



Joint  
Quantum  
Institute

Institute News for December 2009

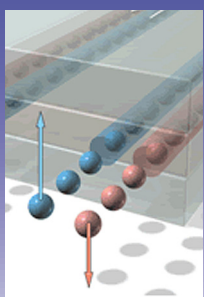
Paul Lett  
Gets DoC  
Gold Medal  
page 2

JQI Theorists  
On VOA TV  
page 3

Teleportation:  
Kudos  
Continue  
page 4

Conference:  
Exotic  
Insulating  
States of  
Matter

Jan. 14-16  
At Johns  
Hopkins  
page 2

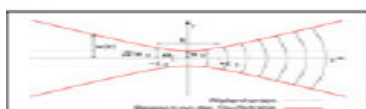
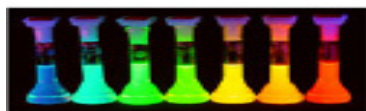
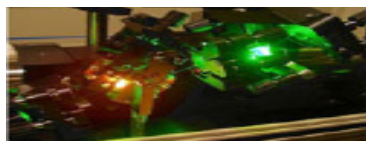


## Two Fellows to Teach New Courses for Winter/Spring

JQI Fellow Charles Clark will teach a Winter Term course on "Case Studies in Scientific Ethics" at the University of Maryland, College Park from January 6-22, 2010.

The one-credit course, offered through the Institute for Physical Science and Technology, will focus on the intersection of ethics and science in several recent cases of open conflict in the physical sciences, using the case-study approach of *On Being a Scientist: A Guide to Responsible Conduct in Research, Third Edition* (National Academies Press, Wash. DC, 2009).

The curriculum is accessible to undergraduates, graduate students and postdocs. A passing grade will certify demonstrated critical understanding of the principles of the Federal Policy on Research Misconduct (Federal Register, Vol. 65, No. 235, Wednesday, Dec. 6, 2000, pp. 76260-76264. The web site is <http://ipst.umd.edu/ethics>.



In the Spring Term, beginning Jan. 25, JQI Fellow Edo Waks will offer a course in Quantum Electronics within the Department of Electrical & Computer Engineering.

EENE790 will develop the fundamentals of laser physics, focusing on quantum mechanical treatment of atomic and semiconductor systems and their interaction with light. Topics that will be covered are classical dispersion theory, quantum treatment of atom-light interactions, laser pumping and oscillation, resonators, quantum treatment of semiconductors, semiconductor lasers and quantum wells, excitons and quantum dots.

For more information, e-mail [edowaks@umd.edu](mailto:edowaks@umd.edu).

For JQI research news, see <http://jqj.umd.edu>, updated daily.

# Lett Gets the Gold



JQI Fellow Paul Lett (left) has received a Gold Medal from the U.S. Department of Commerce -- the agency's highest honor.

The medal is awarded for "distinguished performance characterized by extraordinary, notable or prestigious contributions that impact the mission of the Department of Commerce and/or one operating unit and which reflect favorably on the Department."

Lett was honored "for developing new techniques to produce quantum-squeezed light and images, allowing measurements far better than the standard quantum limit."



## Exotic Conference Slated

A three-day workshop on Exotic Insulating States of Matter will be held January 14-16 at The Johns Hopkins University. It will highlight current progress and fundamental open questions on a variety of exotic insulating states of matter, and address quantum transitions to these states from other states of matter,



with a special emphasis on systems with interesting topological character.

The workshop will focus on experimental and theoretical developments in the areas of:

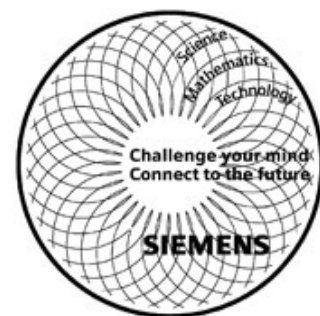
- Topological insulators and the stability of their edge and surface states
- Bose insulating states and the 2D superconductor-insulator quantum phase transition
- Mott insulators and underdoped high-temperature superconductors
- Other unconventional insulating states of matter
- Other states of matter related to exotic insulators by duality relations.

For further information, go to the conference website at: <http://icamconferences.org/jhu2010/> or send e-mail to co-organizer and JQI Fellow Victor Galitski at [galitski@umd.edu](mailto:galitski@umd.edu).



