The Quantum Times

Volume 5, Number 3
Fourth Quarter, 2010

Newsletter of the Topical Group on Quantum Information

American Physical Society

Inside this issue

March Meeting in the Lone Star State

Put on your cowboy hats, it's time to go to Dallas! This year we will have an impressive line-up of quantum information talks for the APS March Meeting in Dallas, Texas, and you won't want to miss it ... or at least you shouldn't!

This will be the biggest year yet for quantum information and computing at an APS March Meeting. There will be over 400 talks on the subject, covering nearly every aspect of the field you can imagine---superconducting qubits, semiconducting qubits, optical qubits, ion traps, entanglement, coherent control, decoherence, quantum error correction, and much, much more. (For gosh sakes, there're even 60 talks on the foundations of quantum mechanics!) On the back of this page, you can find a full list of GQI invited speakers and topics, as well as a list of speakers and topics from other divisions that are directly relevant to GQI concerns. The full schedule of GQI-sponsored talks can be found here: http://meetings.aps.org/Meeting/MAR11/sessionindex2?SponsorID=GQI

Two of the invited sessions particularly stand out. "20 Years of Quantum Information in Physical Review Letters" on the Wednesday will feature five retrospective talks from five of the field's founding fathers. Want to see the man who invented the word qubit (and lived to watch it become an entry in the Scrabble Players' Dictionary)? He'll be there! We're hoping this session will be a big draw for the whole APS and serve to entertain and educate them about our growing field. Before that though, on the Tuesday, there'll be a session titled "Quantum Information: Featured Experiments". Who in the general (non-GQI) APS would have thought that the world's presently most accurate clocks are directly reliant on quantum-

Continued on next page

Letter from the incoming chair

It's hard to compete with last year's letter from last year's chair, Dave "Pledge Drive" Bacon – I won't even try. But pledge drive is what it's all about! So, I am glad he set the tone.

My guess is that this is going to be a key year for the GQI. Presently our membership is just a bit below 1,100. If we can get it up to 1,450 members and sustain that for two years, we can petition to become an APS division. That might look like a lot, but I don't think it is really – that is why I say this could be a key year. With our upcoming much-larger-than-previous turn-out at the APS March Meeting (our submissions grew by 40% from last year!), I think we will be in a very good position to make it happen. The March Meeting is our crystal. We just need to give the APS the best showing of quantum information it's ever seen, and that is bound to build excitement and a desire in many to be part of the topical group. I'll tell two friends, and they'll each tell two friends, and the same for each of you, and we can make this thing happen.

"APS Division of Quantum Information," doesn't that sound so sweet to the ear? And doesn't it sound so respectable? We would obtain for the first time actual representation within the APS – we'd be respected brothers and sisters to the Division of Condensed Matter Physics, the Division of AMO Physics, and all the others. American physics would respond in part to our membership's desires and needs.

I will tell two (embarrassing) stories from my history in this field, from earlier times when I was trying to get a faculty position. At the conclusion of one job colloquium, one of the professors asked me, "This is nice for weekend physics, but what do you during the week?" Of another interview, it was leaked to me that

Continued on next page

Texas, continued

computing techniques? We hope it'll be a lesson. Quantum information is not only crucial for the future of computing; it is forcefully relevant for weights and measures today!

Beyond the talks, GQI will also sponsor a tutorial "Quantum Simulation and Computing with Atoms" (given by Ivan Deutsch), two "Graduate Student Lunches with the Experts" (hosted by Benjamin Schumacher and Anton Zeilinger), and a "pizza and beverage-of-your-choice reception" before the business meeting. (Yes, we'll have beer; it's Texas.)

At the risk of sounding like a Slap Chop infomercial, "But wait, there's more!" The March Meeting in general this year is just going to be an exceptionally good one. For instance, there'll also be a celebration of the 100th year anniversary of superconductivity, with a Nobel laureate session associated with it. Speakers include Ivar Giaever, Wolfgang Ketterle, Sir Anthony Leggett, K. Alexander Mueller, and Frank Wilczek. Furthermore, one of this year's Nobel prize winners for the discovery of graphene, Konstantin Novoselov, will give a special talk.

