

Curriculum Vita

Jianguo Cao

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Department of Mathematics
University of Notre Dame
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Citizenship: USA

Birth Date: January 25, 1960 in Suzhou, China

Higher Education:

B.S., Nanjing University, P.R.C., 1982
S.M., Nanjing University, P.R.C., 1985
Ph.D., University of Pennsylvania, Philadelphia, USA, 1989

Academic Positions Held:

Summer 1988: Instructor, Dept. of Math., University of Pennsylvania.
1990–92: H. C. Wang Assistant Professorship, Cornell University
1992–96: Assistant Professor, Cornell University.
1996–2001: Associate Professor, University of Notre Dame.
2001-present: Full Professor, University of Notre Dame.

Visiting Positions Held:

1989–90: Member, Institute for Advanced Study, Princeton.
Summer 1995: Member, Math. Institute, Univ. of Warwick
Summer 1999: Visiting Professor, Federal University of Ceara, Brazil.
Fall 2002, Visiting Professor, University of Michigan, Ann Arbor, MI, USA.
Spring 2003, Mathematical Sciences Research Institute, Berkeley, CA, USA.
Summer 2003, Max-Planck Institute for Mathematics at Leipzig, Germany.
Summer 2004, Institut Des Hautes Etudes Scientifiques, Paris, France.
Summer 2007-2010, Changjiang Chair Professor, Nanjing University, China.

Scholarships and Fellowships:

1988-1989, Dissertation Fellowship, University of Pennsylvania.

1989-1990, Membership, Institute for Advanced Study, Princeton.

Spring 2003, Membership, Mathematical Sciences Research Institute, Berkeley.

Summer 2004, Membership, IHES, Paris, France.

2007-2010, Changjiang Scholarship of China at Nanjing University

Fields of Research: Differential Geometry

Thesis Advisor: Professor Christopher Croke, University of Pennsylvania.

Distinctions, Honors, Awards:

1991-2010, National Science Foundation research grants awarded:

- (1) 1991-1993, Principal investigator, Project title: “Geodesics and Minimal Surfaces in Manifolds with Non-negative Curvature” funded by National Science Foundation; NSF Award Abstract - #9102212.
- (2) 1993-1995, Principal investigator, Project title: “Manifolds with Positive Curvature” funded by National Science Foundation; NSF Award Abstract - #9303711.
- (3) 1995-1997, Principal investigator, Project title: “Analysis on Manifolds with Non-positive Curvature” funded by National Science Foundation; NSF Award Abstract - #9424191.
- (4) 1998-2001, Principal investigator, Project title: “Geometric Analysis on Manifolds of Non-positive Curvature” funded by National Science Foundation; NSF Award Abstract - #9803230.
- (5) 2001-2004, Principal investigator, Project title: “Geometric Analysis on complete aspherical spaces” funded by National Science Foundation; NSF Award Abstract - #0102552.
- (6) 2004-2007, Principal investigator, Project title: “Geometric Analysis on semi-hyperbolic spaces with variable curvature” funded by National Science Foundation; NSF Award Abstract -Geometric Analysis on Semi-Hyperbolic Spaces with Variable Curvature #0405385
- (7) 2007-2010, Principal investigator, Project title: “Global Riemannian Geometry and Analysis of curved spaces” funded by National Science Foundation; NSF Award #0706513.
- (8) 2008-2010, Supplemental Award to #0706513 as an “U.S.-China Collaboration in Mathematical Research Project” jointly with Professor Yuxin Dong, Fudan University, Shanghai, China.

2004-2007, National Science Foundation conference grants awarded:

- (1) 2004-2005, “Great Lakes Geometry Conference 2004”, (with Liviu Nicolaescu, Richard Hind, Xiaobo Liu, Matthew Gursky), NSF award number

#0333763.

- (2) 2005-2006, “International Conference in Partial Differential Equations, Complex Analysis and Differential Geometry” (with Alex Himonas, Gerard Misiolek, Nancy Stanton, Mei-Chi Shaw), NSF award number #0533431.

Professional Memberships: American Mathematical Society

Doctoral Dissertations Directed:

- (1) Zhou, Gengqiang: “Compactness of isospectral compact manifolds with bounded curvatures.” *Pacific J. Math.* 181 (1997), no. 1, 187–200, *Math. Review* 98m:58140. (Dissertation directed jointly with Professor Robert Strichartz at Cornell University, 1994).
- (2) Bullock, Stephen: “Weighted Cohomology”, (Dissertation directed jointly with Professor Birgit Speh at Cornell University, 2000).

