

**General Information**

Paul Joseph WOLLAN

*Date of Birth:* 21 September 1976*Place of Birth:* Seattle, USA*Citizenship:* United States of America*Languages:* English (native), Italian (fluent), German (basic)*Permanent Address and contact:*Via Caltagirone 15  
00182 Roma Italia*Tel:* +39 347-773-8834*E-mail:* wollan@di.uniroma1.it**Education****Georgia Institute of Technology, USA**

Aug 2001 - Dec 2005

*Ph.D. in Algorithms, Combinatorics, and Optimization*

- Dissertation title: "Extremal Functions for Graph Linkages and Rooted Minors".
- Advisor: Prof. Robin Thomas.

**University of Chicago, USA**

Sept 1995 - June 1999

*Bachelor of the Arts in Mathematics with Honors***Academic Appointments**Dec 2008 - current: **Sapienza University of Rome, Dip. Informatica***Professore Ordinario*

- Ricercatore from Dec 2008 - Oct 2013, Professore Associato from Oct 2013 - Jan 2018
- Confermato Feb 2012.

Jan 2007 - Dec 2008: **University of Hamburg, Dept. of Math, Germany***Humboldt Research Fellow*Jan 2006 - Jan 2007: **University of Waterloo, Dept. of C & O, Canada***Postdoctoral Research Fellow*Aug 2001 - Dec 2005: **Georgia Institute of Technology, USA***Grad Assistant and PhD Candidate*Sept 2000 - June 2001: **Los Alamos National Laboratory, USA***Grad Research Assistant***Teaching Experience - Courses Taught****University of Rome, Rome, Italy:**

2009 - present

*Instructor*Graph Theory - *Laurea Magistrale*. Lead Instructor, taught 8 times: 2010 - 2018.Progettazione di Algoritmi - *Laurea Triennale*. Lead Instructor, taught 4 times 2015 - 2018.Fondamenti di Programazione - *Laurea Triennale*. Laboratory Section, taught 4 times: 2010 - 2014.**University of Hamburg, Hamburg, Germany:**

2009

*Instructor*

Graph Minors - PhD course. Lead Instructor, taught once 2009.

**University of Waterloo, Waterloo, Canada:**

2006

*Instructor*

Linear Algebra - Undergraduate course. Instructor, taught once 2006.

**Georgia Institute of Technology**, Atlanta, USA:

2004 - 2013

*Lead Instructor*

Combinatorics - Undergraduate course. Lead Instructor, taught twice 2004, 2011.

Advanced Combinatorial Optimization - PhD course. Lead Instructor, taught twice 2012, 2013.

**Teaching Experience - Supervised Students and Postdocs**

- Katherine Edwards, 2015 - 2016 *Graduate Researcher*
  - PhD Princeton University 2016
  - Currently Research Staff, Bell Labs
- Gregory Gauthier, 2015 - 2016 *Graduate Researcher*
  - PhD Princeton University 2017.
  - Currently, staff member Google.
- Spencer Backman, 2014 - 2015 *Postdoctoral Researcher*
  - PhD Georgia Institute of Technology 2014
  - Currently Zuckerman STEM Postdoctoral Scholar at Einstein Institute, Hebrew University Israel.
- Ringi Kim, 2014 - 2015 *Graduate Researcher*
  - PhD Princeton University 2016
  - Currently Postdoctoral researcher, KAIST Korea.
- Tony Huynh, 2013 - 2015 *Postdoctoral Researcher*
  - PhD University of Waterloo 2009
  - Currently Postdoctoral researcher, University of Belgium.
- Irene Muzi, current *PhD Student*
  - PhD University of Rome 2017
  - Currently Postdoctoral researcher, University of Warsaw.
- Jan-Oliver Froehlich, 2014-2015 *Postdoctoral Researcher*
  - PhD University Hamburg 2013
- Matteo Pontecorvi, 2011 *Laurea Specialistica*
  - PhD 2018 at the University of Austin Department of Computer Science
  - Thesis work published in *J. Combin. Theory Ser B*, entitled "Disjoint cycles intersecting a set of vertices."

**Funding Information**

2011 - 2017: ERC DASTCO - *European Research Council Starter Grant*

**850,000 €**

Principal Investigator of the ERC project DASTCO, a 5 year project to study structural aspects of signed and directed graphs. Budget includes funding for 2 graduate students and six 1-year post doctoral positions. Awarded by the European Union Research Council.

