

CURRICULUM VITAE

Ivan G. Avramidi

New Mexico Institute of Mining and Technology

Socorro, New Mexico, USA

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PERSONAL DATA

Name **Ivan G Avramidi**
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New Mexico Institute of Mining and Technology
Socorro, NM 87801-5200
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Academic Degrees

1993 **Senior Research Scientist in Theoretical and Mathematical Physics**
Rostov State University (Rostov-on-Don, Russia)
1987 **Candidate of Sciences (Ph.D.) in Physical and Mathematical Sciences**
Moscow State University (Moscow, Russia)
1979 **Diploma of Physicist (M.Sc.) with Highest Distinction**
Rostov State University (Rostov-on-Don, Russia)

Research Interests

- **Geometric Analysis on Manifolds and Spectral Geometry**
- **Spectral Theory of Partial Differential Operators**
- **Mathematical Physics and Integrable Systems**
- **Quantum Field Theory and Gauge Theories**
- **Classical and Quantum Gravity**
- **Differential Geometry**

Academic Career

PRESENT POSITIONS

- since 2005 **Professor**
Department of Mathematics, New Mexico Institute of Mining and Technology
- since 2000 **Adjunct Professor**
Department of Physics, New Mexico Institute of Mining and Technology
(Socorro, New Mexico, USA)

POSITIONS HELD

- 1999 – 2005 **Associate Professor**
Department of Mathematics, New Mexico Institute of Mining and Technology
(Socorro, New Mexico, USA)
- 6 – 7/1999 **Research Scientist**
Department of Mathematics, University of Greifswald
(Greifswald, Germany)
- 1997 – 1999 **Visiting Assistant Professor**
Department of Mathematics, The University of Iowa
(Iowa City, Iowa, USA)
- 1996 – 1998 **Research Scientist**
Department of Mathematics, University of Greifswald
(Greifswald, Germany)
- 1993 – 1996 **Alexander von Humboldt Fellow**
Department of Mathematics, University of Greifswald
(Greifswald, Germany)
- 11 – 12/1995 **Visiting Professor**
Istituto Nazionale di Fisica Nucleare (INFN), and
Department of Physics, University of Naples “Federico II”
(Naples, Italy)
- 1990 – 1995 **Senior Research Scientist**
Research Institute for Physics, Rostov State University
(Rostov-on-Don, Russia)
- 10 – 11/1990 **Visiting Scientist**
Max-Planck Institute for Physics and Astrophysics
Werner-Heisenberg-Institute for Physics
(Munich, Germany)
- 8 – 9/1990 **Visiting Professor**
Institute for Theoretical Physics, University of Karlsruhe
(Karlsruhe, Germany)
- 1989 – 1990 **German Academic Exchange Service (DAAD) Fellow**
Institute for Theoretical Physics, University of Karlsruhe
(Karlsruhe, Germany)

- 1987 – 1990 **Research Scientist**
Research Institute for Physics, Rostov State University
(Rostov-on-Don, Russia)
- 1983 – 1986 **Postgraduate Fellow**
Physics Department, Moscow State University
(Moscow, Russia)
- 1979 – 1983 **Junior Research Scientist**
Physics Department, Rostov State University
(Rostov-on-Don, Russia)

RESEARCH

AND SCHOLARLY ACTIVITIES

Publications

Book

1. I. G. Avramidi, **Heat Kernel and Quantum Gravity**, Lecture Notes in Physics, New Series m: Monographs, LNP:m64 (Berlin-New York: Springer-Verlag 2000)

Refereed Publications

2. I. G. Avramidi, *Heat Kernel Asymptotics on Symmetric Spaces*, International Journal of Geometry and Topology, (2006) (to be published) arXiv:math.DG/0605762
3. I. G. Avramidi, *Non-Laplace type Operators on Manifolds with Boundary*, in: "Analysis, Geometry and Topology of Elliptic Operators", Eds. B. Booss-Bavnbek, S. Klimek, M. Lesch and W. Zhang (Singapore: World Scientific, 2006), pp. 119–152 (Papers in Honor of Krzysztof P. Wojciechowski).
4. I. G. Avramidi, *Dirac Operator in Matrix Geometry*, International Journal of Geometric Methods in Modern Physics, **2** (2005), 227–264 (special issue dedicated to the memory of Dmitri Ivanenko and Vladimir Fock).
5. I. G. Avramidi, *A note on contributions of Prof. Minakshisundaram to mathematical physics*, Proc. of Andhra Pradesh Akademi of Sciences, **8** (2004), 247–248 (special issue dedicated to the memory of Subbaramiah Minakshisundaram).
6. I. G. Avramidi, *Gauged Gravity via Spectral Asymptotics of non-Laplace type Operators*, Journal of High Energy Physics, **07** (2004) 030, 36 pp.
7. I. G. Avramidi, *Matrix General Relativity: A new look at Old Problems*, Classical and Quantum Gravity, **21** (2004) 103–120
8. I. G. Avramidi, *A Noncommutative Deformation of General Relativity*, Physics Letters, **B 576** (2003) 195–198
9. I. G. Avramidi, *Heat kernel asymptotics of Zarembo boundary value problem*, Mathematical Physics, Analysis and Geometry, **7** (2004) 9–46
10. I. G. Avramidi, *Heat kernel in quantum field theory*, Nuclear Physics Proceedings Supplement, **104** (2002) 3–32
11. I. G. Avramidi and T. Branson, *A discrete leading symbol and spectral asymptotics for natural differential operators*, Journal of Functional Analysis, **190** (2002) 292–337

