

PRAHLADH HARSHA

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Education

- 2004 **Massachusetts Institute of Technology (MIT)** Cambridge, MA, USA
Doctor of Philosophy (PhD) in Computer Science
Thesis Title: *Robust PCPs of Proximity and Shorter PCPs*
Advisor: Prof. Madhu Sudan
- 2000 **Massachusetts Institute of Technology (MIT)** Cambridge, MA, USA
Master of Science (SM) in Computer Science
Thesis Title: *Small PCPs with low query complexity*
Advisor: Prof. Madhu Sudan
- 1998 **Indian Institute of Technology (IIT), Madras** Chennai, INDIA
Bachelor of Technology (BTech) in Computer Science and Engineering

Employment

- Dec '09 – present **Tata Institute of Fundamental Research (TIFR)** Mumbai, INDIA
School of Technology and Computer Science
[Jan '15 – present] Associate Professor
[Dec '09 – Dec '14] Reader
- Feb '17 – present **Weizmann Institute of Science** Rehovot, ISRAEL
Visiting Associate Professor, Department of Applied Mathematics and Computer Science
(while on sabbatical from TIFR)
- Sep '16 – Jan '17 **Rutgers University** New Brunswick, NJ, USA
Murray Visiting Professor, DIMACS and Dept. Computer Science
(while on sabbatical from TIFR)
- Aug '13 – Dec '13 **Simons Institute for the Theory of Computing** Berkeley, CA, USA
Visiting Scientist
- Jul '10 – Jul '13 **Institute of Mathematical Sciences (IMSc)** Chennai, INDIA
Visiting Faculty
- Sep '08 – Oct '09 **University of Texas at Austin** Austin, TX, USA
Research Fellow, Dept. Computer Science
- Nov '08 – Jun '09 **Technion, Israel Institute of Technology** Haifa, ISRAEL
Aly Kaufman Visiting Scientist
(while on leave from University of Texas at Austin)
- Sep '04 – Aug '08 **Toyota Technological Institute (TTI), Chicago** Chicago, IL, USA
Research Assistant Professor
- Jan '05 – Sep '05 **Microsoft Research, Silicon Valley** Mountain View, CA, USA
Postdoctoral Researcher
(while on leave from Toyota Technological Institute, Chicago)

Honours and Awards

Swarnajayanti Fellowship Award 2015-16 in Mathematical Sciences (Department of Science and Technology, Government of India)

NASI-SCOPUS Young Scientist Award 2011 for Mathematics.

Associate of the Indian Academy of Sciences (for the period: 2011–2014).

Ranked 7th in the All India Joint Entrance Examination (JEE) for admission into the Indian Institutes of Technology (among the 100,000 candidates who appeared for the examination).

Professional Activities

Editorial Work Associate Editor, SIAM Journal on Computing (2017 – present)
Editor for Proc. 35th FSTTCS 2015, vol 45 of LIPIcs, Schloss Dagstuhl.
Guest Editor for the CCC 2016 Special Issue in Theory of Computing (ToC) journal.

Chair of Program Committee:
FSTTCS 2015 (co-chair)

Member of Program Committee:
RANDOM 2009, APPROX 2011, FSTTCS 2011, RANDOM 2013, FSTTCS 2013, CALDAM 2015, FSTTCS 2015, CCC 2016, FOCS 2016.

Tutorials/Workshops Organized:
Organizer (with Moses Charikar) for the DIMACS Tutorial, *Limits of Approximation Algorithms: PCPs and Unique games*, June 2009.
Organizer (with Amit Deshpande and Saket Saurabh) for the *2nd Annual Mysore Park Workshop in Theoretical Computer Science: Algorithms and Complexity*, May 2011.
Organizer (with Amit Deshpande and Saket Saurabh) for the *3rd Annual Mysore Park Workshop in Theoretical Computer Science: Algorithms and Complexity*, August 2012.
Organizer (with Amit Deshpande and Saket Saurabh) for the *4th Annual Mysore Park Workshop in Theoretical Computer Science: Algorithms and Complexity*, August 2013.
Organizer (with Arkadev Chattopadhyay and Jaikumar Radhakrishnan) for the workshop on *Recent Progress in Arithmetic Complexity*, TIFR, Feb 2014.
Organizer (with Vinod Prabhakaran and Jaikumar Radhakrishnan) for the workshop *Bombay Information Theory Seminar (BITS)*, in commemoration of the birth centenary of Claude E. Shannon, IIT Bombay/TIFR, Jan 2016.

