

## BIOGRAPHICAL SKETCH - Michel L. LAPIDUS

<http://math.ucr.edu/~lapidus>

March 2007

### A. CURRICULUM VITAE

**Citizenship:** U.S.A. (naturalized American since 1988)

#### **Education:**

Ph.D. & Doctorat d'Etat ès Sciences (Mathematics), '*Summa Cum Laude*',  
Université Pierre et Marie Curie (Paris VI), France, 1980 & 1986. Habilitation to Direct Research  
(Paris VI), 1987.

#### **Experience:**

- Professor, University of California, Riverside, 1990-
- Member, Mathematical Sciences Research Institute (MSRI), Berkeley, Spring 1999 and Spring 2001 & Institut Henri Poincaré (IHP), Paris, Spring 2003.
- Member of the Newton Institute for Mathematical Sciences, Cambridge University, UK, (part of) Spring 1999
- Member, Institut des Hautes Etudes Scientifiques (IHES), Bures-sur-Yvette, France, 1994-95 and for several parts of 1995-98
- Visiting Professor, Yale University, New Haven, 1990-91
- Associate Professor, University of Georgia, Athens, 1986-90
- Visiting Assistant Professor, University of Iowa, Iowa City, 1985-86
- Member, Mathematical Sciences Research Institute (MSRI), Berkeley, 1984-85
- Assistant Professor, University of Southern California, Los Angeles, 1980-85
- Research Associate, University of California, Berkeley, 1979-80
- Research Associate, Université Paris VI, France, 1978-80

*Recent Visiting Positions* (over the last five years): Visiting Professor, University of Rome, Italy (five times) and University of Copenhagen, Denmark (four times), as well as Oxford University, England, UK (7/01), Univ. of Paris (VI & VII) and Hebrew Univ. of Jerusalem, Israel.

*Recent Membership in Research Institutes* (Mathematics/Physics/Pluridisc.): Isaac Newton Institute (Cambridge), Max Planck Institute (Dresden & Bonn), IHES (Bures-Sur-Yvette/Paris), MSRI (Berkeley), Fields Institute (Canada), Erwin Schroedinger Institute (Vienna), Feza Gurse National Inst. (Istanbul), Institut Henri Poincaré (IHP, Paris).

#### **Fellowships, Awards and Honors:**

Research Fellowship D.G.R.S.T., Université Paris VI, 1978-80; George Lurcy Fellowship, University of California, Berkeley, 1979-80; My research on "Spectral and Fractal Geometry" was one of the two mathematical works presented by NSF to the "Office of the President" and to the U.S. Congress in the "National Science Foundation 1990 Fiscal Year Budget Proposal to Congress". Award of a university-wide "Creative Research Medal", Univ. of Georgia, Athens, 1989; Recipient of the M. G. Michael Award for Excellence in Research, Univ. of Georgia, Athens, 1989; Honorary Member, Research Board of Advisors, American Biography Institute (ABI), 1997-; Twentieth Century Award for Achievement, International Biographical Institute (IBC), Cambridge, UK, 1998; Outstanding Man of the 20th Century, ABI, 1999; nomin. "100 Geniuses of the 21st

Century" (IBC, 2006). Elected Fellow of the American Association for the Advancement of Science (AAAS), Sept. 2000 [for "*Distinguished Research Contributions to Mathematical Physics and Fractal Geometry*"]; Member, AMS Council, and Associate Secretary of the American Mathematical Society (AMS), Western Section, Feb. 2002-. (Renominated and reconfirmed four times, now through Jan. 2012.) Nominated for membership in the American Academy of Arts and Sciences, 2004-05 &.2006-07.

Discussion in the general scientific press of my (joint) work on the "vibrations of fractal drums" and "the Weyl-Berry conjecture". Please see the articles by Ian Stewart in *Nature* (vol. 333, 5/19/88), Jean-Pierre Fabre in *La Recherche* (vol. 202, 9/88), Barry Cipra in *Science* (vol. 259, 2/12/93), as well as the cover article by Ivars Peterson in *Science News* (vol. 146, No. 12, 9/17/94) and the book by the same author, entitled "*The Jungles of Randomness: A Mathematical Safari*" (Wiley, 1998). Also see the article by Ian Stewart in *New Scientist* (vol. 156, 12/20/97), the article in *La Recherche* (vol. 383, 2/05), and the article by Barry Cipra in *Science* (2/13/09).

### Research Areas:

Mathematical Physics, Functional and Harmonic Analysis, Geometric Analysis, Partial Differential Equations (PDEs), Dynamical Systems, Spectral Geometry, Fractal Geometry; Connections with Number Theory, Arithmetic Geometry and Noncommutative Geometry.

*Current Research Projects:* Mathematical Theory of Feynman Path Integrals; Vibrations of Fractal Drums; Analysis and PDEs On or Off Fractals; Waves and Diffusions in Fractal Media; Origins and Formation of Fractal Structures in Nature; Noncommutative Fractal Geometry; Analogues of Dirac Operators and Geodesics on Self-Similar Fractals and Trees; Fractal Strings and Membranes; Theory of Complex Fractal Dimensions; Analogues in the p-adic and Adelic Realms; Fractal Curvatures and Cohomology; Modular Flows on Moduli Spaces of Fractal Membranes; Noncommutative Flows of Zeros and Zeta Functions; Connections with the Riemann Zeta Function and the Riemann Hypothesis. Ihara Zeta Functions on Infinite Periodic or Self-Similar Graphs.

