



NEWS *from* ICTP



the
abdus salam
international centre for theoretical physics



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Greetings

At a reception held during the general conference of the International Atomic Energy Agency (IAEA) in September 1999, ICTP director Miguel Virasoro and the US Department of Energy's (USDOE) undersecretary, Ernest Moriz, spoke generally about the mutual benefits that could be derived by having the USDOE provide the Centre with a cost-free expert.

Virasoro had noted that many distinguished American physicists have lectured at the Centre since its beginning and



Brian Stewart

that a number of America's most noteworthy physicists, including J.R. Oppenheimer, P.W. Anderson and J.R. Schrieffer, had served on ICTP's Scientific Council. Nevertheless, establishing closer ties with the Centre's research and training activities, a long-standing goal of ICTP's founding director Abdus Salam, had remained elusive. For his part, Moriz acknowledged that closer ties between the physics community in the United States and ICTP in Trieste would likely prove beneficial both to US scientists and US scientific institutions.

My arrival in Trieste last fall marks a successful conclusion both to the casual conversation that took place in 1999 and the series of discussions that ensued.

I think of myself as a scientist. In fact, I hold a doctorate in plasma physics from Rice University in Houston, Texas. Yet I come to ICTP with the unusual title of cost-free expert. Cost-free, you say? Never heard of it. Expert? We'll have to wait and see. That's the reaction that I often receive from my new colleagues here in Trieste when I introduce myself.

This response calls for a bit of an explanation. The United States and other countries routinely provide cost-free experts to the IAEA and other UN-affiliated organisations. For example,

a colleague of mine currently serves as a cost-free expert in IAEA's Department of Nuclear Safety. Another colleague works in the World Health Organization (WHO) in Geneva, Switzerland. However, until now, ICTP has never participated in this programme.

It is called cost-free because I am essentially on loan to ICTP—working on projects under the direction of the director—at no cost to the Centre. My arrival here—in UN terminology, I have been 'seconded' to the Centre from the USDOE—reflects a new level of commitment and support from the United States, and especially from the USDOE, both for the principles and goals of ICTP and the training and research programmes that the Centre has put in place to fulfill its mandate. The USDOE's responsibilities cover a wide range of scientific endeavors, including programmes and initiatives for enhancing collaboration with developing-country scientists.

Upon my arrival, I was assigned to the Office of External Activities (OEA) and asked to work with Faheem Hussain and Gallieno Denardo. My current activities include assistance to the IAEA-ICTP 'sandwich' fellowship programme and updating the experts list for evaluating conference referees. Denardo and I recently traveled to Vienna to discuss joint ICTP/IAEA programmes, most notably the sandwich fellowship programme.

Obviously, I am just beginning to learn about ICTP, the Third World Academy of Sciences (TWAS), and other scientific institutions that together make up the Trieste System. Over time, I hope to help develop broad-based strategies for further enhancing collaboration between developed- and developing-country scientists, using my affiliation with the USDOE to advance this goal. That, after all, is my primary reason for being here.

In my brief time on the job, I have been impressed by the efficiency and high purpose that seems to drive the Centre's work and those who work here. I look forward to learning more about this unique institution in the months ahead.

I view my appointment both as a personal challenge and a broad institutional opportunity that could ultimately enhance the ties between scientists in the United States and those working in the developing world. I can think of no better place to try to forge this relationship than right here at ICTP in Trieste. □

Researchers at the *Eletra* synchrotron facility, ICTP's 'light source' partner in Trieste, have recently discovered a holographic technique for deciphering the structure of atoms.

Atomic Holograms

Atoms may be small, but understanding their structure is no small matter. In fact, since the time of the famed physicist and Nobel Prize winner Ernest Rutherford in the early twentieth century, scientists have sought to discern the structure or arrangement of atoms in molecules, crystals and all sorts of biological, chemical and physical configurations.

How have they sought to accomplish this task? Relying on a variety of tools, including spectroscopic microscopes, X-rays and synchrotron light sources, they have literally bounced stuff off atoms in tiny 'pinball-game-like' environments to produce a scattering process that ultimately projects a discernible pattern. The problem has been that the pattern could only be interpreted through time-consuming calculations.

To simplify and speed up the time for analysis, scientists have sought to apply algorithms to generate an immediate image of the atoms. This process is called 'inversion.'

Now a group of researchers that includes Italian physicist Alberto Morgante, who oversees the Aloisa beamline at the *Eletra* Synchrotron Light Source in Trieste, has taken the inversion process a significant step forward by successfully marrying electron scattering techniques to photoelectronic holography to create 'strikingly beautiful' three-dimensional images of the local arrangement of atoms. Morgante's work was conducted jointly with a group of researchers at the University of Zurich in Switzerland.