There are all kinds of reasons to come. We hope that nearly every member of the GQI will be there. We have a real chance to show our relevance and importance to the APS this year. Going to the March Meeting is, of course, about learning and communicating physics, but it is also about building community and friendships and establishing a base for career paths in our field. Young people need jobs, and one way to see to it that there will be some jobs out there is to get the world physics community to take note of quantum information.

So, please tell your students, tell your teachers and friends, that important things will happen in Dallas this year. Here's the website to go to for all the details on the meeting: http://www.aps.org/meetings/march/. Don't forget, January 21 is the deadline for early registration – thereafter registration fees go up. Get everyone you can to come. Texas (like Hilbert space) is a big place and always accommodating!

–Christopher A. Fuchs

Letter, continued

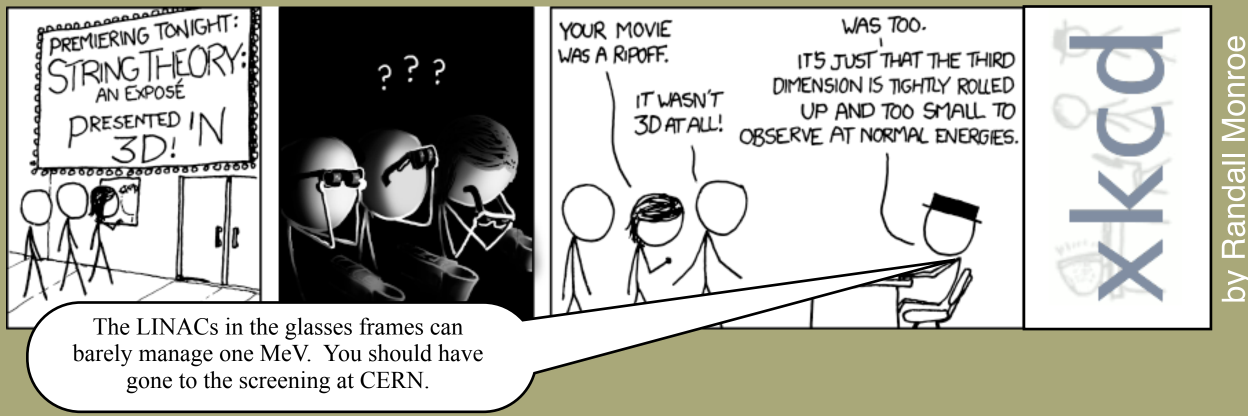
in the faculty discussion after my departure, one of the professors implored, "Well, if he likes quantum mechanics so much, why doesn't he do anything with it!?" But I was doing quantum information then, as I am doing quantum information now – the subject matter has not changed particularly (see the photo on the next page).

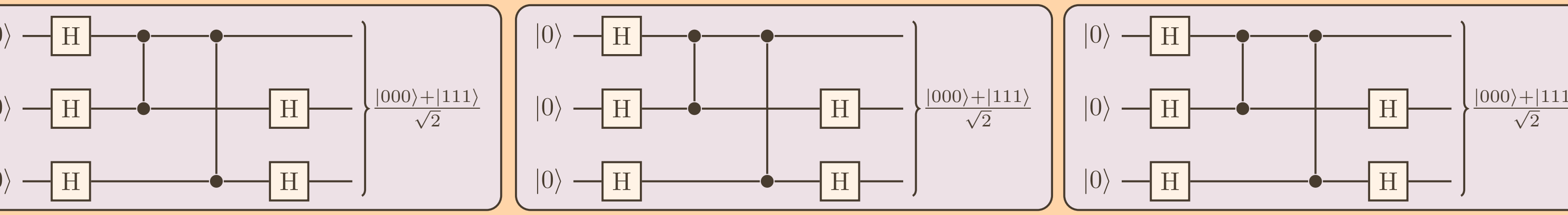
So many of you must have experienced (or will soon experience) something similar in your own careers. But we want that number to be less and less. To the extent that such behavior in hiring committees has abated over the years, it has done so only because of the increased awareness and respect the rest of the physics community has come to for this subject we hold so dear to our hearts. We have made great progress in the 20 years since *Physical Review Letters* started publishing papers in quantum information – 2011 is an anniversary for us – but there is so much further to go.

