

Curriculum Vitae of Alexander Postnikov

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Employment:

- 2006–present *Massachusetts Institute of Technology*
Associate Professor of Applied Mathematics
- 2001–2006 *Massachusetts Institute of Technology*
Assistant Professor of Applied Mathematics
- 1999–2001 *University of California at Berkeley*
Miller Institute for Basic Research in Science
Miller Research Fellow
- 1997–1999 *Massachusetts Institute of Technology*
Applied Mathematics Instructor

Education:

- 1994–1997 *Massachusetts Institute of Technology,*
Ph.D. in Mathematics, June 1997
Thesis: *Enumeration in Algebra and Geometry*
Thesis advisor: Richard Stanley
- 1993–1994 Graduate studies at *Moscow Independent University, Russia*
Academic advisor: Askold Khovanskii
- 1988–1993 *Moscow State University, Russia*
M.S. Diploma with honors in Mathematics, June 1993
Thesis: *Paths in the Young Graph and RSK Correspondence*
Thesis advisor: Askold Khovanskii

Last updated: September 25, 2006.

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Fields of Interest:

Combinatorics, its applications, and its relationship with algebra, geometry, representation theory, physics, and analysis.

National Science Foundation Grants:

2006–present NSF CAREER Award DMS-0504629

2002–2005 NSF Grant DMS-0201494

1998–2000 NSF Grant DMS-9840383

Awards and Fellowships:

2006 Edmund F. Kelly Research Award, M.I.T.

2003–2006 Sloan Research Fellowship, Alfred P. Sloan Foundation

2002–present Solomon Buchsbaum AT&T Research Fund, M.I.T.

1999–2001 Miller Research Fellowship, University of California at Berkeley

1994–1996 M.I.T. Applied Mathematics Graduate Fellowship

1993–1994 French Mathematical Society (CNRS) Grant for graduate students in mathematics from the former Soviet Union

Teaching Experience:

- Taught the following M.I.T. courses:
 - 18.312 *Algebraic Combinatorics* (Spring 2002 and Spring 2005)
 - 18.314 *Combinatorial Analysis* (Fall 2004 and Fall 2005)
 - 18.318 *Topics in Combinatorics* (Spring 2003 and Spring 2004)
- Was a recitation instructor for the following M.I.T. courses:
 - 18.03 *Differential Equations*
(Spring 1998, Fall 1998, Fall 2002, Fall 2004, Fall 2005)
 - 18.01 *Calculus* (Fall 2001)
 - 18.02 *Multivariable Calculus* (Spring 1997)

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- Was a course administrator for 18.03 *Differential Equations* (Fall 2002)
 - Taught 18.03 *Differential Equations* (Summer 1997)
 - Was a teaching assistant (as a graduate student) for *Statistics for Applications, Combinatorial Theory, Probability and Random Variables* (1995–1996)
 - Served as a mentor for Research Science Institute (RSI) summer program for high school students (July 1996)

Journal and Grant Proposal Refereeing:

Inventiones Mathematicae, Journal of the American Mathematical Society, Advances in Mathematics, Proceedings of the American Mathematical Society, American Mathematical Society Translations Series 2, Discrete & Computational Geometry, Journal of Combinatorial Theory Series A, Journal of Algebraic Combinatorics, European Journal of Combinatorics, Advances in Applied Mathematics, Electronic Journal of Combinatorics, Studies in Applied Mathematics, AMS NSA Grant proposals, FPSAC'97 and FPSAC'01.

Other Professional Activities:

Was a faculty judge at the M.I.T. Summer Program in Undergraduate Research (SPUR), Summer 2005 and Summer 2006. Coorganized M.I.T. *Combinatorics Seminar* (2004–present). Coorganized UC Berkeley *Combinatorics Seminar* (1999–2001). Wrote reviews (summaries of accepted articles) for *Mathematical Reviews*.

Papers:

1. Total positivity, Grassmannians, and networks, A. Postnikov: 79 pages.
arXiv: math.CO/0609764.
2. Faces of generalized permutohedra, A. Postnikov, V. Reiner, L. Williams: 55 pages.
arXiv: math.CO/0609184.
3. What power of two divides a weighted Catalan number? A. Postnikov, B. Sagan:
to appear in *Journal of Combinatorial Theory, Series A*, 9 pages.
arXiv: math.CO/0601339.
4. Permutohedra, associahedra, and beyond, A. Postnikov: 59 pages.
arXiv: math.CO/0507163.
5. Schur positivity and Schur log-concavity, T. Lam, A. Postnikov, P. Pylyavskyy: to
appear in *American Journal of Mathematics*, 9 pages.
arXiv: math.CO/0502446.
6. Chains in the Bruhat order, A. Postnikov, R. Stanley: 36 pages.
arXiv: math.CO/0502363.
7. A combinatorial model for crystals of Kac-Moody algebras, C. Lenart, A. Postnikov:
to appear in *Transactions of the American Mathematical Society*, 27 pages.
arXiv: math.RT/0502147.
8. Alcoved Polytopes I, T. Lam, A. Postnikov: to appear in *Discrete & Computational
Geometry*, 26 pages.
arXiv: math.CO/0501246.
9. Affine Weyl groups in K-theory and representation theory, C. Lenart, A. Postnikov:
47 pages.
arXiv: math.RT/0309207.
10. On the X-rays of permutations, C. Bebeacua, T. Mansour, A. Postnikov, S. Severini:
Electronic Notes in Discrete Mathematics **20** (2005), 193–203.
arXiv: math.CO/0506334.

