

# Curriculum vitæ

Charles L. Epstein  
Professor of Mathematics  
Professor of Radiology in Mathematics

November 21, 2008

## 1 General information

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## 2 Education

1974–78 MIT, Department of Mathematics  
SB, February 1978  
1978–79 MIT, Graduate Department of Mathematics  
1979–83 Courant Institute, NYU  
MS, June 1981  
PhD, June 1983  
Thesis title: Spectral Theory of Geometrically Periodic Hyperbolic 3–manifolds  
Doctoral: Professor Peter D. Lax  
Advisor  
Postdoctoral: Professor William P. Thurston  
Advisor

## 3 Academic Positions

2008– Member, Graduate group in Genomics and Computational Biology,  
The School of Medicine, University of Pennsylvania  
2008– Graduate Group Chair in Applied Mathematics and Computational Science,

University of Pennsylvania  
 2007– Member, Institute for Medicine and Engineering, University of Pennsylvania  
 2005– Professor of Radiology in Mathematics, Department of Radiology,  
 School of Medicine, University of Pennsylvania  
 2002–2007 Francis J. Carey Term Chair in Mathematics, University of Pennsylvania  
 2001– Member, Graduate group in Bioengineering, University of Pennsylvania  
 1993– Professor, Department of Mathematics, University of Pennsylvania  
 1989–93 Associate Professor, Department of Mathematics, University of Pennsylvania  
 1985–89 Assistant Professor, Department of Mathematics, University of Pennsylvania  
 1983–86 Instructor and NSF postdoctoral fellow, Department of Mathematics, Princeton University

## 4 Temporary Positions

June 1985	Member of S.F.B. 170, Math. Inst., Göttingen, Germany
Spring 1986	Member of M.S.R.I., Berkeley, CA
1989–90	Visiting Scholar, Department of Mathematics, MIT
June 1990	Member of S.F.B. 170, Math. Inst., Göttingen, Germany
1991–5	Associate Editor, <i>Bulletin of the A.M.S.</i>
1994–5	Member of I.H.E.S., Bures-sur-Yvette, France.
February 1995	Member of S.F.B. 170, Math. Inst., Göttingen, Germany
June, 1995	Visitor, Forschungsinstitut für Mathematik ETH, Zürich.
November, 1995	Member of M.S.R.I., Berkeley.
May, 1996	Visiting Lecturer, Inst. für Mathematik Univ. Bern.
May, 1997	Visiting Prof., University of Paris, VI.
October, 1997	Visiting Member, Fields Institute, Toronto.
June, 1999	Visiting Prof., University of Paris, VI.
July, 1999	Visiting Prof., C.I.R.M., Marseilles.
January, 2001–June, 2007	External Editor, <i>Jour. Inst. Math. Jussieu.</i>
September, 2001–April, 2002	Visitor, Institute for Advanced Studies, Princeton, NJ.
July, 2002–June, 2003	Visiting Prof., Department of Radiology, HUP.
April, 2004–	Series editor, <i>Cornerstones in Mathematics</i> , Birkhäuser.
June, 2005	Visiting Prof., University of Paris, VI.
January, 2007–	Member of the editorial board of <i>Inverse Problems</i> .
February, 2008–	Member-at-Large of the American Mathematical Society Committee on the Profession.

## 5 Peer Reviewed Publications

### 5.1 Journal Articles

- [1] Charles L. Epstein, *Research announcement of Spectral theory of geometrically periodic hyperbolic three manifolds*, C. R. Acad. Sc. Paris Serie I 300(1985), pages 431–434.

