

Curriculum Vitae: Luc Rey-Bellet

Personal History:

Office Address: Department of Mathematics and Statistics
University of Massachusetts
Lederle Graduate Research Tower
Amherst, MA 01003
(413) 545-6020
luc@math.umass.edu

Home Address: 33 Ridgewood Terrace
Northampton, MA 01060
(413) 588-1918

Citizenship: Switzerland, U.S. permanent resident

Educational History:

Ph.D. in Mathematics 1998, Department of Mathematics, University of Geneva, Geneva, Switzerland

Dissertation: *Markov Process and Non-equilibrium Statistical Mechanics*
Adviser: Prof. Jean-Pierre Eckmann

B.A. in Theoretical Physics 1994, Department of Physics, Swiss Federal Institute of Technology (ETH), Zürich, Switzerland

Dissertation: *Low Temperature Expansion for a Variant of the $t - J$ Model*
Adviser: Prof. Jürg Fröhlich

Grants:

Young Researcher Grant of the Swiss National Science Foundation, 1998 (40'000 SFr)

NSF-Grant DMS-0306540 (P.I., award \$101'000): Mathematical Problems in Nonequilibrium Statistical Mechanics (2003-2006)

NSF-Grant DMS-0605058,(P.I., award \$102'000): Mathematical and Computational Problems in Nonequilibrium Statistical Mechanics (2006-2010)

NSF-Grant DMS-1109316 (P.I., award \$95'000): Game Theory and Statistical Mechanics (2011-2015)

DOE-Grant (Co-P.I., total award \$2.25 millions): Mathematical Foundations for Uncertainty Quantification in Materials Design. (5 main investigators at Brown University, University of Delaware and Umass Amherst). (2013–2016)

NSF-Grant DMS-1515712 (P.I., award \$280'000): Mathematical and Computational Methods for Non-Equilibrium Systems (2015-2018)

Editorial Board:

Journal of Statistical Physics since 2013

Graduate students and postdoctoral advising:

Michael Diehl (Graduation 2008, Endicott College)

Sung-Ha Hwang (Graduation 2011, KAIST, Korea)

Dimitrios Tsagkarogiannis (co-advisor, Graduation 2006, University of Sussex)

Sasanka Are (co-advisor, Graduation 2009, Cerner Corporation)

Yannis Pantazis (Postdoctoral fellow, 2012-2013, and 2014-2015 co-advisor, University of Crete)

Kostis Gourgoulis (2014- , co-advisor)

Georgios Arampatzis (Postdoctoral fellow, 2014-2015, co-advisor, ETH Zürich)

Jinchao Feng (2015- , advisor)

Jie Wang (2015- , co-advisor)

Professional and Teaching Experience:

Assistant Professor 2002, Associate Professor 2008, Professor 2013 , Department of Mathematics and Statistics, University of Massachusetts, Amherst MA 01003

Courses: Fall 2002 Math 131 Calculus I
Spring 2003 Math 132 Calculus II
Spring 2003 Math 421 Complex variables
Fall 2003 Math 597/697 Introduction to stochastic processes
Spring 2004 Math 131 Calculus I
Fall 2004 Math 645 Differential equations and dynamical systems
Spring 2005 Math 646 Ergodic theory
Spring 2005 Math 131 Calculus I
Fall 2005 Math 645 Differential equations and dynamical systems
Fall 2005 Stat 515 Introduction to Statistics I
Spring 2006 Math597/697 Introduction to stochastic processes
Fall 2006 Math 623 Real analysis I
Fall 2006 Math 131H Honor calculus I
Spring 2007 Math 624 Real analysis II
Fall 2007 Math 697U Introduction to stochastic processes
Fall 2007 Math 331 Differential equations
Spring 2008 Math 331 Differential equations
Fall 2008 Math 331 Differential equations
Fall 2008 Math 645 Differential equations and dynamical systems
Fall 2009 Math 697EG Evolutionary game theory
Spring 2010 Math 697U Introduction to stochastic processes
Spring 2010 Math 331 Differential equations
Fall 2010 Math 623 Real analysis I
Fall 2010 Math 131H Honor calculus I
Fall 2011 Math 623 Real analysis I
Spring 2012 Math 624 Real analysis II
Spring 2012 Math 456 Mathematical Modeling
Spring 2013 Math 456 Mathematical Modeling
Spring 2013 Math797fn Functional Analysis
Fall 2013 Math 623 Real Analysis I
Spring 2014 Math 624 Real Analysis II
Spring 2014 Math 331 Differential equations
Fall 2014 Math697U Introduction to stochastic processes
Spring 2015 Math 456 Mathematical Modeling
Spring 2015 Math 797MR Information Theory
Fall 2015 Math 797AB Agent-based modeling
Spring 2016 Math 456 Mathematical Modeling
Spring 2016 Math 523H Real analysis
Fall 2016 Math 797SM Statistical mechanics
Spring 2017 Math 331 Differential equations
Spring 2017 Math 523H Real analysis

