THE QUANTUM TIMES

AMERICAN PHYSICAL SOCIETY • TOPICAL GROUP ON QUANTUM INFORMATION

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Quantum Information Technology and Industry

A new era of physics careers in industry is about to begin, based on the quantum information science/technology (QIS/T) revolution. Whether this statement is true, or can be made to be true, is something we should consider. From my viewpoint, the chances are improving, but there are still roadblocks.

To be honest, I have no view – there's no window in my Virginia office. But I do have a perspective I didn't have back in Cambridge, Melbourne, or Wisconsin. As a graduate student and postdoc, I worried about career options. My PhD, though grounded in semiconductor physics and condensed matter theory, was focused on quantum computer issues. Would the association with quantum computing become a negative or a positive? Would quantum information science peak and crash like high-Tc superconductivity? Or would the topic grow, driven by useful applications, like solid-state physics? Many of us have asked these questions.

The magnitude of QIT's industrial manifestation is impossible to predict. But in the spirit of the political season here in the USA, I've attempted to take a poll of industry contacts. My goal: to put some numbers to the anecdotal evidence I see of developments in the field. For example, we know that several large companies with long-running research divisions have been involved in QIS for some time and that a small number of start-up companies also focus on QIT, mostly in quantum communication. Increasingly, we meet physicists from traditional defense contractors at conferences and workshops who represent small QIT-focused groups within their companies. So how many QIT jobs actually exist in industry at present? This survey will be incomplete and mostly wrong; I want to use this article as a starting point, not an end, to collecting quantitative data. More on these results later.

Let's say a QIT revolution is possible, if not inevitable. What are some of the impediments that we as a physics community can address? How can we optimize our involvement? Here, I want to briefly consider only three issues: 1) practical ideas for applications of QIS, 2) jobs and science, and 3) the current culture of the physics world.

Going on 15 years the community has worried about the wasteland between the initial schemes for quantum communication and a large-scale quantum computer. Given some faith, let us posit that we are in the latter half of the first phase of a three-phase technology inception cycle for full-on QIT. The founding phase started in mid-1995 with the Shor algorithm and quantum error correction. 25 years or so is not unusual for the beginning of a typical 70-year S-curve for technology revolutions [1]. This gives us till 2020 for deployed QIT-based devices. (One could also argue it started in the 1980s with BB84, quantum teleportation, and the earliest quantum algorithms, but I will call this "quantum communication" and note that commercial products became available by 2005.)

We are all still searching for applications of quantum speedup or improvement with few quantum resources – the clichéd "killer-app" for business plans to latch onto. To me, there are two answers to "why a quantum repeater?": "build it and they will come" and "so what." It's like predicting Google at the founding of the ARPAnet. Yet, this goal

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Inside...

I'm sure many of us have had a busy, hectic, and, in many cases, difficult last few months with the global financial crisis leaving very few completely untouched. For a wide variety of reasons, some having to do with these problems, this issue was delayed in its publication. I think it was worth the wait for one reason: our cover story by Charlie Tahan.

I know that many of you are active in industry (including our chair-elect who offers his own thoughts on the state of the world later in this issue). So when Charlie suggested an article be written on quantum information and technology in industry, I jumped at the chance. But Charlie produced something well beyond my expectations, embarking on a bit of research in support of the article. So I encourage you to *read Charlie's article*. It hopefully will mark the start of a fruitful dialogue within the QIS community. It also gave me the chance to tell my own personal and rather unconventional story. We would be very appreciative of any letters regarding this topic. So please enjoy and have a very happy and safe holiday season!

ITD

Outside the box
MY LONG, STRANGE TRIP TO QIS

Charlie Tahan's article on quantum information in industry has provided me with an opportunity to tell my own story that I hope may prove to many out there that a) it is never too late to discover your passion and b) persistence is the key ingredient to fulfilling your dreams. It also demonstrates some of the key differences in the types of skills required in industry versus academia.

In order to keep this short, I'll simply state that, when I was younger no one – including myself – ever thought I'd end up in some technical discipline. There's a story-and-a-half behind that and you can ask me about it at the next conference.

