

## PROFESSIONAL VITA: JOAN S. BIRMAN

October 21, 2017

**Title:** Professor Emeritus, Barnard College, 2006-...  
Research Professor, Barnard College-Columbia University, 2006-...

**Preferred address:** 100 Wellington Avenue, New Rochelle, NY 10804.

**Office:** 602 Mathematics, 2990 Broadway, Columbia Univ. N.Y., N.Y. 10027

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### Personal data:

Birth: May 30, 1927, in New York, New York

Home address: 100 Wellington Avenue, New Rochelle, N.Y. 10804-3708

Spouse: Joseph L. Birman

Children: Kenneth Birman, Deborah Birman Shlider, Carl David Birman

### Education:

Dr. Sci. Honoris Causa, Israel Institute of Technology (Technion), June 1997

PhD Courant Institute of New York University, 1968 (Math).

MA Columbia University, 1950 (Physics)

BA Barnard College, 1948.

### Professional Affiliations:

Honorary Member, London Mathematical Society (elected 2015).

Fellow, American Mathematical Society (elected Fellow 2012).

Fellow, American Academy of Arts and Sciences (elected 2012).

Foreign Associate Member, European Academy of Sciences.

Foreign Associate Member, Moscow Math. Society (Honorary Foreign Associate).

Fellow, New York Academy of Sciences.

Member, Mathematical Association of America.

Member, American Women in Mathematics.

Board: Committee of Concerned Scientists, 1980 -

### Professional History:

Research Professor, Barnard College-Columbia University, 2006 -

Professor Emeritus, Barnard College, 2006 -

Professor Mathematics, Barnard College (Columbia University), 1973-2004  
(Chairman, Dept. Math., Barnard College, 1973-87, 1989-1991, 1995-1998.)

Assoc. Professor Mathematics, Stevens Institute of Technology, 1972-73.  
Assistant Professor Mathematics, Stevens Institute, 1968-71.  
Staff Member(part time), Technical Research Group, 1955-60.  
Systems Analysis Dept., W.L.Maxson Corp.,1953-55.  
Systems Analysis Dept.,Gen. Precision Equipment,1950-1953.

### **Editorial positions:**

Editorial Board, *Algebraic and Geometric Topology*, 2000-.  
Editorial Board, *Geometry and Topology*, 1996 - 2012  
Board of Directors, Mathematical Sciences Publishing Company, 2011-Oct. 2013.  
Honorary Board Member, MSP, Oct 2013 -  
Reviewer, *Mathematical Reviews*,~1980-

### **Honors, Awards:**

Sloan Foundation Fellow, 1974-6  
Japan Society for the Promotion of Science, Fellow (Sept.1980).  
Senior Science Faculty Fellow,Great Britain, spring, 1981.  
Institute for Scientific Exchange,Torino,Italy, summer 1986.  
Institute for Advanced Study, Spring 1987.  
Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette,France, summer 1991.  
Guggenheim Foundation Fellow, 1994-5  
Chauvenet Prize, Mathematical Assn. of America, January 1996  
Dr. Sci. Honoris Causa, Israel Institute of Technology (Technion), June 1997  
New York City Mayor's Award in Science and Technology, January, 2006

**Current grants:** Collaborative Research Grant, Simons Foundation, 2012-17

### **Visiting Positions:**

Visiting Assistant Professor,Princeton Univ.,1971-72.  
Visiting Professor, Univ. Paris Sud, Fall 1980  
Lady Davis Visiting Professor, Technion, Spring 1981.  
Visiting Professor, Univ. Paris VII, Fall, 1987.  
Visiting Professor, Hebrew Univ. of Jerusalem 5/88-6/88  
Institute for Advanced Study, Princeton, New Jersey, Spring term 1988.  
Visiting Professor, Technion, Spring term 1995.  
Visiting Member, Math. Sci. Res. Inst., Berkeley, CA, Spring term 1996.

