

Yi-Kai Liu

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Research interests:

Theoretical computer science, quantum computation, machine learning. Particular topics include quantum algorithms and complexity, and compressed sensing.

Employment:

- Postdoctoral Researcher, Institute for Quantum Information, Caltech, 2007-present
- Instructor, Computer Science Department, Caltech, spring quarter 2009

Education:

- Ph.D. in Computer Science, University of California, San Diego, 2007
Dissertation: *The Complexity of the Consistency and N-representability Problems for Quantum States*
Advisors: Russell Impagliazzo and David Meyer
- B.A. in Mathematics, with a certificate in Computer Science, Princeton University, 2002

Awards:

- NSF Mathematical Sciences Postdoctoral Research Fellowship, 2007-2009
- ARO/NSA Quantum Computing Graduate Research Fellowship, 2004-2007
- First-year graduate student fellowship, UCSD computer science dept., 2002
- Honorable mention, NSF Graduate Research Fellowship, 2002

Publications:

- O. Landon-Cardinal, Y.-K. Liu and D. Poulin, "Efficient Direct Tomography for Matrix Product States," ArXiv preprint 1002.4632.
- A. M. Childs and Y.-K. Liu, "Quantum algorithms for testing bipartiteness and expansion of bounded-degree graphs," in preparation; preliminary version at www.its.caltech.edu/~yikailiu/graph-prop3.pdf.
- D. Gross, Y.-K. Liu, S. T. Flammia, S. Becker and J. Eisert, "Quantum state tomography via compressed sensing," submitted; Arxiv preprint 0909.3304.
- Y.-K. Liu, "Quantum Algorithms Using the Curvelet Transform," *Proc. ACM Symposium on Theory of Computing (STOC)*, pp.391-400, 2009; Arxiv preprint 0810.4968.
- Y.-K. Liu, *The Complexity of the Consistency and N-representability Problems for Quantum States*, PhD dissertation, Univ. of California, San Diego, 2007; Arxiv preprint 0712.3041.
- Y.-K. Liu, M. Christandl and F. Verstraete, "N-representability is QMA-complete," *Phys. Rev. Lett.* 98, 110503 (2007); Arxiv preprint quant-ph/0609125.
- Y.-K. Liu, "Consistency of Local Density Matrices is QMA-complete," *Proc. RANDOM* 2006, pp.438-449; Arxiv preprint quant-ph/0604166.
- Y.-K. Liu, V. Lyubashevsky and D. Micciancio, "On Bounded Distance Decoding for General Lattices," *Proc. RANDOM* 2006, pp.450-461.

- Blanc, Y.-K. Liu and A. Vahdat, “Designing Incentives for Peer-to-Peer Routing,” *Proc. INFOCOM* 2005, pp.374-385; preliminary version in P2PEcon 2004.

Unpublished work:

- Y.-K. Liu, “The Local Consistency Problem for Stochastic and 1-D Quantum Systems,” 2007, Arxiv preprint 0712.1388.
- Y.-K. Liu, “Gibbs States and the Consistency of Local Density Matrices,” poster at the SQuInT workshop, 2006; Arxiv preprint quant-ph/0603012.
- K. Levchenko and Y.-K. Liu, “Counting Solutions of Polynomial Equations,” a note regarding the paper: “Improved Range-Summable Random Variable Construction Algorithms,” by A. R. Calderbank et al, *SODA* 2005.
- Y.-K. Liu, “Improved Protocols for Two-way Quantum Cryptography,” undergraduate senior thesis, Princeton Univ., 2002.
- Y.-K. Liu, “Statistical Behavior of the Eigenvalues of Random Matrices,” undergraduate research report, Princeton math junior seminar, 2001.

Teaching experience:

- Instructor, CS 138 “Approximation Algorithms,” Caltech, spring 2009
- Organizer, quantum computing reading group, UCSD, fall 2004
- Teaching assistant, CSE 105, “Introduction to the Theory of Computability,” UCSD, fall 2003

Professional activities:

- Invited speaker at workshops: “Quantum Marginals and Density Matrices,” Fields Institute, 2009; XQIT workshop, MIT, 2008; QIP 2007
- Visiting scholar at: the Kavli Institute for Theoretical Physics, UC Santa Barbara, Sept. 2009; the Institute for Quantum Information, Caltech, summer 2006
- Reviewer for conferences and journals

Other work:

- Summer intern, National Center for Atmospheric Research, Scientific Computing Division, 2000

Citizenship: USA

Place of birth: Boulder, Colorado