Joint Quantum Institute

www.jqi.umd.edu

NEWS FOR FEBRUARY 2008

A Message from the Co-Directors

A century ago, the upstart science of quantum mechanics utterly transformed our understanding of matter and energy.

Christopher Lobb

Carl Williams

Now we are on the threshold of a second quantum revolution, in which the famously weird phenomena that occur at atomic dimensions are controlled and exploited for a host of practical applications.

Some long-awaited potential uses are already well known, including quantum computers that can handle formidable problems such as factoring enormous numbers for secure encryption.

JQI research efforts are addressing that challenge in many ways, from entanglement studies using neutral atoms, ions, atomic gases and superconducting devices to topological solutions.

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NIST, UMD JQI Fellows Honored

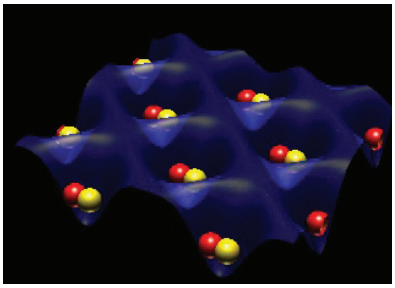
JQI Fellows **Alexander Dragt** and **Paul Lett** were recently elected Fellows of the American Association for the Advancement of Science for pioneering work in physics. Each year, the AAAS Council elects a number of new Fellows whose "efforts on behalf of the advancement of science or its applications are scientifically or socially distinguished." The official induction ceremony took place this month in Boston at the AAAS annual meeting. See http://www.aaas.org/aboutaaas/fellows/new_fellows.shtml.

JQI Fellow **Steve Rolston** was elected a Fellow of the Optical Society of America (OSA). He was recognized for his contribution to the development of atomic quantum optics, including pioneering studies of atoms in optical lattices. See http://www.osa.org/news/pressroom/release/01.2007/osafellows.aspx.

JQI Fellows **Charles Clark** and **Paul Julienne** received 2007 Presidential Rank Awards in November. The awards recognize exceptional long-term accomplishments by career senior government executives. See http://www.nist.gov/public_affairs/techbeat/tb2007_1025.htm.

Selected Research Highlights

JQI expects to produce numerous "firsts" in quantum science, and JQI investigators have garnered national media attention for several recently. **William Phillips**, **Trey Porto** and colleagues induced spin-swapping among rubidium atoms in an optical lattice. (*Nature*, 448, pp. 452-456 [26 Jul 2007]). **Chris Monroe** and collaborators produced the first entanglement between two ions a meter apart. (*Nature*, 449, pp. 68-72 [6 Sept 2007]). And **Phillips**, **Kris Helmerson** and colleagues describe the first observation of fictionless "persistent flow" in a Bose-Einstein condensate in *Physical Review Letters* 99, 260401 (2007).

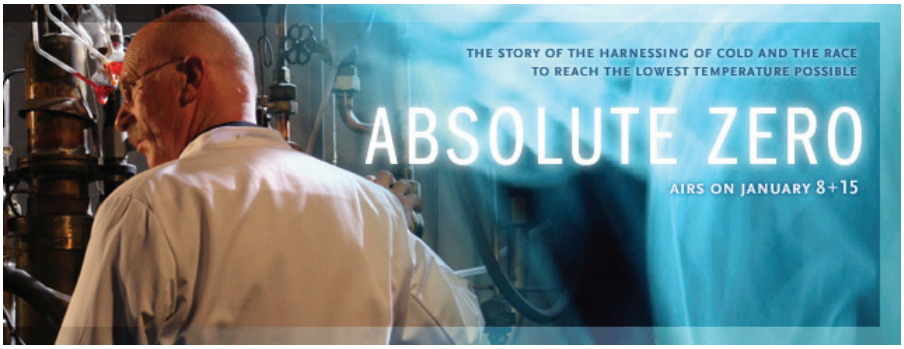


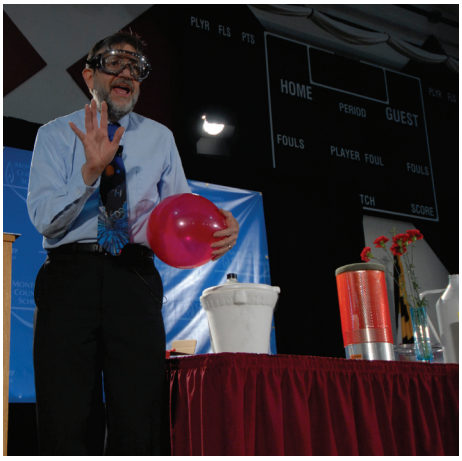
Pairs of rubidium atoms swap spins in an optical lattice.

'Cryo-Outreach' Shows the Cool Side of Physics

On January 9, JQI Fellow and Nobel laureate **William Phillips** spoke about the science of cold temperatures to approximately 800 students at Parkland Magnet Middle School for Aerospace Technology in Rockville, Maryland. The event, including live demonstrations, coincided with the premiere of a two-part PBS program titled "Absolute Zero and the Conquest of Cold."

JQI Fellow **Luis Orozco** appears in the NOVA special.
See: http://www.pbs.org/wgbh/nova/zero/atoms.html.





Phillips chills out.

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But there will surely be other, unanticipated applications that arise from discoveries at the quantum frontier. Just as no one could have foreseen, in the mid-20th century, the myriad uses to which transistors and lasers would be put, it is impossible to predict the ideas and applications that will emerge from JQI's uniquely synergistic combination of condensed-matter physics, atomic, molecular and optical studies, and quantum information science.

That combination has already proven extremely productive. In the 16 months since JQI's creation, our Fellows and their collaborators have published more than 100 papers, observed many phenomena for the first time, and achieved new milestones in quantum manipulation and control. A few are highlighted in this issue. (The entire roster is available at our redesigned web site, ***www.jqi.umd.edu***, under the heading "Publications.")

We are poised to expand those efforts. Since mid-2007, we have gained a new JQI Fellow (**Chris Monroe**, formerly at the University of Michigan), added lab space, upgraded existing facilities, and begun extensive new outreach and education programs.

In addition, after a highly selective search, Roman Lutchyn has been named as a JQI Postdoctoral Fellow, and Elizabeth Goldschmidt and Pavel Nagornykh were awarded JQI Graduate Assistantships.

Building on that solid foundation, we expect 2008 to be an extraordinarily successful year. Subsequent newsletters will keep you informed of progress. In the interim, visit our web site, ***www.jqi.umd.edu***, for the latest developments, seminar schedules and other information. We want to share the excitement of this fast-moving field whose motto might be "You ain't seen nothin' yet!"

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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