

Wim van Dam

CURRICULUM VITAE

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APPOINTMENTS

2004–present Assistant Professor, Department of Computer Science, UC Santa Barbara
Fall 2001 Lecturer, Computer Science Division, UC Berkeley

EDUCATION

Ph.D. Computer Science, University of Amsterdam, 2002
Thesis title: “On Quantum Computation Theory”, supervisor: Prof. P. Vitányi
Ph.D. Physics, University of Oxford, 2000
Thesis title: “Nonlocality & Communication Complexity”, supervisor: Prof. A. Ekert
M.Sc. Mathematics & Computer Science, University of Nijmegen, The Netherlands, 1996
Thesis title: “Quantum Cellular Automata”, supervisors: Prof. K. Koster and Prof. P. Vitányi

RESEARCH INTERESTS

I am interested in theoretical computer science, algorithms and information theory. My current research focuses on the theory of quantum computation and quantum information, with an emphasis on the design of new quantum algorithms, and the investigation of the physical limitations on processing information and the computational consequences of nonlocality.

PROFESSIONAL AND EDUCATIONAL BACKGROUND

2003–2004 Postdoc at the quantum computation group of Ed Farhi at MIT’s Center for Theoretical Physics.
2001–2003 HP/MSRI-postdoctoral fellow at the Mathematical Sciences Research Institute in Berkeley and at the Information Theory Research group of Hewlett-Packard, Palo Alto, headed by Gadiel Seroussi. Also lecturer at the Computer Science Division of UC Berkeley and member of the quantum computation group of Umesh Vazirani.
2000–2001 Postdoctoral researcher at the quantum computation group of Umesh Vazirani, UC Berkeley.
1996–2000 Graduate research in quantum computation and communication at the National Research Institute for Mathematics and Computer Science in Amsterdam (under Paul Vitányi), and at the Centre for Quantum Computation, University of Oxford (under Artur Ekert).
1989–1996 Undergraduate and Master’s studies in computer science and mathematics at the University of Nijmegen in The Netherlands. Specialization in complexity theory, information theory, logic, and discrete mathematics. Also a preliminary year in physics.

TEACHING EXPERIENCE

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| “Foundations of Computer Science” | Fall 2004, UC Santa Barbara |
| “Computability and Complexity” | Fall 2001, UC Berkeley |
| “Computability and Complexity” | Spring 2001, UC Berkeley, Assistant Lecturer to U. Vazirani |
| “Logic for Computer Scientists” | 1999–2000, University of Amsterdam, Teaching Assistant |

AWARDS, HONORS AND FELLOWSHIPS

- Postdoctoral fellowship, Cambridge-MIT Institute, 2003/2004
- Postdoctoral fellowship, Hewlett-Packard/Mathematical Sciences Research Institute, 2002/2003
- Postdoctoral fellowship, Hewlett-Packard/Mathematical Sciences Research Institute, 2001/2002
- TALENT fellowship from The Netherlands Organization for Scientific Research for postdoctoral research at UC Berkeley in 2000/2001
- Graduate award of Wolfson College, University of Oxford, November 1998
- Graduate fellowship from the Institute for Logic, Language and Computation at the University of Amsterdam, 1996–2000
- Highest possible grade (10 out of 10) for M.Sc. thesis
- Cum laude first-year examination Computer Science
- Qualification for the finals of the Dutch Math Olympics, 1988 and 1989
- Eleventh place at the Dutch Physics Olympics, 1989

SERVED AS REFEREE

Journals: Quantum Information and Computation, Quantum Information Processing, Information Processing Letters, Theory of Computing Systems, Theoretical Computer Science, Proceedings of the Royal Society of London, Physical Review Letters, Physics Letters A, Physical Review A, Journal of Modern Optics, Journal of Optics B, Journal of Physics A: Mathematical and General, Algorithmica, New Journal of Physics, and SIAM Journal on Computing.

Conferences: IEEE Symposium on Foundations of Computer Science, ACM Symposium on Theory of Computing, International Colloquium on Automata, Languages and Programming, and IEEE Conference on Computational Complexity.

Books: Kluwer Academic Publishers and *American Scientist*.

ACADEMIC AND PROFESSIONAL SERVICE

- I am on the editorial board of the *Virtual Journal of Quantum Information* of the American Institute of Physics and the American Physical Society, which is available at <http://www.vjquantuminfo.org/>.

