Ben Toner

Current as of 18 November, 2008

Contact Information

Web: `http://bentoner.com`
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Nationality Australian

Current Activities

(Honorary) Fellow, School of Physics, The University of Melbourne **2008 –**

Previous Employment

Centrum voor Wiskunde en Informatica, Amsterdam, The Netherlands (Dutch National Centre for Mathematics and Computer Science) **2006 – 2008**

Scientific Staff Member (postdoc) in group of Prof. Dr. Harry Buhrman

Education

California Institute of Technology, Pasadena, California, USA **2001 – 2006**

Ph. D. in Physics (conferred 8 June, 2007)

- Thesis: *Quantifying quantum nonlocality*
- Advisor: Prof. John Preskill

M. S. in Physics (conferred 11 June, 2004)

The University of Melbourne, Melbourne, Australia **1998 – 2000**

B. Sc. (Hons.) in Physics and Mathematics (conferred 7 March, 2001)

- Honours thesis: *Topics in Higgs boson physics*
- Supervisor: Prof. Ray Volkas

Awards

Netherlands Organization for Scientific Research

Veni grant, Innovational Research Incentives Scheme (€208,000; declined) **2008**

California Institute of Technology

John Stager Stemple Memorial Prize in Physics **2003**
Freshman Summer Institute Outstanding Research Award (mentor) **2003**
Graduate Fellowship **2001 – 2002**

The University of Melbourne

The Thomas H. Laby medal; Dixson Research Scholarship **2000**
Rowden White Prize; Wyselaskie Natural Science Scholarship **1999**
William Sutherland Prize in Physics II; Dean's Prize List **1998**
Dixson Scholarships in Physics II, Pure Mathematics II, and Physics III **1998 – 1999**
Melbourne National Scholarship; Dean's Honours List **1998 – 2000**

Victoria Day Award for Community and Public Service by a Younger Victorian (unable to accept due to absence overseas) **1999**

International Physics Olympiad

Gold medal, Sudbury, Canada **1997**
Bronze medal, Oslo, Norway **1996**

Melbourne Grammar School

Academic Head (Dux) of the School; Maximum Tertiary Entrance Rank (99.95)	**1997**
Premier's VCE Awards in Chemistry, Mathematics, and Physics	**1996 – 1997**
Gold Medal, Australian Chemistry Olympiad	**1997**

PUBLICATIONS

16. **A generalized Grothendieck inequality and entanglement in XOR games**
J. Briët, H. Buhrman, and B. Toner
arXiv:0901.2009 [quant-ph]

15. **Experimental demonstration of preparation contextuality and parity-oblivious multiplexing**
R. W. Spekkens, D. H. Buzacott, A. J. Keehn, B. Toner, and G. J. Pryde
Phys. Rev. Lett., 102, 010401, 2009

14. **Entanglement in cooperative quantum games and quantum interactive proofs**
D. Leung, B. Toner, and J. Watrous
arXiv:0804.4118 [quant-ph]

13. **Nonclassicality without entanglement enables bit commitment**
H. Barnum, O. Dahlsten, M. Leifer, and B. Toner
Proc. 2008 IEEE Information Theory Workshop, pages 386–390, 2008

12. **Finite de Finetti theorem for conditional probability distributions describing physical theories**
M. Christandl and B. Toner
J. Math. Phys. 50, 042104, 2009

11. **The quantum moment problem and bounds on entangled multi-prover games**
A. C. Doherty, Y.-C. Liang, B. Toner, and S. Wehner
Proc. 23rd IEEE Conf. on Computational Complexity, pages 199–210, 2008

10. **Unique games with entangled provers are easy**
J. Kempe, O. Regev, and B. Toner
Proc. 49th IEEE Symp. on Foundations of Computer Science, pages 457-466, 2008

9. **Simulating quantum correlations with finite communication**
O. Regev and B. Toner
Proc. 48th IEEE Symp. on Foundations of Computer Science, pages 384–394, 2007

8. **Entangled games are hard to approximate**
J. Kempe, H. Kobayashi, K. Matsumoto, B. Toner, and T. Vidick
Proc. 49th IEEE Symp. on Foundations of Computer Science, pages 447–456, 2008
Invited to SICOMP special issue for FOCS 2008

7. **Monogamy of Bell correlations and Tsirelson's bound**
B. F. Toner and F. Verstraete
arXiv:quant-ph/0611001

6. **Grothendieck's constant and local models for noisy entangled quantum states**
A. Acín, N. Gisin, and B. Toner
Phys. Rev. A 73(6), 062105, 2006

5. **Monogamy of nonlocal quantum correlations**
B. Toner
Proc. R. Soc. A 465, 59–69, 2009

4. **Consequences and limits of nonlocal strategies**
   R. Cleve, P. Høyer, B. Toner, and J. Watrous
   Proc. 19th IEEE Conf. on Computational Complexity, pages 236–249, 2004

3. **Communication cost of simulating Bell correlations**
   B. F. Toner and D. Bacon
   Phys. Rev. Lett. 91, 187904, 2003

2. **Bell inequalities with auxiliary communication**
   D. Bacon and B. F. Toner
   Phys. Rev. Lett. 90, 157904, 2003

1. **Clash of symmetries on the brane**
   A. Davidson, B. F. Toner, R. R. Volkas, and K. C. Wali
   Phys. Rev. D 65(12), 125013, 2002

Authors in 2, 3, and 15 are ordered by contribution; in other papers the ordering is alphabetical.