There is good reason why this breakthrough technique, which has been labelled "internal source holography," recently received extensive press coverage in *Nature*, *Physical Review Letters*, and *Europhysics News*. Previously, researchers were forced to devise complex mathematical models to project the possible arrangement of atoms. As Morgante explains it, "the analytical process was a difficult one, requiring trial-and-error procedures that were not only terribly time-consuming but often ended in failure. After all," Morgante observes, "modelling researchers were literally working in the dark since there was no way to confirm the models' predictive power through experimentation and observation."

"Internal source holography," Morgante says, "sheds light on the structure of atoms in ways that give researchers a reasonable fix on atomic arrangements without expending

a great deal of time or engaging in a great deal of guess work. In fact, for simple molecules and crystals, the arrangement can be discerned through a few straightforward mathematical calculations no more difficult than multiplication or division."

As a result, while data collection remains a tedious task, the analytical process has become much faster and more reliable. For this reason, Morgante and his colleagues are anticipating that photoelectron holography will prove an invaluable tool in a broad range of fields, including biology (in the study of molecules), chemistry (in the examination of catalysts), and physics (in research on nanostructures).

Internal source holography, notes Morgante, "will reveal the structure of small atomic clusters that cannot be crystallised



Alberto Morgante

for analysis by conventional X-ray crystallography." The result is a more precise picture of our atomic world that is likely to reveal expanded pathways of understanding in a variety of scientific fields. □

For more detailed information about photoelectron holography, see "Hologram of Atoms," Nature 410 (26 April 2001), pp. 1038-1039; "Imaging Atom Sites with Near Node Photoelectron Holography," Europhysics News 32/5 (September/October 2001), pp. 172-175; and "Atomically Resolved Images from Near Node Photoelectronic Holography Experiments on Al(111)," Physical Review Letters 11 (12 March 2001), pp. 2337-2340.

Patricio Cordero recently returned to the Centre after a 20 year absence to recall a part of his past that has meant so much to his career ever since.

Hello Again

When Patricio Cordero, professor of physics at the University of Chile in Santiago, Chile, returned to the Main Building on the ICTP campus this January, one of the first things he did was to stroll the corridors of the second floor to try to determine where Abdus Salam's office had been. "I couldn't visualise its location," he said. "So much has changed."

Cordero was attempting to reach back more than 20 years in time. In fact, the last time that he had visited ICTP was in 1981 as a senior associate. His broad research agenda since then has taken him to Princeton University and the University of California, Los Angeles (UCLA), in the United States, as well as to the University of Bordeaux and the European Centre for Atomic and Molecular Physics (CECAM) in Lyon, France. But for the better part of the past two decades, he has remained at the University of Chile, where he has taught physics and conducted research in a wide variety of fields related to quantum physics, statistical physics and cosmology.

"Returning to ICTP after such a long absence," he notes, "made me feel like Rip Van Winkle, having gone to sleep and reawakened 20 years later." The only difference—and it's a big difference—is that Cordero had been anything but asleep. In fact, during his 20-year absence from the Centre, he has worked hard to become one of the most respected physicists in his country.

ICTP likes to pride itself on being a close-knit community—indeed an extended multicultural family—of scientists. And there is a good deal of truth to this perception. Many of the Centre's visitors first arrive at ICTP as young researchers eager to learn from their senior colleagues who serve as lecturers in the courses and workshops that they attend.

These young scholars often continue their ties with ICTP as they move up their career ladders—returning time and again to the Centre as Regular Associates and then Senior Associates. Because each of these appointments permits three visits to ICTP over a 6-year period (and because appointments are sometimes renewed), it is not unusual for a researcher to have close ties to the Centre for several decades. Those who become Honorary Associates continue to visit ICTP for even longer periods, often coming to view the Centre as 'their home away from home.'

Cordero's experience with the Centre, however, took another route. In 1968, with a freshly minted doctorate from

the University of London in the UK, he became one of the first postdoctorates at ICTP, thanks largely to the encouragement of his former advisor, Igor Saavedra, who was a close friend of Abdus Salam. Cordero's major field of study at the time was quantum field theory.

"The Main Building on the Miramare campus was not yet completed," he recalls. "When I arrived at ICTP, the Centre's administrative offices and classrooms were still located in ICTP's first home in an office building at 6 Piazza Oberdan in downtown Trieste. I remember that within a few weeks after my arrival I was asked to help move books from the library in Piazza Oberdan to the new library in the Main Building at Miramare, lugging the bags onto a van that would take them to their new home on Strada Costiera. It was a tiring but rewarding experience, one that reflected the close-knit family atmosphere that characterised the early years at the Centre."

ICTP scientific and administrative staff, 1968.

