Curriculum Vitae

Edward Taylor

Address: Mathematics and Computer Science Department, Wesleyan University, Middletown, Connecticut, USA.

Phone: (860) 685 - 2193 (Math. Dept.); (860) 685 - 2571 (fax).

E-mail: ectaylor@wesleyan.edu

Education :

1. Ph.D. August 1994, State University of New York at Stony Brook, Stony Brook, NY, USA.
2. M.A. August 1989, University of Texas at Austin, Austin, Texas, USA.
3. B.Sc., June 1985, Brown University, Providence, Rhode Island USA.

Thesis Work :

Advisor: Professor Bernard Maskit.

Field: Geometric Analysis, Differential Geometry, Kleinian Groups.

Title: On Volumes of Convex Cores under Algebraic and Geometric Convergence.

Academic Employment :

Summer 2006 - present, Associate Professor, Wesleyan University.

Fall 2001 - Summer 2006, Assistant Professor, Wesleyan University.

Fall 1999 - Spring 2001, Assistant Professor, Department of Mathematics, University of Connecticut.

1998 - 1999, Research Assistant Professor, Department of Mathematics, University of Michigan (NSF fellowship year.)

1997 - 1998, Research Assistant Professor, Department of Mathematics, University of Kentucky (NSF fellowship year.)

1994 - 1997, Assistant Professor (postdoctoral position), Department of Mathematics, University of Michigan.

Grants :

National Science Foundation:

- NSF Grant (Geometric Analysis), *Collaborative Research: Quasiconformal Symmetries, Extremal Problems, and Patterson-Sullivan Theory*, with P. Bonfert-Taylor (Wesleyan University), July 2007 - June 2010 (DMS 070675).
- NSF Special Semester Grant, *Special semester on Hyperbolic Manifolds and Geometric Analysis*, with P. Bonfert-Taylor (Wesleyan University) and R. Canary (University of Michigan), (DMS-0412837).
- NSF Grant (Geometric Analysis), *Collaborative Research: Analytic and Geometric aspects of convergence groups*, with P. Bonfert-Taylor (Wesleyan University) and M. Bridgeman (Boston College), July 2003 - June 2006 (DMS-0305704.)
- *NSF Postdoctoral Fellowship*, Fall 1997-Spring 2001.

Other:

- Banff International Research Station, Focused Research Group (Aspen Mode) "Quasiconformal Homogeneity: Energy Methods and Sharp Bounds" with P. Bonfert-Taylor (Wesleyan), M. Bridgeman (Boston College), R. Canary (Michigan), G. Martin (Massey), and A. Reid (Texas).
- Banff International Research Station, Focused Research Group(Aspen Mode) "Hyperbolic geometry and quasiconformal mappings," with P. Bonfert-Taylor (Wesleyan University), M. Bridgeman (Boston College), R. Canary (University of Michigan), G. Martin (University of Auckland), R. Schwartz (University of Maryland), August 2005.
- Project to Increase Mastery in Mathematics and Science (PIMMS) CDSHE grant, co-author, May 2003 - July 2004.
- EPSRC grant for visiting Southampton University, England, for summers of 2000 and 2002.
- University of Michigan Rackham Fellowship, Summer 1995.

Papers that have been published or that have been accepted for publication:

1. P. Bonfert-Taylor and E. Taylor, "Quasiconformally Homogeneous Planar Domains," *Conf. Geom. Dyn.* **12**(2008), pp. 188–198.

   Abstract: In this paper we explore the ambient quasiconformal homogeneity of planar domains and their boundaries. We show that the quasiconformal homogeneity of a domain D and its boundary E implies that the pair (D, E) is in fact quasiconformally bi-homogeneous. We also give a geometric and topological characterization of the quasiconformal homogeneity of D or E under the assumption that E is a Cantor set captured by a quasicircle. A collection of examples is provided to demonstrate that certain assumptions are the weakest possible.

2. P. Bonfert-Taylor, R. Canary, G. Martin, E. Taylor, M. Wolf, "Ambient Quasiconformal Homogeneity of Planar Domains," to appear in *Ann. Sci. Fenn.*

   Abstract: We prove that the ambient quasiconformal homogeneity constant of a hyperbolic planar domain which is not simply connected is uniformly bounded away from 1.