12. I. G. Avramidi and T. Branson, *Heat kernel asymptotics of operators with non-Laplace principal part*, *Reviews in Mathematical Physics*, **13** (2001) 847–890
13. I. G. Avramidi and R. Schimming, *A new explicit expression for the Korteweg-De Vries hierarchy*, *Mathematische Nachrichten*, **219** (2000) 45–64
14. I. G. Avramidi, *Covariant techniques for computation of the heat kernel*, *Reviews in Mathematical Physics*, **11** (1999) 947–980
15. I. G. Avramidi and G. Esposito, *Gauge theories on manifolds with boundary*, *Communications in Mathematical Physics*, **200** (1999) 495–543
16. I. G. Avramidi, *One-loop effective potential in higher-dimensional Yang-Mills theory*, *Fortschritte der Physik/Progress of Physics*, **47** (1999) 433–455
17. I. G. Avramidi and G. Esposito, *Foundational Problems in Quantum Gravity*, in: *Recent Developments in General Relativity*, Eds. D. Fortunato, A. Masiello, B. Casciaro and M. Francaviglia, (Berlin: Springer, 1999), pp. 353–362
18. I. G. Avramidi and G. Esposito, *Heat Kernel Asymptotics of the Gilkey-Smith Boundary Value Problem*, in: “Trends in Mathematical Physics”, Eds: V. Alexiades and G. Siopsis, *AMS/IP Studies in Advanced Mathematics*, vol. 13, (American Mathematical Society and International Press, 1999), pp. 15–34
19. I. G. Avramidi and G. Esposito, *On ellipticity and gauge invariance in Euclidean quantum gravity*, in: “Trends in Mathematical Physics”, Eds: V. Alexiades and G. Siopsis, *AMS/IP Studies in Advanced Mathematics*, vol. 13, (American Mathematical Society and International Press, 1999), pp. 33–40
20. I. G. Avramidi, *Green functions of higher-order differential operators*, *Journal of Mathematical Physics*, **39** (1998) 2889–2909
21. I. G. Avramidi and G. Esposito, *Lack of strong ellipticity in Euclidean quantum gravity*, *Classical and Quantum Gravity*, **15** (1998) 1141–1152
22. I. G. Avramidi, *Nonperturbative methods for calculating the heat kernel*, in: “Global Analysis, Differential Geometry and Lie Algebras”, Ed. G. Tsagas, (Bucharest, Geometry Balcan Press, 1998), pp. 7–21;
23. I. G. Avramidi, *Covariant approximation schemes for calculation of the heat kernel in quantum field theory*, in: *Quantum Gravity*, Eds. V. A. Berezin, V. A. Rubakov and D. V. Semikoz, (Singapore: World Scientific, 1998), pp. 61–78
24. I. G. Avramidi, *Singularities of Green functions of the products of the Laplace-type operators*, *Physics Letters*, **B 403** (1997) 280–284
25. I. G. Avramidi and G. Esposito, *New invariants in the one-loop divergences on manifolds with boundary*, *Classical and Quantum Gravity*, **15** (1998) 281–297
26. I. G. Avramidi, G. Esposito and A. Yu. Kamenshchik, *Axial gauge in Euclidean quantum gravity*, in: ‘Constrained Dynamics and Quantum Gravity 1996’, Eds: V. de Alfaro, J. E. Nelson, G. Bandelloni, A. Blasi, M. Cavaglia’ and A. T. Filippov, *Nuclear Physics Proceedings Supplement*, **B 57** (1997), pp. 245–246
27. I. G. Avramidi, G. Esposito and A. Yu. Kamenshchik, *Boundary operators in Euclidean quantum gravity*, *Classical Quantum Gravity*, **13** (1996) 2361–2373
28. I. G. Avramidi, *A new algebraic approach for calculating the heat kernel in quantum gravity*, *Journal of Mathematical Physics*, **37** (1996) 374–394

29. I. G. Avramidi and R. Schimming, *Algorithms for the calculation of the heat kernel coefficients*, in: 'Quantum Field Theory under the Influence of External Conditions', Ed. M. Bordag, Teubner-Texte zur Physik, Band 30, (Stuttgart: Teubner, 1996), pp. 150–162
30. I. G. Avramidi, *Covariant algebraic method for calculation of the low-energy heat kernel*, Journal of Mathematical Physics, **36** (1995) 5055–5070
31. I. G. Avramidi and R. Schimming, *Heat kernel coefficients to the matrix Schrödinger operator*, Journal of Mathematical Physics, **36** (1995) 5042–5054
32. I. G. Avramidi, *Covariant algebraic calculation of the one-loop effective potential in non-Abelian gauge theory and a new approach to stability problem*, Journal of Mathematical Physics, **36** (1995) 1557–1571
33. I. G. Avramidi, *New algebraic methods for calculating the heat kernel and the effective action in quantum gravity and gauge theories*, in: 'Heat Kernel Techniques and Quantum Gravity', Ed. S. A. Fulling, Discourses in Mathematics and Its Applications, (College Station, Texas: Department of Mathematics, Texas A&M University, 1995), pp. 115–140;
34. I. G. Avramidi, *The heat kernel on symmetric spaces via integrating over the group of isometries*, Physics Letters, **B 336** (1994) 171–177
35. I. G. Avramidi, *A new algebraic approach for calculating the heat kernel in gauge theories*, Physics Letters, **B 305** (1993) 27–34
36. I. G. Avramidi, *A method for calculating the heat kernel for manifolds with boundary*, Yadernaya Fizika, **56** (1993) 245–252, [Russian]; Physics of Atomic Nucleus, **56** (1993) 138–142 [English]
37. I. G. Avramidi, *A covariant technique for the calculation of the one-loop effective action*, Nuclear Physics, **B 355** (1991) 712–754
38. I. G. Avramidi, *Gauge invariant theory of higher spin fields in curved space*, International Journal of Modern Physics, **A 6** (1991) 1693–1700
39. I. G. Avramidi, *The covariant technique for calculation of the heat kernel asymptotic expansion*, Physics Letters, **B 238** (1990) 92–97
40. I. G. Avramidi, *The nonlocal structure of one-loop effective action via partial summation of asymptotic expansion*, Physics Letters, **B 236** (1990) 443–449
41. I. G. Avramidi, *Covariant methods of studying the nonlocal structure of an effective action*, Yadernaya Fizika, **49** (1989) 1185–1192, [Russian]; Soviet Journal of Nuclear Physics, **49** (1989) 735–739 [English]
42. I. G. Avramidi, *Background field calculations in quantum field theory (vacuum polarization)*, Teoreticheskaya i Matematicheskaya Fizika, **79** (1989) 219–231, [Russian]; Theoretical and Mathematical Physics, **79** (1989) 494–502 [English]
43. I. G. Avramidi, *Asymptotic behavior of the quantum theory of gravity with higher order derivatives*, Yadernaya Fizika, **44** (1986) 255–263, [Russian]; Soviet Journal of Nuclear Physics, **44** (1986) 160–164 [English]
44. I. G. Avramidi and A. O. Barvinsky, *Asymptotic freedom in higher-derivative quantum gravity*, Physics Letters, **B 159** (1985) 269–274
45. I. G. Avramidi, B. G. Barabashov and G. G. Vertogradov, *A method of reducing the effect of multipath propagation on the accuracy of determining the angles of arrival of radiowaves*, Radiotekhnika, **9** (1983) 69–72 [Russian]; Telecommunications and Radioengineering, **9** (1983) 111–113 [English]