In any case, I graduated from the University at Buffalo (known to non-Buffalonians as SUNY Buffalo) with a degree in mechanical engineering, minor in philosophy, and a desperate desire to work in the space industry. I landed in the DC area where I worked my way through a string of positions, all with the same "beltway bandit," that involved contracts with the FAA, National Weather Service, and NASA. I had apparently achieved my dream once I arrived at the latter. But somewhere along the way I realized I was after the science behind the technology and so I picked up a master's degree in applied physics from Johns Hopkins (I nearly had Jim Franson for quantum mechanics but he took the semester off and later moved to UMBC).

I also discovered I had a latent desire to educate, likely a result of the fact that everyone in my family was or had been a teacher – going back several generations and over a century's time. It was in my blood. So my similarly inclined wife (a political scientist by training) and I began our own educational outreach company, obtaining an SBIR grant from the NSF that got us started. This was a humbling experience as we learned fairly rapidly that, regardless of how good an idea might be, it takes a certain insight into marketing, production, management, and corporate politics to turn an idea into something successful even if it seems as if anyone "can do it." Our idea was founded on the utilization of the web as a major resource *smack in the midst of the dot-com boom*. And yet we failed. The fundamental concept was obviously a good one in principle since there are several projects still out there essentially implementing our idea. But the unique skills required to make something commercially viable were something we lacked and

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of useful systems that show quantum improvement – beyond a quantum repeater – must be diligently and methodically pursued if QIT is to become a viable industry in itself.

Secondly, the number of full-time positions in QIT is another conditional that depends on growth in the field, funding, and the mood of academic search committees and companies. Since the diminishing of corporate research divisions (with a few notable exceptions), much of the research done in the US is performed within academia and government science facilities, where the politics of success are different than in corporations (number of papers vs. experience, talent, ability to collaborate, etc.). Yet – at the very least – there seems to be a recent and growing effort to build expertise in "quantum" at some of the defense-oriented companies, in response to a perceived funding-interest from the government. As a VP at a research corporation recently told me, "they smell government money." Whatever the motivation, if it leads to talented quantum physicists in industry, I'm happy. There is a long history of military funding stabilizing early technology efforts in a new field. Unfortunately, this is not yet a sign of our grand, Ferrari-driving futures. And this isn't the 1960s. In industry, the jobs that do exist can easily go unfound. And some defense contractors require "clear-ability" as a matter of default corporate policy. A national security clearance can facilitate work at or for government institutions – even if the work isn't classified. And the converse issue, a pool of highly qualified people that are willing to leave academia, is just as important. Here, the culture of the physics academic-industry can make the difference.

We come to the state of physics – generally thriving – and physics departments. I started graduate school in 2000. One of the fascinating historical ironies about spin-based quantum computing – my research area then – is that a lot of the original work on the spin properties of electrons and nuclei in semiconductors was done circa 1960. I'm sure that some of you out there, like me, were amazed to see excellent papers around this period written by physicists from blue-chip U.S. companies. And not only AT&T's Bell Labs. I'm talking about GE, RCA, even Ford Motor Company. I remember being shocked, proud, and sad at the same time.

Think about it. How many professors in your department have ever worked in industry? We now largely have a generation of professors removed from any true physics-level corporate interaction. How can they give advice to students? How does this affect the culture and expectations of most departments? If our hoped-for incipient QIT industrial base starts to form, how must physics departments change to facilitate and benefit from this transition?

We could wait for QIT to move into engineering departments and emanate from their culture of startups and industry collaboration. But that may not be optimum.

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To me, this would manifest a belief that there is no added – or alternative – value to having physicists trained in physics departments as opposed to EE or materials science. Once upon a time, a famous condensed matter physicist said that every physicist should spend two years in industry. I bet that statement would be met with a laugh in departments today. And for good reason, since it may very well derail a promising academic future. This "science and jobs"-problem becomes more serious in a field with great technological potential and global competition. Issues like the number of years to get a PhD, the number of post-docs accepted or expected as normal, science as a realistic career (as compared to, for example, patent law) versus science as a passion, the weighted import of number of publications, the salaries of postdocs and professors, and so on – are all relevant. One might argue, convincingly, that of late the bottleneck is not on the academic side but rather on the industry side. Nevertheless, we should prepare for what may be a terrific opportunity where physics and industry can co-exist in a bi-directional way, where fundamental physics can occur on both sides, with historically-proven great dividends.