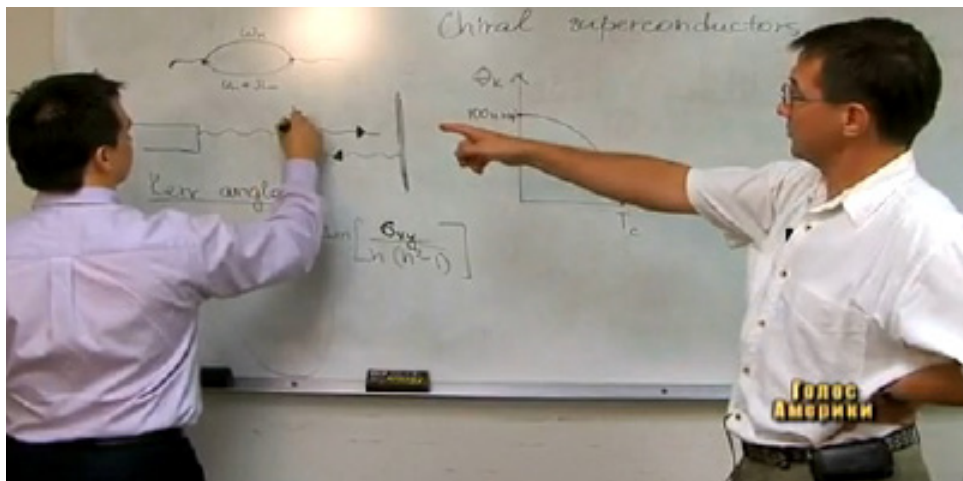
Two JQI alumnae -- Jennifer Wang (right) of Montgomery Blair High School in Silver Spring, MD and Grace Young of The Potomac School in McLean, VA -- have advanced to become regional finalists in the

Siemens Competition in Math, Science and Technology. The finalists will appear in New York City from Dec. 4-7, and the winners will be announced on Dec. 7. Wang and Young worked in Chris Monroe's lab during the past summer.





# JQI Hits Prime Time in the Ukraine



*Top right: Victor Yakovenko talks to VOA. Above: Roman Lutchyn and Yakovenko at the board. Right: Lutchyn interviewed in a JQI lab. All screen shots are from the VOA program "Window on America."*

In early September, journalists from Voice of America's Ukrainian division came to the University of Maryland's College Park campus to interview two Joint Quantum Institute scientists born in the Ukraine -- JQI Fellow Victor Yakovenko and Research Associate Roman Lutchyn -- about their lives, their work on coherent quantum phenomena, and the field of quantum computing and information science in general. Segments were shot in the Toll Physics Building, the Computer and Space Sciences (CSS) building and in an AMO lab in the CSS basement.

VOA producer Ruslan Petrychka and crew also conducted interviews with JQI Co-Director Steve Rolston (seen at right), and videotaped various parts of campus. Additional background footage was provided by UMD's Public Affairs office. The result was a five-minute report in Ukrainian that aired in November as part of the weekly program titled "Window on America."

The show can be seen in its entirety at:  
<http://www.youtube.com/watch?v=H5g-eaU32x4>.



# Recent Publications

"Synthetic magnetic fields for ultracold neutral atoms," Y.-J. Lin, R.L. Compton, K. Jimenez-Garcia, J.V. Porto and I.B. Spielman, *Nature* **462**, 628 (2009).

"Scalable multiplexed detector system for high-rate telecom-band single-photon detection," G. Brida, I. P. Degiovanni, F. Piacentini, V. Schettini, S. V. Polyakov, and A. Migdall, *Rev. Sci. Instrum.* **80**, 116103 (2009).

**AIP** | Review of  
**Scientific Instruments**

"Particle-hole asymmetry and brightening of solitons in a strongly repulsive Bose-Einstein condensate," by Radha Balakrishnan, Indu I. Satija and Charles W. Clark has been accepted for publication in *Physical Review Letters*.

"Creating polarization-entangled photons from a quantum dot," A. Muller, W.F. Fang, J. Lawall and G.S. Solomon has been accepted for publication in *Physical Review Letters*.

**nature**

International weekly journal of science

"4<sup>-</sup>quasi-phase-matched interactions in GaAs microdisk cavities," P. S. Kuo, W. Fang, and G. S. Solomon, *Opt. Lett.* **34**, 3580 (2009).

"Effect of Surface modes on Photon propagation through Dielectric Bandgaps", N. Malkova, G. Bryant, S. Polykov, A. Migdall, *Phys. Rev. B* **80**, 165127 (2009).