   We also consider a component Ω_0 of a finitely generated Kleinian group Γ. We show that if Ω_0/Γ is compact, then Ω_0 is uniformly ambiently quasiconformally homogeneous, and that if Ω_0 is not simply connected and its quotient Ω_0/Γ is non-compact, then it is not uniformly quasiconformally homogeneous.

3. P. Bonfert-Taylor, G. Martin, A. Reid and E. Taylor, "Teichmüller mappings, quasiconformal homogeneity, and non-amenable covers of Riemann surfaces,"to appear in *Pure and Applied Mathematics Quarterly.*

   Abstract: We show that there exists a universal constant K_c so that every K-strongly quasiconformally homogeneous hyperbolic surface X (not equal to $\mathbb{H}^2$) has the property that $K > K_c > 1$. The constant K_c is the best possible, and is computed in terms of the diameter of the $(2, 3, 7)$-hyperbolic orbifold (which is the hyperbolic orbifold of smallest area.) We further show that the minimum strong homogeneity constant of a hyperbolic surface without conformal automorphisms decreases if one passes to a non-amenable regular cover.

4. M. Bridgeman and E. Taylor, "An extension of the Weil-Petersson metric to Quasi-Fuchsian space," *Math. Ann.* **341**(2008) no. 4, pp. 927–943.

   Abstract: We establish a natural symmetric bilinear two-form on quasi-Fuchsian space, derived from the geodesic current length function, that extends the Weil-Petersson metric on the Teichmüller diagonal. The required smoothness properties of this length function are established in the process of constructing the bilinear symmetric two-form.

5. P. Bonfert-Taylor, K. Falk, and E. Taylor, "Gaps in the exponent spectrum of subgroups of discrete quasiconformal groups," *Kodai Math. J.* **31**(2008), pp. 681–81.

6. P. Bonfert-Taylor, M. Bridgeman, R. D. Canary, and E. Taylor, *Quasiconformal homogeneity of hyperbolic surfaces with fixed-point full automophisms, Math. Proc. Camb. Phil. Soc.* **143**(2007), pp. 71–74.

   We show that closed hyperbolic surfaces are uniformly quasiconformally homogeneous with constant uniformly bounded away from 1 provided that we restrict the automorphism classes of the quasiconformal mappings that realize the homogeneity. We also show that, without this restriction, hyperelliptic surfaces are uniformly quasiconformally homogeneous with a universal lower bound on the homogeneity. This result is then generalized to include the locus of c fixed-point full hyperbolic surfaces.

7. P. Bonfert-Taylor and E. Taylor, "Quasiconformal groups and a theorem of Bishop and Jones, " *Journal of Geometric Analysis,* **15(3)**(2005), pp. 373–389.

Abstract: We provide new bounds on the exponent of convergence of a planar discrete quasiconformal group in terms of the associated dilatation and the Hausdorff dimension of its conical limit set. In doing so, we use these bounds to recover a theorem of C. Bishop and P. Jones as the asymptotic limit in the dilatation.

8. M. Bridgeman and E. Taylor, "Patterson-Sullivan measures and quasi-conformal deformations," *Communications in Analysis and Geometry,* **13(3)** (2005), pp. 561–589.

   Abstract: In this paper we relate the ergodic action of a Kleinian group on the space of line elements to the conformal action of the group on the sphere at infinity. In particular, we show for a pair of geometrically isomorphic convex co-compact Kleinian groups that the ratio of the length of the Patterson-Sullivan measure on line element space to the length of its push-forward is bounded below by the ratio of the Hausdorff dimensions of the limit sets. Our primary techniques come from ergodic theory and Patterson-Sullivan theory.

9. P. Bonfert-Taylor, R. Canary, G. Martin and E. Taylor, "Quasiconformal homogeneity of hyperbolic manifolds," *Math. Ann.* **331** (2005), pp. 281–295.

   Abstract: We show that if a hyperbolic manifold is uniformly quasiconformally homogeneous, then there are considerable constraints on its geometry. If $n \geq 3$, a hyperbolic n-manifold is uniformly quasiconformally homogeneous if and only if it is a regular cover of a closed hyperbolic orbifold. Moreover, if $n \geq 3$, we show that there is a constant $K_n > 1$ such that if M is a hyperbolic n-manifold, other than $\mathbb{H}^n$, which is K–quasiconformally homogeneous, then $K \geq K_n$.