### **Selected list of Committees and Elected Offices:**

Council of the Amer.Math.Soc., Member-at-Large, 1990-1993  
Topology Panel, Int. Congress of Mathematicians 1990.  
Executive Committee, Council of the American Math Society, 1992-1996.  
Long Range Planning Committee, Amer. Math Society, 1993-1995 (Chair,94-5)  
Overseers' Committee to Visit the Harvard Mathematics Department, 1992-98  
Human Rights Committee, New York Academy of Sciences, 1995-  
Collected Works Committee, AMS, 2014-16 (Chair 2015-16)

**PhD Theses supervised:**

Richard Fein, Stevens Institute of Technology, 1974  
Marcello Kupferwasser, Columbia University, 1975  
Jerome Powell, Columbia University, 1978  
Jozef Przytycki, Columbia University, 1981  
John McCarthy, Columbia University, 1983  
Pei Jun Xu, Columbia University, 1987  
Rolland Trapp, Columbia University, 1987  
Elizabeth Finkelstein, Columbia University, 1993  
Ted Stanford, Columbia University, 1993  
Zung-He Chen, Columbia University, 1994  
Efstratia Kalfagianni, Columbia University, 1994  
Ka Yi Ng, Columbia University, 1996  
Tat Sang Fung, Columbia University, 1996  
Matt Greenwood, Columbia University, 1996  
Hessam Hamidi-Tehrani, Columbia University, 1997  
Matt Zinno, Columbia University, 2001  
Clement Radu Popescu, Columbia University, 2001  
Tara Brendle, Columbia University, 2002  
Nancy Wrinkle, Columbia University, 2002  
Nathan Broadus, Columbia University, 2003  
Keiko Kawamuro, Columbia University, 2006.

**Selected List of Invited Lectures:**

Ostrom Lecturer, Washington State University (Pullman), 1993.  
A Celebration of Women in Mathematics, invited speaker, MIT, March 1994.  
KAIST Workshop, Taejon, Korea (10 lectures), Aug. 1-12, 1994.  
Dressler Lecturer, Kansas State University, November, 1994.  
Netanyahu Lecture, Technion (Haifa, Israel) April 3, 1994.  
Cantrell Lectures, University of Georgia, April 2003.  
Cornell Topology Conference, May 2003.

Colloquium, Harvard-MIT-Brandeis-Northeastern, March 2005.  
 “Groups, Diffeomorphisms and Dynamics”, U. Tokyo, Sept. 2006.  
 Texas Topology and Geometry Conf., Rice Univ., plenary talk, Oct. 2006.  
 Colloquium, Technion (Haifa, Israel) Jan. 15, 2007.  
 Colloquium, U. Chicago, Feb 2, 2007.  
 “The many strands of the braid groups”, Banff Center, Alberta, Canada, April, 2007.  
 Special lecture, Nankai University, Tianjin, China, May 2007.  
 BRAIDS conference, Singapore (banquet in honor of the JB), June 2007  
 ”The conjugacy problem in the braid groups: respice, adspice, prospice”; conference to honor Wilhem Magnus, CUNY, Sept. 2007  
 CTQM Workshop, University of Aarhus, Denmark, plenary talk, 23-30 Mar. 2008.  
 Adler Lecture, Institute for Advanced Study, talk on “Lorenz Knots”, Nov., 2008.

### **Recent colloquia, seminars and invited talks at conferences**

Invited speaker, Topology workshop, Ohio State Univ., May 2011.  
 Invited speaker, conference, Rouen University, Rouen, France, June 27-30, 2011.  
 Invited speaker, Cascades Topology Festival, April 28-29, 2012.  
 Invited speaker, ”Braids”, Edinburgh, May 2017  
 Colloquium, Temple University, April 2017.  
 Invited speaker, ICERM, Brown University, May 2016.

### **Conferences Organized:**

BRAIDS, Santa Cruz, Cal., 1986 (NSF Research Conference)  
 BRAIDS (in Toplogy and Algebraic Geometry), Jerusalem, May 1995.  
 VASSILIEV INVARIANTS, Oberwolfach, Sept. 1995.  
 MSRI Low Dimensional Topology (1996-7)  
 3-MANIFOLDS, AMS meeting, Barnard College & Columbia Univ., Nov., 2000  
 BRAIDS, Banff B.C., Oct. 2004

## **Publications**

### **Research Manuscripts:**

1. “On braid groups”, *Com. Pure and App. Math.*, **22**, No. 1 (1969), pp. 41-72.
2. “Mapping class groups and their relationship to braid groups”, *Com. Pure and App. Math.*, **22** (1969), pp. 212-238.
3. “Automorphisms of the fundamental group of a closed, orientable 2-manifold”, *Proc. Amer. Math. Soc.* **21**, No. 2 (1969), pp. 351-354.