I've so far excluded the rest of the world. They are not sleeping in this race. If you look at publication records, there are almost three times the number of papers in quantum computing published outside the US as inside since the mid-1990's (it's more like three-and-a-half times for quantum communication). That science and technology drive national wealth and power is no longer a secret. I will only give a few personal experiences to support the issue. I spent two great months with Seigo Tarucha's group in Tokyo in 2005. There I met physicists in incipient quantum groups at some of the world's great companies: Sony, Hitachi, Toshiba. Then there is NTT, Japan's Bell Labs equivalent, except that it still exists. Australia, also, has taken an active role in venture capital funding of quantum communication initiatives – the offices of Quantum Communications Victoria (QCV) were on my floor in the Physics Department at the University of Melbourne while I stayed there. That country's research investment in quantum computing and particularly photonics has made them a major academic player. Canada too has targeted quantum information for national investment. My brief affiliation with Cambridge's entrepreneur association showed me that Europe is also starting to take large-scale venture capital investments seriously. Coupled with a wide and deep brain infrastructure in quantum information [2] and long-term research funding, the result may one day produce a corporate titan. The question though is which will be most successful at translating this infrastructure into global commercial success?

Finally, to the poll: this won't be statistically sound. Nor are the questions perfectly precise. I won't even promise that it's accurate. For the sake of expediency I targeted only U.S. corporations via contacts I've made

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we didn't have the monetary means at the time to bring in someone who *did* have those skills.

Around that time an adjunct gig in the physics department at the US Naval Academy in Annapolis fueled my desire to switch to academia. Being resourceful and persistent with romantic notions of a European education I managed to convince some mathematicians at the University of St. Andrews in Scotland to let me "commute" at odd intervals while completing my PhD.

My dissertation was focused on an in-depth technical study of Arthur Eddington's infamous *Fundamental Theory* and led to my meeting Steven French of Leeds University, a philosopher of physics whose work is focused on foundational issues in quantum theory. Steven served as the external examiner on my dissertation and it was through his work on foundational issues that I was finally led to quantum information science, a field in which I am almost entirely self-taught, but that I have since turned into a passion – my wife might say an obsession.

In the meantime we moved to Maine where I spent three years commuting more than six hours a day to Boston to teach at Simmons College before moving into my current position at Saint Anselm, at 81 miles, a slightly shorter commute. This is where I come almost full circle, back around to industry and engineering again.

Our department is about evenly split between straight physics majors and what are called 3-2 engineering majors – that is they spend three years with us and two years with a partner school and receive two bachelor's degrees in the end – one in physics and one in engineering. We also recently launched a certificate program (similar to a minor) in computational physical sciences, of which I am now the director.

Serving as an advisor to numerous undergraduates I have tried to instill in them a) the conviction that anything is possible and b) it is not end of the world if you change your mind at some point about what you want to do with your life. I feel that my experience in industry and as an entrepreneur has given me a unique and well-rounded perspective that hopefully encourages my students to think outside the box, something that is gaining in importance as the lines between individual disciplines as well as between academia and industry become less well-defined.

Ian Durham *is an Associate Professor of Physics and Director of the Computational Physical Sciences Program at Saint Anselm College.*

