

# Sergiu MOROIANU

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## Contact

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## Research interests

Index theory, pseudodifferential calculus on singular spaces, hyperbolic manifolds, spectral and geometric zeta functions, Einstein manifolds.

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## Diplomas

2013 Abilitare, IMAR.

2010 Qualification à la fonction de Professeur des universités (France).

2004 Habilitation à diriger des recherches, Université Paul Sabatier, Toulouse, France.

1999 PhD in Mathematics, dissertation: *Residue functionals on the algebra of adiabatic pseudo-differential operators*, MIT, USA.

1996 Licențiat în matematică, Universitatea București, România.

1994 DEA de Mathématiques, École Polytechnique, Palaiseau, France.

1991 Bacalaureat, Liceul de Informatică, București, România.

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## Work experience

- Since Oct. 2013: Professor, IMAR, Bucharest, Romania.
  - Sep. 2021: Visiting Professor, Université de Lorraine, Metz, France.
  - Jul. 2005 – Sep. 2013: Associate professor, IMAR.
  - Apr.–Jun. 2012 Visiting Professor, École Polytechnique, Palaiseau, France.
  - Dec. 2011: Visiting Professor, École Polytechnique, Palaiseau.
  - Apr.–Jun. 2011: CNRS Visiting Professor, École Polytechnique, Palaiseau.
  - Sep.–Nov. 2010: CNRS Visiting Professor, École Normale Supérieure, France.
  - Apr. 2006 – Oct. 2008: Director, SNSB Mathematics department.
  - Oct. 2007 Visiting Assistant Professor, Université Paul Sabatier, Toulouse, France.
  - Sep. 2004 – July 2005: Assistant professor, IMAR.
  - Oct. 2002 – Sep. 2004: Post-doc, Université Paul Sabatier, Toulouse.
  - Oct. 2001 – Sep. 2002: Post-doc, Universität Hamburg, Germany.
  - Aug. 1999 – Sep. 2001: Researcher, IMAR.
  - Sep. 1994 – Jul. 1999: Teaching Assistant, MIT, USA.
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## Publications

- (1) *Fredholm Theory for degenerate pseudodifferential operators on manifolds with fibered boundaries*, (with Robert Lauter), *Comm. Partial Diff. Equat.* **26** (2001), 233–285.
- (2) *Homology of pseudo-differential operators on manifolds with fibered boundaries*, (with Robert Lauter), *J. Reine Angew. Math.* **547** (2002), 207–234.
- (3) *The index of cusp operators on manifolds with corners*, (with Robert Lauter), *Ann. Global Anal. Geom.* **21** (2002), 31–49.
- (4) *Sur la limite adiabatique des fonctions  $\eta$  et  $\zeta$* , *Comptes Rendus Math.* **334** (2002), 131–134.
- (5) *K-Theory of suspended pseudo-differential operators*, *K-Theory* **28** (2003), 167–181.