10. P. Bonfert-Taylor, M. Bridgeman, and E. Taylor, "Distortion of the exponent of convergence in space," *Ann. Sci. Fenn.* **29** (2004), pp. 383–406.

    Abstract: In this paper we introduce and develop properties of the chordal exponent of convergence for the Poincaré series of a quasiconformal group acting discontinuously in $\overline{\mathbb{R}}^n$ so that we can establish effective bounds on the distortion of this exponent of convergence under quasiconformal conjugacy. We also relate this exponent of convergence to a geometric variant of the standard exponent of convergence, and in doing so we are able to extend previous results to the full class of discrete quasiconformal groups.

11. J. Anderson, P. Bonfert-Taylor, and E. Taylor, "Convergence groups, Hausdorff dimension, and a theorem of Sullivan and Tukia," *Geometriae Dedicata* **103** (2004), pp. 51–67.

    Abstract: We show that a discrete, quasiconformal group preserving $\mathbb{H}^n$ has the property that its exponent of convergence and the Hausdorff dimension of its limit set detect the existence of a non-empty regular set on the sphere at infinity to $\mathbb{H}^n$. This generalizes a result due separately to Sullivan and Tukia, in which it is further assumed that the group acts isometrically on $\mathbb{H}^n$, i.e. is a Kleinian group. From this generalization we are able to extract geometric information about infinite-index subgroups within certain of these groups.

12. P. Bonfert-Taylor and E. Taylor, "Quasiconformal groups, Patterson-Sullivan theory, and the local analysis of limit sets," *Trans. Amer. Math. Soc.* **355(2)** (2003), pp. 787–811.

    Abstract: We extend to discrete quasiconformal groups the part of Patterson-Sullivan theory that relates the exponent of convergence of the Poincaré series to the Hausdorff dimension of the limit set. In doing so we define new bi-Lipschitz invariants that localize both the exponent of convergence and Hausdorff dimension. We find these invariants help to expose and explain the discrepancy between the conformal and the quasiconformal setting of Patterson-Sullivan theory.

13. P. Bonfert-Taylor and E. Taylor, "The exponent of convergence and a theorem of Astala," *Indiana Univ. Math. J.* **51** (2002), pp. 607–623.

    Abstract: We provide bounds on the exponent of convergence of a planar discrete quasiconformal group in terms of the associated dilatation and (a) the Hausdorff dimension of its conical limit set, or (b) the exponent of convergence of an underlying Kleinian group.

14. P. Bonfert-Taylor and E. Taylor, "Hausdorff dimension and limit sets of quasiconformal groups," *Mich. Math. J.* **49** (2001), pp. 243–257.

    Abstract: To relate the hyperbolic and conformal actions of discrete groups of Möbius transformations, S. Patterson and D. Sullivan connected the exponent of convergence of the Poincaré series to the Hausdorff dimension of the limit set. We explore the relationship between these two objects in the setting of discrete quasiconformal groups preserving the unit ball. We give positive results and also produce examples showing how the theory differs from the conformal setting.

15. M. Bridgeman and E. Taylor, "Length distortion and the Hausdorff dimension of limit sets," *Amer. J. Math.* **122** (2000), pp. 18–40.

    Abstract: Let Γ be a convex co-compact quasi-Fuchsian Kleinian group. We define the distortion function along geodesic rays lying on the boundary of the convex hull of the limit set, where each ray is pointing in a randomly chosen direction. The distortion function measures the ratio of the intrinsic to extrinsic metrics, and is defined asymptotically as the length of the ray goes to infinity. Our main result is that the distortion function is both almost everywhere constant and bounded above by the Hausdorff dimension of the limit set of Γ. As a consequence, we are able to provide a geometric proof of the following result of Bowen: If the limit set of Γ is not a round circle, then the Hausdorff dimension of the limit set is strictly greater than one. The proofs are developed from results in Patterson-Sullivan theory and ergodic theory.

16. R. Canary, Y. Minsky, and E. Taylor, "Spectral theory, Hausdorff dimension and the topology of hyperbolic 3-manifolds," *J. Geom. Anal.* **9** (1999), pp. 18–40.