I look to 2011 to be a bend in our curve of growth within the APS. So, my job for the coming year will be to "tell two friends" every chance I get about the beauty and promise of quantum information. I hope all the GQI will do their best to do the same.

We have a world to change. Let's do it!

***Christopher A. Fuchs** is a Senior Researcher at the Perimeter Institute for Theoretical Physics in Waterloo, Canada and an Adjunct Professor at the University of Waterloo. He is a winner of the 2010 International Quantum Communication Award and Chair of the American Physical Society Topical Group on Quantum Information. His Erdos number is 3, but so is his Einstein number. Mostly, he is very proud that his academic great-great-great-great grandfather Franz Exner (through the lineage Carlton Caves, Kip Thorne, John Wheeler, and up) believed, long before quantum mechanics was around, that our ultimate physics would be indeterministic. Chris's Cambridge University Press book* Coming of Age with Quantum Information *has just appeared at the bookstores, and he's been told, makes for some "great incendiary fun."*





Roughly half of all quantum information researchers in 1994

See if you can name these people. Answers on p.8
Photo courtesy of Charlie Bennett from a gathering in Torino (1994).

Cover photo: The photo in the top right corner of the first page is of Elm Street in Dallas from 1942 taken by well-known photographer Arthur Rothstein for the Farm Security Administration's Office of War Information and is maintained by the Library of Congress.

APS
Topical Group on Quantum Information

March Meeting: invited speakers and sponsored sessions

Session with invited talks

Quantum Information: Featured Experiments

H. Jeff Kimble (CalTech) *Entanglement of Spin Waves among Four Quantum Memories*

Christopher Monroe (JQI/Maryland) *Quantum Networks with Atoms and Photons*

Till Rosenband (NIST) *Quantum-Logic Clocks for Metrology and Geophysics*

Robert J. Schoelkopf (Yale) *Towards Quantum Information Processing with Superconducting Circuits*

Anton Zeilinger (Vienna) *Quantum Information and the Foundations of Quantum Mechanics: A Story of Mutual Benefit*

20 Years of Quantum Information in Physical Review Letters

Charles H. Bennett (IBM) *The Theory of Entanglement and Entanglement-Assisted Communication*

David P. DiVincenzo (Aachen) *Twenty Years of Quantum Error Correction*

Artur Ekert (Oxford/NUS) *Less Reality, More Security*

Richard J. Hughes (LANL) *Twenty-Seven Years of Quantum Cryptography!*

Benjamin Schumacher (Kenyon) *A Brief Prehistory of Qubits*

Symmetric Discrete Structures for Finite Dimensional Quantum Systems

Berthold-Georg Englert (NUS) *Pairwise Complementary Observables and Their Mutually Unbiased Bases (MUBs)*

Asa Ericsson (Institut Mittag-Leffler) *Quantum States as Probabilities from Symmetric Informationally Complete Measurements (SICs)*

Steven T. Flammia (CalTech) *The Lie Algebraic Significance of Symmetric Informationally Complete Measurements*

Christophe Schaef (Vienna) *Experimental Access to Higher-Dimensional Discrete Quantum Systems: Towards Realizing SIC-POVM and MUB Measurements using Integrated Optics*

William K. Wootters (Williams) *Isotropic States in Discrete Phase Space*

Superconducting Qubits - Gates & Algorithms*

John Martinis (UCSB) *Scaling Superconducting Qubits with the ResQu Architecture*

Superconducting Qubits*

Christopher Chudzicki (Williams), *LeRoy Apker Award winner Parallel State Transfer and Efficient Quantum Routing on Quantum Networks*

Quantum Optics with Superconducting Circuits*

Andreas Wallraff (ETH, Zurich) *Tomography and Correlation Function Measurements of Itinerant Microwave Photons*

Semiconducting Qubits - Quantum Control*

Amir Yacoby (Harvard) *Control and Manipulation of Two-Electron Spin Qubits in GaAs Quantum Dots*

Quantum Information for Quantum Foundations - Axiomatics and Toy Models*

Giulio Chiribella (Perimeter) *Toward a Conceptual Foundation of Quantum Information Processing*