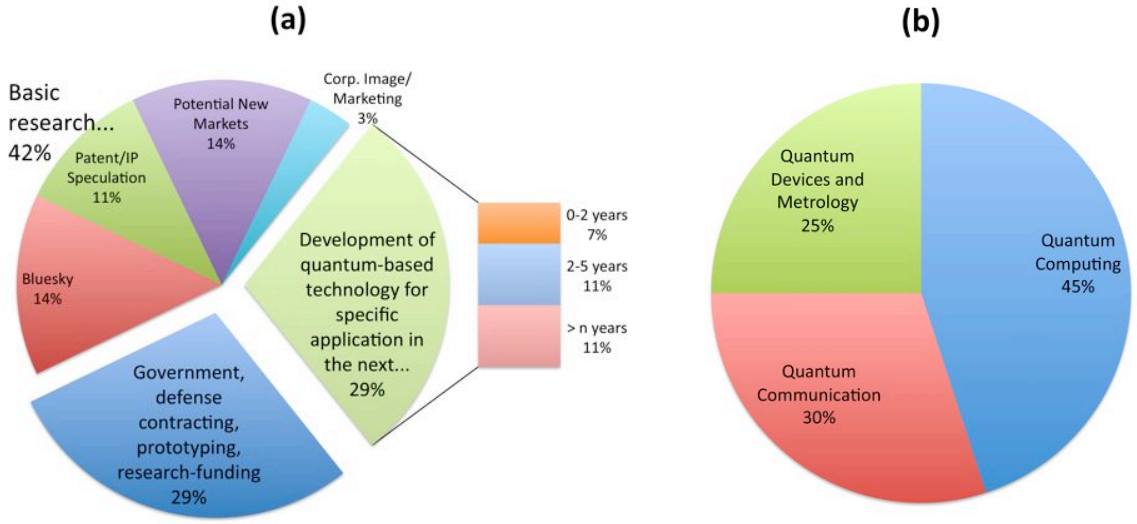

Figure 1. Poll questions, (a) Why is your company/organization interested in quantum information technology? [Check all that apply.] (b) How would you portion the focus of your company's R&D in QIT?

mostly at QIS conferences. I also included federally funded research and development centers like Lincoln Labs, MITRE, and Sandia, on the argument that they operate similarly to defense contractors. I did not however include national labs like NIST, NRL, or LBNL. I'm sure the list is not complete; but it's close. The questionnaire I sent out achieved a relatively successful response rate of over 50%. Because of the small data set and for confidentiality considerations, I won't list the name of the companies, nor specific numbers. Nearly all of the traditional defense contractors did not reply. I won't speculate on the reasons. The first question I asked, of course, was: "How many full time employees does your company employ in the field of quantum information science and technology?" Note that my definition of QIT is very strict and matches what I think readers of *The Quantum Times* would probably expect. I've argued, somewhat controversially, about the definition and language elsewhere (see Ref. [3]):

> ***QIT or "spookytechnology"*** encompasses all functional devices, systems, and materials whose utility relies in whole or in part on higher order quantum properties of matter and energy that have no counterpart in the classical world. These purely quantum traits may include superposition, entanglement, decoherence (along with the quantum aspects of measurement and error correction) or new behavior that emerges in engineered quantum many-body systems.

Just as an example, semiconductor quantum dot work focused on LEDs or other non-quantum-coherent devices would not count. My survey showed roughly 80 full time equivalent (FTE) positions currently in the United States. Adding an educated guess of 30 FTEs for companies I didn't get a response from, I get 110 or so full-time positions in quantum information technology in industry. The last question was: "How many employees do you expect to hire in this area in the next year?" The response: 12-20 FTEs – so we're looking at order 10% growth in the next year. I

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References & Resources
QUANTUM INFORMATION TECHNOLOGY AND INDUSTRY

[1] C. Perez, *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages*, E. Elgar Pub., Cheltenham, UK (2002).
[2] *Quantum Information Processing and Communication (QIPC): Strategic report on current status, visions and goals for research in Europe* (Oct 2007).
[3] C. Tahan, *Spookytechnology and Society*, http://arxiv.org/abs/0710.2537 (Oct 2007).

Contact Charlie at charlie@tahan.com or see his personal website at http://www.tahan.com/charlie/.

consider these lower bound numbers. In between these two basic questions, I asked about the reasons for these positions and the focus of each company's R&D. The answers are illustrated in Figure 1. I don't believe the data is deep enough to allow you to get anything more than a rough idea. I take from this data that we have a reasonable foundation, but it's too soon to discuss trends.

