

Curriculum Vitae of David Galvin — August 19, 2009

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Research Interests

Discrete probability, combinatorics and graph theory; in particular, the applications of combinatorial ideas to the study of phase transitions in statistical physics models, the efficiency of algorithms in theoretical computer science, and long-range correlations in discrete random structures

Education

- Oct 2002: Ph.D. in Mathematics, Rutgers, The State University of New Jersey
Advisor: Jeffrey Kahn
- June 1996: Part III of Mathematical Tripos, Peterhouse, University of Cambridge
- June 1995: B.A. in Mathematics, Peterhouse, University of Cambridge

Employment

- July 2007 – : Assistant Professor, Department of Mathematics, University of Notre Dame
- July 2005 – June 2007: Lecturer, Department of Mathematics, University of Pennsylvania
Mentor: Robin Pemantle
- Sept 2004 – Aug 2005: Member, School of Mathematics, IAS, Princeton
Group leader: Avi Wigderson
- July 2002 – July 2004: Postdoctoral Researcher, Theory Group, Microsoft Research
Supervisors: Jennifer Chayes, Christian Borgs

Visiting Positions

- June 2008: Visiting Fellow, Isaac Newton Institute, University of Cambridge
- Jan – Feb 2005: General Member, MSRI, Berkeley
- Aug – Dec 2003: Auxiliary Faculty, Department of Mathematics, University of Washington

Research Publications — Articles in preparation

- Independent sets of a fixed size in the discrete hypercube
- On phase transition in the 3-coloring model on \mathbb{Z}^d , with J. Kahn, D. Randall and G. Sorkin

Research Publications — Articles submitted

- The number of independent sets in a graph with small maximum degree, with Y. Zhao, submitted Aug 2009
- The finite-state hard core model on a regular tree, with F. Martinelli, K. Ramanan and P. Tetali, submitted April 2009
- A threshold phenomenon for random independent sets in the discrete hypercube, submitted July 2008

Research Publications — Articles appeared or appearing

- An upper bound for the number of independent sets in regular graphs, to appear in *Discrete Math.*
- Matchings and Independent Sets of a Fixed Size in Regular Graphs, with Teena Carroll and Prasad Tetali, *J. Combin. Theory Ser. A* **116** (2009), 1219–1227
- Sampling independent sets on the discrete torus, *Random Structures Algorithms* **33** (2008), 356–376
- Sampling 3-colourings of regular bipartite graphs, *Electron. J. Probab.* **12** (2007), 481–497
- Bounding the partition function of spin systems, *Electron. J. Combin.* **13** (2006), R72
- Slow mixing of Glauber dynamics for the hard-core model on regular bipartite graphs, with P. Tetali, *Random Structures Algorithms* **28** (2006), 427–443
- On weighted graph homomorphisms, with P. Tetali, DIMACS Series in Discrete Mathematics and Theoretical Computer Science **63** (2004) *Graphs, Morphisms and Statistical Physics*, 97–104; summary in Entropy and graph homomorphisms, *Oberwolfach Rep.* **1** (2004), 30–32
- On phase transition in the hard-core model on \mathbb{Z}^d , with J. Kahn, *Combin. Probab. Comput.* **13** (2004), 137–164
- On homomorphisms from the Hamming cube to \mathbb{Z} , *Israel J. Math.* **138** (2003), 189–213

Research Publications — Refereed Conference Proceedings

- Torpid Mixing of Local Markov Chains on 3-Colorings of the Discrete Torus, with D. Randall, *Proc. ACM–SIAM SODA* (2007), 376–384
- Global connectivity from local geometric constraints for sensor networks with various wireless footprints, with R. D’Souza, C. Moore and D. Randall, *Proc. ACM–IEEE IPSN* (2006), 19–26
- Slow mixing of Glauber dynamics for the hard-core model on the hypercube, with P. Tetali, *Proc. ACM–SIAM SODA* (2004), 459–460

Other Research

- Two problems involving the notion of phase transition, Ph.D. dissertation, Rutgers, The State University of New Jersey, Oct 2002
- Ramanujan Graphs, Essay for Part III of Mathematical Tripos, University of Cambridge, June 1996

