



# ITAMP NEWS

*Winter 2002/2003*

## **Year 2002 brought renewed funding**

In March 2002 ITAMP Director Kate Kirby received the good news from the National Science Foundation that the Institute had been granted renewed funding to continue its programs and activities to promote research in theoretical atomic, molecular and optical physics. The celebration was somewhat muted, however, as the decimating budget cuts in the Physics Division of NSF this year were felt throughout the Atomic, Molecular and Optical Physics Community. As a consequence ITAMP will not be able to pursue as many of the outreach activities as it had proposed, and the visitor program has been somewhat reduced. The encouragement and support of the theoretical AMO community is greatly appreciated.

## **New name for ITAMP better defines focus**

As it begins another five-year funding cycle, ITAMP has changed its official name to include "optical" physics. This is in recognition of the evolution in the research being carried out at the Institute. We are now the Institute for Theoretical Atomic, Molecular and Optical Physics. The acronym ITAMP will be kept because of its wide familiarity in the physics community, and undeniably ITAMP rolls more trippingly off the tongue than "ITAMOP."

## **Dalgarno receives medal**

Prof. Alexander Dalgarno, former director of ITAMP, was awarded the Hughes Medal of the Royal Society of the United Kingdom in December 2002. His citation noted his contributions to the theory of atomic and molecular processes, and in particular their applications to astrophysics. "His studies of energy depositions provide the key to understanding emissions from terrestrial aurorae, planetary atmospheres and comets." This was the 100th anniversary of the awarding of the Hughes Medal.

## **Ugo Fano remembered**

A memorial symposium in honor of Prof. Ugo Fano was held at ITAMP July 24-26, 2002, just before what would have been Fano's 90th birthday. Organized by a number of Fano's former students and associates, this meeting highlighted science inspired and admired by Fano and included many topical issues in AMO Physics: mathematical and radiation physics, collective dynamics, multichannel resonance theory, spectroscopy and collisions of ultracold atoms, angular momentum symmetries and coherence, and Rydberg matter. At a conference dinner held at the Harvard Faculty Club, several speakers, including Joe Dehmer (NSF), Irving Wäldawsky-Berger (IBM), Alex Dalgarno (Harvard) and Robert Fano (MIT), Ugo's brother, reminisced about their personal and professional experiences with Ugo.

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## New ITAMP postdoc pursues entanglement

Dr. Anders Sørensen, who received his Ph.D. from the University of Aarhus (Denmark) working with Prof. Klaus Moelmer, started his ITAMP postdoctoral fellowship in September, 2002. As part of his thesis, Sørensen proposed a method to produce multi-particle entangled states of trapped ions. Subsequently, Dave Wineland and the ion-trapping group at NIST-Boulder were able to produce entangled states of four ions, following this proposal. Sørensen intends to continue pursuing research on the physical implementation of quantum computers and the generation of entanglement, as well as other areas of atomic physics, such as Bose-Einstein condensation.

## April workshop explores hot topic

On April 11-13, 2002, ITAMP held a workshop on "Cold Antimatter," which delved into a variety of issues involved in the production of cold antihydrogen. Included in these issues were the production of ultraslow antiprotons, trapping and cooling positrons, the physics of cold neutral plasmas and atom-antiatom interactions.

Several months after this workshop two competing groups at CERN, first



*S. Jonsell, A. Vronin and Froelich*

ATHENA and then ATRAP, made announcements of the observation of cold antihydrogen atoms in magnetic traps. SCIENCE magazine has listed antihydrogen physics as an Area to Watch for 2003. Gerald Gabrielse (Harvard) and Piotr Froelich (Univ. Uppsala) organized the workshop.

## Quantum Dynamics workshop lauded for synergistic interactions

May 9-11, 2002 ITAMP hosted a workshop on "Computational Approaches to Time-Dependent Quantum Dynamics" organized by Charles

Weatherford (Florida A&M) and Robert Wyatt (Univ. of Texas). The participants discussed a variety of different methods used in time-dependent studies, including quantum



wave packet dynamics, Wyatt and Weatherford classical trajectories,

semiclassical dynamics, hydrodynamic and eikonal methods. One participant enthused that the work presented at the workshop "produced a considerable number of synergistic interactions among many of the participants and the seeds for collaborative efforts."

## Casimir Forces workshop draws worldwide expertise

The ITAMP workshop "Casimir Forces: Recent Developments in Experiment and Theory" held on November 14 - 16, 2002 featured presentations and discussions from over 40 attendees from around the world. The Casimir force is a manifestation of the pervasive electromagnetic vacuum energy and it has been predicted to be possibly relevant to applications ranging from nanotechnology to the cosmological dark energy. Experiments carried out using sensitive apparatus in the solid state, using balances, and using ultra-cold atoms were described, as well as theoretical work on various

systems. As one participant put it, "It was incredibly helpful to have in one location a large fraction of the world's expertise on the subject." The meeting was organized by Prof. Umar Mohideen (U.



*Mohideen and Babb*

Cal. Riverside) and Dr. James Babb (ITAMP). [Photo courtesy of M. Bordag.]

## Workshops come to life in Real Video

You can now view the actual proceedings of ITAMP workshops on your computer screen. As part of its outreach efforts to the physics community, the Institute has started recording the workshop presentations and discussions in video format and making them available through the ITAMP website.

The process was first used for the Cold Antimatter workshop in April 2002. The video format is a considerable improvement over the previous scanned vie wgraphs and recorded talks, and a high quality product is ensured by the services of an experienced professional firm with state-of-the-art equipment.