2007 - 2008: *Humboldt Foundation Research Fellowship*:

**69,000 €**

Recipient of a Humboldt Research Fellowship hosted by Prof. Reinhard Diestel at the University of Hamburg. Originally funded for one year, awarded the maximum extension of 1 year in 2008.

2012 - 2013: *ATENEIO Grant:* **25,500 €**

Principal Investigator for a project on problems in graph theory and aspects of proof complexity. Funded by the internal funding agency of the University of Rome La Sapienza.

2016 - 2017: *ATENEIO Grant:* **18,000 €**

Principal Investigator for a project on applications of graph theory in theoretical computer science. Funded by the internal funding agency of the University of Rome La Sapienza.

### **Awards and Honors**

- 2013: Promoted to Associate Professor at Sapienza University through national program from the Ministry of Instruction and Research (*chiamata diretta*).
- 2012: Invited to present as representative of the faculty at the Inauguration of the Academic Year 2012 - 2013 at Sapienza University.
- 2006 - 2007: Humboldt Research Fellowship, awarded by the Alexander von Humboldt Foundation and hosted by the University of Hamburg.
- 2005: “Graduate Student of the Year” 2004-2005, Department of Mathematics, Georgia Institute of Technology.

### **Invited Plenary Presentations**

1. *A “Grid” Theorem for Vertex Minors and Rankwidth*, One Day Meeting in Combinatorics - Oxford University, May 2018.
2. *A New Look at the Structure of Graphs Excluding a Fixed Minor*, European Conference on Combinatorics, Graph Theory, and Applications - EUROCOMB 2017, Vienna, August 2017.
3. *A Shorter Proof for the Graph Minor Structure Theorem with Explicit Bounds*, Structure in Graphs and Matroids, University of Waterloo, July 2017.
4. *When Are Directed Graphs Well-quasi-ordered*, Colloquia in Combinatoric, London School of Economics, May 2014.
5. *A New Proof for the Weak-Structure Theorem with Explicit Bounds*, Dagstuhl Seminar “Bidimensional Structures: Algorithms, Combinatorics and Logic”, Germany, March 2013.
6. *Explicit Bounds for the Weak-Structure Theorem*, Workshop on Graphs and Matroids, Maastricht, Netherlands, August 2012.
7. *Excluding a Clique Immersion*, Graph Theory at Georgia Tech, Atlanta, May 2012.
8. *New Proofs in Graph Minors*, Mathematical Foundations of Computer Science (MFCS), Warsaw, Poland, August 2011.
9. *A Shorter Proof of the Unique Linkage Theorem*, Oberwolfach Workshop, Oberwolfach, Germany, March 2010.

### **Other Invited Presentations**

1. *Coloring graphs with no clique immersion*, SIAM Discrete Math, Denver USA, June 2018.

2. *Explicit bounds for the graph minor structure theorem*, ACO 25, Atlanta USA, January 2017.
3. *Forcing clique immersions through chromatic number*, BIRS Workshop on Graph Coloring, Banff Canada, October 2016.
4. *Packing cycles in doubly group labeled graphs*, SIAM Discrete Mathematics, Atlanta USA, July 2016.
5. *Explicit bounds for the graph minor structure theorem*, Oberwolfach Graph Theory, Oberwolfach, Germany January 2016.
6. *When Are Directed Graphs Well-quasi-ordered*, ICM Satellite Conference on Extremal and Structural Graph Theory, Gyongju Korea, August 2014.
7. *Packing Disjoint A-paths With Specified Ends*, SIAM Discrete Mathematics, Minneapolis USA, July 2014.
8. *Packing A-paths With Specified Endpoints*, Bellairs Workshop on Graph Theory, Holetown, Barbados, March 2014.
9. *Immersions in Highly Connected Graphs*, Oberwolfach Workshop, Oberwolfach, Germany, March 2013.
10. *A Short Proof of the Unique Linkage Theorem*, Atlanta Lecture Series in Combinatorics and Discrete Math, Atlanta, April 2011.
11. *A Shorter Proof of the Unique Linkage Theorem*, SIAM Conference on Discrete Mathematics, Austin, June 2010.
12. *Linking Vortices*, Workshop on Graph Theory, Princeton, May 2009.
13. *Non-zero Cycles in Group Labeled Graphs*, Banf Workshop, Banf, Canada, September 2008.
14. *Packing Disjoint Clique Minors*, Sittard, Netherlands, July 2008.
15. *Complete Minors in Large Six Connected Graphs*, Graph Theory 2007, Fredericia, Denmark, December 2007.
16. *Progress on Removable Paths Conjectures*, Oberwolfach Workshop, Oberwolfach, Germany, March 2007.
17.  *$K_6$  Minors in Large Six Connected Graphs*, SIAM Conference on Discrete Mathematics, Victoria, Canada, June 2006.
18. *Extremal Functions for Linkages and Rooted Minors*, ACCOTA, Combinatorial and Computational Aspects of Optimization, Topology, and Algebra, Guanajuato, Mexico, October 2004.
19. *The Extremal Function for 3-linked Graphs*, SIAM Conference on Discrete Mathematics, Nashville, June 2004.

