

CURRICULUM VITAE OF DAVID GALVIN, FEBRUARY 27, 2012

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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

October 2002: Ph.D. in Mathematics, Rutgers, The State University of New Jersey
(Jeff Kahn, advisor)

June 1996: Part III of Mathematical Tripos (M. Math.), Peterhouse, University of Cambridge

June 1995: B.A. in Mathematics, Peterhouse, University of Cambridge

EMPLOYMENT

July 2007 – present: Assistant Professor, Department of Mathematics, University of Notre Dame

July 2005 – June 2007: Lecturer, Department of Mathematics, University of Pennsylvania
(Robin Pemantle, mentor)

September 2004 – August 2005: Member, School of Mathematics, IAS, Princeton
(Avi Wigderson, group leader)

July 2002 – July 2004: Postdoctoral Researcher, Theory Group, Microsoft Research
(Jennifer Chayes & Christian Borgs, supervisors)

VISITING POSITIONS

June 2011: REGS (Research Experience for Graduate Students) official visitor, Department of Mathematics, University of Illinois at Urbana-Champaign

June 2008: Visiting Fellow, Isaac Newton Institute, University of Cambridge

January – February 2005: General Member, MSRI, Berkeley

August – December 2003: Auxiliary Faculty, Department of Mathematics, University of Washington

RESEARCH ARTICLES UNDER REVIEW

Stirling numbers of forests and cycles (with Do Trong Thanh)

H -coloring tori (with J. Engbers)

The independent set sequence of regular bipartite graphs

RESEARCH ARTICLES ACCEPTED

Maximizing H -colorings of regular graphs, to appear in *J. Graph Theory*

RESEARCH ARTICLES APPEARED

H -colouring bipartite graphs (with J. Engbers)

J. Combin. Theory Ser. B **102** (2012), 726-742

Reverse Mathematics and infinite traceable graphs (with P. Cholak and R. Solomon)

Math. Log. Q. **58** (2012), 18–28

- Two problems on independent sets in graphs
Discrete Math. **311** (2011), 2105–2112
- The multistate hard core model on a regular tree (with F. Martinelli, K. Ramanan and P. Tetali),
SIAM J. Discrete Math. **25** (2011), 894–916
- The number of independent sets in a graph with small maximum degree (with Y. Zhao),
Graphs Combin. **27** (2011), 177–186
- A threshold phenomenon for random independent sets in the discrete hypercube,
Combin. Probab. Comput. **20** (2011), 27–51
- An upper bound for the number of independent sets in regular graphs,
Discrete Math. **309** (2009), 6635–6640
- Matchings and Independent Sets of a Fixed Size in Regular Graphs (with T. Carroll and P. 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
- 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

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 CONFERENCE PROCEEDINGS

- Entropy and graph homomorphisms,
Oberwolfach Rep. **1** (2004), 30–32

GRANT ACTIVITY

- Principal investigator, NSA MSP (Young Investigators Grant)
Phase transitions for spin models on percolation clusters
 March 7 2010 – March 6 2012

TEACHING

University of Notre Dame

Math 40210 (Basic Combinatorics): spring 2012

Math 10550 (Calculus I): fall 2011

Math 30530 (Introduction to Probability): fall 2009, fall 2011*

Math 30440 (Introduction to Probability and Statistics): spring 2010*, spring 2009*, spring 2008

Math 20340 (Probability and Statistics for Life Sciences): fall 2009, fall 2008

Math 60610 (Discrete Mathematics, graduate class): spring 2009

Math 10560 (Calculus II): spring 2008

Math 30210 (Introduction to Operations Research): fall 2007

(*course chair)

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

HONORS AND AWARDS

December 2006: Good Teaching Award, Department of Mathematics, University of Pennsylvania

August 2001 – July 2002: Graduate School Fellowship, Rutgers, The State University of NJ

September 1993 – June 1995: Scholar of Peterhouse, University of Cambridge

July 1990: Represented Ireland at International Mathematical Olympiad

PROFESSIONAL MEMBERSHIPS

2010 – present: Society for Industrial and Applied Mathematics

2003 – present: Mathematical Association of America

1996 – present: American Mathematical Society

CONFERENCE TALKS

SIAM Conference on Discrete Mathematics, Halifax NS, Minisymposium on Graph Coloring, June 2012
Graph Stirling numbers

AMS Sectional Meeting, Tampa FL, Special Session on Extremal Combinatorics, March 2012
The independent set profile in graphs with given minimum degree

AMS Sectional Meeting, Lincoln NE, Special Session on Extremal and Probabilistic Combinatorics,
October 2011 *Counting graph homomorphisms*

AMS Sectional Meeting, Winston-Salem NC, Special Session on New Developments in Graph Theory,
September 2011 *Graph Stirling numbers*

15th International Conference on Random Structures and Algorithms, Atlanta GA, May 2011
The typical appearance of a colouring of a regular bipartite graph