I would like to end with a dream. There is concrete evidence showing that fundamental physics – quantum physics – is becoming vital again to new directions in technology. The technological innovations of the last half of the 20th century were built largely off the basic physics discovered pre-WWII. Now a new era is beginning, based on new insights from the 1980s onward. This is an opportunity where state-of-the-art physics can again cross the industry/academic divide in a full-fledged way instead of a trickle. Our QIT-opia awaits.

This article posed too many questions with not enough answers. If you have anything to add or found this article interesting, contact me. I may write another one a year from now. If you're a student or postdoc interested in a career in QIS outside of academia, I'm happy to give any help or advice where I can.

Charles Tahan *is a former NSF Distinguished Post-doctoral Research Fellow at Cambridge University. He currently works for a major government contractor in the Washington, DC area on the intersection of quantum physics and nanotechnology, sespecially systems for quantum information science and technology. The opinions expressed here are his own and do not reflect any other organization or individual.*

Letter from the Chair-elect

I have sometimes wondered at the fact that our various chief functionaries, previously ordinary sorts of people, when they grasp the reins of power are at the same time seized by literary urgings. My urgings have not been so strong, although I always kind of liked William F. Buckley's practice that every piece should have a couple of words that everybody will have to look up in his or her dictionary. (I'm not sure I liked the pieces themselves.) But, having achieved functionary status, here I am, penning away.

I have been setting things up for our upcoming March meeting, and I am happy to say that there have been plenty of great ideas from you, the GQI membership, for exciting work to be featured there. While we have, I suppose, achieved the status of a "mature" field, the continuing freshness of quantum information science continues to be seen in the number and variety of fundamental advances that have been discussed this year. My favorites are

– Additivity of the Holevo capacity, sought for in work over the last twelve years, has now been disproved.
– Functioning Y-junction ion traps, and myriad other technical advances, continue to bring us closer to operational quantum information processing hardware.
– New states of matter in two dimensions can only be properly seen, for their beauty and usefulness, through the quantum information lens.
– Quantum Shannon theory points the way towards intellectual progress in the understanding of black holes.
– Photons really exist, even in superconducting resonators. (Or do they?)

I am sure my omissions will rightly give offense to many.

I would like to take this opportunity to offer a few words of thanks:

...To Barry Sanders, our Secretary/Treasurer. I regret that we will be without his services after 11:59pm December 31. While Chairs pass in kaleidoscopic succession, S/Ts really keep things functioning. Barry has nurtured this group almost from the beginning, and appreciates all of its varied aspects.

...To Lorenza Viola, my predecessor as Chair. She worked tirelessly (much harder than I have) to attend to the infinite details involved in setting schedules and running committees, with a strong determination to let the science shine through. I am grateful to the many hours she has devoted to helping me deal with the present year.

...To Ian Durham, our editor. Another true believer, his tireless devotion to the *Times* has made it informative, playful, and a real contributor to the community spirit of our little group.

...Finally, to David Bacon, my successor – good luck.

PS to my readers: Please write me about any solecisms.

David DiVincenzo *is Manager of the Physics of Information group at IBM Research in Yorktown, New York. He is also a Fellow of the APS, Editor-in-Chief of the Virtual Journal of Quantum Information, and Chair-elect of the APS' Topical Group on Quantum Information, publisher of this newsletter.*

$|0\rangle$ **The mathematics of invisibility** Two years ago Duke University physicists demonstrated the world's first 'invisibility cloak' – a device that proved to be invisible when viewed in certain microwave wavelengths. Recently, Tomáš Tyc of Masaryk University in the Czech Republic and Ulf Leonhardt of the University of St Andrews in Scotland (alma mater of yours truly) have developed a way to mathematically describe the effect that is no longer dependent on resonances in the material being cloaked. This allows it to work over a wider range of wavelengths. The approach utilizes non-Euclidean geometry and may lead to a way in which the index of refraction, n_r, of a material can be described at a single point for light incident at a specific angle. This is because n_r is dependent on how the transformation stretches the spacetime manifold at that point in order to create the cloaked region. So'wI'ch

$\langle 1|0\rangle$ **Bad news for quantum computers?** David Gross at the University of Braunschweig, Steve Flammia at the Perimeter Institute, and Jens Eisert at the University of Potsdam have determined that most qubits may be *too* entangled to be of any use in actual quantum computers. In measurement-based quantum computation (MBQC) highly entangled states are a key component to the realization of the speed-up over classical computation. This is because the correlations are used for the calculation. But Gross, Flammia, and Eisert have shown that for the vast majority of all states, the fraction of useful n-qubit pure states is less than $\exp(-n^2)$ thus making computational universality a rare property in quantum states. Nonetheless, there are a few special systems that may still fulfill the requirements of universality, so all is not lost.