All recent papers are available electronically at e-print arXiv <http://arxiv.org/> and also on the website <http://math.mit.edu/~apost/>

Papers are listed in the inverse chronological order.

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11. Affine approach to quantum Schubert calculus: A. Postnikov: *Duke Mathematical Journal* **128** (2005), no. 3, 473–509.
arXiv: math.CO/0205165.
 12. Smoothness of Schubert varieties via patterns in root systems, S. Billey, A. Postnikov: *Advances in Applied Mathematics* **34** (2005), 447–466.
arXiv: math.CO/0205179.
 13. Trees, parking functions, syzygies, and deformations of monomial ideals, A. Postnikov, B. Shapiro: *Transactions of the American Mathematical Society* **356** (2004), 3109–3142.
arXiv: math.CO/0301110.
 14. Quantum Bruhat graph and Schubert polynomials: A. Postnikov: *Proceedings of the American Mathematical Society* **133** (2004), no. 3, 699–709.
arXiv: math.CO/0206077.
 15. PP-wave string interactions from perturbative Yang–Mills theory, N. R. Constable, D. Z. Freedman, M. Headrick, S. Minwalla, L. Motl, A. Postnikov, W. Skiba: *The Journal of High Energy Physics*, (2002), no. 7, 017, 56 pp.
arXiv: hep-th/0205089.
 16. Syzygies of oriented matroids, I. Novik, A. Postnikov, B. Sturmfels: *Duke Mathematical Journal* **111** (2002), no. 2, 287–317.
arXiv: math.CO/0009241.
 17. A lattice path approach to counting partitions with minimum rank t , A. Burstein, S. Corteel, A. Postnikov, C. Savage: *Discrete Mathematics* **249** (2002), no. 1-3, 31–39. (Special issue on the 12th Cumberland Conference on Combinatorics, Graph Theory and Computing.)
 18. Symmetries of Gromov–Witten invariants, A. Postnikov: *Advances in Algebraic Geometry Motivated by Physics, Contemporary Mathematics* **276** (2001), 251–258.
arXiv: math.CO/0009174.
 19. On characters of Weyl groups, R. Adin, A. Postnikov, Y. Roichman: *Discrete Mathematics* **226** (2001), 355–358.
arXiv: math.RT/0005021.
 20. Hecke algebra actions on the coinvariant algebra, R. Adin, A. Postnikov, Y. Roichman: *Journal of Algebra* **233** (2000), no. 2, 594–613.
arXiv: math.RT/9908090.

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21. Littlewood-Richardson coefficients via Yang-Baxter equation, O. Gleizer, A. Postnikov: *International Mathematics Research Notices* **2000**, no. 14, 741–774.
arXiv: math.QA/9909124.
 22. Deformations of Coxeter hyperplane arrangements, A. Postnikov, R. Stanley: *Journal of Combinatorial Theory, Ser. A* **91** (2000), no. 1/2, 544–597. (Special issue dedicated to G.-C. Rota.)
arXiv: math.CO/9712213.
 23. Mixed Bruhat operators and Yang-Baxter equations for Weyl groups, F. Brenti, S. Fomin, A. Postnikov: *International Mathematics Research Notices* **1999**, no. 8, 419–441.
arXiv: math.QA/9805079.
 24. Algebras of curvature forms on homogeneous manifolds, A. Postnikov, B. Shapiro and M. Shapiro: Differential Topology, Infinite-Dimensional Lie Algebras, and Applications: D. B. Fuchs' 60th Anniversary Collection, *American Mathematical Society Translations, Ser. 2* **194** (1999), 227–235.
arXiv: math.AG/9901075.
 25. On a quantum version of Pieri's formula, A. Postnikov: *Advances in Geometry, Progress in Mathematics* **172** (1999), 371–383.
 26. Quantum Schubert polynomials, S. Fomin, S. Gelfand, A. Postnikov: *Journal of the American Mathematical Society* **10** (1997), 565–596.
 27. Intransitive trees, A. Postnikov: *Journal of Combinatorial Theory, Ser. A* **79** (1997), no. 2, 360–366.
 28. Combinatorics of hypergeometric functions associated with positive roots, I. M. Gelfand, M. I. Graev, A. Postnikov: in *The Arnold-Gelfand Mathematical Seminars: Geometry and Singularity Theory*, (eds. V. I. Arnold, I. M. Gelfand, et al.), Birkhäuser, Boston, 1997, 205–221.
 29. A generalization of Sylvester's identity, I. Pak, A. Postnikov: *Discrete Mathematics* **178** (1998), 277–281.
 30. Trees associated with the Motzkin numbers, A. Kuznetsov, I. Pak, A. Postnikov: *Journal of Combinatorial Theory, Ser. A* **76** (1996), no. 1, 145–147.
 31. Transversal matroids and strata on a Grassmannian, I. Pak, A. Postnikov: *Functional Analysis and its Applications* **29** (1995), no. 2, 140–143.

