

Curriculum Vitae

Timothy M. Garoni

MASCOS
Department of Mathematics and Statistics
The University of Melbourne
Victoria, 3010
Australia

Phone: +61 3 8344 1619
Fax: +61 3 9347 8165
Mobile: +61 0430 378164
email: t.garoni@ms.unimelb.edu.au
URL: <http://spin.complex.unimelb.edu.au/~tgaroni/>

Education

- 2003 • **Ph.D.** The University of Melbourne, School of Physics.
Thesis title: “Lévy flights, exponential asymptotics; One-dimensional impenetrable bosons”
- 2000 • **B.Sc. (Hons)** The University of Melbourne, School of Physics.

Employment

- January 2008 – present • **Research fellow** at the Australian Research Council Centre of Excellence for Mathematics and Statistics of Complex Systems (**MASCOS**), in the Department of Mathematics and Statistics of the University of Melbourne.
- September 2005 – December 2007 • **Postdoctoral research fellow** in the Physics Department of New York University, working with Professor Alan Sokal.
- September 2003 – September 2005 • **Postdoctoral research fellow** at the Institute for Mathematics and its Applications (**IMA**), at the University of Minnesota. I participated in the *IMA Thematic Year on Probability and Statistics in Complex Systems: Genomics, Networks, and Financial Engineering*.

Professional Associations

- 2004 – present • Member of the American Mathematical Society (AMS).
- 2008 – present • Member of the Australian Mathematical Society (AustMS), and ANZIAM.
- 2008 – present • Member of the ARC Complex Open Systems Research Network (COSNet).

Research interests

- Broadly, my research interests lie in mathematical and computational issues arising in the study of complex systems. One of my current interests is the application of Markov-chain Monte Carlo methods to problems in statistical mechanics, especially to the study of critical phenomena. This involves developing, and rigorously analyzing, new Monte Carlo algorithms which have radically improved efficiency, for studying lattice models in equilibrium statistical mechanics (such as the Ising and random-cluster models for example). I am also very interested in modeling traffic flow on networks, using stochastic cellular automata.

Teaching Experience

March 2009 - June 2009

- **Lecturer** for *Calculus 2*, in the Department of Mathematics and Statistics at the University of Melbourne. This was a large first-year course (over 1100 students), and I taught one of five streams (around 250 students). In addition to presenting three lectures per week, I held three hours of student consultation and presented one tutorial class. I also contributed to the design of the homework assignments, midterm and final exams, and tutorial sheets.

January 2006 - April 2006

- Taught the recitations for the course *Mathematical Physics*, in the Physics Department of New York University. This involved delivering one lecture per week to a class of senior undergraduate students, which discussed the solutions to the weekly homework assignments. I also graded the homework.

September 2004 - December 2004

- **Primary instructor** for the course *Methods of Applied Mathematics*, in the School of Mathematics at the University of Minnesota. This was a fourteen week course and the students included both graduate students and senior undergraduate students. I had sole responsibility for the course; including designing the curriculum, selecting the set text, preparing and delivering three lectures per week, writing the set homework exercises and their solutions, and writing and grading the midterm and final exams. I was also responsible for supervising a teaching assistant who graded the students' weekly homework.

March 2000-June 2003

- Tutor for the University of Melbourne. I taught the tutorials for a variety of subjects at the first year undergraduate level in the Department of Mathematics and Statistics and also the School of Physics.

Postgraduate supervision

- I am currently Associate Supervisor for a PhD student, and Co-Supervisor for an MSc student.

Industry collaborations

- December 2008 - September 2009
- **Scientific Mentor** for the project *Analysis of traffic flow in urban road networks*. This project was funded by **VicRoads** and the Australian Mathematical Sciences Institute (**AMSI**), and performed by the ARC Centre of Excellence for Mathematics and Statistics of Complex Systems (**MASCOS**). The aim of the project was to design stochastic cellular automata models for urban arterial road networks, in order to develop more efficient rules for the operation of traffic lights at signalized intersections. In addition to performing research for this project myself, I am supervising a PhD student. This project has initiated an ongoing collaboration with VicRoads, and funding for a second project is currently being negotiated.

Organization

- Organizer for the international conference **Monte Carlo Algorithms in Statistical Physics**, to be held in Melbourne, 2010. This is a satellite meeting of **Statphys 24**.

Departmental Service

- 2004 - 2005
- Co-organizer of the IMA Postdoc seminar series for the academic year 2004-2005.
- 2003 - 2004
- Co-organizer of the IMA Brown Bag seminar series for the academic year 2003-2004.

Selected seminars and conference presentations

- September 2009
- *New critical exponents for percolation and the random-cluster model*, presented at the 53rd Annual Meeting of the Australian Mathematical Society, the University of South Australia, September 29, 2009.
- September 2009
- *Cellular automata models for traffic networks*, invited lecture in the Hefei National Laboratory for Physical Sciences at the Microscale, the University of Science and Technology of China, September 11, 2009.
- July 2009
- *Worm algorithms*, presented at the inaugural Pacific Rim Mathematical Association (PRIMA) Congress, the University of New South Wales, July 6, 2009.
- June 2009
- *Worm algorithms*, Computational Mathematics Seminar in the Mathematical Sciences Institute, Australian National University, June 29, 2009.
- December 2008
- *Worm algorithms*, presented at the annual Statistical Mechanics Meeting 2008, the University of Melbourne, December 1, 2008.