### **Professional Activities**

- Associate Editor: Discrete Mathematics, 2016 - current.
- Scientific Committee member: SIAM Conference on Discrete Mathematics 2016, Graph Theory at Georgia Tech 2013.
- Program Committee member: SIAM Symposium on Discrete Algorithms (SODA) 2014, 2018, Workshop on Approximation and Online Algorithms (WAOA) 2012, 2015, European Symposium on Algorithms (ESA) 2016.

- Reviewer for national scientific funding agencies: National Science Foundation and National Security Agency (USA), 2008, 2010 - 2013, the Australian Research Council 2011 - 2013, the National Science and Engineering Research Council of Canada 2011, 2014, FONDECYT of Chile, 2011, Czech Science Foundation 2014, and Ministero dell' Istruzione, dell' Università e della Ricerca 2015.
- Chaired of invited session “Structural Graph Theory and Methods,” at the International Symposium on Math Programming (ISMP) in Berlin in Aug 2012. Chair of the invited session “Graph Structure” at the SIAM Conference on Discrete Math held in Minneapolis in June 2014 and at the SIAM Conference on Discrete Math held in Denver in June 2018.
- Organizer of 6 international conferences and workshops: Graph Theory at Georgia Tech in Atlanta, USA 2012, the Bertinoro Workshop on Algorithms and Graphs in 2009, 2011, and 2013, the Southern Italian Workshop on Algorithms and Graphs 2016, and the CIRM Workshop on Graph Theory 2015.

### Most Significant Publications

1. P. Wollan, “The structure of graphs not admitting a fixed immersion.” *J. Combin. Theory, Ser. B.* **110** (2015) 47 – 66.
  - citations: 13 - 97th percentile Field weighted citation impact: 5.02 (scopus)
  - Journal Impact Factor: 1.3
  - On the J. Combin. Theory Ser. B. list of “Most cited articles, 2012 - 2017”
  - Summary: the article develops a structure theory for graph immersions analogous to the graph minor structure theory of Robertson and Seymour, including a general structure theorem and a new width parameter with corresponding grid theorem. The work has seen numerous algorithmic applications, including new FPT algorithms for problems not efficiently solvable on graphs of bounded tree-width.
2. H. Bruhn, R. Diestel, M. Kriesell, R. Pevindigh, and P. Wollan, “Axioms for Infinite Matroids.” *Advances in Mathematics.* **239** (2013) 18 – 46.
  - citations: 15 - 90th percentile Field weighted citation impact: 5.01 (scopus)
  - Journal Impact Factor: 1.79 (researchgate)
  - Summary: the article resolves an open problem of Rota from 1947 by developing a theory of infinite matroids with duality and minors
3. M. Grohe, K. Kawarabayashi, D. Marx, and P. Wollan, “Finding Topological Subgraphs is Fixed Parameter Tractable.” *Proceedings of the ACM Symposium on Theory of Computing (STOC) 2011*, 479 – 488.
  - citations: 51 - 98th percentile Field weighted citation impact: 6.35 (scopus)
  - Summary: the article proves the existence of a fixed parameter time algorithm for testing topological minor containment in graphs. This resolves a conjecture of Downey and Fellows from 1992 and was one of the most significant open problems of the time in the theory of FPT-time algorithms.
4. K. Kawarabayashi and P. Wollan, “A Simpler Algorithm and Shorter Proof for the Graph Minors Decomposition.” *Proceedings of the ACM Symposium on Theory of Computing (STOC) 2011*, 451 – 458.
  - citations: 17 - 94th percentile Field weighted citation impact: 2.58 (scopus)
  - Summary: the article gives a simplified, self contained proof of the graph minors structure theorem which both yields an explicit polynomial time algorithm to find the decomposition and gives explicit bounds on the parameters involved. Moreover, the length of the proof is reduced from over 400 pages in the original work to less than 100.