"Radio-frequency dressing of multiple Feshbach resonances," A. M. Kaufman, R. P. Anderson, Thomas M. Hanna, E. Tiesinga, P. S. Julienne, and D. S. Hall *Phys. Rev. A* **80**, 050701 (2009)

In addition, "Collisional cooling of ultracold-atom ensembles using Feshbach resonances," L. Mathey, Eite Tiesinga, Paul S. Julienne, and Charles W. Clark, *Phys. Rev. A* **80**, 030702 (2009), has been selected for the *Virtual Journal of Atomic Quantum Fluids*.

# Entangled States

In mid-November, JQI Fellow **Bill Phillips** visited Haverford College and gave a general interest lecture as well as a physics colloquium. He also met with physics classes at Bryn Mawr and talked with students at Haverford.

Several JQI Fellows traveled to Miami for a Dec. 1-3 program review of the DARPA "Optical Lattice Emulator" (OLE) program. JQI Fellow **Chris Monroe** is leading a multi-institutional team working on optical lattice emulation of condensed matter mathematical models, along with Phillips and JQI Fellows **Trey Porto** and **Ian Spielman**.

Porto was invited to attend the "Frontiers of Science" symposium from Nov. 12-14, a joint program of the National Academy of Sciences and the Kavli Foundation held in Irvine, California.

continued, next page

## Teleportation in the Top 50

Public acclaim continues for the teleportation demonstration reported by JQI Fellow **Chris Monroe** and colleagues in "Quantum Teleportation Between Distant Matter Qubits," S. Olmschenk, D. N. Matsukevich, P. Maunz, D. Hayes, L.-M. Duan and C. Monroe. *Science* **323**, 486 (23 January 2009).

**TIME**  
**The 50 Best  
Inventions  
Of the Year**

*Time* named it one of the 50 best inventions of the year, ranking No. 6 -- behind tank-bred tuna but ahead of the AIDS vaccine. It is the subject of a forthcoming segment of a new TV series called "Sci-Fi Science: Physics of the Impossible" that debuted Dec. 1 on the Science Channel.

In addition, a crew from PBS' NOVA will be at UMD on Monday, Dec. 7 to begin filming for an upcoming show.

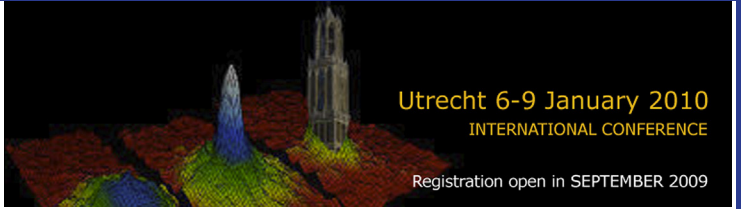
# Entangled States, continued

Spielman and NIST Research Scientist **Tom Hanna** gave talks on Nov. 7 for middle school students at Technology Day 2009, held at the Universities at Shady Grove, Maryland.

Monroe recently gave a tutorial and seminar at the INTRIQ (Institute for Transdisciplinary Research In Quantum Computing) biannual workshop on the physical implementation of quantum information, "Quantum Information with Atoms" (Val David, Quebec), and delivered the Control and Dynamical Systems Distinguished Lecture at the University of Maryland: "Quantum Information Science."

In November, Monroe conducted a seminar at the MIT/Harvard Center for Ultracold Atoms: "Quantum Simulations of Magnetism with Trapped Ions." He also gave a popular lecture titled "Quantum Physics and Computation" at the corporate retreat of Panoramic Universal, Ltd., held in Lake George, New York.

Monroe's group has added a new undergraduate, Marco Tapia-Guilliams.



JQI Fellow **Paul Julienne** had two MURI-related visits in November: four days with Peter Zoller, Guido Pupillo, and Andrea Micheli at the University of Innsbruck working on interactions of ultracold polar molecules in reduced dimension lattices, and three days with Jeremy Hutson and his postdocs and students at the University of Durham, UK, working on the theory of ultracold molecular collisions and understanding Feshbach resonances between ultracold Rb and Cs atoms.

Finally, JQI Fellow **Victor Galitski** has been invited to speak at a workshop on "Spin manipulation in cold atoms and condensed matter," to be held in Utrecht, Holland in January 6-9, 2010. Galitski's presentation will cover "Spin-orbit-coupled Bose-Einstein condensates" -- research directly related to core activities of JQI's Physics Frontier Center, funded by the National Science Foundation.



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JQI is a joint venture of the University of Maryland and the National Institute of Standards and Technology, with support from the Laboratory for Physical Sciences.

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**NIST**