4. “Non-conjugate braids can define isotopic knots”, *Com. Pure and App. Math.* **22**, No. 2 (1969), pp. 239-242.
5. “Abelian quotients of the mapping class group of a 2-manifold”, *Bull. AMS* **76**, No. 1 (1970), pp. 147-150.
6. “On Siegal’s modular group” *Math. Annalen* **191** (1971), pp.59-68.
7. “Mapping class groups of closed surfaces as covering spaces”, (with Hugh M. Hilden), *Annals of Math Studies* **66** (1971), 81-115.
8. “On the homeotopy group of a non-orientable surface”, (with David Chillingworth), *Proc. Cambridge Phil. Soc.* **71**, (1972), pp. 437-448. Erratum: *Math Proc. Cambridge Phil Soc.* **136** (2004), 441.
9. “A normal form in the homeotopy group of a surface of genus 2, with an application to 3-manifolds” *Proc. AMS* **34**, No. 2 (1972), pp. 397-384.
10. “On lifting and projecting homeomorphisms” (with H.M. Hilden), *Archiv der Mathematik* **XXIII**, No. 4 (1972), pp. 428-434.
11. “Isotopies of homeomorphisms of Riemann surfaces and a theorem about Artin’s braid group”, (with Hugh M.Hilden), *Bull.AMS* **78**, No. 6 (1972), 1002-1004.
12. “On isotopies of homeomorphisms of Riemann surfaces”, (with H.M. Hilden), *Annals of Math.* **97**, No. 3 (1973), pp. 424-439.
13. “Poincare’s conjecture and the homeotopy group of a closed, orientable 2-manifold” *J. Australian Math. Soc.* **XVII**, part 2 (1974), pp.214-221.
14. “An inverse function theorem for free groups”, *Proc. AMS* **41**, No. 2 (1983), pp. 634-638.
15. “The homeomorphism problem for  $S^3$ ”, with Hugh M. Hilden, *Bull AMS* **79**, No. 5 (1973), pp. 1006-1010.
16. “Plat presentation for link groups”, *Com.Pure and Applied Math.* **XXVI** (1973) pp. 673-678.
17. “Heegaard splittings of branched covering of  $S^3$ ”, with Hugh M. Hilden, *Trans.AMS* **213** (1975), pp. 315-353.
18. “On the equivalence of Heegaard splittings of closed, orientable 3-manifolds”, *Annals of Math Studies* **84**, Ed. L.P. Neuwirth, Princeton Univ. Press (1975), pp.137-164.
19. “A note on the representation of simply-connected 3-manifolds as branched covering spaces of  $S^3$ ”, *Proc. AMS* **55**, No. 2 (1976), pp. 440-442.

