Curriculum Vitae

Petra Bonfert-Taylor

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Education:

Ph.D. April 1996, Technical University of Berlin, summa cum laude.

Ph.D. advisor: Christian Pommerenke

Thesis title: On Iteration in Planar Domains.

Diplom February 1994, Technical University of Berlin, summa cum laude.

Vordiplom October 1990, Technical University of Berlin.

Research Interests:

Complex analysis, geometric function theory, discrete groups, complex dynamics.

Employment:

2006 - present, Associate Professor of Mathematics, Wesleyan University.

1999 - 2006, Assistant Professor of Mathematics (tenure track), Wesleyan University.

1996 - 1999, Assistant Professor of Mathematics (postdoctoral fellow), University of Michigan.

1995 - 1996, “Assistent” (graduate student instructor), Technical University of Berlin.

1991 - 1994, “Tutor” (teaching assistant), Technical University of Berlin.

Grants and Awards:

National Science Foundation:

- NSF Grant (Geometric Analysis), *Quasiconformal Symmetries, Extremal Problems, and Patterson-Sullivan Theory*, with E. Taylor (Wesleyan University), July 2007 - June 2010 (DMS-0706754).
- NSF Special Semester Grant, *Special Semester on Hyperbolic Manifolds and Geometric Analysis*, with R. Canary (University of Michigan) and E. Taylor (Wesleyan University), July 2004 - June 2005 (DMS-0412837).

- NSF Grant (Geometric Analysis), *Collaborative Research: Analytic and geometric aspects of convergence groups*, with M. Bridgeman (Boston College) and E. Taylor (Wesleyan University), July 2003 - June 2007 (DMS-0305704).
- NSF Grant (Analysis), *The interaction between geometry and analysis in geometric function theory and in the theory of discrete groups*, July 2000 - June 2003 (DMS-0070335).

Other:

- Banff International Research Station (BIRS), Focussed Research Group (Aspen Mode), *Quasiconformal Homogeneity: Energy Methods and Sharp Bounds*, co-organized with E. Taylor (Wesleyan University), March 2007 (07frg127). Invited participants: G. Martin (Massey University, NZ), R. Canary (University of Michigan), A. Reid (University of Texas), M. Wolf (Rice University).
- Banff International Research Station, Focussed Research Group (Aspen Mode), *Hyperbolic geometry and quasiconformal mappings*, with M. Bridgeman (Boston College), R. Canary (University of Michigan), G. Martin (University of Auckland), R. Schwartz (University of Maryland), E. Taylor (Wesleyan University), August 2005 (05frg502).
- Connecticut State Department of Higher Education (CSDHE) grant, co-author with PIMMS, *Hartford Numeracy Coaches Leadership Academy*, a mathematics professional development project for the Hartford school district, May 2003 - July 2004.
- Rackham Fellowship (University of Michigan faculty fellowship), 1998.
- Doctoral Fellowship, “Studienstiftung des deutschen Volkes”, 1994 - 1995 (Federal Republic of Germany National Fellowship).
- Student Fellowship, “Studienstiftung des deutschen Volkes”, 1988 - 1994 (Federal Republic of Germany National Fellowship).

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

1. P. Bonfert-Taylor, K. Falk, and E. Taylor, *Gaps in the exponent spectrum of subgroups of discrete quasiconformal groups*, to appear in `Kodai Math. J.`

   Let G be a discrete quasiconformal group preserving $\mathbb{B}^3$ whose limit set $\Lambda(G)$ is purely conical and all of $\partial\mathbb{B}^3$. Let $\hat{G}$ be a non-elementary normal subgroup of G: we show that there exists a set $\mathcal{A}$ of full measure in $\Lambda(G)$ so that $\mathcal{A}$, regarded as a subset of $\Lambda(\hat{G})$, has “fat horospherical” dynamics relative to $\hat{G}$. As an application we will bound from below the exponent of convergence of $\hat{G}$ in terms of the Hausdorff dimension of $\mathcal{A}$.
2. P. Bonfert-Taylor, M. Bridgeman, R.D. Canary and E. Taylor, *Quasiconformal homogeneity of hyperbolic surfaces with fixed-point full automorphisms*, `Math. Proc. Camb. Phil. Soc.` **143** (2007), 71–74.

