



ITAMP NEWS

Summer, 2001

New director appointed at ITAMP

In February 2001, Kate Kirby accepted the appointment as director of the Institute for Theoretical Atomic and Molecular Physics. The appointment was made by Professor Irwin Shapiro, director of Harvard-Smithsonian Center for Astrophysics following the recommendation of the ITAMP Advisory Board and the approval of the AMO Theory program director at NSF. Kirby, who has been Acting Director of ITAMP for the last two years, becomes the third director of the Institute.

ITAMP postdoc joins Harvard Physics faculty

In December 2000 ITAMP Postdoc Mikhail Lukin accepted the offer of an assistant professorship at Harvard University starting September 1, 2001. Lukin, who received his Ph.D. from Texas A&M, has been at ITAMP since 1998. He has worked on a number of topics in quantum optics including atomic coherence phenomena, lasers without inversion, electromagnetically induced transparency, nonlinear optics and spectroscopy. His most recent research is on the physics of quantum information (see section "In the news"). Lukin will become a member of the ITAMP staff, and some additional space for ITAMP visitors, students and postdocs will be made available in the Harvard Physics Department.

Former director honored

Alexander Dalgarno, Phillips Professor of Astronomy at Harvard University and senior research physicist at Smithsonian Astrophysical Observatory,

was elected to membership in the National Academy of Sciences in May 2001. Dalgarno, who has garnered many honors for his valuable research contributions to astrophysics, atomic and molecular physics, atmospheric physics and chemical physics, was the first director of ITAMP.

In the news!

International attention was focused on ITAMP research in January 2001 with the announcement of successful "light trapping." In May 2000 ITAMP postdocs Mikhail Lukin and Susanne Yelin and long-term visitor Michael Fleischhauer theoretically predicted the possibility of "trapping" photonic quantum states in atoms, thereby storing quantum information carried by light (Phys. Rev. Lett., 84, 4232 (2000)). The technique is based on the dynamic reduction of the group velocity of light to zero. In January 2001 two experiments demonstrated the basic concept of this mechanism.

The two results announced in the same week were obtained by a collaboration of ITAMP scientists with the group of R. Walsworth (Harvard-Smithsonian Center for Astrophysics) and, independently, by the group of L. Hau (Harvard and Rowland Institute).

The New York Times (1/18/01) quoted Steve Harris (Stanford): "It's [stopping and storing light] been done--done very convincingly and beautifully."

Heller in touch with his muse(s)

Former ITAMP director Rick Heller was the subject of a feature article in the Boston Globe

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(2/11/01) describing his crowd-pleasing exhibition "Approaching Chaos--Visions from the Quantum Frontier." Heller's exhibit of computer generated images opened at the MIT Museum's Compton Gallery in Cambridge, after which it will travel to Chicago, Nebraska, Washington, D.C., and Orlando, Florida.

Heller comments: "My brush is the computer; the paints I use are algorithms based on the flow of electrons, the collision of molecules, and the properties of random waves." Examples of these eye-catching images can be accessed on the Web at <http://monsoon.harvard.edu/image-s-ejheller/>.

Strong field of applicants yields two new ITAMP postdocs

With the competition for an ITAMP postdoctoral fellowship appointment remaining very stiff, this year ITAMP was able to make two postdoc appointments. Daniel Vranceanu (Ph.D. 2001, Georgia Inst. of Tech.) and Brian Granger (Ph.D., 2001, Univ. of Colorado) will be arriving in Cambridge in the fall.

The new postdocs will be joining current ITAMP postdocs Ami Vardi (1999) and Michael Moore (2000).

Vardi (Ph.D. Weizmann Institute) has been exploring the quantum dynamics of a two-mode Bose-Einstein condensate and the formation of molecular condensates through photoassociation. Moore (Ph.D. Univ. of Arizona), who was selected as a finalist for the 2001 DAMOP AMO Thesis Prize, gave a talk on "Nonlinear wave mixing between atomic and optical fields" at the DAMOP meeting in London, Ontario.

Moore has also extended his work on atomic four-wave mixing to degenerate Fermi gases. Partially supported this past year by a von Humboldt Foundation postdoctoral fellowship, by ITAMP and by the Air Force Research Laboratory (Hanscom Field, Bedford, MA), Dr. Susanne Yelin has carried out studies of superradiance in dense atomic gases, the trapping of photons using collective atomic excitations, and the development of ultra-sensitive infrared photon detection.

ITAMP affiliates go West

The first part of 2001 saw two ITAMP-affiliated postdocs, Andrei Derevianko and Hyun-Kyung Chung, accepting positions in Nevada and California, respectively. Derevianko left Cambridge in January to become an assistant professor in the Physics Dept. at Univ. of Nevada-Reno; and Chung left in May to take a research position in the plasma modelling group at Lawrence Livermore National Laboratory in California. Joining the western exodus, research

associate N. Balakrishnan has accepted an assistant professorship in chemistry at Univ. of Nevada-Las Vegas. He will be leaving ITAMP at the end of this year.