A young Cordero is in the back row, straight above, looking to his extreme left

"Cordero was not only one of the Centre's first postdocs," says GianCarlo Ghirardi, a long-time consultant to ICTP and currently head of the Centre's Associateship Programme. "He was also one of ICTP's first Associates." In fact, Cordero was appointed an Associate in 1972 and Senior Associate 1978-1982, working closely with Ghirardi on a number of different research projects that resulted in several publications. Cordero and Ghirardi first worked with Assim Barut on a theory for a heavy electron. Later, Cordero and Ghirardi worked on spectrum generating algebras. These efforts led to publications in *Physical Review*, *Il Nuovo Cimento*, *Fortschritte der Physik* and *Journal of Mathematical Physics*.

"During those early years," Cordero recalls, "ICTP had no more than 50 researchers involved in the Centre's training and research activities at any one time. That gave participants an opportunity to receive close personal attention from the scientists who were working as consultants with the Centre." While Salam's leadership ensured that the Centre pursued permanent high energy research activities from its inception

in 1964, permanent research groups in other fields were created later on—for example, in condensed matter physics in 1977 and in mathematics in 1986.

"ICTP was so small back then," says Cordero, "that it was not uncommon for even young researchers to discuss physics directly with Abdus Salam, an opportunity I took advantage of on several different occasions."

Beyond the friendships and the personal attention he received while conducting his research, what Cordero remembers most about the Centre are the major conferences attended by some of the most prominent scientists in their fields, including many Nobel Laureates.

"In particular, I remember the symposium on Contemporary Physics, held in 1968, which included talks by Hans Bethe, Paul Dirac and Werner Heisenberg. It was exhilarating," he says, "to listen to lectures and even exchange ideas with world-renowned physicists whose articles and books I had recently read as an eager student."

That experience, along with the excellent training he received at the Centre, has had a lasting impact on his career. "It's something that I have carried with me for the past two decades," he recalled, "and it was the major reason why I wanted to return to Trieste—to see again the place that meant so much to me."

Cordero last visited the Centre in 1981. His career since then has taken several twists and turns both in terms of his travels to the United States and Europe and in terms of his wide-ranging research agenda, which has moved from quantum field theory to electron theory to spectrum generating algebra.

Today his research focusses on the physics of granular materials, which involves the study of large conglomerations of discrete macroscopic particles. While such materials may seem to be simple at first, they often behave differently than solids, liquids or gases. In fact, some researchers view granular materials as an additional state of matter.

Cordero's initial effort to return to ICTP after his two-decade-long absence took place last year when, in line with his current research interests, he inquired about participating in ICTP's Research Workshop on Challenges in Granular Physics, which was scheduled to take place from 7 to 11 August 2001.

"I contacted Silvio Franz, a staff scientist with the Condensed Matter Physics group, who was serving as the local organiser, to express my interest in coming," Cordero says. "I must admit I had been looking for an excuse to come to Trieste for some time and the conference seemed like an excellent opportunity to satisfy my curiosity while learning something that could contribute to my current research. However, a scheduling conflict made it impossible to arrange the visit. The exchange of e-mails, however, put me back in touch with GianCarlo

Ghirardi for the first time in some five years."

Ghirardi was as anxious to have his old friend Patricio Cordero come to Trieste as Patricio was to return. So when he heard that his friend was to travel from Chile to CECAM in France, in January, for a month-long stay, Ghirardi arranged for Cordero to make a side visit to Trieste to present a seminar on the "Dynamics of Granular Gases," which Cordero did on 28 January.

"My 36-hour stay in Trieste, which included a two-hour seminar, certainly stirred my memory," says Cordero. "I not only spoke to Ghirardi but also had an opportunity to have brief chats with Maria Fasanella, ICTP's head librarian, and André-Marie Hamende, who had served as ICTP's senior administrator and scientific information officer for many years. It was nice to see that they remembered me. After all, my training here ended some 20 years ago and thousands of other researchers have passed through the corridors of ICTP ever since."

And maybe that's the point of Cordero's experience here in Trieste. While we celebrate the presence of Nobel Laureates and Fields Medal winners who come to the Centre in numbers that make their presence seem commonplace, we should not forget that the heart and soul of the Centre resides in the experience of scientists like Cordero and what they take with them from Trieste to their home countries as both researchers and teachers.

Indeed there may be no greater tribute to the impact of ICTP on the development of science in the developing world than Cordero's work as a professor of physics at the University of Chile where, in addition to his research, he teaches a variety of courses in statistical physics, kinetic theory and basic physics courses, while supervising the work of some doctoral students in physics.

