

# 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 – Jul '17    **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 7<sup>th</sup> 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  $\ell_2^2$  metrics into  $\ell_1$ . 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, July 31, 2017