CUA—new research collaboration at HU and MIT

The eagerly anticipated Center for Ultracold Atoms (CUA) opened last September to great fanfare. This collaboration of research groups at MIT (D. Kleppner, T. Greytak, W. Ketterle and D. Pritchard) and at the Harvard Physics Department (J. Doyle, M. Prentiss, E. Heller, A. Dalgarno and M. Lukin) is funded by the National Science Foundation.

The CUA groups carry out collaborative research aimed at exploring basic physics and potential applications of ultracold atoms.

Record number of workshops in 2000

The year 2000 saw ITAMP organizing and hosting a record number of workshops, seven altogether including one mini-symposium. All but one was held at ITAMP.

They include:

Multi-Component and Spinor Bose-Einstein Condensates of Trapped Dilute Vapor held jointly with the Rochester Theory Center at University of Rochester, January 6-8, 2000.

Organizers were Nick Bigelow (U. of Rochester) and Eddy Timmermans (LANL).

Physics and Applications of "Slow" Light, April 3-5, 2000. Organizers were Mikhail Lukin (ITAMP), Atac Imamoglu (U. of California, Santa Barbara), and Lene Hau (Harvard).

Computational Challenges in Atomic and Molecular Physics, May 4-6, 2000. Organizers: Mitch Pindzola (Auburn), Bill McCurdy (LBL), and Kate Kirby (ITAMP).

Wave Functions and QED Effects in Few-Electron Atoms, July 17-21, 2000. Organizers were Gordon Drake (Windsor) and Ian Grant (Oxford).

Coherent Control Mini-Symposium, August 28-29, 2000. Organized by Moshe Shapiro (The Weizmann Institute).

Cold Alkali-Earth Atoms, September 7-9, 2000. Organizers: Paul Julienne (NIST), Kalle-Antti Suomiren (Helsinki Institute) and Nils Andersen (U. of Copenhagen).

Positron and Positronium Interactions:

New Directions, October 12-14, 2000. Organizers were Mike Charlton (U. of Wales Swansea), Franco Gianturco (U. of Rome), Jene Golowchenko (Harvard), Toshio Hyodo (U. of Tokyo), Dave Schrader (Marquette), and C.M. Surko (U. of California, San Diego).

Workshops for 2001-2002

A Topical Group on Quantum Entanglement and Many-Body Systems, March 12-16, 2001. Organizers: Mikhail Lukin (ITAMP); Peter Zoller (Univ. of Innsbruck).

Complex Phenomena Involving Rydberg Atoms and Molecules, April 26-28, 2001. Organizers: Francis Robicheaux (Auburn Univ.) and Robert Jones (Univ. of Virginia).

Atomic, Molecular and Optical Physics at Surfaces, June 14-16, 2001. Organizers: David Micha (Univ. of Florida), Uwe Thumm (Kansas State), John Tully (Yale).

Tests of Fundamental Symmetries in Atoms and Molecules, September 20-22, 2001. Organizers: Andrei Derevianko (Univ. of Nevada-Reno), Walter Johnson (Notre Dame), Ron Walsworth (Harvard-Smithsonian CfA).

Beyond BEC, October or November 2001. Organizers: ITAMP and CUA members.

Anämatter Physics, March 2002. Organizers: Piotr Froelich (Uppsala) and Gerald Gabrielse (Harvard)

Industrial outreach focuses on GOALI research project

A major focus for the last several years has been a research project funded by the NSF under the GOALI (Grant Opportunities for Academic Liaison with Industry) initiative. J. Babb (PI), K. Kirby (co-I) and others at the CfA are among the investigators with industrial partner OSRAM SYLVANIA Inc. The project has involved experimental and theoretical research on pressure-broadened absorption in alkali-metal vapor and inert gas mixtures. The basic physical phenomena are very similar to those operating in high pressure sodium lamps. Interaction between the project investigators, ITAMP members and visitors, and OSRAM SYLVANIA scientists strengthens the collaboration. This year two postdoctoral fellows involved in the experimental and theoretical work, respectively, left for new positions: Max Shurgalin (now at OmniGuide Communications) and Hyun-Kyung Chung (now at LLNL).

Graduate and undergraduate visitors

Björn Hessmo, a graduate student from the Department of Quantum Chemistry, Uppsala University, visited ITAMP for several weeks in June and finished research with J. Babb related to quantum optics in constrained geometries leading to the award of his Ph.D. in October.

V. Kharchenko traveled to Sweden to serve as an external examiner.

Moncef Bouledroua (Univ. of Annaba, Algeria) worked with A. Dalgarno and R. Côté on alkali-metal atom collisions.