Preprints and Reports

46. I. G. Avramidi and G. Esposito, *Universal Functions in Euclidean Quantum Gravity*, Preprint: arXiv:hep-th/9702150, 8 pp.
47. I. G. Avramidi, *The heat kernel approach for calculating the effective action in quantum field theory and quantum gravity*, Preprint: University of Greifswald (June, 1994), arXiv:hep-th/9509077, 21 pp.
48. I. G. Avramidi, *Covariant methods for calculating the low-energy effective action in quantum field theory and quantum gravity*, Preprint: University of Greifswald (March, 1994), arXiv:gr-qc/9403036, 48 pp.
49. I. G. Avramidi, *Covariant Methods for the Calculation of the Effective Action in Quantum Field Theory and Investigation of Higher-Derivative Quantum Gravity*, PhD Thesis, Moscow State University (1986), UDC 530.12:531.51, 178 pp. [Russian]; Available at: arXiv:hep-th/9510140, 159 pp. [English]
50. I. G. Avramidi, *Background field method in quantum theory*, Moscow State University (1984), Deposited at VINITI (Soviet Institute for Scientific and Technical Information, No 1512–85 Dep., VINITI, Moscow, (1985), 41 pp., [Russian]

Conference Abstracts

51. I. G. Avramidi, *Chromomagnetic Vacuum in Yang-Mills Theory*, in: International Congress of Mathematical Physics 2006, Rio de Janeiro, Book of Abstracts, (Rio de Janeiro, Brazil, 2006) (to be published)
52. I. G. Avramidi, *Spectral Asymptotics and Matrix Geometry*, in: International Congress of Mathematicians 2006, Abstracts of Short Communications and Poster Sessions, (Madrid, 2006) (to be published)
53. I. G. Avramidi, *Noncommutative deformation of general relativity*, in: International Congress of Mathematical Physics 2003, Lisbon, Book of Abstracts, (Lisbon, Portugal, 2003)
54. I. G. Avramidi, *Heat kernel asymptotics of Zarembo boundary value problem*, in: International Congress of Mathematicians, Beijing 2002, Aug. 20-28, Abstracts of Short Communications and Poster Sessions, (Beijing: Higher Education Press, 2002), pp. 208–209
55. I. G. Avramidi, *Heat kernel asymptotics of a non-smooth boundary-value problem*, in: International Congress of Mathematical Physics 2000, London, Book of Abstracts, (London, UK, 2000), p. 98
56. I. G. Avramidi, *Heat kernel asymptotics of a non-smooth boundary-value problem*, in: Abstracts of the International Conference “Workshop in Spectral Geometry”, University of Bristol, Bristol, UK, 2000
57. I. G. Avramidi, *Heat kernel asymptotics of operators with non-Laplace principal part*, in: Abstracts of the International Conference “Workshop in Partial Differential Equations”, University of Potsdam, Potsdam, Germany, 1999
58. I. G. Avramidi, *Heat kernel asymptotics of the Gilkey-Smith boundary value problem*, in: Abstracts of 8th International Conference on Differential Equations and Mathematical Physics, University of Alabama, Birmingham, Alabama, 1999
59. I. G. Avramidi, *Heat kernel as the basis for the functional integration in quantum field theory*, in: Functional Integration: Basics and Applications, Eds: C. DeWitt-Morette, P. Cartier and A. Folacci, NATO ASI Series, Series B: Vol. 361, (New York: Plenum Press, 1997), pp. 413–413

60. I. G. Avramidi, *Effective potential in Yang-Mills theory and the stability of the chromomagnetic vacuum*, in: 'Quantum Field Theory under the Influence of External Conditions', Ed. M. Bordag, Teubner-Texte zur Physik, Band 30, (Stuttgart: Teubner, 1996), pp. 168–169
61. I. G. Avramidi, *The low energy heat kernel and the effective action in semiclassical quantum gravity*, Abstracts of 14th International Conference "General Relativity and Gravitation", Florence, Italy, August 6–12, 1995, 2 pp.
62. I. G. Avramidi, *One-loop approximation in quantum theory of scalar, spinor and vector fields in external gravitational background field*, in: Modern theoretical and experimental problems of general relativity and gravitation, Abstracts of VIth Soviet Gravitational Conference, Ed. V. N. Ponomarev (Moscow: Moscow State Pedagogical Institute, 1984), pp. 199–201, [Russian]

Lecture Notes

63. I. G. Avramidi, *Introduction to Differential Geometry, Lecture Notes for MATH 442*, New Mexico Tech, 2005, 210 pp
64. I. G. Avramidi, *Lecture Notes on Linear Algebra and Vector Analysis*, (can be used for MATH 332, MATH 454, MATH 442), New Mexico Tech, 2005, 118 pp.
65. I. G. Avramidi, *Methods of Mathematical Physics, Lecture Notes for MATH 535/536*, New Mexico Tech, 2005, 165 pp
66. I. G. Avramidi, *Basic Concepts of Analysis, Lecture Notes for MATH 372*, New Mexico Tech, 2004, 127 pp
67. I. G. Avramidi, *Basic Concepts of Mathematics, Lecture Notes for MATH 352*, New Mexico Tech, 2004, 110 pp
68. I. G. Avramidi, *Effective Action Approach to Quantum Field Theory*, New Mexico Tech, 2000, 90 pp.
69. I. G. Avramidi, *Lecture Notes in Mathematical Physics*, New Mexico Tech, 2000, 67 pp.
70. I. G. Avramidi, *Notes on Special Relativity and Quantum Fields*, New Mexico Tech, 2000, 27 pp.
71. I. G. Avramidi, *Notes on Lie Groups*, New Mexico Tech, 2000, 14 pp.
72. I. G. Avramidi, *Notes on Hilbert Spaces*, New Mexico Tech, 2000, 17 pp.
73. I. G. Avramidi, *Notes on Asymptotic Expansions*, New Mexico Tech, 2000, 34 pp.
74. I. G. Avramidi, *Notes on Differential Forms*, New Mexico Tech, 2003, 13 pp.
75. I. G. Avramidi, *Elementary Notes on Tensors* New Mexico Tech, 2001, 9 pp.

