *Journal of the ACM (JACM)*. Published as Article no. 30, Volume 58, Issue 6, December 2011. Research highlight in *Communications of the ACM (CACM)*, Vol. 53 No. 12, 2010.
19. Rahul Jain, Iordanis Kerenidis, Greg Kuperberg, Miklos Santha, Or Sattath and Shengyu Zhang. “On the power of a unique quantum witness.” *Theory of Computation (ToC)*, Volume 8, Article 17, pp. 375-400, 2012.
20. Rahul Jain, Alexandra Kolla, Gatis Midrijanis and Ben W. Reichardt. “On parallel composition of zero-knowledge proofs with black-box quantum simulators.” *Quantum Information and Computation (QIC)*, 2009, Vol.9, No.5 and 6, pp. 0513-0532.
21. Richard Cleve, Dmitry Gavinsky and Rahul Jain. “Entanglement-Resistant Two-Prover Interactive Proof Systems and Non-Adaptive Private Information Retrieval Systems.” *Quantum Information and Computation (QIC)*, 2009, Vol.9 No.7 and 8, pp. 0648-0656.
22. Rahul Jain and Shengyu Zhang. “New bounds on classical and quantum one-way communication complexity.” *Theoretical Computer Science (TCS)*, Elsevier, 2009, (410) pp. 2463-2477.
23. Rahul Jain, Jaikumar Radhakrishnan and Pranab Sen. “A new information-theoretic property about quantum states with an application to privacy in quantum communication.” *Journal of the ACM (JACM)*, 2009, Volume 56, Issue 6, Article No.: 33.
24. Rahul Jain, Ashwin Nayak and Yi Su. “A separation between divergence and Holevo information for ensembles.” Invited to a special issue of *Mathematical Structures in Computer Science (MSCS) on TAMC 2008*. Published as *Lecture Notes in Computer Science Volume 4978*, 2008, pp 526-541.
25. Rahul Jain. “New binding-concealing trade-offs for quantum string commitment.” *Journal of Cryptology (JoC)*, 2008, Vol. 21 (4), pp. 579-592.
26. Rahul Jain. “Communication complexity of remote state preparation with entanglement.” In *Quantum Information and Computation (QIC)*, Vol.6 No.4&5 pp. 461-464, 2006.
27. Amit Deshpande, Rahul Jain, Satyanarayana V. Lokam, Jaikumar Radhakrishnan and Kavitha Telikapalli. “Better lower bounds for locally decodable codes.” In *Random Structures and Algorithms (RSA)*, pp. 358-378, 2005.

**Refereed
conference
publications**

1. Anurag Anshu, Rahul Jain and Naqeeb A. Warsi. “One-shot entanglement assisted classical and quantum communication over noisy quantum channels: A hypothesis testing and convex split approach”. IEEE International Symposium on Information Theory (ISIT). 2018. Contributed talk at the 21st Annual Conference on Quantum Information Processing (QIP), 2018.
2. Anurag Anshu, Rahul Jain and Naqeeb A. Warsi. “A hypothesis testing approach for communication over entanglement assisted compound quantum channel”. IEEE International Symposium on Information Theory (ISIT). 2018. Contributed talk at the 21st Annual Conference on Quantum Information Processing (QIP), 2018.
3. Dmitry Gavinsky, Rahul Jain, Hartmut Klauck, Srijita Kundu, Troy Lee, Miklos Santha, Swagato Sanyal, Jevgenijs Vihrovs. “Quadratically tight relations for randomized query complexity”. The 13th International Computer Science Symposium in Russia (CSR) 2018.
4. Anurag Anshu, Dmitry Gavinsky, Rahul Jain, Srijita Kundu, Troy Lee, Priyanka Mukhopadhyay, Miklos Santha and Swagato Sanyal. “A composition theorem for randomized query complexity.” In proceedings of The 37rd Foundations of Software Technology and Theoretical Computer Science (FSTTCS), 2017.
5. Anurag Anshu, Shalev Ben-David, Ankit Garg, Rahul Jain, Robin Kothari and Troy Lee. “Separating quantum communication and approximate rank.” In proceedings of the 32th IEEE Conference on Computational Complexity (CCC), LIPIcs, pp. 24:1-24:33, 2017.
6. Mika Göös, Rahul Jain and Thomas Watson. “Extension Complexity of Independent Set Polytopes.” In proceedings of The 57th Annual IEEE Symposium on Foundations of Computer Science (FOCS), pp. 565-572, 2016.
7. Anurag Anshu, Aleksandrs Belovs, Shalev Ben-David, Mika Göös, Rahul Jain, Robin Kothari, Troy Lee and Miklos Santha. “Separations in communication complexity using cheat sheets and information complexity.” In proceedings of The 57th Annual IEEE Symposium on Foundations of Computer Science (FOCS), pp. 555-564, 2016.
8. Prahladh Harsha, Rahul Jain and Jaikumar Radhakrishnan. “Partition bound is quadratically tight for product distributions.” In proceedings of The 43rd International Colloquium on Automata, Languages, and Programming (ICALP), pp. 135:1-135:13, 2016.
9. Lila Fontes, Rahul Jain, Iordanis Kerenidis, Mathieu Laurière, Sophie Laplante and Jérémie Roland. “Relative discrepancy does not separate information and communication complexity.” In proceedings of The 42nd International Colloquium on Automata, Languages, and Programming (ICALP 2015), vol. 9134, LNCS, pp. 506-516, 2015. Listed among ”Best of 2016” by ACM Computing Reviews.
10. Nathanaël François, Rahul Jain and Frédéric Magniez. “Input/Output Streaming Complexity of Reversal and Sorting.” In proceedings of the 18th International Workshop on Randomization and Computation (RANDOM), pp. 654-668, 2014.
11. Rahul Jain, Attila Pereszlényi and Penghui Yao. “A parallel repetition theorem for entangled two-player one-round games under product distributions.” In proceedings of 29th IEEE Conference on Computational Complexity (CCC), pp. 209 - 216, 2014.