- (6) *Homology of pseudodifferential operators on manifolds with fibered cusps*, (with Robert Lauter), T. Am. Mat. Soc. **355** (2003), 3009–3046.
- (7) *Heat Kernel Asymptotics for Roots of Generalized Laplacians*, (with Christian Bär), Int. J. Math. **14** (2003), 397–412.
- (8) *Adiabatic limits of eta and zeta functions of elliptic operators*, Math. Z. **246** (2004), 441–471.
- (9) *Homology of adiabatic pseudo-differential operators*, Nagoya Math. J. **175** (2004), 171–221.
- (10) *An index formula on manifolds with fibered cusp ends*, (with Robert Lauter), J. Geom. Analysis **15** (2005), 261–283.
- (11) *Cusp geometry and the cobordism invariance of the index*, Adv. Math. **194** (2005), 504–519.
- (12) *Gravitational and axial anomalies for generalized Euclidean Taub-NUT metrics* (with Ion Cotăescu and Mihai Vişinescu), J. Phys. A – Math. Gen. **38** (2005), 7005–7019.
- (13) *On the  $L^p$  index of spin Dirac operators on conical manifolds*, (with André Legrand), Studia Math. **177** (2006), 97–112.
- (14) *On Carvalho’s  $K$ -theoretic formulation of the cobordism invariance of the index*, P. Am. Math. Soc. **134** (2006), 3395–3404.
- (15)  *$L^2$ -index of the Dirac operator of generalized Euclidean Taub-NUT metrics* (with Mihai Vişinescu), J. Phys. A - Math. Gen. **39** (2006), 6575–6581.
- (16) *On the structure of quantum permutation groups* (with Teodor Banica), P. Am. Mat. Soc. **135** (2007), 21–29.
- (17) *Fibered cusp versus  $d$ -index theory*, Rendiconti Semin. Math. Padova. **117** (2007), 193–203.
- (18) *The Dirac spectrum on manifolds with gradient conformal vector fields*, (with Andrei Moroianu), J. Funct. Analysis. **253** nr. 1 (2007), 207–219.
- (19) *Weyl laws on open manifolds*, Math. Annalen **340**, nr. 1 (2008), 1–21.
- (20) *Index and homology of pseudodifferential operators on manifolds with boundary* (with Victor Nistor), Perspect. Operat. Algebras Math. Phys. (2008), 123–148.
- (21) *Spectral analysis of magnetic Laplacians on conformally cusp manifolds* (with Sylvain Golénia), Ann. H. Poincaré **9** (2008), 131–179.
- (22) *Adiabatic limit of the eta invariant over cofinite quotients of  $PSL(2, R)$*  (with Paul Loya and Jinsung Park), Compositio Mat. **144** (2008), 1593–1616.
- (23) *Quasi-fuchsian manifolds with particles* (with Jean-Marc Schlenker), J. Differ. Geom. **83** (2009), 75–129.
- (24) *The spectrum of  $k$ -form Schrödinger Laplacians on conformally cusp manifolds* (with Sylvain Golénia), Trans. Amer. Math. Soc. **364** (2012), 1–29.
- (25) *Regularity of the eta function on manifolds with cusps*, (with Paul Loya and Jinsung Park), Math. Zeitschrift **269** (2011), no. 3–4, 955–975.
- (26) *Eta invariant and Selberg Zeta function of odd type over convex co-compact hyperbolic manifolds*, (with Colin Guillarmou and Jinsung Park), Advances in Math. **225** (2010), no. 5, 2464–2516.
- (27) *The Dirac operator on generalized Taub-NUT spaces*, (with Andrei Moroianu), Commun. Math. Phys. **305** (2011), 641–656.
- (28) *On the Singularities of the Zeta and Eta functions of an Elliptic Operator*, (with Paul Loya and Raphael Ponge), Int. J. Math. **23**, No. 6 (2012), 1250020.
- (29) *Bergman and Calderón projectors for Dirac operators*, (with Colin Guillarmou and Jinsung Park), J. Geom. Analysis **24**, no. 1 (2014), 298–336.