Whyburn Instructor 1999–2002, Department of Mathematics, University of Virginia, Charlottesville VA 22903.

Courses: Fall 1999 APMA 310 Probability
Spring 2000 APMA 206, Differential equations (2 sections)
Fall 2000 APMA 310 Probability
Fall 2000 Math 531 Introduction to real analysis I
Spring 2001 Math 532 Introduction to real analysis II
Fall 2001 Math 131 Calculus I (2 sections)
Spring 2002 Math 845 Ergodic Theory

Research Fellow 1998–1999, Center for Mathematical Sciences Research, Department of Mathematics, Rutgers University, New Brunswick NJ 08854.

Teaching Assistant 1994–1998, Department of Mathematics, University of Geneva, 1211 Geneva, Switzerland.

Courses: 1994-1995 Mathematics II for computer scientists
1994-1995 Function of several complex variables
1995-1996 Analysis I
1995-1996 Dynamical systems and ergodic theory
1996-1997 Mathematics for engineers
1996-1997 Numerical methods for PDE
1997-1998 Analysis II

Research Interests: My research interests are in statistical mechanics, in particular in the foundations of non-equilibrium statistical mechanics, as well as as in the applications of statistical mechanics tools ideas to computational methods, game theory, dynamical systems, and uncertainty quantification.

Publications: (See <http://www.math.umass.edu/~lr7q/publications.html> for downloads). All papers have been refereed, except [6] which was an invited paper for a special volume for the *XIIIth* International Congress of Mathematical Physics held in London in 2000 and [11] which is part of the proceeding of the *XIVth* International Congress of Mathematical Physics held in Lisbon in 2003.

1. Datta N., Fernandez R., Fröhlich J., and Rey-Bellet L.: Low-temperature phase diagrams of quantum lattice systems. II. Convergent perturbation expansions and stability in systems with infinite degeneracy. *Helv. Phys. Acta.* **69**, 752–820 (1996)
2. Fröhlich J. and Rey-Bellet L.: Low-temperature phase diagrams of quantum lattice systems. III. Examples. *Helv. Phys. Acta.* **69**, 821–849 (1996)
3. Eckmann J.-P., Pillet C.-A., and Rey-Bellet L.: Non-equilibrium statistical mechanics of anharmonic chains coupled to two heat baths at different temperatures. *Commun. Math. Phys.* **201**, 657–697 (1999)
4. Eckmann J.-P., Pillet C.-A., and Rey-Bellet L.: Entropy production in non-linear, thermally driven Hamiltonian systems. *J. Stat. Phys.* **95**, 305–331 (1999)

