MILE GU

1/10/2015 **Curriculum Vitae**

Assistant Professor
Institute for Interdisciplinary Information Sciences,
Tsinghua University.

Website: www.milegu.net **E-mail:** cqtmileg@nus.edu.sg
Nationality: New Zealand
Permanent Resident of - Singapore
Research Profile: http://goo.gl/KKGhT

RESEARCH HIGHLIGHTS:

High impact research, including 4 in Nature/Science journals, highlights in Nature, Science (5 separate occasions), and various online and print media (New Scientist, Phys.org etc.). These include:

- Demonstration that Quantum Discord is a physical resource. Published in ***Nature Physics 8, 671–675***, highlighted in ***Nature Photonics 6, 724–725,*** *and awarded* ***Research Highlight of the Month,*** *January 2013 at the National University of Singapore.*

- Proved that the ultimate way to simulate reality requires quantum logic, using combined concepts of complexity and information theory. Published in ***Nature Comm. 3, 762, 1133–1135***. Invited Guest article in ***New Scientist 2995.***

- Demonstration that of emergent physical laws – macroscopic physical laws that cannot be derived from microscopic principles. Published in ***Physica D. 238, 835-839*** and highlighted in ***Nature 459, 332-334*** and ***New Scientist 2676.***

- Jointly proposed continuous variable cluster state computation – a new model of quantum computation has attracted over 400 combined citations and motivated multiple of experiments. See ***Phys. Rev. A 79, 062318*** *and* ***Phys. Rev. Lett., 97(11):110501***

- Jointly proved that the methods of General Relativity can be applied to find optimal quantum algorithms. Published in ***Science, 311(5764):1133–1135*** *and highlighted in* ***Science Perspectives*** *on the same issue.*

PROFFESIONAL HISTORY

11/2013 – Present **Assistant Professor (Tenure-Track)**, Center for Quantum Information, Institute for Interdisciplinary Information Sciences, Tsinghua University, China

11/2013 – Present **Visiting Senior Fellow**, Centre for Quantum Technologies, National University of Singapore

10/2009 - 11/2013 **Research Fellow**, Center for Quantum Technologies, National University of Singapore

2/2009 -10/2009 **Research Assistant** –Center for Quantum Technologies, National University of Singapore

EDUCATION

2005–2009 **PhD** (Quantum Complexity, Emergence and Measurement by Computation) University of Queensland, Brisbane, Australia.
Supervisors: Michael Nielsen, Tim Ralph, Andrew Doherty

2003-2004 **Masters in Physics** (Quantum Optics) *1st Class Honors,* Auckland University, Auckland, New Zealand,
Supervisors: Scott Parkins, Howard Carmichael

2001-2002 **Bachelor of Science** (*Triple Major*, in Physics, Computer Science and Applied Mathematics) Auckland University, Auckland, New Zealand.

AWARDS

2013 ***China Young 1000 Talent*** *- Central Organizing Committee of China*
2013 ***Research Highlight of the Month*** *– National University of Singapore*
2006-2009 ***Australian Postgraduate Award*** *- University of Queensland*
2005 ***Distinguished Scholar Award****, University of Queensland*

GRANTS

2015-2017 ***Occam's Quantum Mechanical Razor: Can Quantum theory admit the Simplest***
246,100 USD ***Understanding of Reality?*** *(Templeton Foundation)*
Role: *Primary Investigator*

2014 ***Using Discord to Preserve the Benefits of Entanglement-Breaking Noise***
200,000 CNY (National Natural Science Foundation of China)
Role: *Primary Investigator*

2013-2016 ***1000 Talent Fellowship***
3,000,000 CNY ***Role:*** *Primary Investigator*

2012-2013 ***Disjointed realities: Is there a universal way to connect quantum and classical theories?***
150,000 GBP (Templeton Foundation) ***Role:*** *Co-investigator*

SELECTED MEDIA AND PRESS

- "Zen and the art of quantum complexity." ***New Scientist,*** *2995, (2014)*
- "Quantum optics: Discord in the Ranks." ***Nature Photonics: News and Views*** 6.11 (2012):
- "How quantum physics could make 'The Matrix' more efficient." **Phys.org** (2012) *http://phys.org/news/2012-03-quantum-physics-matrix-efficient.html*
- "Why nature is not the sum of its parts." ***New Scientist*** 200.2676 (2008)
- "Computation: The edge of reductionism." ***Nature: News and Views*** 459.7245 (2009): 332-334.
- "Implementing a Quantum Computation by Free Fall." ***Science Perspectives,*** 311.5764 (2006)