Students advised

PhD Students • Girish Varma (Thesis: Hardness of Approximate Coloring, TIFR, 2016)
• Swagato Sanyal (Thesis: Complexity Measures of Boolean Functions: Fourier Sparsity, Fourier Dimension and Query Complexity, TIFR, 2017)
• Rakesh Venkat (Thesis: On Sparsest Cut and Parallel Repetition, TIFR, 2017)
• Tulasi Mohan (current)

Undergraduate • Sivakanth Gopi, IIT Bombay (supervised jointly with Prof. Srikanth Srinivasan, IIT Bombay)

Summer Interns • Amey Bhangale (Rutgers University), Abhishek Brushundi (Rutgers University), Akshay Kamath (Chennai Mathematical Institute), Arpit Merchant (IIIT Hyderabad), Sasank Mouli (IIT Kanpur), Vishvajeet Nagargoje (IIT Madras), Aditya Pottukuchi (Rutgers University)

Funding

Israel-India ISF-UGC grant on “Two player games: hardness of approximation and communication” (joint project with Prof. Irit Dinur, Weizmann Institute for 3 years)

Indo-US Joint Center for Research on Pseudorandomness in Computer Science (joint project led by Prof. Arnab Bhattacharyya (IISc, Bangalore) and Prof. Shachar Lovett (Univ. California, San Diego) for 2 years, co-PI's include Prof. Chandan Saha (IISc Bangalore), Prof. Srikanth Srinivasan (IIT Bombay), Prof. Raghu Meka (Univ. California, Los Angeles), Prof. Luca Trevisan (Univ. California, Berkeley) and Prof. Madhur Tulsiani (TTI Chicago)).

Publications

Journals

- [J1] Venkat Guruswami, Prahladh Harsha, Johan Hstad, Srikanth Srinivasan, and Girish Varma. Super-polylogarithmic hypergraph coloring hardness via low-degree long codes. *SIAM Journal of Computing*, 46(1):132–159, 2017. (Preliminary Version in *46th STOC*, 2014).
- [J2] Prahladh Harsha, Adam Klivans, and Raghu Meka. Bounding the sensitivity of polynomial threshold functions. *Theory of Computing*, 10(1):1–24, 2014. (special Issue on Analysis of Boolean Functions; Preliminary version in *42nd STOC*, 2010).
- [J3] Irit Dinur and Prahladh Harsha. Composition of low-error 2-query PCPs using decodable PCPs. *SIAM Journal of Computing*, 42(6):2452–2486, 2013. (special issue for FOCS 2009; Preliminary version in *51st FOCS*, 2009).
- [J4] Prahladh Harsha, Adam Klivans, and Raghu Meka. An invariance principle for polytopes. *Journal of the ACM*, 59(6):29, 2012. (Preliminary version in *42nd STOC*, 2010).
- [J5] Eli Ben-Sasson and Prahladh Harsha. Lower bounds for bounded depth Frege proofs via Buss-Pudlák games. *ACM Transactions on Computational Logic*, 11(3):1–17, 2010.
- [J6] Prahladh Harsha, Rahul Jain, David McAllester, and Jaikumar Radhakrishnan. The communication complexity of correlation. *IEEE Transactions on Information Theory*, 56(1):438–449, 2010. (Preliminary version in *22nd IEEE Conference on Computational Complexity*, 2007).
- [J7] Eli Ben-Sasson, Prahladh Harsha, Oded Lachish, and Arie Matsliah. Sound 2-query PCPPs are long. *ACM Transactions on Computation Theory*, 1(2):1–49, 2009. (Preliminary version in *35th ICALP*, 2008).
- [J8] Prahladh Harsha, Yuval Ishai, Joe Kilian, Kobbi Nissim, and Srinivas Venkatesh. Communication vs. computation. *Computational Complexity*, 16(1):1–33, 2007. (Preliminary version in *31st ICALP*, 2004).
- [J9] Eli Ben-Sasson, Oded Goldreich, Prahladh Harsha, Madhu Sudan, and Salil Vadhan. Robust PCPs of proximity, shorter PCPs and applications to coding. *SIAM Journal of Computing*, 36(4):889–974, 2006. (special issue on Randomness and Computation; Preliminary version in *36th STOC*, 2004).
- [J10] Eli Ben-Sasson, Prahladh Harsha, and Sofya Raskhodnikova. Some 3CNF properties are hard to test. *SIAM Journal of Computing*, 35(1):1–21, 2005. (Preliminary version in *35th STOC*, 2003).
- [J11] Prahladh Harsha and Madhu Sudan. Small PCPs with low query complexity. *Computational Complexity*, 9(3–4):157–201, December 2000. (Preliminary version in *18th STACS*, 2001).

- [J12] Kamala Krithivasan, Sakthi Balan, and Prahladh Harsha. Distributed processing in automata. *International Journal of Foundations of Computer Science*, 10(4):443–463, December 1999.