Book project in progress

76. I. G. Avramidi, **Heat Kernel in Mathematical Physics**

Papers in preparation

77. I. G. Avramidi, *Heat kernel asymptotics on homogeneous bundles over symmetric spaces*
78. I. G. Avramidi, *Spectral geometry of Riemannian submanifolds*
79. I. G. Avramidi, *Modified heat kernel asymptotics on Kähler manifolds*
80. I. G. Avramidi, *On positivity of the spectrum of a certain class of differential operators*

Research Recognition and Professional Activities

Citations

Databases:

- **SPIRES-SLAC** (Stanford Public Information REtrieval System of the Stanford Linear Accelerator Center)
Total number of citations in SPIRES-SLAC (April 2006): **668**
- **SearchPlus** (Science Citation Index) at LANL (Los Alamos National Laboratory)
Total number of citations (February 2005): **613**

Topcited Papers in SLAC-SPIRES

The SLAC-SPIRES preprint database has almost 500,000 records. Just under 12,000 of these have more than 50 citations (~ 2.5%).

Papers with more than 50 citations:

1. Nuclear Physics **B 355** (1991) 712–754; (**102** citations)
2. Physics Letters **B 159** (1985) 269–274; (**69** citations)

Papers with more than 30 citations:

3. Commun. Math. Phys. **200** (1999) 495-543; (44 citations)
4. Phys. Lett. B **238** (1990) 92-97; (41 citations)
5. Class. Quant. Grav. **15** (1998) 281-297; (39 citations)
6. Class. Quant. Grav. **13** (1996) 2361-2374; (36 citations)
7. Theor. Math. Phys. **79** (1989) 494-502; (32 citations)
8. Class. Quant. Grav. **15** (1998) 1141-1152; (30 citations)

Papers with more than 20 citations:

9. Sov. J. Nucl. Phys. **49** (1989) 735-739; (29 citations)
10. Ph.D. Thesis (arXiv:hep-th/9510140); (27 citations)
11. Phys. Lett. B **305** (1993) 27-34; (25 citations)

Awards, Fellowships and Honors

- | | |
|----------------------------|---|
| 1993 – 1996
Awarded by: | Alexander von Humboldt Research Fellowship
Alexander von Humboldt Foundation
(Bonn, Germany) |
| 1993
Awarded by: | Soros Humanitarian Foundations Grant
American Physical Society |
| 1993
Awarded by: | International Science Foundation's Emergency Grant
International Science Foundation |
| 1989 – 1990
Awarded by: | DAAD Research Fellowship
German Academic Exchange Service (DAAD)
(Bonn, Germany) |
| 1976-1979
Awarded by: | Honor Student
Physics Department, Rostov State University
(Rostov-on-Don, Russia) |
| 1978
Awarded by: | Second Place in Student Research Conference
Physics Department, Rostov State University
(Rostov-on-Don, Russia) |
| 1974
Awarded by: | First Place in the Physics Olympiad of the City of Alma-Ata
Siberian Branch of the Academy of Sciences of USSR
(Novosibirsk, USSR) |
| 1974
Awarded by: | Gold Medal (Valedictorian)
High School No 55
(Alma-Ata, USSR) |

Conference Presentations

Date	Place	Title of the Conference
August 22-30, 2006	Madrid (Spain)	<i>International Congress of Mathematicians 2006</i>
August 6-11, 2006	Rio de Janeiro (Brazil)	<i>XV International Congress of Mathematical Physics</i>
May 5-7, 2006	Norman (Oklahoma)	<i>Midwest Geometry Conference 2006</i>
April 6-8, 2006	Albuquerque (New Mexico)	<i>IXth New Mexico Analysis Seminar</i>
April 29-May 1, 2005	Columbus (Ohio)	<i>2005 Midwest Geometry Conference</i>
October 16-17, 2004	Albuquerque (New Mexico)	Organizer of a Special Session on Spectral Geometry, Western Section Meeting of American Mathematical Society
March 26-28, 2004	Pasadena (California)	<i>20th Pacific Coast Gravity Meeting</i>
July 28-August 3, 2003	Lisbon (Portugal)	<i>XIV International Congress on Mathematical Physics</i>
March 6-8, 2003	Albuquerque (New Mexico)	<i>VIth New Mexico Analysis Seminar</i>
April 5-6, 2003	Socorro (New Mexico)	<i>Southwestern Section Meeting of Mathematical Association of America</i>
August 20–28, 2002	Beijing (China)	Chair of a Short Communication Session, International Congress of Mathematicians 2002
June 26–July, 2002	Lexington (Kentucky)	Chair of a Special Session, Workshop on Inverse Spectral Geometry
April 5–7, 2002	Lubbock (Texas)	Invited Plenary Speaker, Texas Geometry and Topology Conference
March 8, 2002	Indianapolis (Indiana)	Invited Keynote Speaker, Conference on Spectral Geometry and Related Topics