Publications (I. Papers refereed and published):

- [1] “Existence of an extremal joining two arbitrary points on a manifold”. (Chinese) *Nanjing Daxue Xuebao, Ziran Kexue Ban*, Nanjing, China, vol. 20 (1984), no. 4, pp 627–640. (*Math. Review*: 87c:58026);
- [2] “Some homotopically equivalent spaces of paths, and Frechet numbers”. (Chinese) *Acta Math. Sinica*, vol. 28 (1985), no. 6, pp 817–824. (*Math. Review*: 87d:58036);
- [3] “The existence of generalized isothermal coordinates for higher-dimensional Riemannian manifolds.” *Trans. Amer. Math. Soc.* vol. 324 (1991), no. 2, pp 901–920. (*Math Review*: 91h:53030);
- [4] “Prescribing Ricci curvature on open surfaces.” *Hokkaido Math. J.* vol. 20 (1991), no. 2, pp 265–278. (with D. DeTurck, *Math Review*: 92k:53068);
- [5] “Simple closed geodesics on convex surfaces.” *J. Differential Geom.* vol. 36 (1992), no. 3, pp 517–549. (with E. Calabi; *Math. Review*: 93h:53039);
- [6] “The Bers-Nielsen kernels and souls of open surfaces with negative curvature”. *Michigan Math. J.* vol. 41 (1994), no. 1, pp 13–30. (*Math Review*: 95d:30085);
- [7] “The Ricci curvature equation with rotational symmetry”. *Amer. J. Math.* vol. 116 (1994), no. 2, pp 219–241. (with D. DeTurck; *Math. Review*: 94m:53052);
- [8] “Rigidity for non-compact surfaces of finite area and certain Kahler manifolds”. *Ergodic Theory Dynam. Systems*, vol. 15 (1995), no. 3, pp 475–516. (*Math Review*, 96e:53046);
- [9] “Examples of simply-connected Liouville manifolds with positive spectrum.” *Differential Geom. Appl.* vol. 6 (1996), no. 1, pp 31–50. (with I. Benjamini, *Math Review* 97b:53036);

- [10] “A new isoperimetric comparison theorem for surfaces of variable curvature.” *Duke Math. J.* vol. 85 (1996), no. 2, pp 359–396. (with I. Benjamini; *Math. Review*, 97m:58046);
- [11] “An isoperimetric comparison theorem for PL-manifolds of non-positive curvature”. *Proceedings of the Third Summer School on Differential Geometry, Partial Differential Equations and Numerical Analysis (Spanish) (Bogota, 1995)*, pp 1–7, *Colec. Mem.*, 7, *Acad. Colombiana Cienc. Exact. Natur.*, Bogota 1996. (*Math Review*: 98a:53061)
- [12] “Topics in geometric analysis via Gromov’s methods”. *Adv. Math. (China)* vol. 26 (1997), no. 6, pp 481–506. (*Math Review*: 99d:53038)
- [13] “Kahler parabolicity and the Euler number of compact manifolds of non-positive sectional curvature”, (with F. Xavier), *Mathematische Annalen*, Volume 319 Issue 3 (2001) pp 483-491.
- [14] “Cheeger isoperimetric constants of Gromov-hyperbolic spaces with quasi-poles”, “*Communication in Contemporary Math.*”, Vol. 2, No. 4 (2000) 511-533.
- [15] “Splittings and Cr-structures for manifolds with nonpositive sectional curvature”, (with J. Cheeger and X. Rong), *Inventiones mathematicae*, Volume 144 Issue 1 (2001) pp 139-167.
- [16] “A New 3-dimensional Curvature Integral Formula for PL-manifolds of Non-positive Curvature”, (with J. F. Escobar), *Comm. Analysis and Geometry*, Volume 11, Number 3, (2003), 489-551.
- [17] “Finsler Geometry of Projectivized Vector Bundles ” (with Pit-Mann Wong), *J. Math. Kyoto Univ.* volume 43, No.2 (2003) 383-424.
- [18] “Local splitting structures on nonpositively curved manifolds and semirigidity in dimension 3”, (with Cheeger and Rong), *Comm. Anal. Geom.*, volume 12, No. 1, (2004), 391-417.
- [19] “Estimates for the d-bar-Neumann problem and nonexistence of C^2 Levi-flat hypersurfaces in CP^n ” (with Mei-Chi Shaw and Lihe Wang), *Mathematische Zeitschrift*, vol 248, (2004) 183-221.
- [20] “The smoothness of Riemannian submersions with nonnegative sectional curvature ” (with Mei-Chi Shaw), *Communication in Contemporary Math.* Vol 7 (2005) p137-144.
- [21] “A new proof of the Takeuchi theorem ” (with Mei-Chi Shaw), *Lecture Notes of Seminario Interdisciplinare di Matematica*, vol. 4(2005) pp.65-72.
- [22] “The d-bar-Cauchy problem and nonexistence of Lipschitz Levi-flat hypersurfaces in CP^n with $n \geq 3$ ” (with M. Shaw), *Math. Zeit*, vol 256 (2007), No. 1, page 175-192.
- [23] “A new proof of Gromoll-Grove diameter rigidity theorem” (with H-Y. Tang), “*Communication in Contemporary Math.*” vol 19 no.3 (2007) 401-419.
- [24] “Martin points on open manifolds of non-positive curvature”, (with HuiJun

Fan and F. Ledrappier), *Transaction of Amer. Math. Soc.*, vol 359 (2007) page 5697-5723.