5. K. Kawarabayashi and P. Wollan, “A Shorter Proof of the Graph Minors Algorithm - The Unique Linkage Theorem.” *Proceedings of the AMS Symposium on the Theory of Computing (STOC) 2010*, 687 – 694.  
- citations: 33 - 98th percentile                      Field weighted citation impact: 4.88 (scopus)  
- Summary: the article presents a self-contained proof for the Unique Linkage Theorem, giving a new proof of correctness for the k-disjoint paths algorithm which includes explicit bounds of run-time of the algorithm. The proof is less than 60 pages, as opposed to over 400 in the original proof.

### **Full List of Publications**

#### JOURNAL:

1. R. Thomas and P. Wollan, “An Improved Linear Edge Bound for Graph Linkages.” *European J. of Combinatorics* **26**, (2005) 309 – 324.
2. G. Brinkmann, S. Greenberg, C. Greenhill, B. McKay, R. Thomas, and P. Wollan, “Generation of Simple Quadrangulations of the Sphere.” *Discrete Math.* **305**, (2005) 33 – 54.
3. K. Kawarabayashi and P. Wollan, “Non-zero Disjoint cycles in Highly Connected Group Labeled Graphs.” *J. Combin. Theory, Ser. B* **96**, (2006) 296 – 301.
4. S. Norine, P. Seymour, R. Thomas, and P. Wollan, “Proper Minor-Closed Families are Small.” *J. Combin. Theory, Ser. B* **96**, (2006) 754 – 757.
5. P. Wollan, “Extremal Functions for Shortening Sets of Paths.” *Combinatorics, Probability, and Computing* **15**, (2006) 927 – 932.
6. R. Thomas and P. Wollan, “The Extremal Function for 3-linked Graphs.” *J. Combin. Theory, Ser. B* **98**, (2008) 939 – 971.
7. K. Kawarabayashi, O. Lee, B. Reed, and P. Wollan, “A Weaker Version of Lovász’ Path Removal Conjecture.” *J. Combin. Theory, Ser. B* **98**, (2008) 972 – 979.
8. P. Wollan, “Extremal Functions for Rooted Minors.” *J. Graph Theory* **58** vol. 2, (2008) 159 – 178.
9. P. Wollan, “Packing Non-zero A-paths in an Undirected Model of Group Labeled Graphs.” *J. Combin. Theory, Ser. B* **100**, (2010) 141 – 150.
10. D. Berg, S. Norine, F. E. Su, R. Thomas, and P. Wollan, “Voting in Agreeable Societies.” *AMS Math. Monthly* **117**, (2010) 27 – 39.
11. P. Wollan, “Bridges in Highly Connected Graphs.” *SIAM J. Disc. Math.* **24**, (2010) 1731 – 1741.
12. P. Wollan, “Packing Cycles with Modularity Constraints.” *Combinatorica* **31**, (2011) 95 – 126.
13. R. Diestel, K. Kawarabayashi, and P. Wollan, “The Erdős-Pósa Property for Clique Minors in Highly Connected Graphs.” *J. Combin. Theory, Ser. B* **102**, (2012) 454 – 469.
14. H. Bruhn and P. Wollan, “Finite Connectivity in Infinite Matroids.” *European J. of Combinatorics* **33** (2012) 1900 – 1912.
15. M. Pontecorvi and P. Wollan, “Disjoint Cycles Intersecting a Set of Vertices.” *J. Combin. Theory, Ser. B* **102** (2012) 1134 – 1141.
16. R. Diestel, K. Kawarabayashi, T. Müller, and P. Wollan, “On the Excluded Minor Structure Theorem for Graphs of Large Tree-width.” *J. Combin. Theory, Ser. B* **102** (2012) 1189 – 1210.