5. Rey-Bellet L. and Thomas L.E.: Asymptotic behavior of thermal non-equilibrium steady states for a driven chain of anharmonic oscillators. *Commun. Math. Phys.* **215**, 1–24 (2000)
6. Bonetto F., Lebowitz J.L. and Rey-Bellet L.: Fourier law. A challenge to theorists. In: *Mathematical Physics 2000*, A. Fokas, A. Grigoryan, T. Kibble and B. Zegarlinski (Eds.), Imp. Coll. Press, London 2000, pp. 128–150
7. Fröhlich J., Rey-Bellet L., and Ueltschi D.: Quantum lattice models at intermediate temperatures. *Commun. Math. Phys.* **224**, 33–63 (2001)
8. Rey-Bellet L. and Thomas L.E.: Exponential convergence to non-equilibrium stationary states in classical statistical mechanics. *Commun. Math. Phys.* **225**, 305–329 (2002)
9. Rey-Bellet L. and Thomas L.E.: Fluctuations of the entropy production in anharmonic chains. *Ann. Henri Poincaré.* **3**, 483–503 (2002)
10. Rey-Bellet L.: Statistical mechanics of anharmonic lattices. In *Advances in differential equations and mathematical physics*, Y. Karpeshina, G. Stolz, R. Weikard, and Y. Zeng (Eds.), Contemporary Mathematics Series, Providence, AMS (2003) pp. 283–298
11. Rey-Bellet L.: Nonequilibrium statistical mechanics of open classical Systems. In *XIVth International Conference on Mathematical Physics*, J.-C. Zambrini (Ed.), Hackensack, NJ, World Scientific pp. 447–454
12. Rey-Bellet L. and Thomas L.E.: Low regularity solutions to a gently stochastic nonlinear wave equation in nonequilibrium statistical mechanics. *Stochastic Process. Appl.* **115**, 1041–1059 (2005)
13. Lenci M. and Rey-Bellet L.: Large deviations in quantum lattice systems: One phase region. *J. Stat. Phys.* **119**, 715–746 (2005)
14. Rey-Bellet L. : Ergodic properties of Markov processes. In *Open Quantum systems II. The Markovian approach*, S. Attal, A. Joye, C.-A. Pillet (Eds), Lecture notes in Mathematics **1881**. Berlin, Springer 2006 pp. 1–39
15. Rey-Bellet L. : Classical open systems. In *Open Quantum systems II. The Markovian approach*, S. Attal, A. Joye, C.-A. Pillet (Eds), Lecture notes in Mathematics **1881**. Berlin, Springer 2006 pp. 40–78
16. Bonetto F. and Rey-Bellet L.: Fourier law. In *Encyclopedia of Mathematical Physics*, J.-P. Francoise, G.L. Naber, T. S. Tsun (Eds) Academic Press 2006, pp. 374–379
17. Katsoulakis M., Plecháč P., Rey-Bellet L. and Tsagkarogiannis D.: Coarse-graining schemes and a posteriori error estimates for stochastic lattice systems. *ESAIM: Mathematical Modeling and Numerical Analysis* **41**, 627–660 (2007)

18. Katsoulakis M., Plecháč P., Rey-Bellet L. and Tsagkarogiannis D.: Mathematical strategies in the coarse-graining of extensive systems: error quantification and adaptivity. *J. Non Newtonian Fluid Mech.* **152**, 101–112 (2008)
19. Rey-Bellet L. and Young L.S.: Large deviations in nonuniformly hyperbolic dynamical systems. *Ergodic Theory and Dynam. Systems* **28**, 587-612 (2008)
20. Katsoulakis M., Plecháč P., and Rey-Bellet L.: Numerical and Statistical Methods for the Coarse-Graining of Many-Particle Stochastic Systems. *J. Sci. Comp.* **37**, 43–71 (2008)
21. Are S., Katsoulakis M., Plecháč P., and Rey-Bellet L.: Multi-body interactions in coarse-graining schemes of extended systems. *SIAM J. Sci. Comput.* **31**, 987-1015 (2008)
22. De Roeck W., Maes C., Netočkny, and Rey-Bellet L.: A note on the non-commutative Laplace-Varadhan integral lemma. *Rev. Math. Phys.* **22**, 939–958 (2010)
23. Nahmod, A., Oh H., Rey-Bellet L, and Staffilani G.: Invariant weighted Wiener measures and almost sure global well-posedness for the periodic derivative NLS. *J. Eur. Math. Soc.* **14**, 1275–1330 (2012)
24. Pillet C.-A., Jaksić V., and Rey-Bellet L.: Entropic fluctuations in statistical mechanics I. Classical dynamical systems. *Nonlinearity* **24** , 699-763 (2011)
25. Ogata Y. and Rey-Bellet L.: Ruelle-Lanford functions and large deviations for asymptotically decoupled quantum spin systems. *Rev. Math. Phys.* **23**, 211–232 (2011)
26. Nahmod, A., Rey-Bellet L., Sheffield, S., and Staffilani G.: Absolute continuity of Brownian bridges under certain gauge transformations. *Math. Res. Lett.* **18**, 875–887 (2011)
27. Hwang S.-H. and Rey-Bellet L.: Decompositions of two player games: potential, zero-sum, and stable games. Unpublished. arXiv:1106.3552
28. Hwang, S.-H., Katsoulakis M., and Rey-Bellet L.: Deterministic equations for stochastic spatial evolutionary games. *Theor. Econ.* **8**, 829–874 (2013)
29. Katsoulakis M., Plecháč P., Rey-Bellet L. and Tsagkarogiannis D.: Coarse-graining schemes for systems with short-range and long-range interactions. *Math. Comp.* **83**, 288, 1757-1793 (2014)
30. Katsoulakis M., Pantazis, Y. and Rey-Bellet L.: Measuring the irreversibility of numerical schemes for reversible stochastic differential equations. *ESAIM: Mathematical Modelling and Numerical Analysis* **48** , 1351–1379 (2014).
31. Rey-Bellet L. and Spiliopoulos K.: Irreversible Langevin samplers and variance reduction: a large deviation approach. *Nonlinearity* **28**, 2081-2103, (2015)