   We show that any closed hyperbolic surface admitting a conformal automorphism with “many” fixed points is uniformly quasiconformally homogeneous, with constant uniformly bounded away from 1. In particular, there is a uniform lower bound on the quasiconformal homogeneity constant for all hyperelliptic surfaces. In addition, we introduce more restrictive notions of quasiconformal homogeneity and bound the associated quasiconformal homogeneity constants uniformly away from 1 for all hyperbolic surfaces.

3. P. Bonfert-Taylor and G. Martin, *Quasiconformal groups with small dilatation II*, `Complex Var. Elliptic Equ.` **51** (2006), no. 2, 165–179.

   We study discrete quasiconformal groups with small dilatation (that is dilatation close to 1) in n dimensions, $n \geq 3$. In particular, we show that under fairly general algebraic assumptions, a discrete quasiconformal group with small dilatation is isomorphic to a discrete group of Möbius transformations. We then analyze under what conditions the algebraic isomorphism is induced by a geometric homeomorphism between the limit sets.

4. P. Bonfert-Taylor and E. Taylor, *Quasiconformal groups and a theorem of Bishop and Jones*, `J. Geom. Anal.` **15** (2005), no. 3, 373–389.

   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 realize a theorem of C. Bishop and P. Jones as an asymptotic limit in the dilatation.

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

   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 $K \geq K_n$.

6. P. Bonfert-Taylor and G. Martin, *Quasiconformal groups of compact type*, `Rev. Mat. Iberoamericana` **21** (2005), no. 3, 997–1012.

   We establish that a quasiconformal group is of compact type if and only if its limit set is purely conical and find that the limit set of a quasiconformal group of compact type is uniformly perfect. A key tool is the result of Bowditch–Tukia on compact–type convergence groups. These results provide crucial tools for studying the deformations of quasiconformal groups and in establishing isomorphisms between such groups and conformal groups.

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

   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.

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

   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.

9. P. Bonfert-Taylor and E. Taylor, *Quasiconformal groups, Patterson-Sullivan theory, and the local analysis of limit sets*, `Trans. Amer. Math. Soc.` **355** (2003), no. 2, 787–811.

   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 to explain the discrepancy between the conformal and quasiconformal setting of Patterson-Sullivan theory.

10. P. Bonfert-Taylor and E. Taylor, *The exponent of convergence and a theorem of Astala*, `Indiana Univ. Math. J.` **51** (2002), no. 3, 607–623.

    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.

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

    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 both positive results and produce examples showing how the theory differs from the conformal setting.

12. P. Bonfert-Taylor and G. Martin *Quasiconformal groups with small dilatation I*, `Proc. Amer. Math. Soc.` **129** (2001) 2019–2029.

    In this paper we show that there exists a Jørgensen inequality for quasiconformal Fuchsian groups with small dilatation in all dimensions. Consequences of this inequality are, for example, that discreteness persists to the limit under algebraic convergence, and that a quasiconformal Fuchsian group is discrete if and only if every two-generator subgroup is discrete.

13. P. Bonfert-Taylor, *Jørgensen's inequality for discrete convergence groups*, `Ann. Acad. Sci. Fenn.` **25** (2000) 131–150.

    We explore in this paper whether certain fundamental properties of the action of Kleinian groups on the Riemann sphere extend to the action of discrete convergence groups on $\overline{\mathbb{R}^2}$. A Jørgensen inequality for discrete K-quasiconformal groups is developed, and it is shown that such an inequality depends naturally on the quasiconformal dilatation K. Furthermore, it is established that no such inequality can hold for general discrete convergence groups. In the discontinuous case a universal constraint on discreteness is formulated for both quasiconformal and general convergence groups.

14. P. Bonfert, *On the Brjuno condition, Part II*, Progress in Complex Dynamics, `Pitman Research Notes in Mathematics` **387** (1998) 17–26.

    This paper was originally the second part of a talk given at the occasion of the "1. Göttinger Tag der Siegelscheiben". The purpose of this invited talk was to present and explain the ideas in Yoccoz's proof of his theorem on linearizability. This theorem says that for each $\alpha \in \mathbb{R} \setminus \mathbb{Q}$ which does not satisfy a certain number-theoretic condition, the so called Brjuno condition, there exists a univalent function $f_\alpha : \mathbb{D} \to \mathbb{C}$ with $f_\alpha(0) = 0$ and rotation number α that is not linearizable at 0.