Refereed Conference Publications

- [C1] Abhishek Bhrushundi, Prahladh Harsha, and Srikanth Srinivasan. On polynomial approximations over $Z/2^kZ$. In Heribert Vollmer and Brigitte Vallée, editors, *Proceedings of the 34th Symposium on Theoretical Aspects of Computer Science (STACS)*, volume 66 of *Leibniz International Proceedings in Informatics*, pages 12:1–12:12. Schloss Dagstuhl, 2017.
- [C2] Irit Dinur, Prahladh Harsha, Rakesh Venkat, and Henry Yuen. Multiplayer parallel repetition for expander games. In Christos Papadimitriou, editor, *Proceedings of the 8th Innovations in Theoretical Computer Science (ITCS)*. ACM, 2017. (Invited paper).
- [C3] Amit Deshpande, Prahladh Harsha, and Rakesh Venkat. Embedding approximately low-dimensional ℓ_2^2 metrics into ℓ_1 . In Akash Lal, S. Akshay, Saket Saurabh, and Sandeep Sen, editors, *Proceedings of the 36th IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS)*, volume 65 of *Leibniz International Proceedings in Informatics*, pages 10:1–10:13. Schloss Dagstuhl, 2016.
- [C4] Prahladh Harsha and Srikanth Srinivasan. Robust multiplication-based tests for Reed-Muller codes. In Akash Lal, S. Akshay, Saket Saurabh, and Sandeep Sen, editors, *Proceedings of the 36th IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS)*, volume 65 of *Leibniz International Proceedings in Informatics*, pages 17:1–17:14. Schloss Dagstuhl, 2016.
- [C5] Prahladh Harsha and Srikanth Srinivasan. On polynomial approximations to AC^0 . In Klaus Jansen, Claire Mathieu, José D. P. Rolim, and Chris Umans, editors, *Proceedings of the 20th International Workshop on Randomization and Computation (RANDOM)*, volume 60 of *Leibniz International Proceedings in Informatics*, pages 32:1–32:14. Schloss Dagstuhl, 2016.
- [C6] Prahladh Harsha, Rahul Jain, and Jaikumar Radhakrishnan. Partition bound is quadratically tight for product distributions. In Ioannis Chatzigiannakis, Michael Mitzenmacher, Yuval Rabani, and Davide Sangiorgi, editors, *Proceedings of the 43rd International Colloquium of Automata, Languages and Programming (ICALP), Part III*, volume 55 of *Leibniz International Proceedings in Informatics*, pages 135:1–135:13. Schloss Dagstuhl, 2016.
- [C7] Amey Bhangale, Prahladh Harsha, and Girish Varma. A characterization of hard-to-cover CSPs. In *Proceedings of the 30th Computational Complexity Conference*, pages 280–303, 2015.
- [C8] Irit Dinur, Prahladh Harsha, and Guy Kindler. Polynomially low error PCPs with poly-loglog n queries via modular composition. In *Proceedings of the 47th ACM Symposium on Theory of Computing (STOC)*, pages 267–276, 2015.
- [C9] Irit Dinur, Prahladh Harsha, Srikanth Srinivasan, and Girish Varma. Derandomized Graph Product Results Using the Low Degree Long Code. In Ernst W. Mayr and Nicolas Ollinger, editors, *Proceedings of the 32nd International Symposium on Theoretical Aspects of Computer Science (STACS)*, volume 30 of *Leibniz International Proceedings in Informatics*, pages 275–287. Schloss Dagstuhl, 2015.
- [C10] Venkat Guruswami, Prahladh Harsha, Johan Hstad, Srikanth Srinivasan, and Girish Varma. Super-polylogarithmic hypergraph coloring hardness via low-degree long codes. In *Proceedings of the 46th ACM Symposium on Theory of Computing (STOC)*, pages 614–623, 2014.
- [C11] Prahladh Harsha and Rahul Jain. A strong direct product theorem for the tribes function via the smooth-rectangle bound. In Anil Seth and Nisheeth K. Vishnoi, editors, *Proceedings*

of the 33rd IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS), volume 24 of *Leibniz International Proceedings in Informatics*, pages 141–152. Schloss Dagstuhl, 2013.