Date	Place	Title of the Conference
July 2–7, 2001	Naples (Italy)	Invited Keynote Lecturer (6 One-hour Lectures), Chair of Several Sessions , International Conference “ <i>Quantum Gravity and Spectral Geometry</i> ”
March 10–24, 2001	Berkeley (California)	General Member , Mathematical Sciences Research Institute (MSRI), Research Program “ <i>Spectral Invariants – Analytic and Geometric Aspects</i> ”
March 12–16, 2001	Berkeley (California)	International Conference “ <i>Geometric Aspects of Spectral Theory</i> ”
Nov. 17–19, 2000	Iowa City (Iowa)	<i>Xth Midwest Geometry Conference</i>
July 17–22, 2000	London (UK)	<i>XIII International Congress on Mathematical Physics</i>
July 10–15, 2000	Bristol (UK)	Plenary Keynote Speaker , International Conference “ <i>Workshop on Spectral Geometry</i> ”
February 24–26, 2000	Las Cruces (New Mexico)	“ <i>Third New Mexico Analysis Seminar</i> ”
July 20, 1999	Potsdam (Germany)	Invited Plenary Speaker, Chair of a Session , International Conference “ <i>Workshop in Partial Differential Equations</i> ”
July 7–10, 1999	Leipzig (Germany)	International Conference “ <i>100 Years After Sophus Lie</i> ”
March 19, 1999	Birmingham (Alabama)	Chair of a Session , “ <i>8th International Conference on Differential Equations and Mathematical Physics</i> ”
Oct. 22–25, 1998	Baton Rouge (Louisiana)	<i>VIIIth Midwest Geometry Conference</i>
October 17, 1998	Knoxville (Tennessee)	(2 Lectures) International Conference “ <i>Trends in Mathematical Physics</i> ”
May 30, 1998	Manhattan (Kansas)	“ <i>Great Plains Operator Theory Symposium (GPOTS 98)</i> ”
April 25, 1998	Des Moines (Iowa)	Invited Speaker , “ <i>Iowa Nebraska Functional Analysis Seminar (INFAS 98)</i> ”
March, 2–8, 1997	Oberwolfach (Germany)	One hour Lecture , International Conference “ <i>Quantum Field Theory and Wave Fronts</i> ”, Mathematisches Forschungsinstitut Oberwolfach

Date	Place	Title of the Conference
Sept. 2–13, 1996	Cargèse (France)	NATO Advanced Study Institute “ <i>Functional Integration: Basics and Applications</i> ”
Aug. 19–23, 1996	Oberwolfach (Germany)	Invited Keynote Speaker , International Workshop “ <i>Calculation of Special Heat Kernel Coefficients</i> ”, Mathematisches Forschungsinstitut in Oberwolfach
Sept. 18–22, 1995	Leipzig (Germany)	(2 Lectures) International Conference “ <i>IIIrd Leipzig Workshop on Quantum Field Theory under the Influence of External Conditions</i> ”
Aug. 6–12, 1995	Florence (Italy)	<i>14th International Conference on General Relativity and Gravitation</i>
June 12–19, 1995	Moscow (Russia)	International Conference “ <i>VIth Moscow Seminar on Quantum Gravity</i> ”
Dec. 12–19, 1994	Thessaloniki (Greece)	Invited Speaker , International Conference “ <i>Global Analysis, Differential Geometry and Lie Algebras</i> ”
Aug. 6–20, 1994	Winnipeg (Canada)	Invited Keynote Plenary Speaker , International Conference “ <i>Heat Kernel Techniques and Quantum Gravity</i> ”
July 1992	Sochi (Russia)	International Conference on “ <i>High-Energy Physics and Cosmology</i> ”
May 1991	Sochi (Russia)	International Conference “ <i>Foundations of Physics</i> ”
July 1990	Trieste (Italy)	<i>Summer School in High-Energy Physics and Cosmology</i>
July 1990	Rapallo (Italy)	<i>XIX International Conference on Differential-Geometric Methods in Theoretical Physics</i>
1984	Moscow (Russia)	<i>VIth Soviet Gravitational Conference</i>

Conference Participation

Date	Place	Title of the Conference
October 11-17, 2004	Albuquerque (New Mexico)	<i>7th New Mexico Analysis Seminar</i>
October 29-31, 2004	College Station (Texas)	<i>Texas Geometry and Topology Conference</i>
November 17-19, 2000	Iowa City (Iowa)	<i>10th Midwest Geometry Conference</i>
September 1998	Baton Rouge (Louisiana)	<i>8th Midwest Geometry Conference</i>

Invited Colloquium Lectures

Date	Place	University
March 16, 2006	Eugene (Oregon)	University of Oregon
May 23, 2003	Naples (Italy)	Istituto Nazionale di Fisica Nucleare (INFN) and Univer- sita di Napoli "Federico II"
March 28, 2003	Los Alamos (New Mexico)	Los Alamos National Lab (LANL)
March 31, 1999	Socorro (New Mexico)	New Mexico Institute of Mining and Technology
Sept. 25, 1998	Indianapolis (Indiana)	Indiana University - Purdue University at Indianapolis (IUPUI)
Jan. 15, 1998	College Station (Texas)	Texas A&M University
May 21, 1997	Athens (Greece)	National Research Center "Democritos"
April 10, 1997	Eugene (Oregon)	University of Oregon
April 4, 1997	Iowa City (Iowa)	University of Iowa
Dec. 15, 1995	Rome (Italy)	University of Rome "La Sapienza", Istituto Nazionale di Fisica Nucleare (INFN)
Sept. 25–30, 1995	York (UK)	University of York
April 3, 1995	Jena (Germany)	University of Jena
April 24, 1995	Erfurt (Germany)	Pedagogical University Erfurt
Oct. 28, 1994	Naples (Italy)	University of Naples

Date	Place	University
Oct. 5, 1994	Trento (Italy)	University of Trento
June 26–July 3, 1994	Jena (Germany)	University of Jena
Dec. 12–15, 1993	Greifswald (Germany)	University of Greifswald

Research Seminars and Colloquiums

Date	Place	University
1999–2006	Socorro (New Mexico)	Department of Mathematics and Department of Physics, New Mexico Institute of Mining and Technology
1998 – 1999	Iowa City (Iowa)	Department of Mathematics and Department of Physics, University of Iowa
Dec. 1, 1995	Naples (Italy)	Department of Physics, University of Naples, and Istituto Nazionale di Fisica Nucleare (INFN)
Aug. 6–20, 1994	Winnipeg (Canada)	Department of Physics and Institute of Theoretical Physics, University of Manitoba
1994–1997; 1999	Greifswald (Germany)	Department of Mathematics and Department of Physics, University of Greifswald
1989–1990	Karlsruhe (Germany)	Department of Physics and Institute for Theoretical Physics, University of Karlsruhe
1986	Moscow (Russia)	Theoretical Physics Division, Lebedev Physical Institute, Russian Academy of Sciences
1983–1986	Moscow (Russia)	Department of Physics, Moscow State University
1987–1993	Rostov-on-Don (Russia)	Nuclear Physics Department, Research Institute for Physics, and Department of Physics, Rostov State University