Advances in Ion Trap Quantum Computation

Richart E. Slusher (Georgia Tech) *Trapped Ion Arrays for Quantum Simulation*

Full GQI session index

20 Years of Quantum Information in Physical Review Letters
Advances in Ion Trap Quantum Computation
Open Quantum Systems and Decoherence
Optomechanics at the Quantum Limit
Quantum Computing and Simulation *(2 sessions)*
Quantum Control and Measurement
Quantum Communication, Theoretical Entanglement, and Cryptography
Quantum Entanglement
Quantum Information: Featured Experiments
Quantum Information for Quantum Foundations - Experiments and Tests*
Quantum Information for Quantum Foundations - Structures in Hilbert Space*
Quantum Information for Quantum Foundations - Information Measures, Entanglement, and Entropies*
Quantum Optics with Superconducting Circuits* *(2 sessions)*
Semiconductor Qubits- Dynamic Decoupling, Dephasing, and Relaxation*
Semiconductor Qubits - In Search of Majorana*
Semiconductor Qubits- Optical Control, Donors, and Hybrid Systems*
Semiconducting Qubits - Quantum Control*
Semiconductor Qubits- Silicon Spin Qubits*
Semiconductor Qubits - Spin Readout, Backaction, and Valley Physics in Silicon*
Semiconductor Qubits - Theory and Experiment*
Superconducting Qubits*
Superconducting Qubits - Coherence and Materials* *(3 sessions)*
Superconducting Qubits - Gates & Algorithms*
Superconducting Qubits - Measurement*
Symmetric Discrete Structures for Finite Dimensional Quantum Systems

* Denotes a “Focus Session.”

Op-ed

A Crisis in US Science

While the readership of *The Quantum Times* spans the globe, it is, nevertheless, a publication of the American Physical Society. Being responsive to member needs and desires while simultaneously representing the larger organization of which it is a part can sometimes require a balancing act. I suspect that reader reaction to a new report from information services provider Thomson Reuters analyzing the United States' research output will be mixed [1]. The report notes that the US, while still holding a commanding lead, is finding its status challenged as the world's leading nation in terms of research output. The Asia-Pacific region, though not a single nation, has overtaken the US both in terms of published papers and total research expenditures, though the US still holds an edge in per capita spending.

Of particular interest to our readers, the Thomson Reuters report notes that research in the physical sciences has suffered perhaps the greatest hit, taking a "back seat" to the biological sciences despite the fact that we, arguably, have an economy largely driven by quantum mechanics. If you aren't sure you believe that claim, stop and think for a moment just how many things within arm's reach of you, as you read this, contain transistors or lasers (most computers contain both). Both are essentially quantum mechanical devices and both were developed in the US. There have been 189 recipients of the Nobel Prize in Physics since the award's inception in 1901, 85 of whom were from the US (that's nearly three times as many as any other country). It would be useful for everyone – the US and the rest of the world – to understand exactly what it was that made the US such fertile ground for new ideas for so long.

On the one hand, the rise of Asia and the Pacific is good news for our colleagues and readers in that region. The growth in this region is evident in the quantum information community with major centers having developed in Australia, Singapore, India, Japan, and, of course, China, and a major conference series, the Asia Pacific Conference in Quantum Information Science, now heading into its sixth iteration.

On the other hand, the US' decline has its drawbacks, particularly in its timing. While it is probably true that the decline has been going on for many years, the world is arguably still in an economic recession and the US still has the world's single largest GDP [2] meaning that, in theory, it is still in the single best position to make a difference. Not doing so will only hasten its decline and set science back years.

The APS, for its part, does what it can by organizing letter-writing campaigns to Congress both at meetings and via mass e-mails to APS members. But the fact is that science – and particularly physics – has little sway in Washington, or anywhere else for that matter. A 2010 report by the US National Science Foundation includes data on R&D spending as a percentage of GDP [3]. Considering how ubiquitous technology has become, it is interesting to note that the country that spends the largest percentage of its GDP on R&D is Israel with 4.68% (this number may be higher since Israel does not divulge its military R&D spending). By contrast, the US spends 2.68% of its GDP on R&D.