SELECTED SCIENTIFIC PRESENTATIONS

Selected list of scientific presentations at various conferences, workshops and institutes:

(FS) AND (PS) DESIGNATE INVITED TALKS:

(FS): FULL SUPPORT
(PS): PARTIAL SUPPORT

2014-12*: Relativistic Quantum Information Workshop, Brisbane, Australia* **(PS)**
2014-09: *FQXi Workshop on Quantum Sequential measurements and complexity, Siegen, Germany* **(FS)**
2014-05: *CQIQC Colloquium, University of Toronto, Canada* **(PS)**
2014-01: *4th Quantum Information Science Workshop, Hong Kong* **(PS)**
2013-12: *East Lake Forum for Outstanding Young Scholars, Wuhan, China* **(FS)**
2013-11: *College of Optoelectronics Colloquium, Tianjin University, China* **(FS)**
2012-07: *QCMC 2012, Vienna, Austria*
2012-06*: Clarendon Laboratory Seminar. Oxford University, United Kingdom.* **(PS)**
2012-04: *Department of Physics Seminar, University of Queensland, Brisbane, Australia* **(PS)**
2011-10: *Institute of Theoretical Physics Seminar, Chinese Academy of Science. China.* **(PS)**
2011-03: *Quantum Simulations Workshop, Benasque, Spain.* **(PS)**
2010-06: *Physics Departmental Seminar, University of Lund, Sweden.* **(PS)**
2010-05: *Quantum Control Seminar Series, Australian National University, Australia.* **(PS)**
2009-01: *Quantum Technology in Biological Systems Workshop, Singapore* **(FS)**
2008-07: *Summer Seminar Series, Max Plank Institute, Erlangen, Germany* **(PS)**

PROFESSIONAL AND PUBLIC SERVICES

- *Referee for high impact scientific journals (including Nature Photonics, PRL)*
- *Invited contributor for New Scientist (Issue 2995), Physics Today, Foundational Questions Institute Blog and the University of Queensland Infinity magazine (Issue 22)*
- *Centerpiece article in the 2012 Center for Quantum Technologies Annual Report*

TEACHING

Course Design: Design of syllabus for undergraduate course, '*Physics of Information*', a unique course for the Institution of Information sciences to integrate physics and information theory.

Lecturing: Special Topics in Information Physics, Physics of Information, General Physics 2 (Relativity Section) at Tsinghua University.

Tutoring: Academic and Personal tutor for 4 undergraduates (Tsinghua University, 2013-Present). Previously resident Tutor in Physics and Computer Science (International House, University of Queensland 2007-2008) and Visiting Physics Tutor (Dushesne College, University of Queensland 2007).

LIST OF PUBLICATIONS:

Refereed

NOTE:
Citation counts are based on Google Scholar as of 1/1/2015

F. Franchini, J. Cui, L. Amico, H. Fan, M.Gu, V. Korepin, L. Kwek, V. Vedral. *Local convertibility and edge states in quantum many body systems, Phys. Rev. X 4, 041028* 2014

M. de Almeida, M Gu, A Fedrizzi, M.A. Broome, T.C. Ralph, A. White. *Entanglement-free certification of entangling gates* Physical Review A 89, 042323, 2014

S.Sridharan, M. McEneaney, M.Gu, M. James. *A reduced complexity min-plus solution method to the optimal control of closed quantum systems.* Applied Mathematics & Optimization, 1-42, 2014

Tan, Ryan, Daniel R. Terno, Jayne Thompson, Vlatko Vedral, and Mile Gu. *Towards Quantifying Complexity with Quantum Mechanics.* EPJ Plus 129, 9, 1-12, 2014

X. Cai, C. Weedbrook, Z. Su, M. Chen, M. Gu, M. Zhu, L. Li, N. Liu, C. Lu, J. Pan. *Experimental Quantum Computing to Solve Systems of Linear Equations* Phys. Rev. Lett, 2013

J. Cui, L. Amico, H. Fan, M. Gu, A. Hamma, V. Vedral. *Local characterization of 1d topologically ordered states.* Phys. Rev. B. 88, 125117, 2013

M. Gu, H. Chrzanowski, S. Assad, T. Symul, K. Modi, T. C.Ralph, V.Vedral, P.K. Lam. *Observing the operational significance of discord consumption* Nature Physics 8, 671–675, 2012. ***100+ Citations*** *(Featured on Nature Photonics, and New Scientist)*