- (30) *Chern-Simons line bundle on Teichmüller space*, (with Colin Guillarmou), *Geometry & Topology* **18** (2014), 327–377.
- (31) *The Cauchy problem for Einstein metrics and parallel spinors*, (with Bernd Ammann and Andrei Moroianu), *Commun. Math. Phys.* **320**, 173–198 (2013).
- (32) *Ricci surfaces*, (with Andrei Moroianu), *Ann. Sc. Norm. Super. Pisa Cl. Sci.* **14**, no. 4 (2015), 1093–1118.
- (33) *The renormalized volume and uniformisation of conformal structures*, (with Colin Guillarmou and Jean-Marc Schlenker), *J. Math. Jussieu* **17**, no. 4, 853–912 (2018).
- (34) *Positivity of the renormalized volume of almost-Fuchsian hyperbolic 3-manifolds* (with Corina Ciobotaru), *Proc. AMS.* **144** (2016), 151–159.
- (35) *A Spinorial Approach to Riemannian and Conformal Geometry* (book in collaboration with Jean-Pierre Bourguignon, Oussama Hijazi, Jean-Louis Milhorat, and Andrei Moroianu, 458 pages), EMS Monographs in Mathematics, 2015.
- (36) *Convexity of the renormalized volume of hyperbolic 3-manifolds*, *Amer. J. Math.* **139** (2017), no. 5, 1379–1394.
- (37) *Renormalized volume on the Teichmüller space of punctured surfaces*, (with Colin Guillarmou and Frédéric Rochon), *Ann. Sc. Norm. Super. Pisa, Cl. Sci.* **17** (2017), 323–384.
- (38) *Boundaries of locally conformally flat manifolds in dimensions  $4k$* , *Indiana University Mathematics Journal* **67** (2018), no. 1, 329–342.
- (39) *The Cotton tensor and Chern-Simons invariants in dimension 3: an introduction*, *Buletinul Academiei de Ştiinţe a Republicii Moldova. Matematica* **78**, no. 2 (2015), 3–20.
- (40) *On pluricanonical locally conformally Kähler manifolds*, (with Andrei Moroianu), *Int. Math. Res. Not.* **2017** (14), 4398–4405 (2017).
- (41) *Locally conformally Kähler manifolds with holomorphic Lee field* (with Andrei Moroianu and Liviu Ornea), *Differential Geom. Appl.* **60**, 33–38 (2018).
- (42) *Odd Pfaffian forms* (with Daniel Cibotaru), *Bull. Brazilian Math. Soc.* **52** (2021), 915–976
- (43) *Higher transgressions of the Pfaffian*, arXiv:2011.06538, *Revista Matemática Iberoamericana* **38**, no. 5 (2022), 1425–1452.
- (44) *Cauchy spinors on 3-manifolds* (with Brice Flamencourt), arXiv:2110.15386, *J. Geom. Analysis* **32**, Article number: 186 (2022).
- (45) *Concentration limit for non-local dissipative convection-diffusion kernels on the hyperbolic space*, (with Maria Del Mar González, Liviu Ignat and Dragoş Manea), arXiv:2302.02624.

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## Courses and talks

- *Courses*:
  - “Riemannian Geometry 1”, Universitatea Bucureşti, 2023–2024.
  - “Complex Analysis and Riemann Surfaces”, Universitatea Bucureşti, 2020–2024.
  - “Pseudodifferential operators and Hodge Theory”, doctoral course, Universitatea Bucureşti, 2021–2022.
  - “Representation theory for finite and compact groups”, Universitatea Bucureşti, 2019–2020.
  - “Riemann Surfaces”, Universitatea Bucureşti, 2019–2020.
  - “ $K$ -theory and pseudodifferential operators”, SNSB, 2018–2019.
  - Mini-course “Lectures on hyperbolic geometry”, University of Iaşi, Oct. 2018.
  - Reading course on the uniformization theorem, SNSB, 2017–2018.
  - “Introduction to de Rham cohomology”, SNSB, 2015–2016.
  - “The Selberg trace formula”, SNSB, 2014–2015.