If there is a silver lining to these numbers as far as the US is concerned it is that US universities, according to the NSF report, generally do not keep track of departmental research that is not separately budgeted and accounted for. For instance, a certain portion of my job is expected to go towards research whether or not I have a grant. According to the US Department of Education, as of 2007, the US had 4,861 colleges and universities [4]. That's a lot of uncounted research dollars.

Nevertheless, it is clear we need to do more, both in the US and elsewhere. We already do quite a bit of education and outreach, indeed they have become an integral part of doing science in the 21st century. Unfortunately it hasn't made the difference that many of us had hoped it would make a decade or more hence. Is it because of the way in which we *do* outreach or is it something else, something larger and more societal? Perhaps it is a mix. Either way it is imperative that we find out and then implement the changes that are called for. To borrow a line from Chris Fuchs, we have a world to change! Let's do it!

Ian T. Durham *is the editor of this rag. In his day job, he is Associate Professor and Chair of the Department of Physics and Director of the Computational Physical Sciences Program at Saint Anselm College in Manchester, New Hampshire. He lives on the coast of Maine and blogs about quantum empiricism at http://quantummoxie.wordpress.com. He once taught an introductory physics class in a full clown costume, red nose and all.*

[1] J. Adams and D. Pendlebury, *Global Research Report: United States*, Thomson Reuters, New York, 2010.

[2] *World Economic Outlook Database*, International Monetary Fund, 2010, http://www.imf.org/external/pubs/ft/weo/2010/02/weodata/index.aspx

[3] *Science and Engineering Indicators: 2010*, National Science Foundation, 2010, http://www.nsf.gov/statistics/seind10/start.htm

[4] "The Almanac of Higher Education," *The Chronicle of Higher Education* **LVI** (1), 5, 2009.

Bits, BYTES, *and Qubits*

QUANTUM NEWS & NOTES

Testing string theory using entanglement

We are not used to associating string theory with entanglement. One tends to be the realm of cosmologists and particle physicists seeking a 'theory of everything' while the other tends to be the realm of, well, us. But now physicists at Imperial College, London have discovered that string theory makes concrete predictions about the behavior of entangled particles.

String theory has been hailed among modern theories as giving us perhaps the best chance of a unified field theory, though it has come under increasing fire in recent years for its lack of experimental support. Part of the problem came from the fact that string theory didn't make many testable predictions. While these new results are certainly encouraging for string theory advocates, the predictions are not novel and thus won't be proof that string theory is the 'correct' theory of everything. Nevertheless, it could serve to open up new areas of research at the interface of quantum information and particle physics.

The research was published in *Physical Review Letters* in September.

A photonic transistor

Researchers at the Max-Planck-Institut für Quantenoptik (MPQ), Ecole Polytechnique Fédérale de Lausanne (EPFL), and the Institut Néél in Grenoble, France, have developed an optical transistor based on the interaction of photons with phonons. In the transistor a light beam passing a chip-based optical micro-resonator can be controlled by a stronger, secondary light beam. When photons are coupled to the resonator, they exert radiation pressure on the resonator.

The basic principle of exploiting radiation pressure to control objects has been in use for many years to trap and cool atoms and is known as electromagnetically induced transparency (EIT). Only in the past five years has it been used to control mechanical vibrations at the micro- and nano-scale. This has led to the creation of an entirely new field of research known as cavity optomechanics.

The specific effect employed in the optical transistor had been theoretically predicted more than two years ago but implementation had been elusive. The micro-resonator serves to amplify the tiny radiation pressure exerted by the photons. This in turn deforms the cavity, hence coupling the photons to the mechanical vibrations (phonons) of the cavity itself. The secondary (control) laser, when coupled to the resonator, produces a 'beat' effect with the primary (signal) laser that produces a vibration in the resonator that can then prevent the signal laser from entering the cavity, eventually leading to a transparency window. Hence the new effect has been dubbed 'optomechanically induced transparency' (OMIT). The application to information storage should be immediately obvious but the devices should also prove useful as an interface in hybrid quantum-classical systems.

The research appeared online in *Science Express* in November and in print in *Science* in December.