- [25] “Pseudo-Einstein and Q-flat metrics with eigenvalue estimates on CR-hypersurfaces”, (with Shu-Cheng Chang), “*Indiana Univ. Math. Journal*”, vol 56, No. 6 (2007), pages 2839-2858.
- [26] “Certain 4-manifolds with non-negative curvature”, *Front. Math.* 2008, volume 3, No. 4 : pages 475-494.

Publications (II. Papers refereed and accepted):

- [1] “An optimal extension of Perelman’s comparison theorem for quadrangles and its applications” (with B. Dai and J. Mei), to appear in “*Proceeding of 2007 International Conference on Geometric Analysis*”, edited by Yng-Ing Lee, International Press, Boston, USA.

Publications (III. Papers published in conference proceedings):

- [1] “The modified Calabi-Yau problems for CR-manifolds and applications” (with Shu-Cheng Chang), in the book “*TOPOLOGY AND PHYSICS Proceedings of the Nankai International Conference in Memory of Xiao-Song Lin Tianjin, China 27 - 31 July 2007*” (edited by Kevin Lin, Zhenghan Wang and Zhenghan Wang), ISBN 978-981-281-910-9 981-281-910-X, Nankai Tracts in Mathematics - Vol. 12 (2008) pages 3-17.

Publications (IV. Preprints):

- [1] “Minimal volume and simplicial norm of visibility n-manifolds and compact 3-manifolds” (with Xiaoyang Chen), preprint 2008, submitted.
- [2] “Rigidity for the marked length-spectrum of higher dimensional nonpositively curved graph-manifolds” (with C. Croke), in preparation.
- [3] “Kähler version of Cheeger-Gromoll-Perelman soul theory with positive bisectional curvature” (with Jiaping Wang), in preparation.
- [4] “The center of mass flow and applications to the topological rigidity of injective F-structure”, (with Jeff Cheeger and Xiaochun Rong), in preparation.
- [5] “An extension of Perelman’s soul theorem for singular spaces” (with Bo Dai and Jiaqiang Mei) Preprint, May 2007, submitted.
- [6] “Harmonic functions of polynomial growth on singular spaces with non-negative Ricci curvature” (with Bobo Hua), in preparation.
- [7] “A quadrangle comparison theorem and its application to soul theory for Alexandrov spaces” (with Bo Dai and Jiaqiang Mei), submitted.
- [8] “A new proof of Perelman’s collapsing theorem for 3-manifolds” (with Jian Ge), 68 pages, submitted.

Books and Monographs:

“*An Introduction to Modern Riemannian Geometry*” (in Chinese), with Yude Wang, Lectures in Contemporary Mathematics, Volume 1, ISBN 7-03-016435-0, Science Press, Beijing, China, February 2006.

Conferences and meetings organized:

- (1) *The special session of Differential Geometry in the American Mathematical Society Meeting* at University of Notre Dame, April 7-9, 2000 (with B. Smyth and F. Xavier)
- (2) *Great Lakes Geometry Conferences* (with R. Hind, L. Nicolaescu and M. Gursky), University of Notre Dame, April 17-18, 2004.
- (3) *International Workshop in Geometry and Analysis*, Nanjing University, Nanjing, China, June 11-June 19, 2005 (with Gang TIAN and Xingwang Xu).
- (4) *The special session of Differential Geometry and Applications in the American Mathematical Society Meeting* at University of Notre Dame, April 8-9, 2006 (with Xiaobo Liu and B. Smyth).
- (5) *International Conference in PDE, Complex Analysis and Differential Geometry*, University of Notre Dame, June 11-16, 2006 (with A. Himonas, G. Misiulek, Mei-Chi Shaw and N Stanton).
- (6) *International Conference in Geometry and Analysis, Nanjing 2007*, Nanjing University, Nanjing, China, August 5-12, 2007 (with Gang Tian, Xingwang Xu, Xiaoping Yang).
- (7) *Special Session on Differential Geometry and Its Applications*, American Mathematical Society Sectional Meeting #1030, Chicago, IL, October 5-6, 2007.
- (8) *Special Session on Differential Geometry and Its Applications*, (with Yuxin Dong), First Joint International Meeting of AMS with the Shanghai Mathematical Society, Shanghai, Peoples Republic of China, December 17-21, 2008 (Wednesday - Sunday) Meeting #1045.
- (9) *Special Session on Differential Geometry and Its Applications*, American Mathematical Society 2009 Spring Central Sectional Meeting Urbana, IL, March 27-29, 2009 (Friday - Sunday) Meeting #1047 (with Stephanie B. Alexander).
- (10) *2009 Nanjing Differential Geometry Summer School and Worskop*, (with Gang Tian and Xingwang Xu), Nanjing University, Nanjing, China, from June 25, 2009 to July 15, 2009.
- (11) *Workshop on Riemannian and Non-Riemannian Geometry*, (with Zhongmin Shen) partially funded by NSF, held at Indiana University-Purdue University Indianapolis, August 8-9, 2009.