**Research Grants** (over the last twenty years): National Science Foundation Research Grants, DMS-8703138 (6/87- 6/89), DMS-8904389 (6/89-6/92), DMS-9207098 (7/92-7/96), DMS-9623002 (9/96-8/99), DMS-0070497 (7/00-7/05), and (current) DMS-0707524 (7/07-7/10). (Sole P.I.)

### Selected Invited Talks (over the last five years):

(a) **Plenary Speaker:** Workshop on "*Fractals and Dynamical Systems*" (IMS, Hong Kong, China, 12/00). Conf. "*Fractals in Graz 2001*" (Graz, Austria, 6/01). Conf. on "*Analysis and Probability on Fractals*" (Cornell Univ., Ithaca, 6/02). Internat. Sympos. on "*Analysis, Geometry and Probability: Feynman's Legacy*" (Lisbon, 6/02). Workshop (and Program) on "*Topology in Condensed Matter Physics*" (Max Planck Inst., Dresden, 7/02). Workshop on "*Feynman Integrals and Applications*" (MSRI, Berkeley, 12/02). Sympos. on "*New Geometric Methods in Modern Science*" (Paris, France, 03/02). Internat. Conf. on "*Differential Equations and Asymptotic Theory*" (Wuhan, China, 10/03) \*. (\* = unable to attend due to other duties.) Workshop on "*Mathematics of Schrödinger Operators, with Applications to Path Integrals*" (Goa, India, 12/03)\*. CMLA Annual Analysis Conf. (ENS Cachan, Paris, 5/04). 5th European Conf. on "*Elliptic and Parabolic Problems: A Special Tribute to the Work of Haim Brezis*" (Gaeta, Italy, 6/04). Internat. Conf. on "*Physics of Irregular Systems*" (Brazil, Fortaleza, 8/04) \*. 2nd Conf. on "*Analysis and Probability on Fractals*" (Cornell Univ., Ithaca, 6/05). Internat. Workshop on "*Fractal Analysis*" (Eisenach, Germany, 9/05). Workshop on "*Traces in Geometry, Number Theory and Quantum Fields*" (Max-Planck Inst., Bonn, Germany, 10/05). Conf. on "*Feynman Integrals in Mathematics and Physics*:" (Lincoln, 5/06). EMS School on "*Arithmetic and Geometry Around Quantization*" (Istanbul, Turkey,

6/06). Sympos. on “*Contemporary Problems of Mathematical Analysis and Mathematical Physics*” (Taormina, Italy, 6/06). Internat. Conf. on “*Analysis on Fractals*” (Kyoto, Japan, 9/06) \*. Internat. Conf. on “*Zeta Functions*” (Moscow, Russia, 9/06). Interdisc. Conf on “*Heat Kernels in Mathematics and Physics*” (Ulm, Germany, 11/06)\*. *To take place*: Workshop on “*Geometric Measure Theoretic Approaches to Potential Theory on Fractals and Manifolds*” (Oberwolfach, Germany, 03/07). Conf. on “*Variational and Topological Methods, Applications and Simulations*” (Flagstaff, 05/07). Workshop on “*Analysis on Graphs and Fractals*” (Newton Inst., Cambridge and Cardiff, UK, 5-6/07)

**(b). Invited Speaker, Mini-Symposia/Special Sessions:** Joint Internat. Mtg. AMS/SMF, Special Session on “*Fractal Geometry, Number Theory and Dynamical Systems*” (ENS Lyon, France, 7/01). Joint Internat. Mtg. AMS/SMM, Sp. Session on “*Dynamical Systems, with Emphasis on Geometric Aspects and Symbolic Dynamics*” (Morelia, Mexico, 5/01), featured speaker. AMS Reg. Mtg., Sp. Session on “*Spectral and Inverse Spectral Theories of Schrödinger Operators*” (Bangalore, India, 12/03). Sp. Session on “*Fractals*” (Columbus, 9/01). AMS Annual Mtg., Sp. Session on “*Fractal Geometry and Applications*” (San Diego, 1/02). ICM Satellite Conf. on “*Fractal Geometry and Applications*” (Nanjing, China, 7-8/02). AMS Reg. Mtg., Sp. Session on “*Analytic Number Theory*” (Salt Lake City, 10/02). Joint Internat. Mtg. AMS/Indian Math. Soc., AMS Sp. Sessions on “*Topics in Spectral Geometry*” (Albuquerque, 9/04) and on “*Iterated Functions Systems and Analysis on Fractals*” (Northwestern Univ., Evanston, 9/04). First Joint Mtg. French/Nordic Math. Soc., Sp. Session on “*Spectral Geometry*” (Reykjavik, Iceland, 1/05) \*. ISAAC Sp. Session on “*Elliptic and Parabolic Nonlinear Problems*” (Catania, Italy, 7/05). “*Einstein Century*” Internat. Sympos., Sp. Session on “*Gravitation and Nature of Spacetime*” (Paris, France, 7/05). AMS Sp. Session on “*Fractal Geometry in Analysis, Mathematical Physics, Number Theory and Dynamical Systems*” (San Francisco, 5/06). Conf. on “*Topology*”, Sp. Session on “*Fractals and Tilings*” (GA, 7/06) \* AMS Sp. Session on “*Analysis and Probability on Fractals*” (Storrs, 9/06). *To take place*: German Math. Soc. Annual Meeting, Sp. Session on “*Geometry of Random Fractals*” (Berlin, 3/07)