Another optical advance

Back in 1999 Dan Gottesman and Ike Chuang theoretically predicted that one could create a quantum logic gate by teleporting certain entangled states, referred to in some publications as the 'GC scheme.' Physicists at the University of Science and Technology of China (USTC) in Hefei and their colleagues at Ruprecht-Karls-Universität Heidelberg in Germany have now developed a physical realization of the GC scheme and have done so using two different methods producing two different gates. In one method the group used a six-photon interferometer to create a controlled-NOT gate while in another method they used four-photon hyperentanglement to create a controlled-Phase gate. The group also confirmed that both gates demonstrated genuine entanglement. In the case of the controlled-Phase gate they were also able to show that it achieves quantum parallelism, meaning that it can't be reproduced by local operations and classical communications (LOCC). The work appeared in the *Proceedings of the National Academy of Science* in December.

Toshiba refutes QKD 'hacking' claims

In the previous issue of *The Quantum Times* we reported that researchers in Norway and Germany had successfully 'hacked' two commercial quantum cryptosystems (one from ID Quantique of Geneva and one from MagiQ Technologies of Boston), reporting their results in *Nature Photonics*. Researchers at Toshiba's Cambridge Research Laboratory have written a rejoinder, also in *Nature Photonics*, that demonstrated that this attack, as with others, is ineffective if the hardware is set up properly. Essentially, the original attack involved 'blinding' the single-counting photodiodes in the system. These photodiodes are implemented with a bias resistor that is actually unnecessary when they are in single-photon mode. The Toshiba group showed that removing this resistor or correctly setting the light thresholds should make any 'blinding' attack detectable.

The authors of the original report detailing the attack were then offered the right to reply. In their reply they indicate that the situation isn't quite as simple as the

Continued on next page

Toshiba team suggests, though they do agree with the basic findings. They note that the two 'hacked' systems were assembled according to manufacturer guidelines and were thus set up 'properly,' i.e. any of these systems that are presently in use remain vulnerable as long as the manufacturers do not issue a patch or alternate guidelines. In addition they showed that, independent of implementation, it is possible to launch a 'blinding' attack on the system even without knowing the details of the detectors. Both pieces appeared in *Nature Photonics* in December.

Testing realism

Most quantum physicists accept that quantum mechanics appears to violate local realism. For one reason or another this is considered to be a bad thing. Local realism is actually the combination of the Principle of Locality – objects are only affected by their immediate surroundings – with the notion of realism – things exist regardless of whether or not we observe them. It's hard to say which part of local realism is more limiting but the Copenhagen interpretation generally rejects the realism part of local realism. But in 2003 Nobel Laureate Sir Anthony Leggett suggested taking the opposite tack – reject locality in favor of realism. In the process he proposed a set of inequalities to test this assertion.

To simplify the arguments and try to understand why people prefer one part of local realism over the other (whichever part that may be), it is easiest to think of locality as preserving causality in the universe (though this is a debatable point). Thus, rejecting locality to some was like rejecting causality which seems to be a tough thing for people to accept. Rejecting realism, on the other hand, meant assuming that objects only 'come into being' when we observe them. Again, this is a highly simplified explanation and brushes over many nuances, but it gives you the basic context for the debate.

Bell's inequalities are usually interpreted as demonstrating that locality must be abandoned in quantum systems (alternative explanations do exist, e.g. epistemic interpretations). Leggett's inequality (which is distinct from the Leggett-Garg inequality that was proposed in 1985 to test macrorealism) passes the Bell test, having first been experimentally tested in 2007. These results suggested that we must also abandon realism in quantum systems. But the question of whether or not Leggett's concept accurately describes the quantum world remained. Arguably this question still remains, but researchers at the Universities of Glasgow and Strathclyde in Scotland have performed a complementary experiment that supports the earlier results via a different method. The original tests of Leggett's inequality looked for correlations between elliptically polarized states. In the new set of tests, the researchers looked instead at the 'orbital' angular momentum of photons. Orbital angular momentum for photons can be understood by assuming the electromagnetic wave rotates around the beam axis as it propagates.

It is important to note that Leggett's inequality only describes a certain class of non-local theories. It is also important to note, as we did earlier, that there are interpretations that preserve locality and/or realism within the context of quantum theory.

The research was published in the *New Journal of Physics* in December.