LECTURES GIVEN:

A. National and International Conferences:

- (1) “*Which 2-tensors can be Ricci tensors?*” Invited Lecture, AMS 857-th meeting, special session on “Recent progress on Einstein manifolds and related topics,” at University Park, Pennsylvania, April 1990.
- (2) “*Simple closed geodesics on convex surfaces*”, The 1990 AMS Summer Research Institute, University of California, Los Angeles, July 1990.
- (3) “*Almost visible manifolds of non-positively curved manifolds*”, Principal Speaker, 29th Annual Topology Festival, Cornell University, May 1991.
- (4) “*A new isopremetric inequality and applications to Martin boundary*”. Invited Lecture, Workshop on Riemannian Geometry, The Fields Institute for Research in Mathematical Sciences, Canada, August 1993.
- (5) “*Rigidity of marked length spectrum*”. Workshop on Geometry, Invited Lecture, Mathematisches Forschungsinstitut Oberwolfach, Freiberg, Germany, October 1993.
- (6) “*A new isopremetric inequality and applications to Martin boundary*” , Invited Lecture, AMS 884-th meeting, Special session on “Differential Geometry and Global Analysis”, Syracuse, New York, September 1993.
- (7) “*Geodesic Flows and Rigidity on Non-compact Surface*” , Invited Lecture, AMS 884-th meeting, Special session on “ Global Analysis”, Brooklyn, New York, February 1994.
- (8) “*Martin boundary of manifolds with Gromov’s hyperbolicity*”, Invited Lecture, Warwick Symposium on Stochastic Analysis and Related Topics 1994-95, Workshop on Differential Geometry and Stochastic Analysis, Mathematical Research Center, University of Warwick, England, July 1995.
- (9) “*Minimal volume for manifolds with Gromov hyperbolicity*” , Invited Lecture, AMS 909-th meeting, Special session on “ Global Analysis”, New York City, New York, April 1996.
- (10) “*An isoperimetric comparison theorem for surfaces of variable curvature*”, Invited Lecture, US-China Differential Equation Conference, Hangzhou, China, June 28, 1996.
- (11) “*An isoperimetric comparison theorem for surfaces of variable curvature*”, the 974th AMS meeting at University of Madison at Milwaukee, October 25, 1997.
- (12) “*Lectures in Differential Geometry*”, a series of 20 lectures in “The 1998 Summer School for Graduate Students in China”, Nanjing, China, July 13-August 1, 1998.
- (13) The “Dirichlet problem at infinity”, Invited Lecture, The 1999 UAB-GIT International Conference on Differential Equations and Mathematical Physics, Birmingham, Alabama, March 16-20, 1999.
- (14) “*The Domains with least perimeter for given area in surfaces of variable curvature*”, Invited Lecture, AMS Special Session, Optimal Geometry at

- the AMS Spring Sectional Meeting, Urbana, Illinois, USA, 18-21 Mar 1999.
- (15) “*Splittings and Cr-structures for manifolds with non-positive sectional curvature*”, The 22nd Colloquia of Brazil Mathematical Society, July 26-30, 1999.
 - (16) “*The Euler number of compact Kähler manifolds with non-positive sectional curvature*”, the 959-th AMS meeting at Columbia University, New York City, November 4, 2000.
 - (17) “*Harmonic functions on open manifolds with big ends*”, National Center for Theoretical Sciences, National TsingHua University, Taiwan, May 30, 2001.
 - (18) “*Compact manifolds with non-positive curvature and small volume*”, National Center for Theoretical Sciences, National TsingHua University, Taiwan, May 31, 2001.
 - (19) “*Compact Manifolds with Non-positive Curvature and Small Volume*”, National Center for Theoretical Sciences, National TsingHua University, Taiwan, June 13, 2001.
 - (20) “*Homotopy Rigidity of Abelian Structure on Compact Manifolds with Non-positive Curvature*”, National Center for Theoretical Sciences, National TsingHua University, Taiwan, June 13, 2001.
 - (21) “*The spectrum of non-compact manifolds with big ends*”, 2001 Summer Program “Geometric Methods in Inverse Problems and PDE Control”, at the Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, July 19, 2001.
 - (22) “*Dirichlet Problem at Infinity for Open Manifolds with big Ends*”, Invited Lecture, AMS 969-th meeting, Special session on “Differential Geometry and Applications”, Columbus, Ohio September 21-23, 2001.
 - (23) “*The rigidity of higher dimensional graph-manifolds*”, Invited Lecture, AMS 974-th meeting, Special session on “Riemannian Geometry and Applications”, Ann Arbor, Michigan, March 24, 2002.
 - (24) “*The Semi-Rigidity of Non-positively Curved Manifolds which admit F-structures*”, Invited Lecture, The World Scientists Forum for Nanjing University 100th Anniversary, Nanjing, China, May 21, 2002.
 - (25) “*Positive harmonic functions on open manifolds with big ends*”, Invited Lecture, Differential Geometry Day, Eastern Illinois University, Charleston, Illinois, November 2, 2002.
 - (26) “*Levi-flat hypersurfaces and a new Liouville type theorem for differential forms*” The conference “Differentialgeometrie im Grossen” at Mathematisches Forschungsinstitut Oberwolfach, Freiberg, Germany, June 17, 2003.
 - (27) “*A new Liouville type theorem for differential forms*” The conference “GEOMETRIC PARTIAL DIFFERENTIAL EQUATIONS” at National University of Singapore, May 30, 2004.
 - (28) “*Positive harmonic functions on open manifolds with non-positive curvature*” American Math Society Meeting #1001, Special Session on Differential