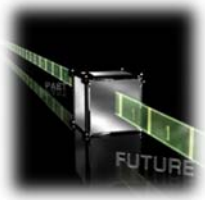
M. Gu, K. Wiesner, E. Rieper, V. Vedral. *Quantum Mechanics can reduce the complexity of classical models.* Nature Communications 3, 762, 2012 *(Featured in New Scientist)*

J. Cui, M. Gu, L.C. Kwek, M.F. Santos, H. Fan, V. Vedral. *Quantum phases with differing computational power.* Nature Communications 3, 812, 2012. ***35 Citations.***

K. Modi, M. Gu . *Coherent and Incoherent Contents of Correlations,* International Journal of Modern Physics B, 27 , 2012.

M. Gu, Alvaro Perales. *Encoding Universal Computation in the Ground States of Ising Lattices,* Phys. Rev. E. 86, 1:011116, 2012.

K. Wiesner, M Gu, E. Rieper, V. Vedral. *Information-theoretic bound on the energy cost of stochastic simulation,* Proceedings of the Royal Society A, 468, 4058–4066



COVER IMAGE FOR THE PAPER 'OCCAM'S QUANTUM RAZOR'. RECENTLY PUBLISHED IN NAT. COMM 3, 762

M. Gu, C.Weedbrook, P. van Loock, and N.Menicucci, Timothy C. Ralph. *Computing with continuous variable clusters.* Phys. Rev. A, 79:063218, 2009. ***100+ Citations.***

S. Sridharan, M. Gu, M.R. James, W. M. McEneaney. *Reduced-complexity numerical method for optimal gate synthesis.* Phys. Rev. A, 82:042319, 2010. ***15 Citations.***

S. Sridharan, M. Gu, M.R. James, W. M. McEneaney *An efficient computational method for the optimal control of higher dimensional quantum systems.* 2010 49th IEEE Conference on Decision and Control (CDC), 2010.

M. Gu, C.Weedbrook, A. Perales, and M. Nielsen. *More really is different.* Physica D. 238, 835-839, 2009. ***19 Citations.*** *(Featured on Nature News and Views, and New Scientist)*

P. van Loock, C.Weedbrook, and M. Gu. *Building Gaussian cluster states by linear optics.* Phys. Rev. A, 76(3):032321, 2007. ***100+ Citations.***

S. Sridharan, M. Gu, and M. James. *Gate complexity using dynamic programming.* Phys. Rev. A, 78(5):052327, 2008. ***13 Citations.***

M. Gu, A. Doherty, and M. Nielsen. *Quantum control via geometry: An explicit example.* Phys. Rev. A, 78(3):032327, 2008.

NC Menicucci, P Van Loock, M Gu, C Weedbrook, TC Ralph, MA Nielsen. *Universal quantum computation with continuous-variable cluster states.* Physical review letters 97 (11), 110501. ***250+ Citations.***

M. Nielsen, M. Dowling, M. Gu, and A. Doherty. *Quantum computation as geometry.* Science, 311(5764):1133–1135, 2006. ***80+ Citations.***

M. Nielsen, M. Dowling, M. Gu, and A. Doherty. *Optimal control, geometry, and quantum computing.* Phys. Rev. A, 311(5764):062323, 2006. ***40 Citations***

M. Gu, and A. S Parkins, and H. J. Carmichael. *Entangled-state cycles from conditional quantum evolution.* Phys. Rev. A. 93:043813, 2006.

Stephen Clark, Amy Peng, Mile Gu, and Scott Parkins. *Unconditional Preparation of Entanglement between Atoms in Cascaded Optical Cavities.* Phys.Rev.Lett. 91:177901, 2003.

Preprint

Xiao Yuan, Syed M. Assad, Jayne Thompson, Jing Yan Haw, Vlatko Vedral, Timothy C. Ralph, Ping Koy Lam, Christian Weedbrook and Mile Gu *Replicating the benefits of closed timelike curves without breaking causality". arXiv:1412.5596.*

C Weedbrook, S Pirandola, J Thompson, V Vedral, M Gu, *Discord Empowered Quantum Illumination,* arXiv:1312.3332, 2013 (corresponding author, highlighted in *Nature Physics 10, 474*)

J. Thompson, M Gu, K Modi, V Vedral, *Quantum Computing with Black-box Subroutines,* arXiv preprint arXiv:1310.2927, 2013

O. Dahlsten, A. Garner, J Thompson, M Gu, V Vedral, *Particle exchange in post-quantum theories*, arXiv preprint arXiv:1307.2529, 2013