24nd Cumberland Conference on Graph Theory, Combinatorics & Computing, Louisville KY,
May 2011 *Independent sets in graphs with given minimum degree*

AMS Sectional Meeting, Iowa City IA, Special Session on Graph Theory, March 2011
Unimodality of the independent set sequence of a graph

AMS Sectional Meeting, Syracuse NY, Special Session on Analytic Combinatorics, October 2010
Unimodality (and otherwise) of some graph theoretic sequences

SIAM Conference on Discrete Mathematics, Austin TX, Session on Probabilistic Combinatorics, June 2010
H-Colouring Regular Bipartite Graphs

AMS Sectional Meeting, Newark NJ, Special Session on Graph Theory, May 2010
The typical structure of H-colourings of regular bipartite graphs

AMS Sectional Meeting, Boca Raton FL, Special Session on Graph Theory, October 2009
The number of independent sets in graphs with small maximum degree

22nd Cumberland Conference on Graph Theory, Combinatorics & Computing, Bowling Green KY,
May 2009 *Counting independent sets in regular graphs*

DIMACS Workshop on Discrete Mathematics and Statistical Mechanics, Piscataway NJ, December 2008
A threshold phenomenon for independent sets in the hypercube

47th Midwest Graph Theory Conference, Chicago IL, November 2008
Is the independent set sequence of the hypercube unimodal?

AMS Sectional Meeting, Bloomington IN, Special Session on Probability and Spatial Systems, April 2008
Sampling 3-colourings of the discrete torus

1st Canadian Discrete and Algorithmic Mathematics Conference, Banff AB, Problems at the interface of
discrete mathematics and statistical physics, May 2007
Counting matchings and independent sets of a fixed size

ACM-SIAM Symposium on Discrete Algorithms, New Orleans LA, January 2007
Sampling 3-colourings of the discrete torus

DIMACS-DIMATIA-Renyi Partnership Meeting, Piscataway NJ, Algebraic and Geometric Methods in
Combinatorics, November 2005
Bounding the partition function of spin-systems

INFORMS Applied Probability Conference, Ottawa ON, Special Session on Spatial Dependence in
Stochastic Networks, July 2005
Long-range influence in the hard-core model

Canadian Mathematical Society Summer Meeting, Waterloo ON Special Session on Random Graphs
and their applications, June 2005,
Bounding the partition function of spin-systems

MSRI Program on Probability, Algorithms and Statistical Physics, Workshop on Mixing of Markov Chains
in Physics and Algorithms, February 2005
Slow mixing of local dynamics for 3-colourings on regular bipartite graphs

Mathematisches Forschungsinstitut Oberwolfach, Workshop in Combinatorics, January 2004
Entropy and graph homomorphisms

ACM-SIAM Symposium on Discrete Algorithms, New Orleans LA, January 2004
Slow mixing of Glauber dynamics for the hard-core model on the hypercube

BIRS Focused Research Group, Problems in Discrete Probability, Banff AB, July 2003
Asymptotically enumerating graph homomorphisms

AMS Sectional Meeting, Bloomington IN, Special Session on Probability, April 2003

Entropy and graph homomorphisms

DIMACS-DIMATIA-Renyi Partnership Meeting (HOMONOLO' 02), Prague, Workshop on Graph Homomorphisms, December 2002

Counting weighted graph homomorphisms

Isaac Newton Institute programme on Computation, Combinatorics and Probability, Cambridge, Workshops on Combinatorial and Computational aspects of Statistical Physics, and Random Graphs and Structures, August 2002 Homomorphisms from the Hamming cube to \mathbb{Z}

SEMINARS AND COLLOQUIA

3/2/12: Unimodality, log-concavity and asymptotic normality of combinatorial sequences

(Mathematics Colloquium, University of Nebraska)

11/29/11: An extremal problem for independent sets

(Graph Theory seminar, Western Michigan University)

6/29/11: Entropy and Counting

(Graph Theory and Combinatorics Seminar, University of Illinois at Urbana-Champaign)

6/27/11: Unimodality of combinatorial sequences

(Graph Theory and Combinatorics Seminar, University of Illinois at Urbana-Champaign)

4/14/11: Counting graph homomorphisms: some results and questions

(Mathematics Colloquium, Western Michigan University)

4/11/11: Hard-constraint spin systems: some results and questions

(Applied Mathematics Colloquium, Illinois Institute of Technology)

4/11/11: Brégman's theorem and extensions (Graduate student seminar, Illinois Institute of Technology)

3/2/11: Unimodality (and otherwise) of some graph theoretic sequences

(Discrete Mathematics Seminar, University of Delaware)

12/15/10: Unimodality (and otherwise) of some graph theoretic sequences

(Combinatorics Seminar, Georgia Institute of Technology)

4/27/10: The typical appearance of colourings of regular bipartite graphs

(Graph Theory and Combinatorics Seminar, University of Illinois at Urbana-Champaign)