32. Rey-Bellet L. and Spiliopoulos K.: Variance reduction for irreversible Langevin samplers and diffusion on graphs. *Elec. Commun. Prob.* 20, Article 15, 1–16 (2015)
33. Hwang S.-H. and Rey-Bellet L.: Strategic decompositions of normal form games: potential games and zero-sum games. Submitted. arXiv:1602.06648
34. Hwang S.-H. and Rey-Bellet L.: Simple characterizations of potential games and zero-sum games. Submitted. arXiv:1602.04410
35. Gourgoulis, K., Katsoulakis, M. and Rey-Bellet L.: Information metrics for long-time errors in splitting schemes for stochastic dynamics and parallel kinetic Monte Carlo. *SIAM J. Sci. Comp.* 38, No. 6, A3808-A3832 (2016)
36. Arampatzis, G., Katsoulakis, M. and Rey-Bellet L.: Efficient estimators for likelihood ratio sensitivity indices of complex stochastic dynamics. *J. Chem. Phys.* 144, 104107 (2016)
37. Hall E., Katsoulakis, M. and Rey-Bellet L.: Uncertainty quantification for generalized Langevin dynamics. *J. Chem. Phys.* 145, 224108 (2016)
38. Rey-Bellet L. and Spiliopoulos K.: Improving the convergence of reversible samplers. *J. Stat. Phys.* 164, 472-494 (2016)
39. Gourgoulis K., Katsoulakis M. and Rey-Bellet L.: Information criteria for quantifying loss of reversibility in parallelized KMC, *J. Comp. Phys.* 328, 1,438-454 (2017)
40. Katsoulakis M., Rey-Bellet L. and Wang. J.: Scalable Information Inequalities for Uncertainty Quantification. *J. Comp. Phys.* 336, 1, 513-545 (2017)
41. Hwang S.-H. and Rey-Bellet L.: Positive feedback in coordination games: stochastic evolutionary dynamics and the logit choice rule. Submitted. arXiv:1701.04870

Scientific Visits:

Institut des Hautes Etudes Scientifiques (IHES), May-June 2000 (Prof. Ruelle)
 University of Geneva, July-August 2000 (Prof. Eckmann)
 Swiss Federal Institute of Technology (ETHZ), June 2001 (Prof. Fröhlich)
 University of Geneva, July-August 2001 (Prof. Eckmann)
 Mc Gill University, July 2002 (Prof. Jaksic)
 University of Geneva, June 2003 (Prof. Eckmann)
 Institut Fourier, University of Grenoble, June-July 2003 (Prof. Joye and Prof. Attal)
 McGill University, August 2004 (Prof Jaksic)
 Institut des Hautes Etudes Scientifiques (IHES), January 2005 (Prof. Ruelle and Prof. Lebowitz)
 Schrödinger Institute, Vienna, June 2008 (Special program on hyperbolic dynamics)
 University du Sud Toulon (Invited Professor, 1 month 2009-2010, Prof. Pillet)
 University of Tokyo, January 2010, Prof. Ogata
 University of Crete, Archimedes Center for Modeling, Analysis & Computation, January-April 2011 (3 months, Prof. Katsoulakis)