- “Introduction to Chern-Simons invariants in dimension 3”, doctoral course, University of Bucharest, 2014.
- “Riemann surfaces from the geometric and analytic viewpoint”, SNSB, 2013–2014.
- Reading course on Riemann surfaces, IMAR, 2013.
- “Braid groups and mapping class groups”, SNSB, 2013.
- “Riemann surfaces”, Școala Normală Superioară Bucharest, 2009.
- Mini-course ”Spectral asymptotics for Dirac operators”, Korea Institute of Advanced Studies summer school, 2007.
- ”Hyperbolic manifolds in dimensions 2 and 3”, Școala Normală Superioară Bucharest, 2007 (with Jean-Marc Schlenker).
- “ $K$ -theory and differential operators”, Școala Normală Superioară, 2005.
- “Algebraic Topology”, University of Bucharest, 2005.
- Mini-course “Introduction to Global Analysis”, Instituto Superior Tecnico, Lisbon, Feb. 2002.
- “Differential geometry”, University of Pitești, 2001.
- “Mathematical methods for engineers”, MIT, 1999.
- “Differential equations”, MIT, 1998.
- “Linear Algebra”, MIT, 1997.
- *Conference talks:*
  - *Anderson Localization*, Auffargis, Nov. 2023.
  - *Geometry beyond Riemann: Curvature and Rigidity*, Vienna, Oct. 2023.
  - *Prospects in Geometry and Global Analysis*, Schloss Rauischholzhausen, Aug. 2023.
  - *Arithmetic Quantum Unique Ergodicity*, Cap Ferret, Jun. 2023.
  - *Semiclassical Analysis*, Auffargis, Nov. 2022.
  - *Entropy of semiclassical measures*, Marseille, Jun. 2022.
  - *Semiclassical trace formula*, Paris-Auffargis, Nov. 2021.
  - *SSMR conference XXIII*, Pitești, Oct. 2019.
  - *IMAR 70 conference*, Bucharest, Oct. 2019.
  - *Conference of the Mathematical Society of the Republic of Moldova*, Chișinău, Sept. 2019.
  - *Geometry Day*, AIC University Iași, Sep. 2017.
  - *Geometry and PDE’s*, Timișoara, Jun. 2016.
  - *MITRE 2015*, Chișinău, Jul. 2015.
  - *Géométrie spinorielle et analyse sur les variétés*, Marsilia, Oct. 2014.
  - *CAIM 2013*, Bucharest, Sep. 2013.
  - *150 years Conference of the Science Faculty*, Bucharest, Aug. 2013.
  - *WYRM 3*, Constanța, May 2013.
  - *Conference in honor of Cabiria Andreian-Cazacu*, Bucharest, Feb. 2013.
  - *Analysis and Geometric Singularities*, Oberwolfach, May 2012.
  - *Analysis, Geometry and Surfaces*, Autrans, Jan. 2012.
  - *CAIM 20*, Iași, Sep. 2011.
  - *Microlocal Methods in Math. Physics and Global Analysis*, Tübingen, Jun. 2011.
  - *Analysis, Geometry and Surfaces*, Autrans, Mar. 2011.
  - *Lectures on Spectral invariants and Moduli spaces*, Seoul, Jun. 2010.
  - *IMAR 60 International Conference*, Jun. 2009.
  - *Geometric Applications of Microlocal Analysis*, Luminy, Jun. 2008.
  - *Workshop on Analysis and Geometry*, Hannover, Sep. 2007.
  - *Spectral problems for Dirac and Laplace operators*, Paris, Jan. 2007.

- *Spectral theory and Global Analysis*, Oldenburg, Aug. 2006.
- *PDE's on noncompact and singular manifolds*, Potsdam, Aug. 2006.
- *KIAS Workshop on Spectral Invariants and Related Topics*, Seoul, May 2006.
- *7<sup>th</sup> Intl. Workshop on Differential Geometry and Applications*, Deva, Sept. 2005.
- *Analysis and Geometric Singularities*, Oberwolfach, Aug. 2005.
- *Second joint meeting of AMS, DMV, ÖMV*, Mainz, Jun. 2005.
- *Degenerate PDE's and Singular Geometries*, Potsdam, Aug. 2004.
- *Analyse Géométrique*, CIRM Marseille, March 2004.
- *Operator Algebras, Singularities, Deformation Quantisation*, Potsdam, Mar. 2004.
- *Operator algebras on manifolds with singularities*, Potsdam, Mar. 2003.
- *Journées Nancéiennes de Géométrie*, Nancy, Jan. 2003.
- *Geometric analysis and singular spaces*, Oberwolfach, June 2002.
- *5<sup>th</sup> Intl. Workshop on Diff. Geometry and Applications*, Timișoara, Sept. 2001.
- *Ellipticity and Parabolicity in Analysis and Geometry*, Potsdam, Aug. 2001.
- *Geometric Analysis*, Potsdam, Oct. 2000.
- *L<sup>2</sup>-Methods in Geometry*, Sarasota, Jan. 2000.
- *4<sup>th</sup> Intl. Workshop on Differential Geometry and Applications*, Brașov, Sept. 1999.
- *Operator Algebras and Asymptotics on Manifolds with Singularities*, Warsaw, April 1999.
- *Seminar invited talks*
  - 2023: University of Bucharest.
  - 2021: Metz; Luxembourg.
  - 2020: Kampala.
  - 2018: Nancy.
  - 2016: Fribourg.
  - 2014: IMAR.
  - 2013: University of Bucharest; IMAR.
  - 2012: IHP Paris.
  - 2011: Regensburg; Nantes.
  - 2010: Toulouse; IHP Paris.
  - 2009: Bucharest.
  - 2007: Chișinău; Toulouse.
  - 2006: Toulouse.
  - 2005: Potsdam.
  - 2004: Bucharest.
  - 2003: Ecole Polytechnique; HU Berlin; Ecole Normale Lyon; Clermont-Ferrand.
  - 2002: IST Lisbon; Paris 6.
  - 2001: Paris 11; Mainz.