Grant activity

- NSF proposal (Algebra, Number Theory and Combinatoric Disciplinary Research Program) in preparation (due 10/6/09)
- Principal investigator, NSA Mathematical Science Program, Young Investigators Grant
 - Project title: Phase transitions for spin models on percolation clusters
 - Funding period: September 1 2009 – August 31 2011
 - Amount of funding: \$14,483.52 (year 1), \$14,817.98 (year 2)

Honors and Awards

- Dec 2006: Good Teaching Award, Department of Mathematics, University of Pennsylvania
- Aug 2001 – July 2002: Graduate School Fellowship, Rutgers, The State University of New Jersey
- Sept 1993 – June 1995: Scholar of Peterhouse, University of Cambridge
- 1990: Represented Ireland at International Mathematical Olympiad

Professional Memberships

- 1996 – : American Mathematical Society
- 2003 – : Mathematical Association of America

Teaching

- University of Notre Dame
 - Math 30530 (Introduction to Probability): fall 2009
 - Math 20340 (Probability and Statistics for Life Sciences): fall 2009, fall 2008
 - Math 30440 (Introduction to Probability and Statistics): spring 2009 (course chair), spring 2008
 - Math 60610 (Discrete Mathematics, graduate class): spring 2009

- Math 10560 (Calculus II): spring 2008
- Math 30210 (Introduction to Operations Research): fall 2007
- University of Pennsylvania
 - Math 581 (Probabilistic Methods in Combinatorics, graduate class): spring 2007
 - Math 114 (Calculus II): spring 2007, fall 2006, fall 2005
 - Math 313/CSE 313 (Computational Linear Algebra): spring 2006
 - Math 430 (Introduction to Probability): fall 2005
- University of Washington
 - Math 324 (Calculus III): fall 2003
- Rutgers, The State University of New Jersey
 - Math 356 (Number Theory:) summer 2001
 - Math 134 (Calculus I): Head Teaching Assistant 2000 – 2001
 - Math 152 (Calculus II): summer 2000
 - Recitation instructor (various courses): 1997 – 2000
 - Math 250 (Linear Algebra): summer 1998
 - Grader (300- and 400-level courses): 1996 – 1997

Conferences

- *AMS Sectional Meeting*, Boca Raton FL, Special Session on Graph Theory, upcoming (Oct 2009)
- *22nd Cumberland Conference on Graph Theory, Combinatorics & Computing*, Bowling Green KY, May 2009
- *DIMACS Workshop on Discrete Mathematics and Statistical Mechanics*, Piscataway NJ, Dec 2008
- *47th Midwest Graph Theory Conference*, Chicago IL, Nov 2008
- *AMS Sectional Meeting*, Bloomington IN, Special Session on Probability and Spatial Systems, Apr 2008
- *1st Canadian Discrete and Algorithmic Mathematics Conference*, Banff AB, Problems at the interface of discrete mathematics and statistical physics, May 2007
- *ACM–SIAM Symposium on Discrete Algorithms*, New Orleans LA, Jan 2007
- *DIMACS-DIMATIA-Renyi Partnership Meeting*, Piscataway NJ, Nov 2005, Algebraic and Geometric Methods in Combinatorics

- *INFORMS Applied Probability Conference*, Ottawa ON, Special Session on Spatial Dependence in Stochastic Networks, July 2005
- *Canadian Mathematical Society Summer Meeting*, Waterloo ON Special Session on Random Graphs and their applications, June 2005,
- *MSRI Program on Probability, Algorithms and Statistical Physics*, Workshop on Mixing of Markov Chains in Physics and Algorithms, Feb 2005
- *Mathematisches Forschungsinstitut Oberwolfach*, Workshop in Combinatorics, Jan 2004
- *ACM–SIAM Symposium on Discrete Algorithms*, New Orleans LA, Jan 2004
- *BIRS Focused Research Group*, Problems in Discrete Probability, July 2003
- *AMS Sectional Meeting*, Bloomington IN, Special Session on Probability, April 2003
- *DIMACS-DIMATIA-Renyi Partnership Meeting*, Prague, HOMONOLO' 02, Workshop on Graph Homomorphisms, Dec 2002
- *Isaac Newton Institute programme on Computation, Combinatorics and Probability*, Cambridge, Workshops on Combinatorial and Computational aspects of Statistical Physics, and Random Graphs and Structures, Aug 2002