**(c) Invited Participant:** Research Programs on “*Spectral Invariants*” (MSRI, Berkeley, 3-6/01) and on “*Noncommutative Geometry and K-Theory*” (Inst. Henri Poincaré (IHP), Paris, 3-7/04), and (to take place) on “*Analysis on Graphs and Fractals*” (Newton Inst., Cambridge & Cardiff Univ., UK, 5-6/07).

## B. Assorted Publications: <sup>1</sup>

1. “*The Feynman Integral and Feynman’s Operational Calculus*”, Oxford Mathematical Monographs, Oxford Univ. Press, Oxford and New York, 2000, approx. 800 pp. (precisely, 771+(xviii) pp.), (with G. W. Johnson.) (Paperback edition: 2002, OUP). [Refereed research monograph.]
2. “*Fractal Geometry and Number Theory: Complex dimensions of fractal strings and zeros of zeta functions*”, Birkhäuser, Boston, 2000, 268+(xii) pp., (with M. van Frankenhuysen). [Refereed research monograph.]
3. “*A Koch Tube Formula for the Koch Snowflake Curve, with Applications to Complex Dimensions*”, J. London Math. Soc. No.2, **74**(2006), 397-414, (with E. P. J. Pearse).
4. “*Fractal Geometry, Complex Dimensions and Zeta Functions: Geometry and spectra of fractal strings*”, Springer Monographs in Mathematics, Springer-Verlag, New York, 2006, approx. 500 pp. (precisely, 460+(xxiv) pp.), (with M. van Frankenhuysen). [Refereed research monograph.]
5. “*In Search of the Riemann Zeros: Strings, fractal membranes and noncommutative spacetimes*”, Amer. Math. Soc., Providence, R I, 2008, 600 pp. (precisely, 558+(xxix)

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<sup>1</sup> This is an excerpt from a publication list of 94 entries, of which 83 have appeared or are in press.

pp.). [Refereed research monographs.] January, 2008. ISBN-10: 0-8218-422-5. US Library of Congress Classification: QA333.L37 2007].

6. "*Generalized Dyson Series, Generalized Feynman Diagrams, the Feynman Integral and Feynman's Operational Calculus*", *Memoirs of the American Mathematical Society* No. 351, **62**(1986), pp. 1-78, (with G. W. Johnson).
7. "*Remainder Estimates for the Asymptotics of Elliptic Eigenvalue Problems with Indefinite Weights*", *Archives for Rational Mechanics & Analysis* **98**(1987), pp. 329-356, (with J. Fleckinger).
8. "*Counterexamples to the Modified Weyl-Berry Conjecture*", *Mathematical Proceedings of the Cambridge Philosophical Society*, **119**(1996), pp. 167-178, (with C. Pomerance).
9. "*Towards a Noncommutative Fractal Geometry? Laplacians and Volume Measures on Fractals*", *Contemporary Mathematics, American Mathematical Society* **208**(1997), pp. 211-252.
10. "*Self-Similarity of Volume Measures for Laplacians on P.C.F. Self-Similar Fractals*", *Communications in Mathematical Physics* **217**(2001), pp. 165-180, (with J. Kigami).

**D. Four Examples of Synergistic Activities:** (i) Associate Secretary, Amer. Math. Soc. (in charge of all the scientific meetings in the Western Section and of some of the national and international meetings of the AMS (including the forthcoming Joint National Meeting in San Diego, 1/08). (ii) Organizer of many research conferences in Mathematical Physics, Analysis, Dynamical Systems, Spectral Geometry or Fractal Geometry. (iii) Editor of several collective volumes at the interface of the above areas. (iv) Creation of a number of (Honors, undergraduate or graduate) courses and seminars in those areas as well as in Mathematical Biology.

**E. Recent and Current Ph.D. Students and Postdocs:** Elie Atallah\*, Vicente Alvarez, Scot Childress, Britta Daudert, Cheryl Griffith, Christina He, Hafedh Herichi\*, Nishu Lal\*, Hung (Tim) Lu, Michael Maroun\*, Robert Niemeyer\*, Jason Payne\*, Erin Pearse, John Rock, Jonathan Sarhad\*. **NSF Postdocs:** Alexander Teplyaev (8/00-12/02). Michael Anshelevich (9/02-8/04). Other Postdoc: Steffen Winter (07). **Recent VAPs:** Mark Comerford (02-04), Cristina Ivan/Antonescu (04-05), Dana Clahane (05-08), Aviv Censor (07-09).