- [2] —, James Lee Hafner and Peter Sarnak, *Zeros of L-functions attached to Maass forms*, Math. Zeit., 190(1985), pages 113–128.
- [3] Charles L. Epstein, *Incoming and outgoing waves*, J. of Diff. Eq., 60(1985), pages 337–362.
- [4] —, *Orthogonally integrable line fields*, Comm. in Pure and Applied Math., 1985(38), pages 599–608.
- [5] —, *Visibility of the Martin Boundary for quasiconformal metrics on  $D_1$* , Contemporary Mathematics, 1986(51), pages 45–50.
- [6] —, *The hyperbolic Gauss map and quasiconformal reflections*, J. reine angew. Math., 1986(372), pages 96–135.
- [7] —, *The asymptotic boundary of a surface imbedded in  $\mathbb{H}^3$* , Michigan Math. J., 1987(34), pages 227–239.
- [8] — and M. I. Weinstein, *A stable manifold theorem for the curve shortening equation*, Comm. Pure and Applied Math., 1987(40), pages 119–139.
- [9] Charles L. Epstein, *Univalence criteria and surfaces in hyperbolic space*, J. reine angew. Math., 1987(380), pages 196–214.
- [10] —, *Asymptotics for closed geodesics in a homology class, the finite volume case*, Duke Math. J., 1987(55), pages 717–757.
- [11] — and D. M. Burns Jr. , *A global invariant for three dimensional CR-manifolds*, Invent. math., 1988(92), pages 333–348.
- [12] Charles L. Epstein, *Positive harmonic functions on Abelian covers*, J. of Funct. Anal., 1989(82), pages 303–315.
- [13] — and D. M. Burns Jr. , *Characteristic numbers of bounded domains*, Acta Math., 1990(164), pages 29–71.
- [14] Charles L. Epstein, Troels Jorgensen and Curt McMullen, *Multiple intersections on negatively curved surfaces*, J. Diff Geo., 33(1991), pages 253–261.
- [15] Charles L. Epstein, R. B. Melrose and Gerardo Mendoza, *Resolvent of the Laplacian on strictly pseudoconvex domains*, Acta Math. , 167(1991), pages 1–106.
- [16] Charles L. Epstein and D. M. Burns, Jr., *Embeddability for three dimensional CR-manifolds*, Jour. of A. M. S., 3(1991), pages 809–841.
- [17] Charles L. Epstein, *Some explicit trace formulae* , Advanced Studies in Pure Mathematics, Zeta Functions in Geometry, 21(1992), pages 127–140.
- [18] —, *CR-structures on three dimensional circle bundles*, Inv. Math. 1992(109), pages 351–403.

- [19] — and Bruce Kleiner, *Spherical means in annular regions*, C.P.A.M., 44 (1993), pages 441-451.
- [20] Charles L. Epstein and John Bland, *Embeddable CR-structures and Deformations of Pseudoconvex Surfaces, part 1: Formal Deformations*, Jour. of Alg. Geo., 5(1996), pages 277-368.
- [21] Charles L. Epstein and John Bland, *Embeddable CR-structures and Deformations of Pseudoconvex Surfaces*, AMS/IP Studies in Advanced Mathematics, 5(1997), pages 1-27.
- [22] Charles L. Epstein, *A relative index for embeddable CR-structures, I*, Annals of Math., 147(1998), pages 1-59. *Erratum: A relative index for embeddable CR-structures, I*, Annals of Math., 154(2001), 223-226.
- [23] —, *A relative index for embeddable CR-structures, II*, Annals of Math., 147(1998), pages 61-91.
- [24] —, *Appendix A to “Divisor of the Selberg Zeta Function for Kleinian Groups, I. Even Dimensions” by S.J. Patterson and Peter A. Perry*, Duke Journal, 106 (2001), pages 370-379.
- [25] —, *Deformations of singularities, complex manifolds and CR-structures*, in Advanced Studies in Pure Mathematics, CR-Geometry and Overdetermined Systems., Math. Soc. of Japan, 25(1997), pages 85-109.
- [26] — and Gennadi Henkin, *Extension of CR-structures for three-dimensional pseudoconcave manifolds*, Contemporary Mathematics, 205(1997), pages 51-67.
- [27] Charles L. Epstein and Gennadi Henkin, *Stability of embeddings for pseudoconcave surfaces and their boundaries*, Acta Math., 185(2000), pages 161-237.
- [28] Charles L. Epstein and R.B. Melrose, *Contact degree and the Index of Fourier Integral Operators*, MRL, 5(1998), pages 363-381.
- [29] Charles L. Epstein and G. Henkin, *Two Lemmas in Local Analytic Geometry*, Contemporary Mathematics, 251(2000), pages 189-195.
- [30] Charles L. Epstein and G. Henkin, *Embeddings for 3-dimensional CR-manifolds*, Progress in Mathematics, 188(2000) Birkhäuser Verlag, pages 223-236.
- [31] Charles L. Epstein and Yong Ouyang, *Deformations of open Stein manifolds*, Comm. in PDE, 25(2000), pages 2333-2351.
- [32] Charles L. Epstein and Gennadi Henkin, *Can a good manifold come to a bad end?*, Proceedings of Steklov Institute, 235(2001), pages 64-86.
- [33] Charles L. Epstein, *Geometric bounds on the relative index*, JIMJ, 1(2002), pages 441-465.