**Refereed
conference
publications**

12. Prahladh Harsha and Rahul Jain. “A strong direct product theorem for the Tribes function via the smooth-rectangle bound.” In proceedings of the 33rd Foundations of Software Technology and Theoretical Computer Science (FSTTCS), pp. 141-152, 2013.
13. Rahul Jain, Yaoyun Shi, Zhaohui Wei and Shengyu Zhang. “Efficient protocols for generating bipartite classical distributions and quantum states.” In proceedings of the ACM-SIAM Symposium on Discrete Algorithms (SODA), pp. 1503-1512, 2013.
14. Rahul Jain, Attila Perézszlenyi and Penghui Yao. “A direct product theorem for bounded-round public-coin randomized communication complexity.” In proceedings of The 53rd Annual IEEE Symposium on Foundations of Computer Science (FOCS), pp. 167-176, 2012.
15. Rahul Jain and Penghui Yao. “A parallel approximation algorithm for positive semidefinite programming.” In proceedings of the 52nd Annual IEEE Symposium on Foundations of Computer Science (FOCS), pp. 463-471, 2011.
16. Rahul Jain, Hartmut Klauck and Shengyu Zhang. “Depth-Independent Lower bounds on Communication Complexity of Read-Once Boolean Functions.” In proceedings of the 16th Annual International Computing and Combinatorics Conference (COCOON), 2010. Lecture Notes in Computer Science, 2010, Volume 6196/2010, 54-59.
17. Rahul Jain and Hartmut Klauck. “The Partition Bound for Classical Communication Complexity and Query Complexity.” In proceedings of the 25th IEEE Conference on Computational Complexity (CCC), 2010, pp. 247-258.
18. Rahul Jain, Zhengfeng Ji, Sarvagya Upadhyay and John Watrous. “QIP = PSPACE.” In proceedings of The 42nd ACM Symposium on Theory of Computing (STOC), pp. 573-582, 2010. Recipient of the best paper award.
19. Rahul Jain, Iordanis Kerenidis, Greg Kuperberg, Miklos Santha, Or Sattath and Shengyu Zhang. “On the power of a unique quantum witness.” In proceedings of the 1st Annual Conference on Innovations in Theoretical Computer Science (ITCS), pp. 470-481, 2010.
20. Rahul Jain, Sarvagya Upadhyay and John Watrous. “Two-message quantum interactive proofs are in PSPACE.” In proceedings of the 50th Annual Symposium on Foundations of Computer Science (FOCS), 2009, pp. 534-543.
21. Rahul Jain and Hartmut Klauck. “New Results in the Simultaneous Message Passing Model via Information theoretic techniques.” In proceedings of the 24th IEEE Conference on Computational Complexity (CCC), 2009, pp. 369-378.
22. Rahul Jain and John Watrous. “Parallel approximation of non-interactive zero-sum quantum games.” In proceedings of the 24th IEEE Conference on Computational Complexity (CCC), 2009, pp. 243-253.
23. Rahul Jain, Ashwin Nayak and Yi Su. “A separation between divergence and Holevo information for ensembles.” In proceedings of The 5th Annual Conference on Theory and Applications of Models of Computation (TAMC), 2008, pp. 526-541.
24. Rahul Jain, Hartmut Klauck and Ashwin Nayak. “Direct product theorems for communication complexity via subdistribution bounds.” In proceedings of The 40th ACM Symposium on Theory of Computing (STOC), 2008, pp. 599-608.