$\langle 1|0\rangle$ **Schneier disses quantum cryptography** By now most people interested in quantum cryptography will have have heard that cryptography guru Bruce Schneier, creator of the *Solitaire* encryption algorithm (called *Pontifex* in Neal Stephenson's opus *Cryptonomicon*), has declared that quantum cryptography "as a product ... has no future." The commentary, entitled "Quantum Cryptography: As Awesome As It Is Pointless," was published on his online column *Security Matters* at Wired.com, the web presence of *Wired* magazine. The debate over this pronouncement raged throughout the blogosphere with strong opinions being voiced on both sides of the debate (a sampling can be found at http://scienceblogs.com/pontiff/2008/10/shorter_bruce_schneider_blind.php). Schneier's argument is that existing security techniques are already secure enough. One common counter-argument is that, just because existing encryption algorithms are exceptionally secure, doesn't mean they're necessarily perfect. In addition Schneier's criticism ignores a few key points. The most obvious is that it would behoove us to have usable quantum cryptographic devices in place *prior* to the wide-spread distribution of quantum computers. In addition, nearly all long distance communication is now transmitted via fiber optic cables (as opposed to via satellites a decade ago) that are ideally suited for implementing quantum encryption protocols. While existing devices have only been proven over short distances, they nonetheless appear to be a natural technological fit for optical transmission methods. If you wish to read Schneier's original article, it may be found at http://www.wired.com/politics/security/commentary/securitymatters/2008/10/securitymatters_1016.

$\langle 1|0\rangle$ **New record set for entanglement** A research group led by Jian-Wei Pan at the University of Heidelberg and including colleagues at the University of Science and Technology of China and the University of Innsbruck, has entangled a record ten qubits. The qubits in this instance were photons created by passing infrared laser pulses through three successive crystals, the first being lithium triborate (LBO) with the succeeding two being beta-barium borate (BBO), after which additional entanglement is produced via beamsplitters. The photons were in Schrödinger cat states, however, making them less useful for computational tasks since an accidental measurement on one would reveal the states of the others destroying all entanglement. Pan and his colleagues have thus proposed ways their experiment might be extended to so-called graph states that are more useful for computation since measurement on one only reveals a subset of the other qubits, leaving some entanglement intact.

$\langle 1|0\rangle$ **Ultra-cold molecules created** Two groups – one joint NIST/University of Colorado program at JILA and one at the University of Innsbruck – have created ultra-cold molecules in large numbers a few hundred billionths of a degree above absolute zero. The new research has greatly boosted the efficiency of the process that has been

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considered as one possible way to implement a quantum computer. In the Boulder experiment, the molecules were formed by bonding a potassium atom to a rubidium atom forming a dipole. In the Innsbruck experiment the molecules consisted of a pairs of rubidium atoms in an optical lattice. The density of molecules set a record with more than one billion per cubic centimeter.

⟨1|0⟩ **ISO standards for quantum technology?** A group of researchers at the University of Calgary has developed a method for testing the functionality and accuracy of quantum optical processes. The lead author on the paper announcing the result, Mirko Lobino, has suggested the work may lead to a certification process for quantum mechanical devices. The method involves homodyne tomography and analyzes a quantum process' effect on a set of coherent states. The group experimentally verified the effect of such a test on a squeezed vacuum, a state of light that they had proven, independently of a second group, could be created and stored, providing some insight into what memory systems for quantum computers might look like. The group, in addition to Lobino, included Dmitry Korystov, Connor Kupchak, Eden Figueroa, Alexander Lvovsky, and GQI's very own Barry Sanders.