20. “On the stable equivalence of Heegaard splittings of plat presentation of links”, *Canad. J. Math.* **XXVIII**, No. 2 (1976), pp. 264-290.
21. “Heegaard splittings of prime 3-manifolds are not unique” (with J.M. Montesinos and F. Gonzales-Acuna) *Mich. J. Math.* **23**, No. 26 (1976).
22. “On the  $\mu$ -invariant of Z-homology spheres”, (with R. Craggs) *Bull.AMS* **82**, No. 2 (1976), pp. 253-255.
23. “The  $\mu$ -invariant of 3-manifolds and certain structural properties of the group of homeomorphisms of a closed, oriented 2-manifold” (with R. Craggs) *Trans.AMS* **237** (1978), pp. 283-309.
24. “Special Heegaard splittings for closed, oriented 3-manifolds”, *Topology* **17** (1978), pp. 157-166.
25. “Special representations for 3-manifolds” (with Jerome Powell), in *Geometric Topology* Ed. Cantrell, Academic Press (1979), pp. 23-51.
26. “On minimal Heegaard splittings” (with J.M. Montesinos) *Mich. Math. J.* **27** (1980), pp. 47-57.
27. “A representation theorem for fibered knots and their monodromy maps”, in *Topology of Low Dimensional Manifolds*, Ed. R. Fenn, Springer-Verlag Lecture Notes No. 722, 1981.
28. “Knotted periodic orbits in dynamical systems I; Lorenz’s equations” (with R.F. Williams) *Topology* **22**, No. 1 (1983), pp. 47-82. Erratum, <http://www.math.columbia.edu/jb>
29. “Knotted periodic orbits in dynamical systems II; Knot holders for fibered knots” (with R.F. Williams), *Contemporary Mathematics* **20** (1983), pp. 1-60.
30. “Fixed points of pseudo-Anosov diffeomorphism of surfaces” (with Mark Kidwell) *Advances in Math.* **46**, No. 2 (1982), p. 217-220.
31. “One sided Heegaard splittings and homeotopy groups of surfaces” (with J.H. Rubinstein), *Proc. London Math. Soc. (3)*, **49** (1984), p. 517-536.
32. “Abelian and solvable subgroups of mapping class groups of surfaces” (with Alex Lubotzky and John McCarthy), *Duke Math. J.* **50**, No. 4 (Dec. 1983), pp. 1107-1120).
33. “An algorithm for simple curves on surfaces” (with Caroline Series), *J. London Math. Soc. (2)* **29**, (1984), pp. 331-342.

34. "Geodesics with bounded intersection number on surfaces are sparsely distributed" (with Caroline Series), *Topology* **24** (1985), p. 217-225.
35. "3-fold branched coverings and the mapping class group of a surface" (with B. Wajnryb), Springer-Verlag Lecture Notes **1167**, 1986.
36. "Geodesics with multiple self-intersections and symmetries on Riemann surfaces" (with Caroline Series), London Math Soc. Lecture Notes **12**, 1988, pp.3-11.
37. "Dehn's algorithm revisited, with applications to simple curves on surfaces" (with Caroline Series), *Annals of Math Studies* **111** (1989), pp.451-478.
38. "On the Jones polynomial of closed 3-braids", *Inven. Math.* **81** (1985), pp. 287-294.
39. "Algebraic linearity in the mapping class group of a surface" (with Caroline Series), *J. of Pure and Applied Algebra* **52** (1988),p. 227-275).
40. "Jones' braid-plat formula and a new surgery triple", (with T. Kanenoba), *Proc. AMS* **102**, No.3, (1988), pp.687-695.
41. "Markov classes in certain finite quotients of Artin's braid group" (with B. Wajnryb), *Israel J. Math.* **56**, No.2 (1986), pp. 160-178.
42. "Braids, link polynomials and a new algebra" (with H. Wenzl), *Trans.AMS* **313**, No. 1 (1989) 249-273.
43. "A calculus on links in the 3-sphere" (with W. Menasco), in KNOTS '90, Editor A. Kawachi, W. De Gruyter, Berlin and New York, 1992.
44. "Studying Links Via Closed Braids I: A Finiteness Theorems"(with W. Menasco), *Pacific J. Math.* **154**, No. 1 (1992), 17-36.
45. "Studying Links Via Closed Braids II: On a Theorem of Bennequin" (with W. Menasco) *Topology and its Applications* **40** (1991), 71-82.
46. "Studying Links Via Closed Braids III: Classifying Links which are Closed 3-Braids" (with W. Menasco) *Pacific J. Math.* Vol **161**, No 1 (1993), 25-113.
47. "Studying Links Via Closed Braids IV: "Closed Braid Representatives of Split and Composite Links" (with W. Menasco), *Invent. Math.* **102**, Fasc. 1 (1990), 115-139. See also Erratum, *Invent, Math.* **160**, No. 2 (2005), 447-452.
48. "Studying Links Via Closed Braids V: "Closed Braid Representatives of the Unlink" (with W. Menasco), *Trans. AMS* **329**, No. 2 (1992) pp. 585-606.