    Abstract: Let M be a compact 3-manifold whose interior admits a complete hyperbolic structure. Define $\Lambda(M)$ to be the supremum of the $\lambda_0(N)$, where N varies over all hyperbolic 3-manifolds homeomorphic to the interior of M. Similarly, we define $D(M)$ to be the infimum of the Hausdorff dimensions of limit sets of Kleinian groups, whose quotients are homeomorphic to the interior of M. We establish the relation $\Lambda(M) = D(M)(2 - D(M))$, provided M is not a handlebody or a thickened torus. A characterization is given of exactly when $\Lambda(M) = 1$ and $D(M) = 1$ in terms of the characteristic submanifold of the incompressible core of M.

17. R. Canary and E. Taylor, "Hausdorff dimension and limits of Kleinian groups," *Geom. Func. Anal.* **9** (1999), pp. 283–297.

    Abstract: We prove that if M is a compact, hyperbolizable 3-manifold, which is not a handlebody, then the Hausdorff dimension of the limit set is continuous in the strong topology on the space of marked hyperbolic 3-manifolds homotopy equivalent to M. We similarly observe that for any compact hyperbolizable 3-manifold M (including a handlebody), the bottom of the spectrum of the Laplacian gives a continuous function in the strong topology on the space of topologically tame hyperbolic 3-manifolds homotopically equivalent to M.

18. T. Comar and E. Taylor, "Geometrically convergent Kleinian groups and the lowest eigenvalue of the Laplacian," *Indiana Univ. Math. J.* **49(2)** (1998), pp. 601–623.

    Abstract: In this paper we investigate the continuity properties of the lowest value of the Laplacian on quotient manifolds formed from convergent sequences of Kleinian groups. We show that the lowest eigenvalues are continuous on geometrically convergent sequences of geometrically finite infinite-volume manifolds formed from an infinite-volume hyperbolic Dehn surgery construction due to Bonahon-Otal and (independently) Comar. Using these techniques we are able to make progress on showing the conjectural continuity of the lowest eigenvalue on strongly convergent sequences of Kleinian groups. Examples are developed that show that the assumption of strong convergence cannot, in general, be replaced by less stringent convergence assumptions.

19. D. Borthwick, A. McRae, and E. Taylor, "Quasi-rigidity of hyperbolic 3-manifolds and scattering theory," *Duke Math. J.* **89** (1997), pp. 225–236.

    Abstract: Take two isomorphic convex co-compact infinite-volume Kleinian groups between which there is an isomorphism induced by a diffeomorphism of the regular sets. The quotient of hyperbolic 3-space by these groups gives two hyperbolic 3-manifolds whose scattering operators may be compared. We prove that if the operator norm of the difference between the scattering operators is small, then the groups are conjugate to each other by a correspondingly small quasi-conformal deformation. This result in turn implies that the two hyperbolic 3-manifolds are themselves K-quasi-isometric, where the distortion K decreases as the operator norm of the difference of the scattering operators decreases.

20. E. Taylor, "Geometric finiteness and the convergence of Kleinian groups," *Communications in Analysis and Geometry* **5(2)** (1997), pp. 497–533.

Abstract: Fix a compact hyperbolizable 3-manifold M with boundary, so that at least one of the components of ∂M is not a torus. Our main result is that the marked, geometrically finite (infinite-volume) hyperbolic 3-manifolds homotopy equivalent to M are open in the topology defined by strong convergence on the space of all marked hyperbolic 3-manifolds homotopy equivalent to M. As a corollary we observe that a sequence of degenerate groups converging algebraically on the boundary of a Bers' slice to a geometrically finite group does not converge strongly. We also note that, in a special case, our main result is true under weaker convergence assumptions. A sequence of Kleinian groups converging geometrically to a convex co-compact group, so that the limit sets are converging in the Hausdorff set metric, has the property that eventually all of the groups in the sequence are themselves convex co-compact.

We finish by sharpening our main result to show that the volume of the convex cores is continuous under strong convergence.

21. R. Canary and E. Taylor, "Kleinian groups with small limit sets," *Duke Math. J.* **73**(1994), pp. 371–381.

    Abstract: It is established that any geometrically finite Kleinian group whose limit set has Hausdorff dimension less than or equal to 1 is quasi-conformally conjugate to a Fuchsian group. We also establish that any topologically tame hyperbolic 3-manifold N such that $\lambda_0(N) = 1$ is homeomorphic to either a handlebody or an I-bundle. (Here $\lambda_0(N)$ is the bottom of the spectrum of the Laplacian acting on $L^2(N)$.)