Presentations

- Upcoming (October 2009): The number of independent sets in graphs with small maximum degree (AMS Sectional Meeting, Boca Raton FL)
- 5/22/09: Counting independent sets in regular graphs (22nd Cumberland Conference on Graph Theory, Combinatorics & Computing, Bowling Green KY)
- 4/4/09: Ramsey theory (Talk for visiting Graduate School applicants, University of Notre Dame)
- 3/11/09: A threshold phenomenon for independent sets in the hypercube (Combinatorics Seminar, University of Illinois at Chicago)
- 12/18/08: A threshold phenomenon for independent sets in the hypercube (DIMACS Workshop on Discrete Mathematics and Statistical Mechanics, Piscataway NJ)
- 12/4/08: Counting matchings and independent sets of a fixed size (Combinatorics, Optimization and Algorithms Seminar, Carnegie Mellon University)
- 11/8/08: Is the independent set sequence of the hypercube unimodal? (47th Midwest Graph Theory Conference, Chicago IL)
- 10/16/08: Combinatorics and Probability in Statistical Mechanics (Mathematical Physics and Physical Mathematics Seminar, University of Notre Dame)
- 9/26/08: Graph colouring (Mathematical Research at Notre Dame, University of Notre Dame)

- 9/1/08: The “Happy End” Problem — A Mathematical Love Story (Graduate Student Seminar, University of Notre Dame)
- 4/28/08: Independent sets in graphs (Applied Mathematics Colloquium, University of Notre Dame)
- 4/6/08: Sampling 3-colourings of the discrete torus (AMS Sectional Meeting, Bloomington IN)
- 5/29/07: Counting matchings and independent sets of a fixed size (Canadian Discrete and Algorithmic Mathematics Conference, Banff AB)
- 2/13/07: Spin models in combinatorics, computer science and statistical physics (Colloquium, University of Memphis)
- 2/06/07: Spin models in combinatorics, computer science and statistical physics (Colloquium, Dartmouth College)
- 1/30/07: Spin models in discrete probability, statistical physics and theoretical computer science (Colloquium, University of Notre Dame)
- 1/23/07: Spin models in discrete probability, statistical physics and theoretical computer science (Mathematics Seminar, University of Pennsylvania)
- 1/7/07: Sampling 3-colourings of the discrete torus (ACM–SIAM Symposium on Discrete Algorithms, New Orleans LA)
- 11/29/06: Global connectivity from local conditions (Discrete Mathematics Seminar, Princeton University)
- 11/15/06: Spin models: Gibbs measures and mixing times (Colloquium, Lehigh University)
- 10/6/06: Counting colourings (Combinatorics Seminar, University of Delaware)
- 4/21/06: Erdős’ proof of Bertrand’s postulate (Graduate Pizza Seminar, University of Pennsylvania)
- 3/28/06: The range of the cube-indexed random walk (Combinatorics and Probability Seminar, University of Pennsylvania)
- 3/10/06: Bounding the partition function of spin-systems (Combinatorics Seminar, Georgia Institute of Technology)
- 11/17/05: The influence of variables on Boolean functions III (Probability Working Group, University of Pennsylvania)
- 11/10/05: The influence of variables on Boolean functions II (Probability Working Group, University of Pennsylvania)
- 11/8/05: Bounding the partition function of spin-systems (DIMACS-DIMATIA-Renyi Workshop on Algebraic and Geometric Methods in Combinatorics, Piscataway NJ)