49. "Studying Links Via Closed Braids VI: "A Non-Finiteness Theorem" (with W. Menasco), *Pacific J. Math.* **156**, No. 2 (1992) p. 265-285.
50. "Special Positions for Essential Tori in Link Complements" (with W. Menasco), *Topology* **33**, No. 3, (1994), 525-556. Errata: *Topology*
51. "Knot polynomials and Vassiliev's Invariants" (with Xiao-Song Lin), *Invent.Math.* **111** (1993), 225-270.
52. "New points of view on knots and links", *Bull.AMS /* **28**, No. 2 (1993), 253-287.
53. "Linear representations of the braid group" (with D. Long and J. Moody), *Contemporary Mathematics* **169**, (1994), 123-132.
54. "Braided chord diagrams" (with Roland Trapp), *Journal of Knot Theory and its Ramifications*, **7**, No.1 (1998), 1-22.
55. "Studying surfaces via closed braids" (with Elizabeth Finkelstein), *Journal of Knot Theory and its Ramifications*, **7**, No.3 (1998), 267-334.
56. "A new approach to the word and conjugacy problems in the braid groups" (with J.S.Lee and K.H.Ko), *Advances in Mathematics*, **139**, No. 2 (1998), 322-353.
57. "A new algorithm for recognizing the unknot" (with Michael Hirsch), *Geometry and Topology*, **Vol.2**(1998), 178-220.
58. "Holonomic and Legendrian parametrizations of knots" (with Nancy Wrinkle), *Journal of Knot Theory and its Ramifications*, **9**, No.3 (2000), 293-309.
59. "On transversally simple knots" (with Nancy Wrinkle), *Journal of Differential Geometry*, **55** (2000), 325-354.
60. "The infimum, supremum and geodesic length of a braid conjugacy class", (with K.H. Ko and S.J. Lee), *Advances in Mathematics*, **164** (2001), 41-56.
61. "On Markov's theorem", with William Menasco, *Journal of Knot Theory and its Ramifications*, **11**, No. 3 (2002), 295-310.
62. "Toward an implementation of the B-H algorithm for recognizing the unknot", with M. Rampichini, P. Boldi and S. Vigna, *J.Knot Theory and its Ramifications* **11**, No. 4 (2002), 601-645.
63. "Obstructions to trivializing a knot and representations of braid groups", with John Moody, *Israel Journal of Mathematics*, **142** (2004), 125-162.



64. “Stabilization in the braid groups I: MTWS”, with William Menasco, *Geometry and Topology*, **10** (2006), 413-540.
65. “Stabilization in the braid groups II: Transversal simplicity of knots”, with William Menasco, *Geometry and Topology* **10** (2006), 1425-1452.
66. “Conjugacy in Garside groups-I: Cycling, Powers and Rigidity”, with Volker Gebhardt and Juan Gonzalez-Meneses, *Groups, Geometry and Dynamics*, **1**, No. 3 (2007), 221-279.
67. “Conjugacy in Garside groups-II: Structure of the Ultra Summit Set”, with Volker Gebhardt and Juan Gonzalez-Meneses, *Groups, Geometry and Dynamics*, **2**, No.1 (2008), 13-61.
68. “Conjugacy in Garside groups-III: Periodic braids”, with Volker Gebhardt and Juan Gonzalez-Meneses, *Journal of Algebra*, **316** (2007) 746776.
69. “A note on closed 3-braids”, with William W.Menasco, *Communications in Contemporary Mathematics* **10** Suppl. 1 (2008), 1-15.
70. “Calculating the image of the second Johnson-Morita representation”, with Tara E. Brendle and Nathan Broaddus, in “Groups of Diffeomorphisms”, *Advanced Studies in Pure Mathematics* **52** (2008), Mathematical Society of Japan, 119-134.
71. “Symplectic Heegaard splittings and linked abelian groups”, with Dennis Johnson and Andrew Putman, in “Groups of Diffeomorphisms”, *Advanced Studies in Pure Mathematics* **52** (2008), Mathematical Society of Japan, 135-220.
72. “A new twist on Lorenz knots”, with Ilya Kofman, *Journal of Topology* **2** (2009), 227-248.
73. “On pseudo-Anosov mapping classes with minimum dilatation and Lanneau-Thiffeault polynomials” (unpublished) arXiv:1101.2383v2, [math.GT]14 April 2011.
74. “A polynomial invariant of pseudo-Anosov maps”, with Peter Brinkmann and Keiko Kawamuro”, *Journal of Topology and Analysis*, **04**, No. 1 (2012), 13-47.
75. “The curve complex has dead-ends”, with William W. Menasco, *Geometriae Dedicata*, online version DOI 10.1007/s10711-014-9978-y, 10 Apr 2014; arXiv:1210.6698v3 [math.GT].
76. “Finite rigid sets and homologically non-trivial spheres in the curve complex of a surface”, with Nathan Broaddus and William Menasco, *Journal of Topology and Analysis*, 2015; online version DOI: 10.1142/S179352531550003; arXiv:1311.7646.