⟨1|0⟩ **Quantum physicist named energy secretary** Physicists – particularly those in quantum-related fields – around the world experienced a surreal moment recently when Nobel Laureate Steven Chu was named by US President-elect Barack Obama as the country's next energy secretary. As one member of the GQI Executive Committee put it, Secretary-elect Chu may be the first cabinet member with a paper on the arXiv. Chu, of course, shared the 1997 Nobel Prize with Claude Cohen-Tannoudji and William Phillips for his work on the laser cooling of atoms. (Side note: Phillips actually contributed to this very newsletter a few years ago, though Chu is *not* a member of GQI.) Since 2004, Chu has been director of Lawrence Berkeley National Laboratory and Professor of Physics at UC-Berkeley after having served for many years as a professor of physics at Stanford. His most recent research has focused on studying biological systems at the level of single molecules. ⟨1|

ITD

Group News & Announcements

ELECTION RESULTS

The GQI Election has recently been completed. There were 200 online votes and 8 postal votes. We would like to congratulate Chris Fuchs on his election as Vice-Chair, Ivan Deutsch on his election as Secretary-Treasurer, and Ivette Fuentes-Schuller on her election as Member-at-Large for a two-year term. Their terms begin 1 January 2009. We would also like to extend GQI's thanks to Daniel Gottesman, Todd Brun, and Konrad Lehnert for competing for these positions.

–Barry C. Sanders
Department of Physics and Astronomy
& Institute for Quantum Information Science
University of Calgary

NEW APS POLICY ON UNIT NEWSLETTERS

APS encourages all of its units to provide newsletters to their members. Many of these newsletters contain only news about the unit's activities; others contain articles and opinion pieces. Today with electronic transmission, it is very easy for bloggers and others to pick up items from these newsletters and present them as the policy or opinion of APS. In order to prevent this, each paper and pdf version of the newsletter must contain a clear statement that the articles and opinion pieces are not peer refereed and represent solely the views of the authors and not necessarily the views of APS. In the case of online newsletters available in html format, each individual article or opinion piece must have this disclaimer clearly visible as part of the posting.

APS also requests that each unit that regularly includes opinion pieces in its newsletter appoint an editorial board that oversees the work of the editors. This board should have the authority to recommend the discontinuation of one or more of the newsletter editors if the editors do not abide by this policy or if the editor shows other behavior that the board finds unacceptable. The unit's executive committee will then make the final decision on this matter.

Announcements

Post-doc position at SQIG-Instituto de Telecomunicações, Lisbon, Portugal

The Security and Quantum Information Group (SQIG) at Instituto de Telecomunicações, in Lisbon, Portugal, invites applications for a post-doctoral fellowship in quantum information theory. Candidates should have a Ph.D. (at the time of the beginning of the contract) and a record of ability or potential for excellence in research. The appointment is for one year, renewable for up to three years by applying to the Portuguese Science Foundation (FCT). The deadline is 15 December 2008 and the job can start as early as January 2009.

Candidates should send their curriculum vitae, a statement of research interests and two reference letters to: yasser.omar (at) ist.utl.pt

Instituto de Telecomunicações (IT) is a national research laboratory with a long tradition in research and development. IT is actively involved in both fundamental and applied research in all aspects of telecommunications. Simultaneously, it is committed to foster higher education and advanced training, namely by hosting undergraduate and graduate students in research projects. SQIG is a group of Instituto de Telecomunicações and carries out theoretical research and advanced scientific training in the fields of quantum information, logic and information security. IT-Lisbon is located in the campus of Instituto Superior Técnico, the science and engineering school of the Technical University of Lisbon, and most of the researchers at IT are faculty members in the different departments of the university.