Geometry, Evanston, Illinois, USA, Oct. 24, 2004.

- (29) “*Open Kähler manifolds with positive bi-sectional curvatures*” 111th Annual Meeting of the American Mathematical Society, Atlanta, Georgia, USA, January 5-8, 2005.
- (30) “*A rapid course in Riemannian Geometry*”, The National-wide Summer School in Mathematics for Chinese Graduate Students, Nanjing University, Nanjing, China, a mini-course of 20 lectures, June 20-July 20, 2005.
- (31) “*New estimates for \bar{d} -Cauchy problem and applications to CR-geometry*”, Mid-western Geometry Conference, Norman, Oklahoma, May 5-7, 2006.
- (32) “*Rigidity of time-conjugate geodesic flows on graph-manifolds*”, Nanjing Conference on Hamiltonian Dynamics 2006, Nanjing University, Nanjing, China, June 21, 2006.
- (33) “*Lectures on Geodesic flows*”, The First National-wide Summer School in Dynamic Systems for Chinese Graduate Students, Nanjing University, Nanjing, China, a mini-course of 12 lectures, June 26-July 8th, 2006.
- (34) “*An extension of Perelman’s soul theorem for singular spaces*”, 2007 International Conference on Geometric Analysis, Taiwan University, Taipei, June 18, 2007.
- (35) Ten lectures on “*Metric Geometry and applications to Perelman’s work on Poincare-Thurston conjecture*”, 2008 Math Summer School for Graduate Students in China, Fudan University, Shanghai, China, June 1-16, 2008.
- (36) “*The modified Calabi-Yau Problems for CR-manifolds*”, 2008 International Conference on Complex Analysis, Tongji University, Shanghai, China, June 17-21, 2008.
- (37) Four special lectures on “*Metric geometric portion of Perelman’s work on Poincare-Thurston conjecture*”, International Workshop on Geometric Analysis, East China Normal University, Shanghai, China, July 21-30, 2008.

B. Lectures at Research Institutions and Universities:

- (1) “*The shortest closed geodesic is simple on smooth convex surface*”, Colloquium Lecture, University of Notre Dame, Indiana, February 1989.
- (2) “*The uniqueness and non-existence of rotationally symmetric metrics with prescribed Ricci curvature*”, Topology and Geometry Seminar, University of California at Santa Barbara, March 1989.
- (3) “*Simple closed geodesics on convex surfaces*”, Members’ Seminar, Institute for Advanced Study, Princeton, January 1990.
- (4) “*4-manifolds with non-negative sectional curvature*”, Geometry and Analysis Seminar, Columbia University, March 1990.
- (5) “*4-Manifolds with Non-negative Curvature*”, Topology Seminar, Cornell University, September 1990.
- (6) “*Simple closed geodesics on convex surfaces*”, Olivetti Club, Cornell University, October 1990.
- (7) “*The souls and Bers-Nielsen kernels of surfaces*”, Complex Analysis Semi-