3/11/09: A threshold phenomenon for independent sets in the hypercube

(Combinatorics Seminar, University of Illinois at Chicago)

12/4/08: Counting matchings and independent sets of a fixed size

(Combinatorics, Optimization and Algorithms Seminar, Carnegie Mellon University)

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)

3/10/06: Bounding the partition function of spin-systems

(Combinatorics Seminar, Georgia Institute of Technology)

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)

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)
- 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)
- 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)
- 9/16/03: Slow mixing of Glauber dynamics for the hard-core model on the hypercube
(Combinatorics Seminar, Georgia Institute of Technology)
- 4/21/03: Gibbs measures for independent set models (Probability Seminar, University of Washington)
- 1/29/03: Counting functions on the discrete cube (Combinatorics Seminar, University of Washington)
- 2/08/02: Phase transition in the hard-core model on \mathbb{Z}^d
(Combinatorics Seminar, Massachusetts Institute of Technology)
- 1/18/02: Phase transition in the hard-core model on \mathbb{Z}^d
(Combinatorics Seminar, Georgia Institute of Technology)
- 10/24/01: Phase transition in the hard-core model on \mathbb{Z}^d
(Discrete Mathematics Seminar, Institute for Advanced Study, Princeton)

STUDENTS SUPERVISED

Do Trong Thanh, Glynn Family Honors Program Summer Research, summer 2011

Justin Hilyard, Ph.D., April 2010 – present

Passed candidacy exam February 2011

John Engbers, Ph.D., April 2009 – present

Passed candidacy exam January 2010

Bethany Herwaldt, Senior thesis, April 2009 – April 2010

Primality testing algorithms

Went on to M.S. in Applied Mathematics, University of Washington

Andrew McConvey, Senior thesis, April 2009 – April 2010

The stable marriage problem

Went on to M.S. in Combinatorics and Optimization, University of Waterloo

Meagan Pitluck, Senior thesis, November 2007 – April 2009

An Introduction to Voting Systems: Flaws, Failures, and Potential Solutions

Went on to M.S. in Computer Science, The College of William and Mary

DEPARTMENTAL AND UNIVERSITY SERVICE

2007 – present: University of Notre Dame

Panel member for discussion on postdoctoral experience, Professional Development Seminar, 2/21/12

Postdoctoral search committee, 2011-2012

ND-Navy Research Forum presentation, 10/28/2011

First year advisor (Hank Ditton), 2011 – 2012

Ph.D. defense examiner (Hyunju Kim, Department of Physics), 5/19/11

Panel member for discussion on job search experience, Mathematics Teaching Seminar, 5/3/11

Department representative, Undergraduate Admissions Admitted Student Open House, 4/7/11

Ph.D. defense Outside Chair (Ge Liu, Department of Sociology), 4/5/11

Committee on an ethics requirement for Science majors, spring 2011
 Mathematical Research at Notre Dame talk, 8/10/10
 Ph.D. oral candidacy Outside Chair (Kan Wang, Department of Aerospace and Mechanical Engineering), 8/17/10
 Panel member for discussion on job search experience, Mathematics Teaching Seminar, 4/29/10
 Ph.D. defense Outside Chair (Thomas Apker, Department of Aerospace and Mechanical Engineering), 12/11/09
 Ph.D. defense examiner (Radha Krishna Ganti, Department of Electrical Engineering), 10/8/09
 Combinatorics and Logic seminar co-organizer, 2009 – present
 First year advisor (Justin Hilyard), 2009 – 2010
 Undergraduate Committee, 2009 – 2010
 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, April 2009 – present
 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
 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 – 2000: Rutgers, The State University of New Jersey
 Graduate Student Seminar Coordinator, Department of Mathematics

SERVICE TO THE PROFESSION

2010: External reviewer of grant proposal
 2006 – present: Reviewer, Mathematical Reviews
 1999 – present: Refereeing
 Algorithmica, Discrete Mathematics, Random Structures & Algorithms, SIAM Journal of Discrete Mathematics, Electronic Journal of Probability, Journal of Physics **A**, Proceedings of the AMS, Combinatorica, Journal of Graph Theory, Annals of Probability, Symposium on the Theory of Computing, Annales de l'Institut Henri Poincaré

CONFERENCE ORGANIZATION

AMS 2010 Fall Central Section Meeting, Notre Dame IN, November 2010
 Special Session coorganizer (with Hemanshu Kaul) *Graphs and hypergraphs*
 1st Canadian Discrete and Algorithmic Mathematics Conference, Banff AB, May 2007
 Invited Minisymposium Organizer *Problems at the interface of discrete math and statistical physics*

OUTREACH ACTIVITIES

Judge, The Siemens Competition in Math, Science & Technology, Regional final, 11/19/11
 Judge, The Siemens Competition in Math, Science & Technology, Regional final, 11/20/10
 Judge, Northern Indiana Regional Science Fair, 21/3/09
 Judge, The Siemens Competition in Math, Science & Technology, Regional final, 11/14/09