**Refereed
conference
publications**

25. Prahladh Harsha, Rahul Jain, David McAllester and Jaikumar Radhakrishnan. "The communication complexity of correlation." In proceedings of 22nd IEEE Conference on Computational Complexity (CCC), pp. 10-23, 2007.
26. Rahul Jain, Jaikumar Radhakrishnan and Pranab Sen. "Prior entanglement, message compression and privacy in quantum communication." In proceedings of 20th IEEE Conference on Computational Complexity (CCC), pp. 285-296, 2005.
27. Rahul Jain, Jaikumar Radhakrishnan and Pranab Sen. "Privacy and interaction in quantum communication complexity and a theorem about the relative entropy of quantum states." In proceedings of 43rd IEEE Symposium on Foundations of Computer Science (FOCS), 2002, pp. 429-438.
28. Amit Deshpande, Rahul Jain, Satyanarayana V. Lokam, Jaikumar Radhakrishnan and Kavitha Telikapalli. "Better lower bounds for locally decodable codes." In proceedings of 17th IEEE Conference on Computational Complexity (CCC), pp. 184-193, 2002.
29. Rahul Jain, Jaikumar Radhakrishnan and Pranab Sen. "A lower bound for bounded round quantum communication complexity of set disjointness." In proceedings of 44th IEEE Symposium on Foundations of Computer Science (FOCS), 2003, pp. 220-229.
30. Rahul Jain, Jaikumar Radhakrishnan and Pranab Sen. "A direct sum theorem in communication complexity via message compression." In proceedings of 30th International Colloquium on Automata, Languages and Programming (ICALP), 2003, pp. 300-315. Invited to a special issue of Theoretical Computer Science (TCS) on ICALP 2003.
31. Rahul Jain, Jaikumar Radhakrishnan and Pranab Sen. "The quantum communication complexity of the pointer chasing problem: the bit version." In proceedings of 22nd conference on the Foundations of Software Technology and Theoretical Computer Science (FSTTCS), 2002, pp. 218-229.

Manuscripts

1. Anurag Anshu, Min-Hsiu Hsieh and Rahul Jain. “Noisy quantum state redistribution with promise and the Alpha-bit.” 2018. ArXiv:1803.03414.
2. Anurag Anshu, Min-Hsiu Hsieh and Rahul Jain. “Quantifying resource in catalytic resource theory.” 2017. ArXiv:1708.00381.
3. Rahul Jain, Carl A. Miller and Yaoyun Shi. “Parallel device-independent quantum key distribution.” 2017. ArXiv:1703.05426.
4. Anurag Anshu, Rahul Jain and Naqeeb Ahmad Warsi. “A unified approach to source and message compression.” 2017. ArXiv:1707.03619.
5. Anurag Anshu, Rahul Jain and Naqeeb Ahmad Warsi. “One-shot measurement compression with quantum side information using shared randomness.” 2017. ArXiv:1703.02342.
6. Rahul Jain, Troy Lee and Nisheeth K. Vishnoi. “A quadratically tight partition bound for classical communication complexity and query complexity.” 2014. ArXiv:1401.4512.
7. Rahul Jain and Penghui Yao. “A strong direct product theorem in terms of the smooth rectangle bound.” 2012. ArXiv:1209.0263.
8. Rahul Jain and Ashwin Nayak. “Accessible versus Holevo information for a binary random variable.” 2006. At quant-ph/0603278.
9. Rahul Jain. “An approach from classical information theory to lower bounds for smooth codes.” 2007. At cs.CR/0607042.
10. Rahul Jain. “Distinguishing sets of quantum states.” 2005. ArXiv:quant-ph/0506205.
11. Rahul Jain. “A super-additivity inequality for channel capacity of classical-quantum channels.” 2005. ArXiv:quant-ph/0507088.