Invited Research Visits

Not Listed Above

March 15-20, 2006	Department of Mathematics, University of Oregon (Eugene, Oregon)
Purpose of visit	Research Collaboration
May 11–26, 2003	Istituto Nazionale di Fisica Nucleare (INFN) and Universita di Napoli "Federico II" (Naples, Italy)
Purpose of visit	Research Collaboration
July 2–7, 2001	Department of Mathematics, University of Oregon (Eugene, Oregon)
Purpose of visit	Research Collaboration

Colloquiums and Seminars at New Mexico Tech

Date	Dept.	Title
10/07/05	Math	<i>Spectral Asymptotics and Geometry</i>
9/30/04	Math	Invited Lecture in ED 101, NMT First Year Experience Program for freshmen and first year students in physics and mathematics
9/24/04	Math	<i>Semiclassical Approximation for Equations of Quantum Mechanics</i>
11/7/02	Phys	<i>Why There Is No Quantum Gravity Yet?</i>
10/4/02	Math	<i>Oblique Boundary Value Problems</i>
10/26/01	Math	<i>Heat Kernel Asymptotics of Zaremba Boundary Value Problem</i>
9/28/01	Phys	<i>Introduction to Quantum Field Theory</i>
9/7/01	Math	<i>Infinite-Dimensional Integrable Hamiltonian Systems and Isospectrality</i>
4/10/01	Math	<i>Approximation Schemes for the Heat Kernel</i>
2/9/01	Math	<i>Green functions of higher-order differential operators</i>
12/01/00	Math	<i>Algebraic Approach to the Heat Equation</i>
11/02/00	Phys	<i>Vacuum Structure of Yang-Mills Theory</i>
09/08/00	Math	<i>Heat Kernel Asymptotics of Differential Operators of non-Laplace Type</i>
04/20/00	Phys	<i>Effective Action Approach in Quantum Field Theory</i>
02/04/00	Math	<i>Heat Kernel Asymptotics for a Nonsmooth Boundary Value Problem</i>
10/08/99	Math	<i>Topics in Mathematical Physics</i>
03/31/99	Math	<i>Elliptic Differential Operators on Manifolds</i>

Chair of the Mathematics Department Seminar (since 2001)

Organizer of the Topology Seminar (2004)

Presented **numerous talks** at the Seminar in Control Theory (2003)

Workshops at New Mexico Tech

Date	Title
Apr. 23–24, 2004	Organizer of the <i>Applied Mathematics Problems Workshop</i> , sponsored by NMT Department of Mathematics
March 22–23, 2002	<i>Applied Mathematics Problems Workshop</i> , sponsored by NMT Department of Mathematics
Apr. 27–28, 2001	<i>Applied Mathematics Problems Workshop</i> , sponsored by NMT Department of Mathematics
Sept. 14, 2000	<i>Proposal Development Workshop</i> , sponsored by R&ED Office of NMT
June 19–23, 2000	<i>Technology Assisted Learning Workshop</i> , organized by the NMSU C&N Scholarly Technology Unit, sponsored by NMT Computer Center
Apr. 1–2, 2000	<i>Applied Mathematics Problems Workshop</i> , sponsored by NMT Department of Mathematics

Grants (Funded)

- 2006 **NSF Block Travel Grant**
 Conference: to attend *XV International Congress of Mathematical Physics*, Rio de Janeiro, Brazil
 Budget: \$1,500
 Funding Inst.: **National Science Foundation**
 Awarded by: American Mathematical Society
- 2006 **NSF Block Travel Grant**
 Conference: to attend *International Congress of Mathematicians 2006*, Madrid, Spain
 Budget: \$2,100
 Funding Inst.: **National Science Foundation**
 Awarded by: American Mathematical Society
- 2003 **NSF Block Travel Grant DMS-0306887**
 Conference: to attend *XIV International Congress of Mathematical Physics*, Lisbon, Portugal
 Budget: \$2,100
 Funding Inst.: **National Science Foundation**
 Awarded by: American Mathematical Society
- 2002 **NSF Block Travel Grant DMS-0123494**
 Conference: to attend *International Congress of Mathematicians 2002*, Beijing, China
 Budget: \$2,100
 Funding Inst.: **National Science Foundation**
 Awarded by: American Mathematical Society
- 2002 **NSF Grant DMS-0207125**
 Conference: to attend *Conference on Inverse Spectral Geometry*, Lexington, Kentucky
 Budget: travel, lodging, local expenses
 Funding Inst.: **National Science Foundation**
 Awarded by: University of Kentucky (Lexington, Kentucky)
- 2002 **Invited Plenary Speaker**
 Conference: *Texas Geometry and Topology Conference*, Lubbock, Texas
 Budget: Full Financial Support (travel, lodging, local expenses)
 Funding Inst.: **National Science Foundation**
 Awarded by: Texas Tech University (Lubbock, Texas)
- 2002 **Invited Plenary Speaker**
 Conference: *Mini Conference on Spectral Geometry and Related Topics*, Indianapolis, Indiana
 Budget: Full Financial Support (travel, lodging, local expenses)
 Funding Inst.: **National Science Foundation**
 Awarded by: Indiana University-Purdue University at Indianapolis (Indianapolis, Indiana)