Invited Conference Talks

6. **Unique games with entangled provers are easy**
   Workshop on Quantum Algorithms and Complexity Theory
   Centre for Quantum Technologies, National University of Singapore, 20 November, 2008

5. **Coherent state exchange in multi-prover quantum interactive proof systems**
   Workshop on Information Primitives and Laws of Nature
   ETH Zürich, Switzerland, 13 May, 2008

4. **Simulating quantum correlations with finite communication**
   Conference on New Directions in the Foundations of Physics
   College Park, MD, USA, 26 April, 2008

3. **The unique games conjecture with entangled provers is false**
   CIFAR Workshop
   Newport, RI, USA, 27 October, 2007

2. **Simulating quantum correlations with finite communication**
   Dagstuhl Seminar on Algebraic Methods in Complexity Theory
   Schloss Dagstuhl, Germany, 12 October, 2007

1. **De Finetti theorems for conditional probability distributions**
   Workshop: Operational Probabilistic Theories as Foils to Quantum Theory
   University of Cambridge, UK, 9 July, 2007

Other Talks

13. **Symmetry and global independence in classical and quantum theories**
    Perimeter Institute, 7 November, 2007

12. **Unique games with entangled provers are easy**
    49th IEEE Symposium on Foundations of Computer Science, Philadelphia, PA, USA, 27 October, 2008
    IQC Colloquium, University of Waterloo, 29 October, 2007

11. **Simulating quantum correlations with finite communication**
    48th IEEE Symposium on Foundations of Computer Science, Providence, RI, USA, 22 October, 2007

10. **Monogamy of Bell correlations and Tsirelson's bound**
    QIP 2007, Brisbane, Australia, 30 January, 2007

9. **De Finetti theorems for conditional probability distributions**
   Theory of Computation Seminar, Computer Science Dept., Tel-Aviv University, 15 May, 2007
   QAP workshop, Bristol, 20 April, 2007
   Laboratoire de Recherche en Informatique, Université Paris-Sud, 7 December, 2006
   University of Queensland, 1 September, 2006

8. **How to simulate quantum correlations with classical communication**
   Trimester on quantum information, computation and complexity, Institute Henri Poincaré, Paris, 21 February, 2006

7. **Quantifying quantum nonlocality**
   Perimeter Institute, 1 February, 2006

6. **Monogamy of nonlocal quantum correlations**
   QIP 2006, Paris, 19 January, 2006
   IQI/CPI Workshop on classical and quantum information security, Caltech, 17 December, 2005

5. **Local models for noisy quantum states**
   QiSci Seminar, University of Queensland, 6 September, 2005

4. **Generalizing and quantifying the Kochen-Specker theorem**
   QiSci Seminar, University of Queensland, 1 October, 2004
   DIRO Seminar, Université de Montréal, 15 and 16 April, 2004

3. **Entanglement and cooperative games with incomplete information**
   SQuInT, San Diego, CA, 20 February, 2004

2. **Quantifying quantum nonlocality**
   Quantum Science & Technologies Group, Jet Propulsion Laboratory, 5 September, 2003
   Institute for Quantum Information Science, University of Calgary, 3 July, 2003

1. **The communication cost of quantum correlations**
   Department of Physics, University of Melbourne, 17 June, 2003
   QIP 2003, MSRI, Berkeley, CA, 18 December, 2002

Professional Service

Referee for journals: Annals of Physics, European Physical Journal D, Foundations of Physics, Journal of Physics A: Mathematical and Theoretical, New Journal of Physics, Quantum Information and Computation, Physical Review A, Physical Review Letters, Theory of Computing

Referee for conferences: IEEE Conference on Computational Complexity (CCC), ERATO conference on Quantum Information Science (EQIS), European Symposium on Algorithms (ESA), IEEE Symposium on Foundations of Computer Science (FOCS), International Colloquium on Automata, Languages and Programming (ICALP), IEEE International Symposium on Information Theory (ISIT), ACM Symposium on Theory of Computing (STOC), Quantum Information Processing (QIP)

Opposed at Ph. D. defence of Robert Špalek **2006**

Committee member, Victorian Branch of the Australian Institute of Physics **1999 – 2000**

Other Academic Experience

California Institute of Technology, Pasadena, CA, USA

Teaching Assistant for:
- Ph/CS 219: Quantum Computation **2003 – 2004**
- Ph12: Waves, quantum physics, and statistical mechanics **2002 – 2003**

Freshman Summer Institute Research Mentor **2003**

The University of Melbourne, Melbourne, Australia

Laboratory Demonstrator, Part I Laboratories, School of Physics **2000 – 2001**

The Australian National University, Canberra, Australia

Summer Research Scholar at Mount Stromlo Observatory **1999 – 2000**

Australian Science Olympiads, Canberra, Australia

Senior Tutor, Examiner, and Victorian Convenor (Physics programme) **1997 – 1999**