17. B. Guenin, I. Pivotto, and P. Wollan, “Relations Between Pairs of Representations of Signed Binary Matroids.” *SIAM J. Disc. Math.* **27** (2013) 329 – 341.
18. H. Bruhn, R. Diestel, M. Kriesell, R. Pevindigh, and P. Wollan, “Axioms for Infinite Matroids.” *Advances in Mathematics* **239** (2013) 18 – 46.
19. D. Marx and P. Wollan, “Immersion in highly connected graphs” *SIAM J. of Disc. Math.* **28**(1) (2014) 503 – 520.
20. P. Wollan, “The structure of graphs not admitting a fixed immersion.” *J. Combin. Theory, Ser. B.* **110** (2015) 47 – 66.
21. B. Guenin, I. Pivotto, and P. Wollan, “Displaying Blocking Pairs in Signed Graphs.” *Europ. J. Combin.* **51** (2016) 135 – 164.
22. B. Guenin, I. Pivotto, and P. Wollan, “Stabilizer Theorems for Even Cycle Matroids.” *J. Combin. Theory, Ser B.* **118** (2016) 44 – 75.
23. Z. Dvorak and P. Wollan, “A structure theorem for strong immersions.” *J. Graph Theory.* **83**(2) (2016) 152 – 163.
24. D. Marx, P. Seymour, and P. Wollan, “Rooted grid minors.” *J. Combin. Theory, Ser B.* **122**(1) (2017) 428 – 437.
25. P. Bennett, I. Bonacina, N. Galesi, T. Huynh, M. Molloy, and P. Wollan, “Space proof complexity for random 3-CNFs.” *Information and Computing* **255** (2017) 165 – 176.
26. K. Kawarabayashi, S. Norine, R. Thomas and P. Wollan, “ $K_6$  Minors in 6-connected Graphs of Bounded Treewidth.” to appear: *J. Combin. Theory, Ser. B.*
27. K. Kawarabayashi, S. Norine, R. Thomas, and P. Wollan, “ $K_6$  Minors in Large 6-connected Graphs.” to appear: *J. Combin. Theory, Ser. B.*
28. K. Kawarabayashi, R. Thomas, and P. Wollan, “A new proof of the flat wall theorem.” to appear: *J. Combin. Theory, Ser B.*
29. F. Joos, T. Huynh, and P. Wollan, “A unified Erdős-Pósa theorem for labeled graphs.” to appear: *Combinatorica*.

#### REFEREED CONFERENCE PROCEEDINGS:

30. K. Kawarabayashi and P. Wollan, “A Shorter Proof of the Graph Minors Algorithm - The Unique Linkage Theorem.” *Proceedings of the AMS Symposium on the Theory of Computing (STOC) 2010*, 687 – 694.
31. K. Kawarabayashi, B. Reed, and P. Wollan, “The Graph Minor Algorithm with Parity Conditions.” *Proceedings of the IEEE Symposium on Foundations of Computer Science (FOCS) 2011*, 27 – 36.
32. K. Kawarabayashi and P. Wollan, “A Simpler Algorithm and Shorter Proof for the Graph Minors Decomposition.” *Proceedings of the ACM Symposium on Theory of Computing (STOC) 2011*, 451 – 458.
33. M. Grohe, K. Kawarabayashi, D. Marx, and P. Wollan, “Finding Topological Subgraphs is Fixed Parameter Tractable.” *Proceedings of the ACM Symposium on Theory of Computing (STOC) 2011*, 479 – 484.

34. D. Marx, and P. Wollan, “An Exact Characterization of Tractable Demand Patterns for Maximum Disjoint Path Problems.” *Proceedings of the ACM/SIAM Symposium on Discrete Algorithms (SODA) 2015*, 642 – 661.
35. K. Edwards, I. Muzi, P. Wollan, “The half-integral disjoint paths problem in highly connected directed graphs.” *Proceedings of the 2017 European Symposium on Algorithms (ESA)*.

### Summary of citation record

Values taken from Scopus database.

<u>Parameter</u>	<u>Database</u>	<u>Value</u>
Total citations	scopus	399
H-index	scopus	11