- 2001
Invited Keynote Lecturer
 Conference: International Conference “*Quantum Gravity and Spectral Geometry*”
 Budget: Full Financial Support (travel, lodging, local expenses)
 Funding Inst.: **Istituto Italiano per gli Studi Filosofici and Azienda Autonoma Soggiorno e Turismo di Napoli**
 Awarded by: Istituto Nazionale di Fisica Nucleare and Universita degli Studi di Napoli “Federico II” (Naples, Italy)
- 2001
General Member
 Program: “*Spectral Invariants – Analytic and Geometric Aspects*” and the International Conference “*Geometric Aspects of Spectral Theory*”
 Duration: 1 month
 Budget: \$2,384
 Funding Inst. **National Science Foundation**
 Awarded by: **Mathematical Sciences Research Institute** (Berkeley, California)
- 2000
NSF Block Travel Grant DMS-9988119
 Conference: to attend *XIII International Congress on Mathematical Physics*, London, UK
 Budget: \$1,789
 Funding Inst.: **National Science Foundation**
 Awarded by: University of Arizona (Tucson, Arizona)
- 2000
Research Summer Grant
 Duration: 2 months
 Budget: \$10,060
 Funding Inst.: **New Mexico Institute of Mining and Technology** (Socorro, New Mexico)
- 1994–2000
Grants to attend numerous conferences in USA, UK, Italy, Germany, France, Canada and Greece (see list of conferences)
 Budget: travel, accomodation and registration expenses
 Funding Inst. : Organizing Committees of the Conferences
- 1996–1998; 1999
Co-Principal Investigator
 Project: “*Asymptotic methods for the calculation of the heat kernel and the associate constructions in quantum field theory and differential geometry*”
 Duration: 2 years
 Budget: One full-time Research Scientist position, travel and other expenses
 Funding Inst.: **German Research Foundation (DFG)** (Bonn, Germany)
- 1991–1993
Principal Investigator
 Project: “*New covariant methods for calculating the effective action in quantum field theory and quantum gravity*”
 Duration: 2 years
 Budget: One full-time Research Scientist position
 Funding Inst.: **Russian Ministry of Science and Higher Education** (Moscow, Russia)

Grants (Not Funded)

- 2004
Principal Investigator
Proposal *Noncommutative Gravity and Matrix Geometry*
Duration: 3 years
Budget: \$203,208
Funding Inst.: **US Department of Energy**, Office of Science, Program: “High Energy Physics”
- 2003
Principal Investigator
Proposal *Noncommutative Deformation of General Relativity*
Duration: 3 years
Budget: \$183,838
Funding Inst.: **National Science Foundation**, Directorate for Mathematical and Physical Sciences, Division of Physics, Program: “Gravitational Physics”
- 2002
Principal Investigator
Proposal *Heat Kernel Asymptotics*
Duration: 3 years
Budget: \$170,747
Funding Inst.: **National Science Foundation**, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, Program: “Geometric Analysis”
- 2001
Principal Investigator
Proposal *Heat Kernel Asymptotics in Mathematical Physics and Differential Geometry*
Duration: 3 years
Budget: \$187,780
Funding Inst.: **National Science Foundation**, Directorate for Mathematical and Physical Sciences, Division of Mathematical Sciences, Program: “Geometric Analysis”

Summary of Research

The main part of my research is devoted to the study of spectral asymptotics of elliptic partial differential operators via heat kernel methods and to the application of these methods to various problems of spectral geometry, mathematical physics, quantum field theory and quantum gravity. The main results are:

1. A new manifestly covariant algorithm for calculation of the off-diagonal local heat kernel coefficients for Laplace type differential operators. Explicit expression for the local heat kernel coefficient a_4 .
2. Leading derivative terms (quadratic in curvatures) in all global heat invariants for Laplace type operators on manifolds without boundary.
3. A new algebraic method for calculation of the local heat kernel diagonal for a Laplace type operator on arbitrary symmetric spaces and vector bundles with parallel curvature (covariantly constant curvatures) and slight perturbations thereof. In particular, calculation of all heat invariants in arbitrary symmetric space.
4. Asymptotic expansion of Green functions of higher-order operators near the diagonal.
5. Improved algorithms and explicit expressions for all off-diagonal local heat kernel coefficients for a matrix Laplace type operator in one dimension. A new explicit expression for the whole Korteweg-de Vries hierarchy.
6. A new method for calculation of the local heat kernel asymptotic expansion for non-Laplace type operators. Explicit expression for the global heat invariant A_1 for non-Laplace type operators on manifolds without boundary. A representation-theoretic analysis of the leading symbols of non-Laplace type natural operators.
7. A new method for calculation of global heat invariants for Laplace type operator on manifolds with boundary. Analysis of the oblique boundary value problem (when the boundary operator includes tangential derivatives) for Laplace type operator on manifolds with boundary and explicit calculation of the leading heat invariant A_1 . Construction of global parametrix for Zarembo boundary value problem (with discontinuous boundary conditions, which include Dirichlet conditions on one part of the boundary and Neumann ones on another part), and explicit calculation of leading parametrix and the leading non-trivial global heat kernel coefficient A_1 .
8. Analysis of ellipticity of gauge invariant boundary value problems in gauge field theories and quantum gravity. It is shown that the gauge invariant oblique boundary value problem in are strongly elliptic it is not strongly elliptic in General Relativity.
9. Calculation of the low-energy effective action and analysis of stability of the vacuum in the Yang-Mills theory with arbitrary compact simple gauge group for an arbitrary covariantly constant Savvidy type chromomagnetic background with multiple independent color components and multiple "magnetic fields" in each color component. Discovery of a nonperturbative stable vacuum in dimensions $n = 8 + 8k$.
10. Analysis of the ultraviolet behavior of higher-derivative quantum gravity with quadratic lagrangian of general type. Correction of an error in calculations of previous authors. Discovery of the fact that the conformal coupling is not asymptotically free in the 'physical' region of coupling constants.
11. Construction of a consistent nonlocal theory of massless higher spin fields in arbitrary curved background spacetime.
12. Development of a non-commutative deformation of Riemannian geometry and a noncommutative deformation of General Relativity (gravitational chromodynamics).

SERVICE

Professional Service

• Referee of the Journals

- Proceedings of the American Mathematical Society, (American Mathematical Society, USA)
- Contemporary Series of the American Mathematical Society (American Mathematical Society, USA)
- International Journal of Geometric Methods in Modern Physics (World Scientific, Singapore)
- Journal of Geometry and Physics, (Elsevier, Netherlands),
- Acta Mathematicae Applicatae Sinica (Chinese Mathematical Society, China)
- Reviews in Mathematical Physics, (World Scientific, Singapore),
- Applicable Analysis, (Taylor & Francis, UK)
- Journal of Physics A: Mathematical and General, (Institute of Physics, UK),
- Journal of Physics G: Nuclear and Particle Physics, (Institute of Physics, UK),
- Classical and Quantum Gravity, (Institute of Physics, UK),
- Physica Scripta, (Royal Swedish Academy of Sciences, Sweden).
- Central European Journal of Mathematics, (Springer, Germany)
- Journal of High Energy Physics, (Institute of Physics Publishing, UK)

• Reviewer of the Journal

- Mathematical Reviews, (American Mathematical Society, USA)

• Reviewer of Books and Book Proposals for

- CRC Press (USA)

• Reviewer of Grant Proposals for

- National Science Foundation (NSF) Division of Mathematical Sciences, Program in Geometric Analysis,
- National Science Foundation (NSF), Division of Mathematical Sciences, Program in Applied mathematics,
- National Science Foundation (NSF), Division of Physics, Program in Elementary Particle Physics
- U.S. Civilian Research & Development Foundation, Cooperative Grants Program

- **Memberships**

- American Mathematical Society,
- American Physical Society,
- International Association of Mathematical Physics,
- Sigma Xi Research Society (**Treasurer** of the New Mexico Tech Chapter).