Selected seminars and conference presentations (continued)

- November 2008 • *Worm algorithms*, invited lecture in the Hefei National Laboratory for Physical Sciences at the Microscale, the University of Science and Technology of China, November 6, 2008.
- October 2008 • *Worm algorithms*, invited lecture in the Department of Physics, Suzhou University, October 31, 2008.
- April 2008 • *Maybe some local algorithms aren't so bad...?*, Statistical Mechanics and Combinatorics Seminar in the Department of Mathematics and Statistics, the University of Melbourne, April 14, 2008.
- December 2005 • *Asymptotics of Hankel determinants generated by Fisher-Hartwig symbols defined on the real line*, presented at the 94th Statistical Mechanics Conference, Rutgers University, December 20, 2005.
- July 2005 • *Impenetrable bosons, random matrices, and generalized Fisher-Hartwig determinants*, Statistical Mechanics Seminar in the Department of Mathematics and Statistics, the University of Melbourne, July 7, 2005.
- January 2005 • *On the asymptotics of some large Hankel determinants generated by Fisher-Hartwig symbols defined on the real line*, presented at the Joint Mathematics Meetings of the American Mathematical Society (AMS) and the Mathematical Association of America (MAA), in the AMS Session on Applied Math I, Atlanta, January 6, 2005.
- February 2004 • *Absolute moments of products of characteristic polynomials, and impenetrable bosons*, Random Matrix Seminar in the School of Mathematics, the University of Minnesota, February 17 and February 24, 2004.
- November 2003 • *Impenetrable bosons, random matrix averages and log-gases*, Institute for Mathematics and its Applications (IMA) Seminar, the University of Minnesota, November 12, 2003.
- December 2002 • *One dimensional impenetrable Bose systems*, presented at the annual Statistical Mechanics Meeting 2002, the University of Melbourne, December 3, 2002.
- November 2001 • *Lévy Flights in d dimensions; Exact Results and Asymptotics beyond all orders*, presented at the annual Statistical Mechanics Meeting 2001, Australian National University, November 27, 2001.

Publications

Recent preprints

- Youjin Deng, Wei Zhang, Timothy M. Garoni, Alan D. Sokal, and Andrea Sportiello, *New critical exponents for percolation and the random-cluster model*, arXiv:0904.3448v1

Refereed Journal Articles

- Wei Zhang, Timothy M. Garoni, and Youjin Deng, *A worm algorithm for the fully-packed loop model*, Nucl. Phys. B **814**, 461-484 (2009).

Publications (continued)

- Timothy M. Garoni, Anthony J. Guttmann, Iwan Jensen, and John C. Dethridge, *Prudent walks and polygons*, J. Phys. A: Math. Theor. **42**, 095205 (2009).
- Youjin Deng, Timothy M. Garoni, and Alan D. Sokal, *Dynamic critical behavior of the worm algorithm for the Ising model*, Phys. Rev. Lett. **99**, 110601 (2007).
- Youjin Deng, Timothy M. Garoni, Jonathan Machta, Giovanni Ossola, Marco Polin, and Alan D. Sokal, *Critical Behavior of the Chayes-Machta-Swendsen-Wang Dynamics*, Phys. Rev. Lett. **99**, 055701 (2007).
- Youjin Deng, Timothy M. Garoni, and Alan D. Sokal, *Critical Speeding-Up in the Local Dynamics of the Random-Cluster Model*, Phys. Rev. Lett. **98**, 230602 (2007).
- Youjin Deng, Timothy M. Garoni, Wenan Guo, Henk W. J. Blöte, and Alan D. Sokal, *Cluster Simulations of Loop Models on Two-Dimensional Lattices*, Phys. Rev. Lett. **98**, 120601 (2007).
- Youjin Deng, Timothy M. Garoni, and Alan D. Sokal, *Ferromagnetic Phase Transition for the Spanning-Forest Model ($q \rightarrow 0$ Limit of the Potts Model) in Three or More Dimensions*, Phys. Rev. Lett. **98**, 030602 (2007).
- P. J. Forrester, N. E. Frankel, and T. M. Garoni, *Asymptotic form of the density profile for Gaussian and Laguerre random matrix ensembles with orthogonal and symplectic symmetry*, J. Math. Phys. **47**, 023301 (2006).
- T. M. Garoni, P. J. Forrester, and N. E. Frankel, *Asymptotic corrections to the eigenvalue density of the GUE and LUE*, J. Math. Phys. **46**, 103301 (2005).
- T. M. Garoni, *On the asymptotics of some large Hankel determinants generated by Fisher-Hartwig symbols defined on the real line*, J. Math. Phys. **46**, 043516 (2005).
- P. J. Forrester, N. E. Frankel, and T. M. Garoni, *Random matrix averages and the impenetrable Bose gas in Dirichlet and Neumann boundary conditions*, J. Math. Phys. **44**, 4157 (2003).
- P. J. Forrester, N. E. Frankel, T. M. Garoni, and N. S. Witte, *Finite one-dimensional impenetrable Bose systems: Occupation numbers*, Phys. Rev. A **67**, 043607 (2003).
- P. J. Forrester, N. E. Frankel, T. M. Garoni, and N. S. Witte, *Painlevé Transcendent Evaluations of Finite System Density Matrices for 1d Impenetrable Bosons*, Commun. Math. Phys. **238**, 257 (2003).
- T. M. Garoni and N. E. Frankel, *On the ubiquity of the Lévy integral – its relationship with the generalized Euler-Jacobi series and their asymptotics beyond all orders*, Fractals **11**, 93 (2003).
- T. M. Garoni and N. E. Frankel, *d-dimensional Lévy flights: Exact and asymptotic*, J. Math. Phys. **43**, 5090 (2002).
- T. M. Garoni and N. E. Frankel, *Lévy flights: Exact results and asymptotics beyond all orders*, J. Math. Phys. **43**, 2670 (2002).

Publications (continued)

- T. M. Garoni, N. E. Frankel, and M. L. Glasser, *Complete asymptotic expansions of the Fermi-Dirac integrals*, J. Math. Phys. **42**, 1860 (2001).