## Burnett and Murnane join Institute Board

Prof. Keith Burnett [Oxford] and Prof. Margaret Murnane [UCol/JILA] have agreed to serve on the ITAMP board beginning in late 2002. Board members serve for three years and provide vital input into the administration of ITAMP, its programs and outreach to the AMO Physics Community.

The Board met at ITAMP on April 18-19 in much more salubrious weather than the blizzard of their last meeting in Cambridge. Attending were Prof. Stephen Lundeen (Colorado State), Prof. James McGuire (Tulane), Prof. Chris Greene (Univ. of Colorado/JILA), Prof. Pierre Meystre (Univ. of Arizona), Prof. Michael Pinzola (Auburn Univ.) and Dr. Charles Clark (NIST). We will be sorry to lose the wise counsel of Lundeen and McGuire who completed their terms as board members with the April meeting. Many thanks to them and to all the board members who make time in their busy schedules to come to Cambridge and provide us with their advice and expertise.

## Yelin divides time between University of Connecticut and ITAMP

In August 2002 Dr. Susanne Yelin (Ph.D. Univ. Munich) joined the Physics Department at the University of Connecticut as an assistant professor. As a postdoctoral associate at ITAMP with partial support from the von Humboldt Foundation, she has pursued research on stopping and storing light

implementation of quantum coherence effects in solids and dense gases, and quantum information. Yelin continues to spend several days a week at ITAMP to pursue her own research and to organize a series of tutorial lectures in quantum information and quantum computation.



Yelin

## Ben Gurion University welcomes another ITAMP postdoc

At the end of July 2002 Dr. Ami Vardi (Ph.D. Weizmann Institute) completed the third year of his



Vardi

ITAMP postdoctoral fellowship and left to take a lecturer position (equivalent to an assistant professorship in the U.S.) at Ben-Gurion University in Beersheva, Israel. There he joins other former ITAMP postdoctoral associates, Bilha Segev and Doron Cohen, as well as former ITAMP visitor Yehuda Band. Dr. Vardi has explored various aspects of molecular Bose Einstein condensates.

## ITAMP's Visitors Program deemed "professionally energizing"

A "critical mass of cutting edge researchers" is how one visitor described ITAMP's Visitors Program after what he termed a "professionally energizing" stay in Cambridge. Researchers making long-term visits to ITAMP in 2002 were:

Prof. Michael Crescimanno (Youngstown State U)  
Dr. Sergey Levin (St. Petersburg State U)  
Prof. Keith MacAdam (U Kentucky)  
Prof. Paul Berman (U Michigan)  
Dr. Jamal Berakdar (Max-Planck Inst)  
Prof. Piotr Froelich (Uppsala U)  
Prof. Raymond Flannery (Georgia Tech)  
Prof. Maxim Olshanii (USC)  
Prof. Robert Forrey (Penn State)  
Prof. N. Balakrishnan (U of Nevada, Las Vegas)

Prof. Bernard Zygelman (U of Nevada, Las Vegas)  
Prof. Klaus Bartschat (Drake U)  
Prof. Michael Jamieson (U of Glasgow)  
Prof. Janine Shertzer (College of the Holy Cross)  
Prof. Valentin Ostrovsky (U of St. Petersburg)  
Dr. Robert Reid (Queen's U of Belfast)  
Dr. Petra Zdanska (Technion)  
Prof. Nimrod Moiseyev (Technion)  
Prof. Lorenz Cederbaum (U of Heidelberg)  
Prof. Victor Flambaum (U of New South Wales)  
Prof. Sandra Wård (U of North Texas)

Prof. Michael Baer completed in January 2002 a long-term visit started in 2001. Many other theorists and experimenters made shorter visits, some of whom gave invited talks at the Joint Atomic Physics Colloquia in the Harvard University Physics Department.

## In other news...

Dr. Barry Schneider, program director of Atomic, Molecular and Optical Physics Theory at NSF, was elected vice-chair of the Division of Computational Physics of the American Physical Society, to become chair in 2005. Schneider has successfully spearheaded a move to fund more "computational physics" at the NSF. A workshop which he organized to highlight opportunities in this area took place on September 11 - 12, 2001 in Washington, D.C., several miles from the Pentagon - a truly unforgettable meeting for those of us who attended. The result is that the Physics Division will be starting a program in computational and data intensive physics beginning in FY04. Those interested should keep their eyes on the PHY home page.

## Fall 2001 saw experiment with new workshop format

In November 2001 the MIT-Harvard Center for Ultracold Atoms and ITAMP joined forces to host a workshop on "Beyond BEC: Ultracold Atoms Beyond Mean-Field Physics." Organizers James Anglin (CUA), Dan Kleppner (MIT), Kate Kirby (ITAMP) and Mikhail Lukin (ITAMP and CUA) experimented with a new

format: for each half-day session with a topical focus a plenary/tutorial lecture was presented, followed by 4 or 5 brief presentations and then a panel discussion involving substantial audience participation. The workshop was well attended with approximately 80 people sitting in on the sessions on Quantum Phase Transitions, Quantum Information, BEC in Low Dimensions, and Degenerate Fermions.

Also in November the workshop on "Tests of Fundamental Symmetries in Atoms and Molecules," delayed by the events of September 11, went forward as planned. On November 29-December 1 theorists and experimentalists exploring symmetry-violating effects came together to participate in the two and a half day meeting organized by Andrei Derevianko (Univ. of Nevada-Reno), Walter Johnson (Notre Dame) and Ron Walsworth (Harvard-Smithsonian Center for Astrophysics). A variety of topics were explored, including tests of CPT and Lorentz invariance in atomic systems, searches for a permanent electric dipole moment of the electron, and parity nonconservation.

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