- 11/3/05: The influence of variables on Boolean functions I (Probability Working Group, University of Pennsylvania)
- 7/8/05: Long-range influence in the hard-core model (13th INFORMS Applied Probability Conference, Ottawa ON)
- 6/4/05: Bounding the partition function of spin-systems (Canadian Mathematical Society Summer Meeting, Waterloo ON)
- 3/9/05: Entropy and graph homomorphisms (Combinatorics Seminar, Graduate Center, City University of New York)
- 2/22/05: Entropy and graph homomorphisms (Combinatorics Seminar, University of Pennsylvania)
- 2/3/05: Slow mixing of local dynamics for 3-colourings on regular bipartite graphs (Probability, Algorithms and Statistical Physics Workshop, MSRI, Berkeley)
- 1/26/05: Homomorphisms from the Hamming cube to \mathbb{Z} (Probability Seminar, University of California – Berkeley)
- 1/24/05: Entropy and graph homomorphisms (Probability Seminar, Stanford University)
- 12/9/04: Slow mixing of local dynamics for uniform colourings and independent sets (Probability and Algorithms Seminar, University of Pennsylvania)
- 12/1/04: Homomorphisms from the Hamming cube to \mathbb{Z} (Discrete Mathematics Seminar, Princeton University)
- 11/16/04: Slow mixing of local dynamics for uniform colourings and independent sets II (Discrete Mathematics Seminar, Institute for Advanced Study, Princeton)
- 11/9/04: Slow mixing of local dynamics for uniform colourings and independent sets I (Discrete Mathematics Seminar, Institute for Advanced Study, Princeton)
- 10/4/04: Counting graph homomorphisms (Members' Research Seminar, Institute for Advanced Study, Princeton NJ)
- 2/12/04: The entropy method in combinatorics (Combinatorics, Optimization and Algorithms Seminar, Carnegie Mellon University)
- 2/2/04: The entropy method in combinatorics (Probability Seminar, University of Washington)
- 1/26/04: The hard-core model: where statistical physics, communications networks and computer science meet (Colloquium, University of Rochester)
- 1/12/04: Slow mixing of Glauber dynamics for the hard-core model on the hypercube (ACM–SIAM Symposium on Discrete Algorithms, New Orleans LA)
- 1/9/04: Entropy and graph homomorphisms (Combinatorics Workshop, Mathematisches Forschungsinstitut Oberwolfach, Oberwolfach, Germany)

- 12/16/03: The hard-core model: where statistical physics, communications networks and computer science meet (Nonlinear Systems Seminar, Stevens Institute of Technology)
- 11/14/03: The hard-core model: where statistical physics, communications networks and computer science meet (Colloquium, George Washington University)
- 10/6/03: Slow mixing of Glauber dynamics for the hard-core model on the hypercube (Research Seminar, Microsoft Theory Group, Redmond WA)
- 9/16/03: Slow mixing of Glauber dynamics for the hard-core model on the hypercube (Combinatorics Seminar, Georgia Institute of Technology)
- 7/14/03: Asymptotically enumerating graph homomorphisms (BIRS focussed research group on problems in discrete probability, Banff AB)
- 4/21/03: Gibbs measures for independent set models (Probability Seminar, University of Washington)
- 4/5/03: Entropy and graph homomorphisms (AMS Sectional Meeting, Bloomington IN)
- 1/29/03: Counting functions on the discrete cube (Combinatorics Seminar, University of Washington)
- 12/17/02: Counting weighted graph homomorphisms (Combinatorics Seminar, Microsoft Theory Group, Redmond WA)
- 12/17/02: Counting weighted graph homomorphisms (DIMACS-DIMATIA-Renyi Workshop on Graph Homomorphisms, Prague, Czech Republic)
- 8/28/02: Homomorphisms from the Hamming cube to \mathbb{Z} (Workshop on Random Graphs and Structures, Isaac Newton Institute, Cambridge, England)
- 6/6/02: Two problems involving the notion of phase transition (Ph.D. Thesis Defense, Rutgers, The State University of New Jersey)
- 2/08/02: Phase transition in the hard-core model on \mathbb{Z}^d (Combinatorics Seminar, Massachusetts Institute of Technology)
- 1/24/02: Phase transition in the hard-core model on \mathbb{Z}^d (Research Seminar, Microsoft Theory Group, Redmond WA)
- 1/18/02: Phase transition in the hard-core model on \mathbb{Z}^d (Combinatorics Seminar, Georgia Institute of Technology)
- 11/16/01: WeBWorK: providing real technological support for a real course (VIGRE seminar, Rutgers, The State University of New Jersey (with Professor Stephen Greenfield))
- 11/13/01: Phase transition in the hard-core model on \mathbb{Z}^d (Discrete Mathematics Seminar, Rutgers, The State University of New Jersey)
- 10/24/01: Phase transition in the hard-core model on \mathbb{Z}^d (Discrete Mathematics Seminar, Institute for Advanced Study, Princeton)