Penn State undergraduate, Joseph Flasher, joined ITAMP in the summer of 2000 to investigate ultracold collisions between argon atoms and H₂ molecules with A. Dalgarno and R. Forrey.

Two undergraduates Jacob Taylor (Harvard) and Elena Sergueeva (Univ. of Virginia), who have been involved in research with ITAMP members, graduated from their home institutions in 2000. Taylor finished work related to the dipole polarizability of the hydrogen molecular ion with J. Babb and A. Dalgarno. He received a travel award from the APS to present his work at the Stars DAMOP meeting. Sergueeva returned to ITAMP in the summer of 2000 to work with N. Balakrishnan and A. Dalgarno on the ultraviolet spectra of Saturn, Uranus, and Neptune.

Advisory Board braves winter storm to meet in Cambridge

Narrowly missing the brunt of March's much ballyhooed blizzard, the ITAMP Advisory Board flew into Boston once again to lend their much appreciated advice and support to the ITAMP staff. Attending the meeting on March 8 and 9, 2001 were Dr. Mary Mandich (Lucent), Prof. John Delos (College of William & Mary), Prof. Jim McGuire (Tulane), Prof. Steve Lundeen (Colorado State), Prof. Chris Greene (U. of Colorado/JILA) and Prof. Pierre Meystre (U. of Arizona). The Advisory Board heard presentations by ITAMP postdocs, and reviewed past and future workshops and visitors to ITAMP. Advisory Board members serve a 3-year term. Retiring members Mandich and Delos will be replaced by Charles Clark (NIST, Gaithersburg) and Mitch Pindzola (Auburn University). Again, many thanks to the Advisory Board for interrupting their busy schedules to favor the Institute with their valuable input.

ITAMP takes talks dissemination one step further

Starting in the fall of this year, ITAMP will be offering workshop presentations in video-taped form to

viewers of our web page. This is a refinement of our previous practice of audio taping and posting the viewgraphs of participants' talks. We hope this new format will be even more informative to the AMO community tuning in. Broadcast of the presentations is voluntary, but we have been gratified at the enthusiasm with which participants have embraced this method of reaching the scientific public.

ITAMP visitors program

Long-term visitors enjoying and contributing to the profitable exchange of ideas and research at ITAMP in the year 2000 were:

Chris Greene (U. of Colorado/JILA)
David Micha (U. of Florida)
Q-Han Park (Kyung Hee U., Korea)
Michael Fleischhauer (U. Kaiserslautern)
Moshe Shapiro (The Weizmann Institute)
Robert Forrey (Penn State U.)
Brendan McLaughlin (Queen's U. of Belfast)
Dimitar Bakalov (Bulgarian Academy of Sciences)
Vladimir Korobov (Joint Inst. for Nuclear Research, Dubna)
Krzysztof Pachucki (Warsaw U.)
Maurice Cohen (The Hebrew U. of Jerusalem)
Robin Reid (The Queen's U. of Belfast)
Nikolai Cherepkov (State U. of Aerospace Instrumentation, St. Petersburg)
Petr Kral (The Weizmann Institute)
Jurgen Hinze (Universität Bielefeld)
Hanno Hammer (The Weizmann Institute)
Cecil Laughlin (U. of Nottingham)

Long- and short-term visitors just completing visits in 2001 include: Tom Bergeman (Stony Brook), Vladimir Yurovsky (Tel Aviv Univ.), Ewan Wright (Univ. of Arizona) and Maxim Ol'shanii (USC).

There were many other visitors of shorter duration who enlivened the research climate and participated in workshops at ITAMP in 2000. A number of AMO physicists, experimenters as well as theorists, gave invited talks at the Joint Atomic Physics Colloquia in the Harvard Univ. Physics Dept.

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Director's Corner

This is an exciting time at ITAMP. One of our ITAMP postdocs, Mikhail Lukin, will be joining the Harvard Physics Department and with the added presence of CUA (see article "CUA--new research...") we anticipate closer connections with both Harvard and MIT physics groups. There has been a lively exchange of visitors to both institutions, an on-going BEC discussion group meeting weekly over lunch and an average of at least two AMO Physics colloquia/seminars per week this past year. We are currently planning a jointly sponsored ITAMP/CUA workshop for the fall of 2001 on "Beyond BEC."

With all this synergistic overlap in research interests between ITAMP and CUA, we anticipate significant new opportunities for theoretical advances, and most important, for a healthy and productive interaction between theory and experiment.

The mission of ITAMP, however, is to support and promote the wide range of topics within AMO Theory and thus to serve the AMO Physics community. Your interest and support are critical to our success. We welcome your proposals for future workshops and for visits to ITAMP and your comments and suggestions for serving the community better.

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