15. P. Bonfert, *On Iteration in Planar Domains*, `Mich. Math. J.` **44** (1997) 47–68.

    It is established that an analytic function f mapping a hyperbolic subdomain G of the complex plane into itself, without fixed points, is semi-conjugate to a Möbius transformation φ mapping an auxiliary planar domain H onto itself. In other words, there is an analytic function $g : G \to H$ semi-conjugating f to φ, i.e. $g \circ f = \varphi \circ g$. We also establish certain geometric relations between the function f and any of its lifts to the unit disk. Furthermore we prove that for fixed $z \in G$, the density ρ of the hyperbolic metric along the sequence of iterates $\{f^n(z)\}$ is comparable to the quasihyperbolic density. In particular, there exists a constant $c > 0$ depending on z such that $c < \rho(f^n(z))/\text{dist}(f^n(z), \partial G) < 1$ for all n.

Papers that have been submitted:

1. P. Bonfert-Taylor, G. Martin, A. Reid, and E.C. Taylor, *Teichmüller mappings, quasiconformal homogeneity, and non-amenable covers of Riemann surfaces.*

   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.

Selected Invited Talks:

1. Invited visitor to Institute of Advanced Study, New Zealand, June 20 – July 15, 2007.
2. Invited speaker, topology seminar, Yale University, April 2007.
3. Invited speaker, complex analysis seminar, CUNY Graduate Center, March 2007.
4. Invited participant, workshop on "Women in Mathematics", Banff International Research Station, September 23-28, 2006.
   (a) Leader of panel on "Hiring and Recruitment" at workshop on "Women in Mathematics".
   (b) "Women Mathematicians in the Academic Ranks: A Call to Action Report of the BIRS Workshop on Women in Mathematics September 24 - 28, 2006", primary author (with E.C. Taylor) of subsection "Hiring, Retention and Promotion"
5. Invited speaker, International Workshop on "Teichmüller theory and Moduli Problems", Harish-Chandra Research Institute, Allahabad, India, January 2006 (participation canceled due to illness).
6. Plenary speaker, Hyperbolic Geometry Workshop, Hamilton Institute of Mathematics (Ireland), October 2005 (participation canceled due to illness).
7. Invited speaker, Ahlfors-Bers Colloquium, Workshop on "Conformal Analysis and Geometric Function Theory", Ann Arbor, May 2005.
8. Invited colloquium lecture, University of Oklahoma, February 2005.
9. Invited speaker, special-session at AMS national meeting, Atlanta, January 2005.
10. Invited speaker, Tag der Funktionentheorie, Würzburg, Germany, June 2004.
11. Invited lecture, Nevanlinna Colloquium, Jyväskylä, Finland, June 2003.
12. Invited colloquium lecture, Washington and Lee University, April 2003.
13. Invited colloquium lecture, Southampton University, Southampton, England, June 2002.
14. Invited colloquium lecture, Washington University, St. Louis, April 2002.
15. Invited speaker, special-session at AMS sectional meeting, Ann Arbor, Michigan, March 2002.
16. Invited speaker, special-session at AMS sectional meeting, Lawrence, Kansas, March 2001.
17. Invited plenary lecture, Iberoamerican Congress on Geometry, Mexico, January 2001.
18. Invited speaker, analysis seminar, University of Michigan, Ann Arbor, Michigan, January 2000.
19. Invited speaker, analysis seminar, University of Connecticut, Storrs, Connecticut, November 1999.

20. Invited speaker, special session at AMS sectional meeting, Charlotte, North Carolina, October 1999.
21. Invited speaker, geometry seminar, SUNY at Stony Brook, New York, September 1999.
22. Invited colloquium lecture, University of Illinois at UrbanaChampaign, Illinois, November 1998.
23. Invited speaker, special session at AMS sectional meeting, Louisville, Kentucky, March 1998.
24. Invited speaker, analysis seminar, Purdue University, West Lafayette, Indiana, January 1998.
25. Invited speaker, analysis seminar, University of Illinois, Urbana-Champaign, Illinois, January 1998.
26. Invited speaker, special session at AMS sectional meeting, Chattanooga, Tennessee, October 1996.
27. Invited speaker, Annual meeting of the "Deutsche Mathematiker Vereinigung" (German equivalent to national AMS meeting), Ulm, September 1995.
28. Invited speaker, conference at "Tag der Siegelscheibe", Göttingen, June 1995.