Conferences: Invited talks

01. Journées semi-classiques 1998, Grenoble, February 1998
02. Statphys 20, Paris, July 1998
03. 80th Statistical mechanics conference, Rutgers University, December 1998
04. Non equilibrium statistical mechanics, Schrödinger Institute, February 1999
05. AMS sectional meeting, Birmingham, November 2000
06. The 2002 UAB International conference on differential equations and mathematical physics, March 2002
07. Workshop on Fokker-Planck equations, Rennes, France, February 2003
08. ODYN-II, Probability and statistical mechanics, CIRM, Marseilles, March 2003
09. 89th Statistical mechanics conference, Rutgers university, May 2003
10. Summer school on open quantum systems, Grenoble, July 2003
11. International congress of mathematical physics, ICMP 2003, Lisbon, August 2003
12. Young researcher symposium, Lisbon, July 2003
13. Workshop on dynamics and statistical mechanics, CRM, Montreal, August 2004
14. SIAM conference on applications of dynamical systems, Snowbird, May 2005
15. International congress on the applications of mathematics, Santiago de Chile, March 2006
16. AMS sectional meeting, Miami, April 2006
17. Workshop on statistical mechanics, CPT-CNRS, Marseilles, July 2006
18. 96th Statistical mechanics Conference, Rutgers University, December 2006
19. Workshop on nonequilibrium statistical mechanics, Schrödinger Institute, Vienna, June 2008
20. Workshop on stochastic dynamical systems, Bielefeld, November 2008
21. Arizona school of analysis with applications I (Entropy and the Quantum) University of Arizona, March 2009
22. NORDITA Stockholm, Multiscale modeling and simulation in science workshop, November 2009
23. SAMSI, Theory and qualitative behavior of stochastic dynamics workshop, February 2010
24. Arizona school of analysis with applications II, University of Arizona, March 2010
25. Indam meeting, Corinaldo, Hyperbolic dynamical systems in the sciences, June 2010
26. SIAM conference on nonlinear waves and coherent structures, August 2010
27. Oberwolfach seminar on ergodic theory of Markov processes, October 2010
28. 105th Statistical mechanics Conference, Rutgers University, May 2011
29. FRG workshop on quantum spin systems, Harvard University, May 2011
30. Workshop on Coarse-graining of many-body systems: analysis, computations and applications, Archimedes Center for Modeling, Analysis & Computation, University of Crete, June 2011
31. Summer school non-equilibrium statistical mechanics, Montreal, July 2011
31. ENUMATH conference: minisymposium on Numerical Methods for Molecular Dynamics. September 2011
32. Workshop on Metastability and stochastic processes, (3 hours mini-course on Non-equilibrium statistical mechanics) Ecole des Ponts ParisTech, September 2011

33. Workshop on Stochastic Dynamics in Mathematics, Physics and Engineering, Bielefeld, November 2011
34. Banff Workshop on Nonequilibrium Statistical Mechanics, November 2012 (cancelled)
35. SIAM conference on Mathematical aspects of material sciences, Philadelphia, June 2013
36. SPA conference (Stochastic processes and applications), Boulder, August 2013
37. AMS sectional meeting, Session on ergodic properties of dynamical systems. Saint Louis, October 2013
38. Randomness and Long-Time Dynamics in Nonlinear Evolution Differential Equations, Radcliffe Institute, Cambridge MA, November 2014
39. CIRM Workshop on Averaging and Homogenization in Deterministic and Stochastic Systems, Marseille, May 2015
40. CRiSM Workshop on Non-Reversible Markov Chains for Monte-Carlo Sampling, Warwick, September 2015
41. Meeting of the Canadian Mathematical Society, Montreal, December 2015
43. 114th Statistical Mechanics Conference, Rutgers, December 2015
42. Computational Statistics and Molecular Simulation (COSMOS), Paris, 2-5 February 2016
42. Numerical Aspects of Nonequilibrium Dynamics, Institut Henri Poincaré, Paris, 25-27 April 2017