Testing freedom of measurement

In addition to locality and realism there is actually a third assumption that is inherent in most tests of Bell's inequalities: the freedom to independently choose which local measurements to make. This assumption is sometimes glossed over in both experimental tests as well as alternative interpretations of quantum theory. Michael J.W. Hall of the Australian National University, in a recent issue of *Physical Review Letters*, investigates what would happen if this freedom of choice were gradually taken away. He achieves this by making the distribution of the local hidden variables dependent on the actual measurements that are made. In other words, the experimenter has complete freedom in his or her choice of which measurement to make first, but the subsequent choices become more and more dependent on the results that are found.

What Hall finds is that experiments of this sort can, in theory, achieve the algebraic limit of 4 for the CHSH inequalities, in contrast to the classical limit of 2 and the quantum mechanical limit of 2.82. Since the classical case assumes that no freedom is sacrificed the question then becomes, exactly how much freedom must be sacrificed to achieve the quantum mechanical result? The answer, Hall finds, is approximately 14%.

News shorts

- A group of researchers at TU Delft and Eindhoven University of Technology in the Netherlands has successfully controlled qubits using an electric field by exploiting the spin-orbit coupling of electrons. The work recently appeared in *Nature*.
- A group of researchers at the University of Utah, Florida State University, and University College, London have found a way to store and read nuclear spins in phosphorous doped silicon. Details were published in *Science* in December.
- Two independent groups have demonstrated the ability of entangled photons to transfer their entanglement to and from a solid, a process that could one day form the basis of quantum repeaters. One group included researchers at the Universities of Calgary (Canada) and Paderborn (Germany) while the other was from the University of Geneva. Both results were recently published in *Nature*.

–ITD

The Quantum Times

Volume 5, Number 3
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The Quantum Times is a publication of the Topical Group on Quantum Information of the American Physical Society. It is published four times per year, usually in March, June, September, and December, though times may vary slightly.

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Contributions

Contributions from readers for any and all portions of the newsletter are welcome and encouraged. We are particularly keen to receive

- **op-ed pieces and letters** (the APS is *strongly* encouraging inclusion of such items in unit newsletters)
- **books reviews**
- **review articles**
- **articles describing individual research** that are aimed at a broad audience
- **humor** of a nature appropriate for this publication

Submissions are accepted at any time. They must be in electronic format and may be sent to the editor at idurham@anselm.edu. Acceptable forms for electronic files (other than images) include LaTeX, Word, Pages (iWork), RTF, PDF, and plain text.

Editorial policy

All opinions expressed in *The Quantum Times* are those of the individual authors and do not represent those of the Topical Group on Quantum Information or the American Physical Society in general.

Announcements

Foundations announcement list

A new (moderated) quantum foundations mailing list, with a broad scope and involving the international foundations community, has been established by the Quantum Group at Oxford's Computing Laboratory. Currently the group has roughly 500 members. To subscribe, send a blank e-mail to

quantum-foundations-subscribe@maillist.ox.ac.uk

To make a post, send an e-mail to

quantum-foundations@maillist.ox.ac.uk

Quantum random number generator service

PicoQuant GmbH and the Department of Physics – Nanooptics of Humboldt University have launched an internet-based, high bit rate quantum random number generator service. Using the service is free of charge but requires registration. Details may be found at

http://qrng.physik.hu-berlin.de/

Key to Torino photo from p. 3

Front, kneeling: Charles Bennett
First line across: Chiara Machiavello, Hideo Mabuchi, Michael Biafore, Sam Braunstein
Next line: Bruno Huttner, Adriano Barenco (blue shirt) – gap – Chris Fuchs (yes, that's really him, sans glasses!), Kalle-Antii Suominen (purple sweater)
Next line: Artur Ekert (head partially covered by Huttner), some Russian guy never seen again (blue suit), Massimo Palma (beard, glasses), Asher Peres (brown sweater), Harald Weinfurter (white shirt)
Next line: Tal Mor (sitting high), Peter Shor (mustache), John Rarity (white hair), Guenter Mahler (red sweater), Peter Zoller (head partially hidden because of Peres' and Fuchs' heads), David DiVincenzo
Remaining left cluster, three people: Claude Crépeau (barely visible behind Peter Shor's head), Dominic Mayer, Norman Margolus (blue shirt)
Remaining right cluster, three people: Lev Vaidman (blue sweater), Christian Kurtsiefer (striped shirt), Nicolas Gisin (red sweater)

