

Shawn Xingshan Cui | CV

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Employment

Postdoctoral Fellow

Stanford University

2016 –

Education

Mathematics Department

University of California Santa Barbara

Ph.D.

2011–2016

Mathematics Department

Sun Yat-Sen University, China

Master program

2010–2011

Mathematics Department

Sun Yat-Sen University, China

B.Sc

2007–2010

Research Interests

- Quantum topology/algebra, knot theory, quantum invariants
- Topological quantum field theory, higher category theory
- Topological quantum computation, quantum information

Awards

- 2011-2013, Microsoft Graduate Fellowship
- 2012, Department of Mathematics Raymond L. Wilder Award
- 2015-2016, Graduate Division Dissertation Fellowship

Experiences

- 2012.6–2012.9, 2013.6–2013.9, 2014.6–2014.9, 2015.4–2015.6, Research Assistant for Professor Zhenghan Wang, UCSB.
- 2014.12, 2015.3, Microsoft Consulting Researcher, in Microsoft Station Q.
- 2015.6–2015.9, Research Intern, in Quantum Architectures and Computation Group, Microsoft.

Publications and Preprints

- [1] S. X. Cui, “Higher categories and topological quantum field theories,” *arXiv: 1610.07628*, 2016. Submitted.
- [2] S. X. Cui, D. Gottesman, and A. Krishna, “Diagonal gates in the clifford hierarchy,” *arXiv:1608.06596*, 2016. Submitted.
- [3] S. X. Cui, Z. Ji, N. Yu, and B. Zeng, “Quantum capacities for entanglement networks,” *Accepted*

in 2016 IEEE International Symposium on Information Theory(ISIT). arXiv:1602.00401.

- [4] A. Bocharov, S. X. Cui, M. Roetteler, and K. M. Svore, “Improved quantum ternary arithmetics,” *Quantum Information and Computation*, vol. 16, no. 9&10, 2016.
- [5] S. X. Cui, C. Galindo, J. Y. Plavnik, and Z. Wang, “On gauging symmetry of modular categories,” *Communications in Mathematical Physics*, pp. 1–22, 2015.
- [6] S. X. Cui, M. H. Freedman, O. Sattath, R. Stong, and G. Minton, “Quantum max-flow/min-cut,” *Journal of Mathematical Physics*, vol. 57, p. 062206, 2016.
- [7] A. Bocharov, X. Cui, V. Kliuchnikov, and Z. Wang, “Efficient topological compilation for a weakly integral anyonic model,” *Physical Review A*, vol. 93, no. 1, p. 012313, 2016.
- [8] S. X. Cui, N. Yu, and B. Zeng, “Generalized graph states based on hadamard matrices,” *Journal of Mathematical Physics*, vol. 56, no. 3, p. 072201, 2015.
- [9] L. Chang, M. Cheng, S. X. Cui, Y. Hu, W. Jin, R. Movassagh, P. Naaijken, Z. Wang, and A. Young, “On enriching the Levin–Wen model with symmetry,” *Journal of Physics A: Mathematical and Theoretical*, vol. 48, no. 12, p. 12FT01, 2015.
- [10] S. X. Cui and Z. Wang, “Framed cord algebra invariant of knots in $S^1 \times S^2$,” *Journal of Knot Theory and Its Ramifications*, vol. 24, no. 14, p. 1550067, 2015.
- [11] S. X. Cui and Z. Wang, “Universal quantum computation with metaplectic anyons,” *Journal of Mathematical Physics*, vol. 56, no. 3, p. 032202, 2015.
- [12] S. X. Cui, S. M. Hong, and Z. Wang, “Universal quantum computation with weakly integral anyons,” *Quantum Information Processing*, vol. 14, no. 8, pp. 2687–2727, 2015.
- [13] S. X. Cui, M. H. Freedman, and Z. Wang, “Complexity classes as mathematical axioms II,” *Quantum Topology*, vol. 7, no. 1, pp. 185–201, 2016.

Public Patents–Pending

- Efficient Topological Compilation for Metaplectic Anyon Model,
Alex Bocharov, Xingshan Cui, Vadym Kliuchnikov, and Zhenghan Wang. Application No. 62/141,771. Patent filed April 2015.
- Method and System for Efficient Quantum Ternary Arithmetic,
Alex Bocharov, Xingshan Cui, Martin Roetteler, and Krysta Svore. Application No. 62/261,179. Patent filed November 2015.

Talks

- Complexity classes as mathematical axioms,
Seminar on Low Dimensional Topology, Liaoning Normal University, China, July, 2013.
- Framed cord algebra invariants of knots in $S^1 \times S^2$,
Knot Theory and Its Applications to Physics and Quantum Computing, University of Texas at Dallas, USA, January, 2015.
- Universal quantum computation with metaplectic anyons,
Quantum Information and Fusion Categories in AMS Joint Mathematics Meetings, San Antonio, Texas, USA, January, 2015.
- Quantum Max-flow/Min-cut,
Workshop on Quantum Marginals and Numerical Ranges, University of Guelph, Canada, August, 2015.
Quantum Architectures and Computation Group, Microsoft Research, Redmond, WA, December, 2015.
Department of Mathematics, Tsinghua University, China, July, 2016

- Topological Quantum Computation and Compilation,
Joint Center for Quantum Information and Computer Science, University of Maryland, College Park, December, 2015.
Perimeter Institute for Theoretical Physics, Waterloo, ON, Canada, December, 2015.
- Higher Categories and Topological Quantum Field Theory,
2016 SIAM Annual Meeting, Boston, MA, July, 2016.
Modular Categories—Their Representations, Classification, and Applications, CMO-BIRS, Oaxaca, Mexico, August, 2016.
Quantum Information and Operator Algebras Mini Workshop, Beijing, 2016.
- Factoring with Qutrits,
16th Asian Quantum Information Science Conference, Academia Sinica, Taiwan, September, 2016

Teaching Assistant

- Fall 2012: Calculus with Applications II
- Spring 2013: Vector Calculus I
- Winter 2014: Differential Equations
- Fall 2014: Linear Algebra with Applications
- Fall 2015: Calculus with Applications I
- Winter 2013: Calculus for Social Sciences II
- Fall 2013: Calculus for Social Sciences II
- Spring 2014: Vector Calculus II
- Winter 2015: Differential Equations

References

- Zhenghan Wang (zhenghwa@microsoft.com) (supervisor)
- Michael Freedman (michaelf@microsoft.com)
- Bei Zeng (zengb@uoguelph.ca)
- Krysta M. Svore (ksvore@microsoft.com)
- Martin Roetteler (martinro@microsoft.com)
- Hector Ceniceros (hdc@math.ucsb.edu) (on teaching)

Additional Qualifications

- Extensive experience in C++, Mathematica, and Maple.
- Created several Mathematica packages to compute the cord algebra of knots in $S^1 \times S^2$, the de-equivariantization of the MTC $SU(2)_8$, the partition function of a closed 4-manifold from a G -crossed braided category, etc.
- Occasional experience in HTML, Matlab, and C#.