Seminars:

01. Mathematical physics seminar, ETH, Zürich January 1998
02. Mathematical physics seminar, CPT-CNRS, Marseille, January 1998
03. Mathematical physics seminar, Institut Fourier Grenoble, February 1998
04. Mathematical physics seminar, University Paris-XI Orsay, April 1998
05. Mathematical physics seminar, University of Virginia, November 1998
06. Colloquium, University of Ottawa, January 1999
07. Statistical mechanics seminar, Princeton University, February 1999
08. Mathematical physics seminar, University of Geneva, July 1999
09. Dynamical systems seminar, SUNY at Stony Brook, November 1999
10. Mathematical physics seminar, University of Geneva, July 2000
11. Mathematical physics seminar, ETH, Zürich, August 2000
12. Colloquium, University of Arizona, October 2000
13. Statistical mechanics seminar, Princeton University, February 2001
14. Applied mathematics seminar, University of Toronto, March 2001
15. Theoretical physics seminar, University of Geneva, May 2001
16. Mathematical physics seminar, ETH Zürich, June 2001
17. Analysis seminar, University of Helsinki, August 2001
18. Mathematical physics seminar, University of Texas at Austin, January 2002
19. Colloquium, University of Massachusetts, Amherst, January 2002
20. Colloquium, University of Maryland, College Park, January 2002
21. Colloquium, University of Rochester, February 2002
22. Colloquium, University of Notre Dame, February 2002
23. Statistical mechanics seminar, Institute of Advanced Study, February 2002

24. Nonlinear analysis seminar, Stevens Institute of Technology, May 2002
25. Mathematical physics seminar, Rutgers University, October 2002
26. Stochastic processes seminar, Brown University, November 2002
27. Mathematical physics seminar, University of Virginia, January 2003
28. Condensed matter seminar, University of Massachusetts, April 2003
29. Probability seminar, EPFL, Lausanne, June 2003
30. Mathematical physics seminar, University of Geneva, June 2003
31. Applied mathematics seminar, Duke University, March 2004
32. Mathematical physics seminar, University of Geneva, January 2005
33. Analysis and numerics seminar, München University, January 2005
34. Mathematical physics seminar, München University, January 2005
35. Dynamical systems seminar, Boston University, April 2005
36. Nonlinear systems seminar, Stevens Institute of Technology, April 2005
37. Mathematical physics seminar, Rutgers University, September 2005
38. Mathematical physics seminar, University of Virginia, November 2006
39. Mathematical physics seminar, Rutgers University, November 2006
40. Applied mathematics seminar, Dartmouth College, April 2007
41. Mathematical physics seminar, University of Arizona, October 2007
42. Analysis seminar, University of Toronto, October 2007
43. Applied mathematics seminar, Brown University, November 2007
44. Colloquium, University of Connecticut, February 2009
45. Probability seminar, University of Wisconsin, March 2009
46. Theoretical physics Seminar, University of Geneva, April 2009
47. Mathematical physics Seminar, University of Rome, April 2009
48. Mathematical physics Seminar, University of Bologna, April 2009
49. Mathematical physics Seminar, University of Grenoble, May 2009
50. Applied mathematics Seminar, University of Crete, May 2009
51. Mathematical physics seminar, Rutgers University, November 2009
52. Operator algebra, University of Tokyo, January 2010
53. Joint PDE seminar Boston University – Brown University, November 2010
54. Applied Mathematics Seminar, University of Crete, March 2011
55. Probability Seminar, Warwick University, March 2011
56. Probability Seminar, Boston University, September 2012
57. Probability Seminar, University of Delaware, October 2013
58. Probability Seminar, Concordia University, May 2015
59. Probability Seminar, Brown University, November 2016