32. Increasing trees and alternating permutations, A. Kuznetsov, I. Pak, A. Postnikov: *Russian Mathematical Surveys* **49** (1994), no. 6, 79–110.
33. Resolutions for S_n -modules corresponding to skew hooks, and combinatorial applications, I. Pak, A. Postnikov: *Functional Analysis and its Applications* **28** (1994), no. 2, 132–134.
34. Enumeration of spanning trees in some graphs, I. Pak, A. Postnikov: *Russian Mathematical Surveys* **45** (1990), no. 3, 220–221.

Proceedings of Refereed Conferences:

1. Permutohedra, associahedra, and beyond (extended abstract), A. Postnikov: *Proceedings of the 17-th International Conference on Formal Power Series and Algebraic Combinatorics* (FPSAC'05), Taormina, Italy, 2005, 12 pages.
2. Affine Weyl groups in K-theory and representation theory, A. Postnikov, C. Lenart: *Proceedings of the 16-th International Conference on Formal Power Series and Algebraic Combinatorics* (FPSAC'04), University of British Columbia, Vancouver B.C., 2004, 12 pages.
3. Chern forms on flag manifolds and forests, A. Postnikov, B. Shapiro and M. Shapiro: *Proceedings of the 10-th International Conference on Formal Power Series and Algebraic Combinatorics* (FPSAC'98), Fields Institute, Toronto, 1998, 5 pages.
4. Oscillating tableaux, $S_n \times S_m$ -modules, and Robinson-Schensted-Knuth correspondence, I. Pak, A. Postnikov: *Proceedings of the 8-th International Conference on Formal Power Series and Algebraic Combinatorics* (FPSAC'96), University of Minnesota, Minneapolis, 1996, 391–402.
5. Enumeration of trees and one amazing representation of the symmetric group, I. Pak, A. Postnikov: *Proceedings of the 8-th International Conference on Formal Power Series and Algebraic Combinatorics* (FPSAC'96), University of Minnesota, Minneapolis, 1996, 385–389.

Theses:

1. *Enumeration in Algebra and Geometry*, A. Postnikov: Ph.D. thesis, M.I.T., 1997. Thesis advisor: Richard Stanley.
2. *Paths in the Young Graph and Robinson-Schensted-Knuth Correspondence*, A. Postnikov: M.S. thesis, Moscow State University, Russia, 1993. Thesis advisor: Askold Khovanskii.

Papers in Preparation:

1. Deformations of polytopes and generalized permutohedra, A. Postnikov, in preparation.
2. Binomial random walk, A. Postnikov, in preparation.
3. Flow polytopes and Kostant's partition function, A. Postnikov, R. Stanley: in preparation.
4. Newton polyhedra and generalized hypergeometric functions, A. Khovansky, A. Postnikov: in preparation.

Progress Reports and Preprints:

1. Counting Morse curves and links, A. Postnikov, preprint dated December 4, 2000, available at the website, 8 pages.
2. On generalizations of Abel's and Hurwitz's identities, A. Kelmans, A. Postnikov: RUTCOR Research Report RRR 48-99, December 1999, 8 pages.
3. Tree and forest volumes of graphs, A. Kelmans, I. Pak, A. Postnikov: DIMACS Technical Report 2000-03, January 2000, 31 pages.
4. Noncommutative Lagrange theorem and inversion polynomials, I. Pak, A. Postnikov, V. Retakh: preprint, 1994, available at the website; presented at *7-th International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC'95)*, University of Paris, France, 1995, 13 pages.
5. Enumeration of spanning trees of graphs, I. Pak, A. Postnikov: preprint dated November 1, 1994, available at the website, 18 pages.