- nar, City University of New York, Graduate Center, May 1991.
- (8) “*The rigidity of the marked length spectrum and geodesic flow*”, Special Lecture, Institute of Mathematics, Academia Sinica, Beijing, China, August 1991.
 - (9) “*Rigidity of surfaces of finite area*”, Geometry Seminar, Cornell University, August 1991.
 - (10) “*Martin boundary and positive harmonic functions on visibility manifolds*”, Geometry Seminar, Cornell University, April 1992.
 - (11) “*Harmonic functions and Martin boundaries on manifolds with no conjugate points*”, Colloquium Lecture, University of Rochester, October 1992.
 - (12) “*Isoperimetric inequality and applications to Martin boundary problem*”, Analysis Seminar, Cornell University, February 1993.
 - (13) “*A new isoperimetric comparison theorem on surfaces with variable curvature*”, Analysis Seminar, Cornell University, October 1993.
 - (14) “*Marked length spectrum on non-compact surfaces*”, Geometry and Topology Seminar, Boston University, December 1993.
 - (15) “*Minimal volume and Betti numbers of manifolds with non-positive curvature*”, Geometry Seminar, Cornell University, March 1994.
 - (16) “*Bounded harmonic functions and isoperimetric inequalities on non-compact manifolds*”, Complex Analysis Seminar, City University of New York, Graduate Center, New York, February 1995.
 - (17) “*Bounded harmonic functions and isoperimetric inequalities on non-compact manifolds*”, Department of Mathematics, Chinese University of Hong Kong, March 1995.
 - (18) “*The rigidity of marked length spectrum on non-compact surface of finite area*”, Chinese University of Hong Kong, March 1995.
 - (19) “*Positive harmonic functions on manifolds with Gromov’s hyperbolicity*”. Invited Lecture, Institute of Mathematics, Academic Sinica, Beijing, China, June 24, 1996.
 - (20) “*Geodesic flow and rigidity non-compact surfaces*”, Invited Lecture, Nanjing University, Nanjing, China, July 1, 1996.
 - (21) “*Martin boundary problem for manifolds with Gromov’s hyperbolicity*”, Tongji University, Shanghai, China, July 3, 1996.
 - (22) “*Minimal volume and bounded co-homology of manifolds with negative curvature*”, Invited Lecture, Institute of Mathematics, Fudan University, July 5, 1996
 - (23) “*The Martin boundary for manifolds with Gromov’s hyperbolicity*”, Invited Lecture, Massachusetts Institute of Technology, Cambridge, November 20, 1996.
 - (24) “*Gromov’s minimal volume gap conjecture for manifolds of non-positive curvature*”, Indiana University and Purdue University at Indianapolis, October 5, 1997.

- (25) “Kähler parabolicity and the Euler number of compact manifolds of non-positive sectional curvature”, Institute of Mathematics, Chinese Academy of Sciences, December 2, 1997.
- (26) “Gromov’s minimal volume gap conjecture for manifolds of non-positive curvature”, Beijing University, January 3, 1998.
- (27) “Gromov’s minimal volume gap conjecture for manifolds of non-positive curvature”, Cornell University, March 9, 1998.
- (28) “Cheeger Isoperimetric constants of Gromov-hyperbolic spaces” , Rutgers University, October 13, 1998.
- (29) “Gromov minimal volume conjecture for manifolds with non-positive curvature” , Purdue University, October 19, 1998.
- (30) “Manifolds of non-positive curvature and small volume”, University of Michigan, Ann Arbor, November 9, 1998.
- (31) “Topics in Geometric Analysis via Gromov’s methods”, Federal University of Ceara, Fortaleza, Brazil, July 22-25, 1999.
- (32) “Manifolds of non-positive curvature and small volume”, Ohio State University, Columbus, Ohio, June 2, 2000.
- (33) “Gromov’s minimal volume conjecture,” University of Illinois at Urbana-Champaign, October 18, 2001.
- (34) “Harmonic functions on non-compact manifolds with big ends,” Northwestern University, March 29, 2001.
- (35) “An inverse problem for surfaces of finite area”, National National Taiwan University, Taiwan, June 4, 2001.
- (36) “Gromov’s minimal volume conjecture”, Institute of Mathematics. Academic Sinica, Taiwan, June 7, 2001.
- (37) “The Semi-Rigidity of Non-positively Curved Manifolds which admit F -structures”, Colloquium, University of California, Irvine, May 7, 2002.
- (38) “Euler number compact Kähler manifolds with non-positive curvature”, Geometry Seminar, University of California, Irvine, May 8, 2002.
- (39) “Harmonic functions on non-compact manifolds with big ends”, School of Mathematics, Chinese Academy of Sciences, Beijing, China, June 11, 2002.
- (40) “Higher dimensional graph-manifolds of non-positive curvature”, School of Mathematics, Tsinghua University, Beijing, China, June 14, 2002.
- (41) “Euler number compact Kähler manifolds with non-positive curvature”, Geometry Seminar, University of Michigan, September 17, 2002.
- (42) “Compact manifolds with non-positive curvature and small injectivity radius”, Geometry Seminar, University of Michigan, October 22, 2002.
- (43) “The Semi-Rigidity of Non-positively Curved Manifolds which admit F -structures”, Geometry Seminar, University of Michigan, November 5, 2002.
- (44) “The $\bar{\partial}$ -Neumann boundary problem and Levi-flat hypersurfaces”, Complex Analysis Seminar, University of Michigan, February 12, 2003.
- (45) “Euler number compact Kähler manifolds with non-positive curvature”, Ge-

