**Work Address**

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## EXPERIENCE

| Title/Program | Employer | Years |
|---|---|---|
| National Research Council (NRC) Postdoc, mathematics | `National Institute of Standards and Technology` | Summer2003-present |
| Term Assistant Professor, mathematics | University of Michigan | Fall2000-Summer2003 |
| Teaching-Research Assistant | Cornell University | Fall98-Spring00 |
| Teaching Assistant | Notre Dame University | 1997-98 academic year |
| Teaching Assistant | Cornell University | Fall94-Spring97 |

## RESEARCH INTERESTS

- quantum circuits models for quantum computing; quantum logic synthesis
    - quantum logic synthesis using exotic *KAK* metadecompositions arising from globally symmetric geometries $SU(2^n)/K$
    - synthesis with measurement using Hermitian density matrix formalism
- entanglement theory and implications for quantum circuit design

## EDUCATION

| Degree | University | Awarded | comment |
|---|---|---|---|
| Ph.D. | Cornell University | May, 2000 | mathematics, under Birgit Speh |
| M.A. | Cornell University | August, 1996 | differential geometry |
| B.S. | University of Georgia | June 1994 | summa cum laude, ΦβκΦβκ |

## PAPERS & PREPRINTS

**"Canonical Decompositions of n-qubit Quantum Computations and Concurrence,"** joint with Gavin K. Brennen, `N.I.S.T.` atomic physics, `quant-ph/0309104`, to appear, *Journal of Mathematical Physics*.

**"Smaller Circuits for Arbitrary n-qubit Diagonal Computations,"** joint with Igor L. Markov, *Quantum Information and Computation*, vol. 4(1), 027, February 2004. `quant-ph/0303039`

**"An Arbitrary Two-qubit Computation in** 23 **Elementary Gates,"** joint with Igor Markov, *Physical Review A* vol. 68(1), 012318, July 2003. `quant-ph/0211002`

**"Unreduced Gaussian weighted $L_2$ cohomology of locally symmetric spaces,"** *New York Journal of Mathematics*, vol.8, 2002, pp. 241-256.

**"Weighted $L_2$ cohomology of asymptotically hyperbolic manifolds,"** *New York Journal of Mathematics*, vol.7, 2001, pp. 7-15.

## DRAFTS

**"Time Reversal and $n$-qubit Canonical Decompositions,"** joint with Gavin K. Brennen, `N.I.S.T.` atomic physics, `quant-ph/0402051`.

**"Recognizing Small-Circuit Structure in Two-Qubit Operators,"** joint with Vivek V. Shende, University of Michigan and Igor L. Markov, U.Michigan E.E.C.S., `quant-ph/0308045`.

**"On Universal Gate Libraries and Generic Minimal Two-qubit Quantum Circuits,"** joint with Vivek V. Shende, University of Michigan and Igor L. Markov, U.Michigan E.E.C.S., `quant-ph/0308033`.

## MATHEMATICAL SPECIALTIES

**Lie Groups, Lie Theory**

- Structure theory of real groups, Satake & Vogan diagrams, representation theory
- Locally symmetric Riemannian manifolds

**Riemannian geometry and smooth topology**

- de Rham cohomology, sheaf cohomology, Lie algebra cohomology, Hodge theory
- nonpositive curvature, esp. locally symmetric Riemannian manifolds

## COMPUTER SKILLS

**Proficient:** LATEX 2$_\varepsilon$, `C++`, `RedHat Linux`, `Maple`

**Familiar:** `MatLab`, `html`

## INVITED TALKS & COMPUTER SCIENCE CONFERENCE PAPERS

| Title | Coauthors | Venue | Date |
|---|---|---|---|
| Entanglement Capacity of $n$-qubit quantum comp. | Gavin Brennen | `SPIE` symposium `www.spie.org` | April 13, 2004 |
| Finding small two-qubit circuits | Igor Markov Vivek Shende | `SPIE` symposium `www.spie.org` | April 14, 2004 |
| Gaussian weighted $L_2$ cohomology | - | Loc.Sym.Space Conf. M.F.Oberwolfach | Oct. 3, 2003 |
| "Symmetry Groups of the n-tangle and Maximal Concurrence" | - | Institute for Defense Analyses, `CSS` | Sept. 8, 2003 |
| "An Arbitrary Two-Qubit Quantum Computation in 23 gates" | Igor Markov | `Design Automation Conf.` (`www.dac.com`) | July 2003 B.P.A. nominee |
| Weighted $L_2$ cohomology | - | **AMS** midwest section meeting, d.g. session | March 2002 |

## REFERENCES

Isabel Beichl (superviser) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . isabel.beichl@nist.gov
Birgit Speh . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . speh@math.cornell.edu
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