- [34] —, *Minimum energy pulse synthesis via the inverse scattering transform*, Jour. Magn. Reson., 167(2003), pages 185-210
- [35] —, *Introduction to Magnetic Resonance Imaging for Mathematicians*, Ann. Inst. Four., 54(2004), 1697-1716.
- [36] —, *Magnetic Resonance Imaging in Inhomogeneous Fields*, Inverse Problems, 20(2004), 753-780.
- [37] —, *Convergence of the Neumann series in higher norms*, Comm. in PDE, 29(2004), 1429-1436.
- [38] —, *How well does the finite Fourier transform approximate the Fourier transform?*, Comm. Pure and App. Math., 58(2005), 1421-1435.
- [39] —, *Subelliptic  $Spin_C$  Dirac operators, I*, Annals of Math, 166(2007), 225-256.
- [40] —, *Subelliptic  $Spin_C$  Dirac operators, II*, Annals of Math 166(2007), 723-777.
- [41] —, *Subelliptic  $Spin_C$  Dirac operators, III: The Atiyah-Weinstein conjecture*, Annals of Math, 168(2008), 299-365.
- [42] Jeremy Magland and Charles L. Epstein, *Exact half pulse synthesis via the Inverse Scattering Transform*, Jour. Magn. Reson., 171/2(2004), 305-313.
- [43] Jeremy Magland and Charles L. Epstein, *Practical pulse synthesis via the Discrete Inverse Scattering Transform*, Jour. Magn. Reson., 172(2005), 63-78.
- [44] — and Jeremy Magland, *A novel technique for imaging with inhomogeneous fields*, Jour. Magn. Reson., 183(2006), 195-204.
- [45] Charles L. Epstein, *Anderson Localization, Non-linearity and Stable Genetic Diversity*, Jour. Stat. Phys., 124(2006), 25-46.
- [46] — and John Schotland, *The Bad Truth about Laplace's Transform*, SIAM Review, 50(2008), 504-520.
- [47] Charles L. Epstein, *What is a Bad End?*, The Notices of the AMS, 53(2006), 1028-1029.
- [48] —, *Subelliptic boundary conditions for  $Spin_C$ -Dirac operators, gluing, relative indices and tame Fredholm pairs*, Proc. of Nat. Acad. Sci. of the USA, 103(2006), 15364-15369.
- [49] Tim A.J. Hopper, Branimir Vasilic, James M. Pope, Catherine E. Jones, Charles L. Epstein, Hee Kwon Song, Felix W. Wehrli, *Experimental and computational analyses of the effects of slice distortion from a metallic sphere in an MRI phantom*. Magnetic Resonance Imaging 24 (2006) 1077-1085.
- [50] Brian B. Avants, H. Hurt, J. Giannetta, C.L. Epstein, D. Shera, H. Rao, J. Wang, J., and J.C. Gee. *Effects of heavy in utero cocaine exposure on adolescent caudate morphology*. Pediatr Neurol. 37, 4 (Oct 2007), 275-279.

- [51] Brian B. Avants, C. L. Epstein, M. Grossman, and J. C. Gee, *Symmetric Diffeomorphic Image Registration with Cross-Correlation: Evaluating Automated Labeling of Elderly and Neurodegenerative Brain*, *Med Image Anal.* 12, 1 (Feb 2008), 26-41.
- [52] Charles L. Epstein, *Cobordism, Relative Indices, and Stein Fillings*, to appear *Jour. of Geo. Anal.*, 2008, 28 pages.
- [53] Charles L. Epstein, *The Spectrum and Pseudospectrum of Non-Self Adjoint Pseudodifferential Operators*, to appear, *Pure and Applied Math Quarterly*, 2008, 12 pages.
- [54] Charles L. Epstein and Leslie Greengard, *Debye Sources and the Numerical Solution of the Time Harmonic Maxwell Equations*, submitted, 71 pages, 2008.

## 5.2 Refereed Books or Book Chapters

- [1] Charles L. Epstein, *The spectral theory of geometrically periodic hyperbolic 3-manifolds*, *Memoirs of the American Mathematical Society*, no. 335 58(1985), pages 1–161.
- [2] — and Michael Gage, *The curve shortening flow*, in *Math. Sci. Research Inst. Publications, Wave Motion, Theory and Modeling*, 1987 pages 15–59.
- [3] Charles L. Epstein, *Introduction to the Mathematics of Medical Imaging*, Prentice Hall, Saddle River, NJ, 2003, ix+739 pages.
- [4] —, *Lectures on indices and relative indices on contact and CR-manifolds*, in *Woods Hole Mathematics*, edited by Nils Tongring and R.C. Penner, World Scientific Pub., Singapore, 2004, pp 27–93.
- [5] Charles L. Epstein and Felix W. Wehrli, *Magnetic Resonance Imaging*, in *Encyclopedia of Mathematical Physics*, 367–375, Elsevier, 2006.
- [6] Charles L. Epstein, *Pseudodifferential Methods for Boundary Value Problems*, in *Pseudo-Differential Operators: Partial Differential Equations and Time-Frequency Analysis*, Luigi Rodino, Bert-Wolfgang Schulze, and M. W. Wong, editors. Fields Institute Communications, volume 52. AMS, Providence, RI. 414pp., 2007.
- [7] Charles L. Epstein, *Introduction to the Mathematics of Medical Imaging, 2nd Ed.*, SIAM, Philadelphia, PA, 2008, xxxiii+761 pages.