INVITED TUTORIALS

- 12/2004 Workshop on “Quantum Algorithms for Signal, Image and Data Processing”, San Diego, California
- 10/2002 Workshop on “Quantum Information and Quantum Computation”, Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
- 7/2001 HP Research Labs, Palo Alto, California
- 9/2000 Workshop on “Alternative Computational Models”, City University of Hong Kong, Hong Kong
- 3/1998 Winter School on “Parallel and Quantum Computation”, CS & IT Education Development Center for Estonian Universities, Estonia
- 9/1997 Department of Computer Science, University of Helsinki, Finland

INVITED LECTURES

- 11/2004 The Distinguished Lecture Series on Complexity, Entropy, and the Physics of Information, Santa Fe Institute, Santa Fe, New Mexico
- 12/2002 5th Workshop on Quantum Information Processing, UC Berkeley
- 10/2002 Seminar on Algebraic Methods in Quantum and Classical Models of Computation, Dagstuhl, Germany
- 9/2002 Quantum Algorithms and Complexity, Banff, Canada
- 5/2002 24th MRST Conference on Theoretical Physics, Perimeter Institute, Waterloo, Canada
- 1/2002 AMS Special Session on Quantum Computation and Information, San Diego, California
- 9/2001 Conference on Quantum Computing and Communication, University of Georgia, Georgia
- 2/2001 QRandom Workshop, Eurandom, Netherlands
- 1/2001 Fourth Workshop on Quantum Information Processing, Amsterdam, Netherlands
- 5/1999 Unisys Users Association Conference, Frontiers in Computing Seminar, Madrid, Spain
- 11/1998 4th UK Quantum Theory meeting, Imperial College, London, UK
- 9/1998 American Institute of Physics conference on “Mysteries, paradoxes and puzzles in quantum mechanics”, Lake Garda, Italy
- 1/1998 1st Workshop on Algorithms in Quantum Information Processing, Aarhus, Denmark

LANGUAGE SKILLS

Dutch (mother tongue), English (fluent), German and French (basic)

PERSONAL

Born: March 14, 1971; Nationality: Dutch; US Visa status: Permanent Resident

PUBLICATIONS**Journal and Conference Articles***

- [1] “The Statistical Strength of Nonlocality Proofs”, Wim van Dam, Richard Gill, and Peter Grünwald, to appear in *IEEE Transactions on Information Theory*; arXiv:quant-ph/0307125 (2003)
- [2] “Adiabatic Quantum Computation is Equivalent to Standard Quantum Computation”, Dorit Aharonov, Wim van Dam, Julia Kempe, Zeph Landau, Seth Lloyd, and Oded Regev, *Proceedings of the 45th Annual IEEE Symposium on Foundations of Computer Science*, pages 42–51 (2004); arXiv:quant-ph/0405098
- [3] “Comment on ‘Quantum identification schemes with entanglements’ ”, Wim van Dam, *Physical Review A*, Volume 68, Number 2, Article 026301 (2003); arXiv:quant-ph/0307126
- [4] “Experimental implementation of an adiabatic quantum optimization algorithm”, Matthias Steffen, Wim van Dam, Tad Hogg, Greg Breyta, and Isaac Chuang, *Physical Review Letters*, Volume 90, Number 6, Article 067903 (2003); arXiv:quant-ph/0302057
- [5] “Quantum Algorithms for some Hidden Shift Problems”, Wim van Dam, Sean Hallgren, and Lawrence Ip, *Proceedings of the ACM-SIAM Symposium on Discrete Algorithms*, pages 489–498 (2003); arXiv:quant-ph/0211140
- [6] “Universal entanglement transformations without communication”, Wim van Dam and Patrick Hayden, *Physical Review A*, Rapid Communications, Volume 67, Number 6, Article 060302(R) (2003); arXiv:quant-ph/0201041 (under the title “Embezzling Entangled Quantum States”)
- [7] “How Powerful is Adiabatic Quantum Computation?”, Wim van Dam, Mike Mosca, and Umesh Vazirani, *Proceedings of the 42nd Annual Symposium on Foundations of Computer Science*, pages 279–287 (2001); arXiv:quant-ph/0206003
- [8] “Quantum Algorithms for Weighing Matrices and Quadratic Residues”, Wim van Dam, *Algorithmica*, Volume 34, No. 4, pages 413–428 (2002); arXiv:quant-ph/0008059
- [9] “Quantum Kolmogorov Complexity”, André Berthiaume, Wim van Dam, and Sophie Laplante, *Journal of Computer and System Sciences*, Volume 63, No. 2, pages 201–221, September 2001; preliminary version appeared in *Proceedings of the 15th Annual IEEE Conference on Computational Complexity*, pages 240–249 (2000); arXiv:quant-ph/0005018
- [10] “Self-Testing of Universal and Fault-Tolerant Sets of Quantum Gates”, Wim van Dam, Frédéric Magniez, Michele Mosca, and Miklos Santha, *Proceedings of the 32nd Annual ACM Symposium on Theory of Computing*, pages 688–696 (2000); arXiv:quant-ph/9904108
- [11] “Quantum Bounded Query Complexity”, Harry Buhrman and Wim van Dam, *Proceedings of the 14th Annual IEEE Conference on Computational Complexity*, pages 149–156 (1999); arXiv:quant-ph/9903035
- [12] “Quantum Communication Using a Nonlocal Zeno Effect”, Lucien Hardy and Wim van Dam, *Physical Review A*, Volume 59(4), pages 2635–2640 (1999); arXiv:quant-ph/9805037 (under the title “Quantum Whispers”)
- [13] “Quantum Oracle Interrogation: Getting all information for almost half the price”, Wim van Dam, *Proceedings of the 39th Annual IEEE Symposium on Foundations of Computer Science*, pages 362–367 (1998); arXiv:quant-ph/9805006
- [14] “Multiparty Quantum Communication Complexity”, Harry Buhrman, Wim van Dam, Peter Høyer, and Alain Tapp, *Physical Review A*, Volume 60(4), pages 2737–2741 (1999); arXiv:quant-ph/9710054
- [15] “Quantum Entanglement and the Communication Complexity of the Inner Product Function”, Richard Cleve, Wim van Dam, Michael Nielsen, and Alain Tapp, *Proceedings of the 1st NASA International Conference on Quantum Computing and Quantum Communications*, (editor: C.P. Williams), Lecture Notes in Computer Science, Volume 1509, pages 61–74, Springer-Verlag (1999); arXiv:quant-ph/9708019
- [16] “Quantum Entanglement and Communication Complexity”, Harry Buhrman, Richard Cleve, and Wim van Dam, *SIAM Journal on Computing*, Volume 30, Number 6, pages 1829–1841 (2001); arXiv:quant-ph/9705033