Call for Papers (special issue)

International Journal of Quantum Information

Quantum Correlations: entanglement and beyond

GUEST EDITORS
Shunlong Luo (Chinese Academy of Sciences)
Sabrina Maniscalco (Heriot-Watt University)
Kavan Modi (National University of Singapore)
G. Massimo Palma (University of Palermo)
Matteo G. A. Paris (University of Milano)

Quantum correlations have been the subject of intensive studies in the last two decades, mainly due to the general belief that they are fundamental resources for quantum information processing and other tasks in quantum technology. The first rigorous attempt to address the classification of quantum correlations was put forward by Werner, who formalized the elusive concept of quantum entanglement. More recently, other quantities, as such quantum discord, have been proposed to capture different aspects of the quantumness of correlations. In parallel, several applications where quantum, classical, hybrid correlations play a role have been suggested and implemented. Among them we mention quantum imaging, interferometry, state engineering, computing and entanglement-assisted quantum measurements.

This special issue is aimed to collect papers addressing both fundamental problems and applications, thus offering to readers comprehensive and up-to-date overview on the characterization and use of quantum correlations. We welcome papers that address fundamental aspects of quantum and classical correlations in discrete and continuous variable systems, propose implementations to make quantitative measurements of quantum correlations, or describe experiments that exploit quantum correlations as a resource for quantum technology.

Possible topics include, but are in no way limited to: characterization and measurement of entanglement and quantum discord, discrimination of classical and quantum correlations in quantum systems, applications of quantum correlations to quantum technology, dynamics of quantum correlations in open systems, decoherence, metrology, error correction.

Manuscripts should be submitted to matteo.paris@fisica.unimi.it with subject "[QCSPE] and must meet the normal refereeing standards of IJQI.

LaTeX is the exceedingly preferred format, IJQI macros are available at http://www.worldscinet.com/style_files/ijqi/187-readme_2e.shtml

Deadline for submission is **May 15th 2011**. Publication is expected within 2011.

International Workshop on Mathematical and Physical Foundations of Discrete Time Quantum Walk

March 29th - 30th, 2011 Tokyo Institute of Technology Oh-okayama Campus

Aim

What is probability and stochastic process in quantum mechanics? To study the foundations of the stochastic process in quantum mechanics, the discrete time quantum walk (DTQW), which is a quantum analogue of the random walk, may be useful. This has recently been the hot research field, especially in quantum information science, and been experimentally realized. This workshop will bring the theoretical researchers in the DTQW. While this workshop is focused on the theoretical side, we also welcome experimentalists. We take the advantages of special opportunities to invite founders of DTQW. The organizers strongly encourage young researchers to actively join us to this workshop.

Scope

Mathematical Foundations of Discrete Time Quantum Walk
Stochastic Process in Quantum Probability Theory
Weak Limit Theorem
Classification between Localization and Delocalization
Physical Foundations of Discrete Time Quantum Walk
Mapped to Schroedinger equation and Dirac equation
Non-local effect, entanglement, and super-oscillation
Application to Quantum Information Science

Invited speakers

Yakir Aharonov (Tel-Aviv University, Israel / Chapman University, USA)
Stanley Gudder (University of Denver, USA) (to be confirmed)
Luis Velazquez (Zaragoza University, Spain) (to be confirmed)
Takuya Kitagawa (Harvard University, USA) (to be confirmed)

Abstract submission

Oral abstract submission closed on December 31st, 2010. If you are interested in a poster presentation, please send your absract by February 28th, 2011(poster). There are 20 slots for posters available on a first-come, first-reserved basis. To submit and/or register, please visit the workshop website: http://www.th.phys.titech.ac.jp/~shikano/dtqw/

While the speakers of this workshop are theoreticians, we also welcome experimentalists and other researchers interested in DTQW. Because of limitations at the conference location, the registration will be limited to 70 people.

Organizers

Norio Konno (Yokohama National University)
Etsuo Segawa (Tokyo Institute of Technology)
Yutaka Shikano (Tokyo Institute of Technology / Massachusetts Institute of Technology, Chair)

Inquiries

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