Conferences Organized:

1. Co-organizer, *AMS 2008 Fall Eastern Section Meeting, special session "Geometric Function Theory and Geometry"*, (with P. Bonfert-Taylor and K. Matsuzaki), Wesleyan University, October 11 - 12, 2008.
2. Co-organizer, *Northeast Hyperbolic Geometry* (with A. Basmajian) Special Session, American Mathematical Society Sectional Meeting #1036 (New York University, March 15-16, 2008).
3. Co-organizer, *Wesleyan Dynamical Systems Conference*, (with P. Bonfert-Taylor, A. Fieldsteel, M. Keane), Wesleyan University, October 13 - 14, 2007.
   See `http://dynamicsfest07.wesleyan.edu/`.
4. Co-organizer, *Diversity in the Mathematics and Scientific Community I and II*, (with P. Bonfert-Taylor, R. Kuske, N. Nigam, K. Park, S. Pinho), Banff International Research Station, July 27 - 29, 2007. See `http://mathdiversity.wesleyan.edu/`.
5. Co-organizer, *Conference on Hyperbolic Manifolds and Geometric Analysis*, including graduate student pre-conference lecture series (with P. Bonfert-Taylor and R. Canary), Wesleyan University, October 15 - 17, 2004.
   See `http://condor.wesleyan.edu/pbonfert/wesgeom04/`.

Selected Invited Talks :

- Invited Plenary speaker (two 75 minute talks), “Teichmüller Theory and Moduli Problems,” Bhaskaracharya Institute of Mathematics, University of Pune, India, January 2008.
- Tufts University Geometric Group Theory and Topology Seminar, May 2008.
- Analysis Seminar, CUNY Graduate Center, March 2008.
- Invited Speaker, University of Connecticut Math Club, April 2008.
- Invited Panel Member, “Hiring and Retention of Women and of Members of Under-Represented Groups,” PIMS Conference “Diversity in Mathematical Sciences and Scientific Communities I and II,” July 27–29, 2007.
- Invited visitor to Institute of Advanced Study, New Zealand, June 20 - July 15, 2007.
- Complex Analysis Seminar, CUNY Graduate Center, February 2007.
- Geometry Seminar, University of Connecticut, February 2007.
- Invited Speaker, Teichmüller theory and Moduli Problems, Harish Chandra Research Institute (India), January 2006.
- Plenary Speaker, Hyperbolic Geometry Workshop, Hamilton Institute of Mathematics (Ireland), October 2005.
- Brown University Topology/Geometry Seminar, April 2005.
- Indiana University Dynamics Seminar, March 2005.
- University of Oklahoma Colloquium, February 2005.
- Invited talk, A.M.S. sectional meeting (Complex and Hyperbolic Geometry section), Los Angeles, April 2004.
- Yale University Topology/Geometry Seminar, March 2004.
- Washington and Lee University Colloquium, April 2003.
- Harvard University Dynamics Seminar, December 2002.
- Southampton University Colloquium, June 2002.
- Washington University Colloquium, April 2002.
- Invited talk, A.M.S sectional meeting (Hyperbolic Manifolds and Discrete Groups section), Ann Arbor, March 2002.
- Plenary Speaker, Ahlfors-Bers Colloquium, October 2001.
- Invited talk, Complex Analysis Seminar at CUNY, April 2001.
- Invited talk, Complex analysis Seminar, SUNY Stony Brook, March 2000.
- University of Connecticut Colloquium, February 1999.
- University of Nevada (Reno) Colloquium, February 1999.
- Invited talk, A.M.S. sectional meeting (Spectral Geometry section) in Louisville, March 1998.

- Invited talk, Topology Seminar, University of Southern California, March 1998.
- Invited talk, A.M.S./S.M.M. sectional meeting (Complex and Functional Analysis section), in Oaxaca, Mexico, December 1997.
- University of Oklahoma Colloquium, April 1997.
- Claremont McKenna College Colloquium, February 1997.
- Plenary Speaker, Hyperbolic Geometry and Low-dimensional Topology Conference, Institut Henri Poincaré, June 1996.
- University of Illinois Colloquium, March 1995.
- Multiple seminar presentations at the University of Michigan in both the Geometry Seminar and the Complex Analysis Seminar from 1994 - 1999.