77. “Efficient geodesics and an effective algorithm for distance in the complex of curves”, with Dan Margalit and William Menasco, *Mathematische Annalen*, on-line version DOI 10.1007/s00208-015-1357-y, Jan 25 2016; arXiv:1408.4133-v3.

**Expository and review articles, book reviews:**

1. “The algebraic structure of surface mapping class groups”, *Discrete groups and automorphic forms*, Ed. W. Harvey, Academic Press 1977, pp. 163-198.
2. “Mapping class groups of surfaces; a survey”, *Annals of Math Studies* **111**, Princeton University Press, 1974.
3. “Nielsen’s investigations of surface mapping class groups”, *J. Nielsen: Collected Works*, p. 407-416, Birkhauser, 1986.
4. “Mapping class groups of surfaces”, *Contemporary Mathematics* 78, BRAIDS, 1988
5. Burde and Zieschang’s “Knots” and Kauffman’s “On Knots”, *Bull.AMS* **19**, No.2 (1988) p.550-558.
6. “Coxeter Graphs and Towers of Algebras”, by Goodman, de la Harpe and Jones, *Bull.AMS*
7. “Recent Developments in Knot and Link Theory”, *Mathematical Intelligencer*, Volume 13, Number 1, 1991, p. 52-60.
8. “A progress report on the study of links via closed braids” , to appear in the Proceedings of the March 1990 conference to celebrate 300 Years of the Mathematische Gesellschaft in Hamburg.
9. “On the Work of Vaughan Jones”, *Proc.International Congress of Mathematicians 1990*, pages 9-18, Springer-Verlag, New York, 1992.
10. “On the Combinatorics of Vassiliev invariants”, in *Braid Groups, Knot Theory and Statistical Mechanics II*, Editors Yang and Ge, World Scientific Press, 1994.
11. “Knots”, by Charles Livingston, *MAA Monthly* August 1995.
12. “Scientific Publishing: A Mathematician’s Viewpoint”, *Notices of the American Mathematical Society*, **47**, No. 7, August 2000, 770-774.
13. “Braids:A Survey”, with Tara Brendle, in *Handbook of Geometric Topology*, Editors Menasco and Thistlethwaite, Elsevier 2005.
14. “Braids, knots and contact structures”, lecture notes for a talk given at the First East Asian Conference on Knots and Related Topics in Seoul, Korea, February 2004. Posted on arXiv.

15. “The topology of 3-manifolds, Heegaard distance and the mapping class group of a 2-manifold”, in “Problems on mapping class groups”, Editor Benson Farb, Proc. Symp. Pure Mathematics **74**(2006), 133-149. arXiv math.GT/0502545.
16. “Braid groups”, by C. Kassel and V. Turaev, and ”Ordering Braids”, by Patrick Dehornoy, *Bull. American Mathematical Society* **48**, No. 1 (2011), 137-146.

**Books:**

1. Braids, links and mapping class groups, Ann. Math Studies 82, Princeton University Press, 1975. List of Errata can be downloaded from <http://www.math.columbia.edu/jb>
2. Editor English language translation of Seifert and Threlfall: A Textbook of Topology, Academic Press, 1980
3. Editor (with A. Libgober), Braids, Contemporary Mathematics 78, Amer. Math Society, 1988
4. Editor (with W. Abikoff and K. Kuiken), The mathematical legacy of Wilhelm Magnus, Contemporary Mathematics 169, 1993.
5. Guest Editor (with Mina Teicher), Braids in Knot Theory and Algebraic Geometry, *Topology and its Applications*