For further information or enquiries, please contact: yasser.omar (at) ist.utl.pt or visit the Security and Quantum Information Group: http://sqig.math.ist.utl.pt/ or the Instituto de Telecomunicações: http://www.it.pt/

Additional position announcements

One of the best places to find updated position announcements is at the site Quantiki where you can also find meeting announcements, discussion boards, and more. See http://quantiki.org

the lighter side: Seth Lloyd at EU QUIST

photo courtesy Christopher Altman
with permission of Seth Lloyd

2009 APS March Meeting

MARCH 16-20, PITTSBURGH, PA

Important deadlines
Early bird registration **ends January 19, 2009**
Late registration runs from
January 20, 2009 to **February 6, 2009**

After February 6, you **must** register on-site. On-site registration **begins March 15, 2009** at the David L. Lawrence Convention Center

For more information please visit:
http://www.aps.org/meetings/march/index.cfm

Quantum Simulation/Computation with Cold Atoms and Molecules

ASPEN CENTER FOR PHYSICS SUMMER WORKSHOP 2009

May 24 - June 14, 2009, Aspen, Colorado

For more information see: http://www.aspenphys.org/documents/program/summer09.html

REQUEST FOR NOMINATIONS FOR THE INAUGURAL JOHN STUART BELL PRIZE FOR RESEARCH ON FUNDAMENTAL ISSUES IN QUANTUM MECHANICS AND THEIR APPLICATIONS

Dear friends and colleagues:

We are pleased to announce the inauguration of a new award, and to ask for your assistance in identifying candidates for the award.

The John Stuart Bell Prize for Research on Fundamental Issues in Quantum Mechanics and their Applications (short form: "Bell Prize") will be awarded every other year, starting in 2009, for significant contributions first published in the 6 years preceding January 1st of the award year. The award is meant to recognize major advances relating to the foundations of quantum mechanics and to the applications of these principles – this covers, but is not limited to, quantum information theory, quantum computation, quantum foundations, quantum cryptography, and quantum control. The award is not intended as a "lifetime achievement" award, but rather to highlight the continuing rapid pace of research in these areas. It is intended to cover even-handedly theoretical and experimental research, both fundamental and applied.

The award is funded and managed by the University of Toronto Centre for Quantum Information and Quantum Control (CQIQC), but the award selection will be handled by an arms-length selection committee. The membership of the 2009 committee is Alain Aspect, chair, Aephraim Steinberg, *ex officio* vice-chair, Gilles Brassard, Richard Hughes, and Peter Zoller. The award will be presented as part of the biennial CQIQC conference, during which the awardee will be invited to deliver a prize lecture.

To nominate a candidate for this award, please email your nomination to Anna Ho, CQIQC administrative assistant, at aho@chem.utoronto.ca The nomination should include the name and affiliation of the nominee, a 1-2 paragraph statement of the importance of the contribution on the basis of which you are making the nomination, and the principal literature citations to this work (which must have been published between January 2003 and December 2008). Self-nomination is prohibited.

All nominations received prior to December 25, 2008 will be considered (although the committee will not be bound to restrict itself to these nominations).

Thank you in advance for your assistance,

Aephraim Steinberg
University of Toronto
on behalf of the Bell Prize selection committee

QIP 2009 – 12th WORKSHOP ON QUANTUM INFORMATION PROCESSING

Santa Fe, New Mexico USA. January 12-16, 2009.

http://qipworkshop.org/

INVITED SPEAKERS:

Andrew Childs (Waterloo)
Avinatan Hassidim (Jerusalem)
Matt Hastings (LANL)
Charles Marcus (Harvard)
Lluis Masanes (Barcelona)
Graeme Smith (IBM, TJ Watson)

Topical Group on Quantum Information

Contributors wanted!!!

The Quantum Times is seeking contributions from readers for all areas of the newsletter. In particular we are interested in articles, meeting summaries, and op-ed pieces. If you would like to contribute something to *The Times* please contact the editor or a member of the editorial board.

Newsletter Information

The Quantum Times is published four times per year, usually in February, May, August, and November, though times can vary slightly.

Electronic submissions are strongly encouraged and may be sent to the editor at idurham@anselm.edu. Acceptable forms for electronic files (other than images) include LaTeX, Word (*not* Word '08), RTF, PDF, and plain text.

Hard copies of submissions must first be approved by the editor. If they are approved they may be sent to the editor at:

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Happy Holidays!!!