Talks:

- November 1994 *Gelfand Seminar*, Rutgers University.
- June 1996 8-th International Conference FPSAC,
University of Minnesota, Minneapolis.
- October 1996 *Combinatorics Seminar*, Northeastern University.
- November 1996 *Special Session on Lie Groups and Physics*,
AMS Meeting, Columbia, Missouri.
- April 1997 *Seminar on Discrete Mathematics*, University of California, Berkeley.
- April 1997 *Workshop on Representation Theory and Symmetric Functions*,
MSRI, Berkeley, California.
- June 1997 *New York Journal of Mathematics Conference*,
University at Albany, New York.
- January 1998 *Mathematics Colloquium*, Bar Ilan University, Israel.
- January 1998 *Combinatorics Seminar*, Bar Ilan University, Israel.
- February 1998 *Combinatorics and Representation Theory Seminar*,
Princeton University.
- April 1998 *Topology and Geometry Seminar*, University of Wisconsin, Madison.
- June 1998 *10-th International Conference FPSAC*,
Fields Institute, Toronto, Canada.
- July 1998 *International Conference on Combinatorial Methods in
Representation Theory* (RIMS Project'98), RIMS, Kyoto, Japan.
- August 1999 *Combinatorics Seminar*, University of California, Berkeley.
- February 2000 *Combinatorics Seminar*, University of California, Berkeley.
- October 2000 *Mathematics Colloquium*, University of Arizona, Tucson.

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| October 2000 | <i>Special Session on Algebraic and Geometric Combinatorics</i> ,
AMS Meeting at San Francisco, California. |
| November 2000 | <i>Combinatorics Seminar</i> , University of Minnesota, Minneapolis. |
| January 2001 | <i>Mathematics Colloquium</i> , Cornell University. |
| February 2001 | <i>Geometry/Topology Seminar</i> , University of California, Davis. |
| May 2001 | <i>Combinatorics Seminar</i> , University of California, Berkeley. |
| October 2001 | <i>Special Session on Algebraic and Topological Combinatorics</i> ,
AMS Meeting, Williamstown, Massachusetts. |
| January 2002 | <i>Combinatorics Seminar</i> , University of Michigan, Ann Arbor. |
| March 2002 | <i>Special Session on Algebraic Combinatorics</i> ,
AMS Meeting, Atlanta, Georgia. |
| April 2002 | <i>Geometry Seminar</i> , Boston University. |
| June 2002 | <i>Special Session on Algebraic Geometry and Combinatorics</i> ,
AMS Meeting, Portland, Oregon. |
| October 2002 | <i>Special Session on Ring Structures in the Schubert Calculus</i> ,
AMS Meeting, Boston, Massachusetts. |
| March 2003 | <i>Fellowship of the Ring</i> , Brandeis University. |
| April 2003 | <i>Geometry-Algebra-Singularities-Combinatorics Seminar</i> ,
Northeastern University. |
| April 2003 | <i>Mathematics Colloquium</i> , Purdue University. |
| October 2003 | <i>Geometry-Algebra-Singularities-Combinatorics Seminar</i> ,
Northeastern University. |
| June 2004 | <i>SIAM Conference on Discrete Mathematics</i> , Nashville, Tennessee. |
| June 2004 | <i>Richard Stanley's Birthday Conference</i> , M.I.T. |
| July 2004 | <i>16-th International Conference FPSAC</i> ,
University of British Columbia, Vancouver, Canada. |

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| July 2004 | <i>Summer Program for Undergraduate Research (SPUR)</i> , M.I.T. |
| October 2004 | <i>Special Session on Modern Schubert Calculus</i> ,
AMS Meeting, Evanston, Illinois. |
| November 2004 | <i>Combinatorics Seminar</i> , University of California, Berkeley. |
| November 2004 | <i>Workshop on Combinatorial Aspects of Hyperplane Arrangements</i> ,
MSRI, Berkeley, California. |
| November 2004 | <i>Discrete Mathematics & Representation Theory Seminar</i> ,
University of California, Davis. |
| November 2004 | <i>Algebraic Geometry Seminar</i> , Brown University. |
| April 2005 | <i>Seminar on Geometric Methods in Representation Theory</i> ,
University of North Carolina, Chapel Hill. |
| July 2005 | <i>Summer Program for Undergraduate Research (SPUR)</i> , M.I.T. |
| October 2005 | <i>Special Session on Algebraic and Geometric Combinatorics</i> ,
AMS Meeting, Bard College, NY. |
| April 2006 | <i>Special Session on Enumerative Aspects of Polytopes</i> ,
AMS Meeting, San Francisco State University. |
| May 2006 | <i>Combinatorics Seminar</i> , University of California in San Diego. |
| July 2006 | <i>Summer Program for Undergraduate Research (SPUR)</i> , M.I.T. |
| October 2006 | <i>Special Session on Algebraic & Analytic Combinatorics</i> ,
AMS Meeting in Storrs, Connecticut, (forthcoming talk). |
| October 2006 | <i>Special Session on Combinatorial Methods in Equivariant Topology</i> ,
AMS Meeting in Storrs, Connecticut, (forthcoming talk). |