- [C12] Steve Chien, Prahladh Harsha, Alistair Sinclair, and Srikanth Srinivasan. Almost settling the hardness of noncommutative determinant. In *Proceedings of the 43rd ACM Symposium on Theory of Computing (STOC)*, pages 499–508, 2011.
- [C13] Prahladh Harsha, Adam Klivans, and Raghu Meka. An invariance principle for polytopes. In *Proceedings of the 42nd ACM Symposium on Theory of Computing (STOC)*, pages 543–552, 2010.
- [C14] Ilias Diakonikolas, Prahladh Harsha, Adam Klivans, Raghu Meka, Prasad Raghavendra, Rocco Servedio, and Li-Yang Tan. Bounding the average sensitivity and noise sensitivity of polynomial threshold functions. In *Proceedings of the 42nd ACM Symposium on Theory of Computing (STOC)*, pages 533–542, 2010.
- [C15] Irit Dinur and Prahladh Harsha. Composition of low-error 2-query PCPs using decodable PCPs. In *Proceedings of the 50th IEEE Symposium on Foundations of Computer Science (FOCS)*, pages 472–481, 2009.
- [C16] Venkat Chandrasekaran, Nathan Srebro, and Prahladh Harsha. Complexity of inference in graphical models. In *Proceedings of the 24th Conference on Uncertainty in Artificial Intelligence (UAI)*, 2008.
- [C17] Eli Ben-Sasson, Prahladh Harsha, Oded Lachish, and Arie Matsliah. Sound 3-query PCPPs are long. In Luca Aceto, Ivan Damgård, Leslie Ann Goldberg, Magnús M. Halldórsson, Anna Ingólfssdóttir, and Igor Walukiewicz, editors, *Proceedings of the 35th International Colloquium of Automata, Languages and Programming (ICALP), Part I*, volume 5125 of *Lecture Notes in Computer Science*, pages 686–697. Springer, 2008.
- [C18] Prahladh Harsha, Thomas Hayes, Hariharan Narayanan, Harald Räcke, and Jaikumar Radhakrishnan. Minimizing average latency in oblivious routing. In *Proceedings of the 19th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA)*, pages 200–207, 2008.
- [C19] Prahladh Harsha, Rahul Jain, David McAllester, and Jaikumar Radhakrishnan. The communication complexity of correlation. In *Proceedings of the 22nd IEEE Conference on Computational Complexity*, pages 10–23, 2007.
- [C20] Eli Ben-Sasson, Oded Goldreich, Prahladh Harsha, Madhu Sudan, and Salil Vadhan. Short PCPs verifiable in polylogarithmic time. In *Proceedings of the 20th IEEE Conference on Computational Complexity*, pages 120–134, 2005.
- [C21] Prahladh Harsha, Yuval Ishai, Joe Kilian, Kobbi Nissim, and Srinivas Venkatesh. Communication vs. computation. In Josep Díaz, Juhani Karhumäki, Arto Lepistö, and Donald Sannella, editors, *Proceedings of the 31st International Colloquium of Automata, Languages and Programming (ICALP)*, volume 3142 of *Lecture Notes in Computer Science*, pages 745–756. Springer, 2004.
- [C22] Eli Ben-Sasson, Oded Goldreich, Prahladh Harsha, Madhu Sudan, and Salil Vadhan. Robust PCPs of proximity, shorter PCPs and applications to coding. In *Proceedings of the 36th ACM Symposium on Theory of Computing (STOC)*, pages 1–10, 2004.
- [C23] Eli Ben-Sasson, Prahladh Harsha, and Sofya Raskhodnikova. Some 3CNF properties are hard to test. In *Proceedings of the 35th ACM Symposium on Theory of Computing (STOC)*, pages 345–354, 2003.
- [C24] Prahladh Harsha and Madhu Sudan. Small PCPs with low query complexity. In Afonso Ferreira and Horst Reichel, editors, *Proceedings of the 18th Annual Symposium on Theoretical Aspects of Computer Science (STACS)*, volume 2010 of *Lecture Notes in Computer Science*, pages 327–338. Springer, 2001.

Courses Taught

TIFR	Coding theory: An Algorithmic Viewpoint	Monsoon 2016
TIFR	Expander Graphs: Constructions and Applications	Winter/Summer 2016 (co-taught with Anish Ghosh)
TIFR	Math Structures for Computer Science	Monsoon 2015 (co-taught with Jaikumar Radhakrishnan)
TIFR	PCPs & limits of approximation	Winter/Summer 2015 (two module course)
TIFR	Probability and Computing	Monsoon 2014
TIFR	Computational Complexity	Winter/Summer 2014
TIFR	Computational Complexity	Winter/Summer 2013
TIFR	Computational Complexity	Winter/Summer 2012
TIFR & IMSc	Communication Complexity	Monsoon 2011 (co-taught with Meena Mahajan and Jaikumar Radhakrishnan)
TIFR	Computational Complexity	Winter/Summer 2011
TIFR & IMSc	Limits of Approximation Algorithms: PCPs and Unique Games ..	Winter/Summer 2010
DIMACS	Tutorial on Limits of Approximation Algorithms: PCPs and Unique Games ..	June 2009 (co-organized with Moses Charikar)
Univ. Chicago	PCPs, codes and inapproximability	Autumn 2007
Stanford	Expanders in Computer Science	Spring 2005 (co-taught with Cynthia Dwork)

Mumbai, INDIA, May 2, 2017