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## PhD Students

- Cipriana Anghel (graduated 2023)
- Rareș Stan (started 2020)

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## Community work

- Since 2021: member in the Mathematics Committee of the CNCS.
- 2023 Co-organizer of the section on “Algebraic, Complex and Differential Geometry and Topology” of the 10th Congress of Romanian Mathematicians, Pitești.
- 2021 Co-organizer of the workshop “Semiclassical trace formula”, Auffargis, France.

- 2019 Co-organizer of the section on “Algebraic, Complex and Differential Geometry and Topology” of the Ninth Congress of Romanian Mathematicians, Galați.
- 2019 Co-organizer of the Bucharest Conference on Geometry and Physics, Bucharest.
- 2019 Co-organizer of the “Workshop on Riemannian and Kähler Geometry, IMAR Bucharest.
- 2018 Co-organizer of “Topology and Geometry: A conference in memory of Ștefan Papadima (1953–2018)”, București.
- 2016 (May–November) Member of the Mathematics commission CNATDCU of the Ministry of Research.
- 2016 Special Session on Algebra, Geometry and Topology Dedicated to the 150th Anniversary of the Romanian Academy, Constanța.
- 2014 Co-organizer of the “4th Workshop for Young Researchers in Mathematics”, Constanța.
- 2014 Co-organizer of the meeting “Real and Complex Differential Geometry”, University of Bucharest.
- 2011–2012 Member of the Mathematics commission CNATDCU of the Ministry of Research.
- 2007–2011 Co-organizer of three International Workshops on Differential Geometry and its Applications: Cluj-Napoca (2007), Iași (2009) and Constanța (2011).
- 2006–2008 Director of the Mathematics Department of Școala Normală Superioară Bucharest.
- Editor of three proceedings volumes for the International Workshops on Differential Geometry and its applications: Deva 2005, Cluj-Napoca 2007, Iași 2009.
- 2006–2012 Member of the Users Committee SCUC for Zentralblatt Math.

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### Honors and awards

- Premiul Ad Astra pentru “Excelența în cercetare – afiliere în România”, 2014.
- Romanian Academy prize “Simion Stoilow”, 2003 (awarded in 2005).
- National Foundation for Science and Arts prize, 2004.
- International Mathematical Olympiads
  - 1991: first prize (42 pts.).
  - 1990: second prize.

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### Grants

- Principal investigator, Grant PN-III-P4-ID-PCE-2020-0794 “Spectral Methods in Hyperbolic Geometry”, 1118K lei.
- Principal investigator, Grant PN-III-P4-ID-PCE-2016-0330, 850K lei.
- Principal investigator, Grant PNII-TE-0053/2011 “Quantum invariants in hyperbolic geometry”, 2012–2014, 705K lei.
- Principal investigator, Grant PNII-ID-1188/2009 “Geometric and quantum invariants of 3-manifolds and applications”, 2009–2011, 1000K lei.
- Principal investigator, CNRS – Romanian Academy grant, 2006–2007.
- Principal investigator, Marie Curie European reintegration grant MERG-006375, 2004–2005, 40K €.

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### Languages

- Romanian: native.
- English, French: fluent.

- German: advanced.
- Italian, Portuguese, Spanish: beginner.