## 5.3 Refereed Meeting Abstracts

- [1] Jeremy Magland and Charles L. Epstein, *Equiripple RF-pulse pulse design using Inverse Scattering Theory*, *Proceedings of the ISMRM annual meeting*, 2005.
- [2] Charles L. Epstein and Jeremy Magland, *Slant slice imaging in inhomogeneous fields*, *Proceedings of the ISMRM annual meeting*, 2006.

- [3] B. B. Avants, C.L. Epstein, and J.C. Gee *Symmetric shape averaging in the diffeomorphic space*. In IEEE Intl Symp on Biomed Imaging: Macro to Nano (2007), pp. 636-639.
- [4] B. B. Avants, H. Hurt, J. Giannetta, C.L. Epstein, D. Shera, J. Wang, and J. C. Gee, *Analyzing effects of intra-uterine cocaine exposure on adolescent brain structure with symmetric diffeomorphisms*. In IEEE Comp Soc Conf on Comp Vis and Pattern Recognition (2006), H. Hurt, Ed., pp. 94-94.
- [5] B. B. Avants, C.L. Epstein, and J.C. Gee *Geodesic image normalization and temporal parameterization in the space of diffeomorphisms*. In Medical Imaging and Augmented Reality (2006), vol. 4091 of Lecture Notes in Computer Science, Springer Berlin / Heidelberg, pp. 9-16.
- [6] B. B. Avants, C.L. Epstein, and J.C. Gee, *Geodesic image interpolation: Parameterizing and interpolating spatiotemporal images*. In Variational, Geometric, and Level Set Methods in Computer Vision (2005), vol. 3752 of Lecture Notes In Computer Science, Springer Berlin / Heidelberg, pp. 247-258.
- [7] Charles L. Epstein and Jeremy F. Magland, *A Simple Method for Measuring and Removing Susceptibility Artifacts*, ISMRM annual meeting, Berlin, Germany
- [8] Charles L. Epstein, *Models and equations for RF pulse design*, ISMRM annual meeting, Toronto, Canada, May, 2008.

#### 5.4 Unpublished Preprints

- [1] Charles L. Epstein *Envelopes of Horospheres and Weingarten Surfaces in Hyperbolic 3-Space*, preprint, 63 pages, 1984.  
available at: <http://www.math.upenn.edu/~cle/papers/WeingartenSurfaces.pdf>.
- [2] Charles L. Epstein *The Theorem of A. Schur in Hyperbolic Space*, preprint, 46 pages, 1985.  
available at: <http://www.math.upenn.edu/~cle/papers/SchursLemma.pdf>
- [3] Charles L. Epstein and R.B. Melrose, *Shrinking Tubes and the  $\bar{\partial}$ -Neumann Problem*, manuscript, 300 pages, 1990.  
available at: <http://www.math.upenn.edu/~cle/papers/stdbnp.pdf>
- [4] Charles L. Epstein and R.B. Melrose, *The Heisenberg Algebra, Index Theory and Homology*, manuscript, , 250 pages, 2003.
- [5] Charles L. Epstein and Jack Morava, *Tempering the Polylogarithm*, available at: [arXiv.org: math.CA/0611240](http://arXiv.org:math.CA/0611240), 12 pages, 2006.

## 6 Patents

- [1] Charles L. Epstein and Jeremy Magland, *Practical Pulse Synthesis via the Inverse Scattering Transform*, US patent 7,038,452, May 2, 2006.
- [2] Charles L. Epstein and Jeremy Magland, *Exact half pulse synthesis via the Inverse Scattering Transform*, US patent 7,166,998, January 23, 2007.
- [3] Charles L. Epstein and Jeremy Magland, *Methods and Apparatus for Magnetic Resonance Imaging in Inhomogeneous Fields*, US patent 7,309,986, December 18, 2007.
- [4] Charles L. Epstein and Jeremy Magland, *Practical Pulse Synthesis via the Discrete Inverse Scattering Transform*, US Patent 7,436,175, October 14, 2008.
- [5] Charles L. Epstein, *Enhanced Audio Intelligibility*, preliminary application with the US Patent Office, September, 2006.