- ometry Seminar, University of California, Riverside, April 15, 2003.
- (46) “*The $\bar{\partial}$ -Neumann boundary problem and Levi-flat hypersurfaces*”, Differential Equation Seminar, University of California, Berkeley, May 2, 2003.
 - (47) “*Levi-flat hypersurfaces and a new Liouville type Theorem*”, Geometry Seminar, University of Zürich, Switzerland, June 20, 2003.
 - (48) “*Levi-flat hypersurfaces and a new Liouville type Theorem*”, Geometry Seminar, University of Augsburg, Germany, July 18, 2003.
 - (49) “*A new proof of Cheeger-Gromoll soul conjecture and Oka Lemma*”, Geometry Seminar, Max-Planck Institute for Mathematics at Leipzig, Germany, July 24, 2003.
 - (50) “*Boundary regularity of $\bar{\partial}$ -Neumann problem on Kähler domains*”, Analysis Seminar, Department of Math., Beijing University, Beijing, China, December 24, 2003.
 - (51) “*Geometric analysis on manifolds of non-positive curvature*”, Colloquium lecture, Institute of Math., Beijing Normal University, Beijing, China, December 26, 2003.
 - (52) “*The $\bar{\partial}$ -Neumann problem on manifolds with boundary*”, Colloquium lecture, Institute of Mathematical Sciences, Chinese Academy of Sciences, Beijing, China, January 2, 2004.
 - (53) “*Geometric analysis on manifolds with non-negative sectional curvature*”, Geometry Seminar, Institute of Mathematical Sciences, Chinese Academy of Sciences, Beijing, China, January 5, 2004.
 - (54) “*Boundary regularity of $\bar{\partial}$ -Neumann problem on Kähler domains*”, Geometry Seminar, Madison, University of Wisconsin, Madison, March 26, 2004.
 - (55) “*A Liouville Theorem for differential forms on Kähler domains in CP^n* ”, Colloquium Lecture, Ohio State University, Columbus, Ohio, April 8, 2004.
 - (56) “*Positive harmonic functions on open manifolds*”, Geometry Seminar, University of Minnesota, Minneapolis, Minnesota, April 7, 2005.
 - (57) “*Martin points for manifolds with non-positive curvature*”, Analysis Seminar, Chinese East Normal University, Shanghai, China, June 10, 2005.
 - (58) “*Open Kaehler manifold with non-negative bi-sectional curvature*”, Geometry Seminar, Fudan University, Shanghai, China, July 7, 2005.
 - (59) “*A new proof of the Gromoll-Grove diameter rigidity theorem*”, National Center for Theoretical Sciences, Math Division, National Tsing Hua University, Taiwan, December 26, 2005.
 - (60) “*A new version of Perelman’s flat strip theorem*”, National Center for Theoretical Sciences, Math Division, National Tsing Hua University, Taiwan, Jan 2, 2006.
 - (61) “*Positive harmonic functions on open manifolds of non-positive curvature*”, Colloquium lecture, Institute of Mathematics, Academic Sinica, Taiwan, Jan 5, 2006.
 - (62) “*Minimal volume of collapsible manifolds with non-positive curvature*”, Ge-

- ometry Seminar, Department of Mathematics, National Taiwan University, Taiwan, Jan 12, 2006.
- (63) “*Gromov’s minimal volume conjecture on compact manifolds of non-positive sectional curvature*”, Geometry Seminar, Department of Mathematics, University of Maryland, College Park, Maryland, February 2006.
 - (64) “*A new proof of Gromoll-Grove diameter rigidity theorem*”, Geometry Seminar, Department of Mathematics, University of California, Santa Barbara, May 19, 2006.
 - (65) “*Q-flat and pseudo-Einstein metrics on CR-hypersurfaces*”, Department of Mathematics, Nanjing University of Sciences and Technology, Nanjing, China, June 28, 2006.
 - (66) “*Q-flat and pseudo-Einstein metrics on CR-hypersurfaces*”, Department of Mathematics, Fudan University, Shanghai, China, July 14, 2006.
 - (67) “*Q-flat and pseudo-Einstein metrics on CR-hypersurfaces*”, Department of Mathematics, Capital Normal University, Shanghai, China, July 20, 2006.
 - (68) “*A new eigenvalue estimate for (p, q) -forms and applications to CR-geometry*”, Department of Mathematics, Peking University, Beijing, China, July 22, 2006.
 - (69) “*The d -bar Cauchy problem and applications to CR-geometry*”, colloquium lecture, Institute of Mathematics, Chinese Academy of Sciences, Beijing, China, August 1, 2006.
 - (70) “*Kähler version of Cheeger-Gromoll-Perelman soul theory with positive bi-sectional curvature*”, colloquium lecture, Department of Mathematics, University of Miami, Miami, Florida, April 6, 2007.
 - (71) “*Morse theory of distance functions on curved spaces*”, a mini-course, 8 lectures, National Center for Theoretic Sciences, National Tsinghua University, Hsinchu, Taiwan, May 19 - August 17, 2007.
 - (72) “*Alexandrov spaces, old and new*”, a mini-course, 10 lectures, National Taiwan University, Taipei, Taiwan, May 26 - July 16, 2007.
 - (73) “*The d -bar Cauchy problem and applications to CR-geometry*”, colloquium lecture, National Chung Cheng University, Jiayi, Taiwan, June 14, 2007.
 - (74) “*Alexandrov spaces, old and new*”, 2 lectures, Chinese University of Hong Kong, Hong Kong, China, July 19 - July 24, 2007.
 - (75) “*Riemannian geometric part of Perelman’s work on Thurston’s geometrization conjecture I*”, Fudan University, Shanghai, China, July 25, 2007.
 - (76) “*Positive harmonic functions on manifolds of non-positive curvature*”, Suzhou University, Suzhou, China, July 27, 2007.
 - (77) “*Positive harmonic functions on manifolds of non-positive curvature*”, Nanjing University of Sciences and Technology, Nanjing, China, July 31, 2007.
 - (78) “*Riemannian geometric part of Perelman’s work on Thurston’s geometrization conjecture II*”, Fudan University, Shanghai, China, August 2, 2007.
 - (79) “*The d -bar Cauchy problem and applications to CR-geometry*”, colloquium