- **Conferences**

- **Organizer** of professional conferences and **Chair** of many sessions at numerous conferences.

TEACHING

Courses taught at New Mexico Tech

No	Course	Level	Credits
MATH 104 Semesters:	<i>Trigonometry</i> Fall 2003 (course supervision)	freshman	3
MATH 131 Semesters:	<i>Calculus and Analytic Geometry I</i> Fall 1999	freshman	3
MATH 132 Semesters:	<i>Calculus and Analytic Geometry II</i> Spring 2000	freshman	4
MATH 231 Semesters:	<i>Calculus and Analytic Geometry III</i> Summer 2003	sophomore	4
MATH 332 Semesters:	<i>Vector Analysis</i> Summer 2005, Spring 2004, Fall 2002, Spring 2002, Summer 2001, Spring 2001, Spring 2000	junior	3
MATH 335 Semesters	<i>Applied Analysis I</i> Summer 2004, Summer 2003, Spring 2003, Spring 2002, Summer 2001, Fall 2000	junior	3
MATH 335L Semesters:	<i>Applied Analysis I Lab</i> Spring 2002, Fall 2000	junior	1
MATH 352 Semesters:	<i>Basic Concepts of Mathematics</i> Summer 2006, Spring 2006, Summer 2005, Spring 2005, Summer 2004	junior	3
MATH 372 Semesters:	<i>Basic Concepts of Analysis</i> Fall 2005, Fall 2004, Fall 2003, Fall 2002, Fall 2001, Fall 2000, Fall 1999	junior	3
MATH 401 Semesters:	<i>Putnam Competition</i> Fall 1999	senior	1
MATH 435 Semesters:	<i>Complex Analysis</i> Fall 2005, Fall 2003, Fall 2002, Fall 2001 (directed study)	senior	3

No	Course	Level	Credits
MATH 442 Semesters:	<i>Introduction to Differential Geometry</i> Fall 2005, Spring 2004, Spring 2002, Spring 2000	senior	3
MATH 454 Semesters:	<i>Linear Algebra</i> Summer 2006, Spring 2003	senior	3
MATH 471 Semesters:	<i>Introduction to Real Analysis</i> Spring 2003	senior	3
MATH 491 Semesters:	<i>Topics in Classical and Quantum Gravity</i> Summer 2004 (directed study)	senior	3
MATH 500 Semesters:	<i>Directed Research</i> Fall 2005)	graduate	3
MATH 501 Semesters:	<i>Professional Development Seminar</i> Fall 2001, Fall 2000	graduate	3
MATH 502 Semesters:	<i>Professional Development Seminar</i> Spring 2002, Spring 2001	graduate	3
MATH 535 Semesters:	<i>Methods of Mathematical Physics</i> Fall 2004, Fall 2000	graduate	3
MATH 536 Semesters:	<i>Methods of Mathematical Physics</i> Spring 2005, Spring 2001	graduate	3
MATH 581 Semesters:	<i>Advanced Topics in Differential Geometry</i> Spring 2006	graduate	3
MATH 581 Semesters:	<i>Introduction to Quantum Field Theory</i> Spring 2004 (3 cr), Fall 2003 (3 cr), Fall 2001 (directed study, 3 cr), Summer 2001 (directed study, 4 cr), Spring 2001 (directed study, 2 cr)	graduate	varies
MATH 581 Semesters:	<i>Quantum Field Theory in Curved Spacetime</i> Spring 2002 (directed study, 2 cr)	graduate	varies
MATH 591 Semesters:	<i>Thesis</i> Summer 2005 (6 cr), Spring 2005 (9cr), Fall 2004 (3 cr), Summer 2004 (6 cr)	graduate	varies
PHYS 500 Semesters:	<i>Topics in Quantum Field Theory</i> (directed research) Fall 2003 (12cr), Summer 2003 (6 cr), Spring 2003 (4 cr), Fall 2002 (8 cr), Summer 2002 (6 cr)	graduate	varies
PHYS 590 Semesters:	<i>Independent Study</i> Spring 2006 (2cr), Fall 2005 (8 cr)	graduate	varies

Courses taught at Other Schools

Course	Level	Credits
The University of Iowa (Iowa City, Iowa)		
<i>Calculus II</i> Semesters: Spring 1999, Fall 1998	(undergraduate)	3
<i>Engineering Calculus II</i> Semesters: Fall 1998, Spring 1998 (2 Sections)	(undergraduate)	3
<i>Engineering Vector Calculus</i> Semesters: Spring 1998	(undergraduate)	3
University of Greifswald (Greifswald, Germany)		
<i>Quantum Field Theory</i> Semesters: Spring 1996, Fall 1997	(special course)	
University of Naples (Naples, Italy)		
<i>Effective Action in Quantum Field Theory</i> Semesters: Fall 1995	(graduate)	
Moscow State University (Moscow, Russia)		
<i>Theoretical Mechanics</i> Semesters: Fall 1985, Spring 1986	(junior)	

Graduate Students

Date	Name	Status	Area	Degree Sought
since 2003	Andrey Novoseltsev	current	Applied Mathematics	MSc (2005)
	Thesis: <i>Spectral Geometry of Riemannian Submanifolds</i>			
2000-2003	William Oxford	former	Mathematical Physics	PhD
since 2005	Samuel Collopy	current	Mathematical Physics	MSc (2007)
since 2005	Guglielmo Fucci	current	Mathematical Physics	PhD (2010)
since 2006	David McMahon	prospective	Mathematical Physics	PhD (2011)