*The quant-ph no. refers to the e-print archive on quantum physics at <http://www.arxiv.org/>

- [17] “A Universal Quantum Cellular Automaton”, Wim van Dam, *Proceedings of PhysComp96*, New England Complex Systems Institute, (editors: T. Toffoli, M. Biafore, and J. Leão), pages 323–331; InterJournal manuscript no. 91 (1996)

Popular Articles and Book Reviews

- [18] “Think Nonlocally” (book review of Amir D. Aczel’s “Entanglement: the greatest mystery in physics”), Wim van Dam, *American Scientist*, Volume 91, No. 3, pp. 270–271 (2003)
- [19] “Physicists triumph at ‘Guess My Number’ ”, Andrew Steane and Wim van Dam, *Physics Today*, Volume 53(2), pages 35–39 (2000)

Theses

- [20] “On Quantum Computation Theory”, Wim van Dam, Ph.D. thesis, Department of Computer Science, University of Amsterdam, The Netherlands (2002)
- [21] “Nonlocality & Communication Complexity”, Wim van Dam, Ph.D. thesis, Department of Physics, University of Oxford, United Kingdom (1999)
- [22] “Quantum Cellular Automata”, Wim van Dam, Master thesis, Department of Mathematics and Computer Science, University of Nijmegen, The Netherlands (1996)

Articles in Submission or Unpublished

- [23] “Implausible Consequences of Superstrong Nonlocality”, Wim van Dam, arXiv:quant-ph/0501159
- [24] “Optimal measurements for the dihedral hidden subgroup problem”, Dave Bacon, Andrew M. Childs, and Wim van Dam, arXiv:quant-ph/0501044
- [25] “Quantum Computing and Zeroes of Zeta Functions”, Wim van Dam, arXiv:quant-ph/040581
- [26] “Summary of Delsarte’s ‘Nombre de Solutions des Équations Polynomiales sur un Corps Fini’”, Wim van Dam, arXiv:math.HO/0401066
- [27] “Quantum Computing Discrete Logarithms with the Help of a Preprocessed State”, Wim van Dam, arXiv:quant-ph/0311134 (2003)
- [28] “Efficient Quantum Algorithms for Estimating Gauss Sums”, Wim van Dam and Gadiel Seroussi, submitted; arXiv:quant-ph/0207131 (2002)
- [29] “Rényi-entropic bounds on quantum communication”, Wim van Dam and Patrick Hayden, submitted; arXiv:quant-ph/0204093 (2002)
- [30] “Efficient quantum algorithms for Shifted Quadratic Character Problems”, Wim van Dam and Sean Hallgren, arXiv:quant-ph/0011067 (2000)
- [31] “Two Classical Queries versus One Quantum Query”, Wim van Dam, arXiv:quant-ph/9806090 (1998)