- lecture, Georgetown University, October 26, 2007.
- (80) “*An extension of Perelman’s comparison theorem for quadrangles and its applications*”, colloquium lecture, Capital Normal University, Beijing, China, December 26, 2007.
 - (81) “*The \bar{d} -Cauchy problem and applications to CR-geometry*”, Partial Differential Equation seminar, Nanjing University, December 28, 2007.
 - (82) “*An extension of Perelman’s soul theorem for singular spaces*”, Colloquium, Fudan University, Shanghai, China, December 29, 2007.
 - (83) “*An extension of Perelman’s comparison theorem for quadrangles and its applications*”, Colloquium, Institute of Mathematics, Chinese Academy of Sciences, January 4, 2008.
 - (84) “*Alexandrov geometry and applications to Perelman’s work on Thurston’s geometrization*”, Colloquium, University of Iowa, Iowa, USA, April 10, 2008.
 - (85) “*Alexandrov geometry and applications to Perelman’s work on Poincare-Thurston’s geometrization*”, University of Chicago, Chicago, USA, Geometry and Topology Seminar, May 15, 2008.
 - (86) “*The \bar{d} -equations on domains in complex projective spaces*”, PDE seminar, Nanjing University, July 4, 2008.
 - (87) “*A generalized Perelman’s soul theorem for singular spaces*”, Karcher Colloquium lecture, University of Oklahoma, October 9, 2008.
 - (88) “*Positive harmonic functions on singular spaces with non-negative Ricci curvature*”, Karcher Seminar, University of Oklahoma, October 10, 2008.
 - (89) “*Perelman’s convexity lemma and applications to collapsing of 3-manifolds*”, Geometry Seminar, University of California, Irvine, November 4, 2008.
 - (90) “*A simplified proof of Perelman’s collapsing theorem for 3-manifolds*”, Geometry Seminar, Fudan University, Shanghai, China, January 2, 2009.
 - (91) “*A new proof of Perelman’s collapsing theorem for 3-manifold and applications to geometrisation*”, University of Toronto, Canada, Geometry Seminar, April 6, 2009.
 - (92) “*Convex boundary of singular spaces with curvature bounded from below*”, Fudan University, Shanghai, China, June 15, 2009.
 - (93) “*A new proof of Perelman’s collapsing theorem for 3-manifolds*”, Southeastern University, Nanjing, China, June 22, 2009.
 - (94) “*Perelman’s collapsing theorem for classifications of 3-manifolds*”, Nanjing University of Sciences and Technology, Nanjing, China, June 26, 2009.
 - (95) “*A short course on Perelman’s collapsing theorem for 3-manifolds*”, ten lectures at Capital Normal University, Beijing, China, July 15-25, 2009.
 - (96) “*Perelman’s collapsing theorem for 3-manifolds*”, colloquium, Chinese Academy of Sciences, Beijing, China, July 22, 2009.
 - (97) “*Positive harmonic functions on singular spaces*”, East China Normal University, Shanghai, China, July 31, 2009.
 - (98) “*Perelman’s Collapsing Theorem*”, Three lectures, Michigan State Univer-

sity, East Lansing, Michigan, September 28-29, 2009.

- (99) “*A proof of Perelman’s Collapsing Theorem*”, Lehigh University, Bethlehem, Pennsylvania, October 19, 2009.