- 9/19/01: Conway’s solitaire army problem (Graduate Student Seminar, Rutgers, The State University of New Jersey) (★)
- 3/28/01: Erdős’ proof of Bertrand’s postulate (Graduate Student Seminar, Rutgers, The State University of New Jersey) (★)
- 1/30/01: WeBWorK instructional seminar (Learning Resource Center, Rutgers, The State University of New Jersey)
- 1/19/01: WeBWorK instructional seminar (Instructional Seminar, Rutgers, The State University of New Jersey)
- 9/22/00: Equilateral sets in the ℓ_1 -norm (Graduate Student Seminar, Rutgers, The State University of New Jersey)
- 5/1/00: A triptych of recreational problems (DIMACS Graduate Student Seminar, Piscataway NJ)
- 9/15/99: Hilbert’s third problem (Graduate Student Seminar, Rutgers, The State University of New Jersey)
- 4/6/99: Schnirelmann density, Waring’s problem and Goldbach’s conjecture (Graduate Student Seminar, Rutgers, The State University of New Jersey)
- 3/3/98: The finitization of Eckhoff’s conjecture (Graduate Student Seminar, Rutgers, The State University of New Jersey)

(★) – voted best seminar of semester

Students supervised

- John Engbers, Ph.D. (beginning Apr 2009)
- Meagan Pitluck, Senior thesis (beginning November 2007, completed Apr 2009)
“An Introduction to Voting Systems: Flaws, Failures, and Potential Solutions”
- Bethany Herwaldt, Senior thesis (beginning April 2009, due to be completed Apr 2010)
- Andrew McConvey, Senior thesis (beginning April 2009, due to be completed Apr 2010)

Service

- 2007 – : University of Notre Dame
 - Ph.D. defense examiner (Radha Krishna Ganti, Department of Electrical Engineering, upcoming (10/8/09))
 - Combinatorics and Logic reading seminar co-organizer (fall 2009)
 - First year advisor (Justin Hilyard, 2009 – 2010)

- Undergraduate Committee (2009 –)
- Senior thesis reader (Logan Zoellner, May 2009)
- Department representative, Undergraduate Admissions Admitted Student Open House, 4/16/09
- Research talk for visiting Graduate School applicants, 4/4/09
- Undergraduate advising (beginning Apr 2009)
- Ph.D. defense Outside Chair (ShaoPing Shen, Department of Physics, 4/2/09)
- Ph.D. oral candidacy examiner (Hyunju Kim, Department of Physics, 3/17/09)
- Ph.D. written candidacy examiner (Hyunju Kim, Department of Physics, 10/8/08)
- 2006 – : Reviewer, Mathematical Reviews
- 2005 – 2007: University of Pennsylvania
 - Probability and Combinatorics Seminar Coordinator
 - Preliminary Exam Committee
 - Class of 1880 Prize Exam Committee
 - Masters thesis examiner
 - Oral qualifying examiner
- 1999 – : Refereeing
 - Algorithmica
 - Discrete Mathematics
 - Random Structures and Algorithms
 - SIAM Journal of Discrete Mathematics
 - Electronic Journal of Probability
 - Journal of Physics **A**
 - Proceedings of the AMS
 - Combinatorica
 - Journal of Graph Theory
- 1999 – 2000: Rutgers, The State University of New Jersey
 - Graduate Student Seminar Coordinator, Department of Mathematics

Conference Organization

- 1st Canadian Discrete and Algorithmic Mathematics Conference, Banff AB, May 2007
Invited Minisymposium Organizer

Outreach Activities

- Judge, Northern Indiana Regional Science Fair, 21/3/09