The big idea embodied in ICTP's mandate often finds itself on quiet display in places that never receive a great deal of attention. Cordero's recent visit to ICTP reminds us just how important these places can be. □



Patricio Cordero

The 'sandwich programme' is the latest in a series of cooperative activities between ICTP and Mongolia's scientific community that date back the Centre's earliest days.

FEATURES

From Here To Mongolia

It's a long way from Trieste, Italy, to Ulanbataar, Mongolia—some 8000 kilometers. But the ICTP 'sandwich programme,' which enables promising young students to spend a year of study in Trieste and then return home to complete their doctorate degrees, is bringing the scientific communities in both places closer together. At the same time, it's helping to build a strong foundation for the future of science in Mongolia.

"I'm likely to become the first laser optics specialist in Mongolia," says Tuvshintugs Damdinsuren, who arrived in Trieste last September from the Mongolia University of Science and Technology with his master's degree in physics already in hand and eager to take the next steps he will need to earn a doctorate.

To reach his ultimate goal, Damdinsuren will spend a year in Italy devoting much of his time studying and attending

courses at ICTP while conducting laser experiments at the *Elettra* synchrotron light facility's laser and fibre optics laboratory, located on the campus of Area Science Park less than 15 kilometers northeast of the Centre. "Because my university does not have a programme in laser physics and nonlinear optics," he notes, "it would be extremely difficult for me to pursue my research interests if I remained in Mongolia."

The 'sandwich' programme, which is sponsored by the International Atomic Energy Agency (IAEA) in Vienna, Austria, is just one of several Centre-based activities that have benefitted Mongolia's scientific community for nearly four decades.

For example, since the Centre's inception in 1964, some 50 Mongolian scientists have attended ICTP research and training activities, ranging from cosmology to condensed matter physics to the mathematics of economics. The knowledge and skills that they have acquired by participating in the Centre's conferences, seminars, schools and workshops have served them well when they returned to their universities to resume their teaching and research responsibilities.

At the same time, a total of eight young Mongolian scientists have received a certificate from ICTP's year-long Diploma Course programme, which was launched in 1991.

Horgolkhuu Odbadrakh, for example, attended the Diploma Course in condensed matter physics in 1994-1995 and Agvaanluvsan Undraa was a member of the Diploma Course class of 1996-1997 in high energy physics. Odbadrakh went on to receive a masters degree at the University of South Wales in Sydney in Australia and has returned to the National University of Mongolia to teach physics and to continue his research in the classical states of matter and thermodynamics. Undraa, meanwhile, is currently studying for her Ph.D. in physics at North Carolina State University, USA, where she was awarded an international graduate student fellowship in 2000.

"For more than 40 years," notes Oidov Lhagva, distinguished professor of theoretical physics at the National University of Mongolia who last visited the Centre in February, "ICTP has provided Mongolian scientists with a link to the outside world." The President of Mongolia, Natsagyn Bagabandi, warmly acknowledged the role that ICTP has played in the development of his nation's scientific community when he visited the Centre in summer 2000.

That role may be more important than ever as Mongolia's universities continue to make a slow but steady shift from a Soviet-style system of higher education to a Western-style system of higher education.

Today the National University of Mongolia has about 20 professors and lecturers in its physics department, half of whom were trained at Moscow State University or Dubna Joint Institute for Nuclear Research before the collapse of communism in the late 1980s. These instructors are responsible for teaching physics to some 800 undergraduate and 70 graduate students.

"The university is increasingly shedding its Soviet dress for more Western attire," explains Lhagva, "but sometimes the substantive changes have been slower than the stylistic ones. Faculty and student visits to Trieste—and specifically to ICTP—have helped facilitate the transition by enabling us to keep in close contact with the global scientific community."

"Mongolia is a remote country," Lhagva continues, "and even under the best of circumstances it is not easy for scientists to develop meaningful and lasting contacts with colleagues in other countries. The Centre has provided a sturdy bridge of communication during this dramatic period of transition."

Another challenge facing Mongolia's scientific community is that it has yet to train a sufficient number of physicists to ensure that all basic fields of study can be offered to students.



Oidov Lhagva

For example, the National University of Mongolia has an ample number of professors and lecturers trained in nuclear and condensed matter physics, but its faculty in high energy physics remains slim and its faculty in quantum physics and nonlinear optics is too small to even offer an undergraduate degree in these subfields, which are currently among the most vigorous in physics.

ICTP helps Mongolia's physics community meet these shortcomings in two important ways.

First, the Centre's research and training activities, which number about 40 each year in a variety of subjects related to physics and mathematics, fill an important void for scientists from Mongolia and other nations that face the same set of problems. Although the Centre's activities will never compensate for the lack of a degree-granting subfield at a national university, they nevertheless enable scientists to be introduced to subjects that they would not have an opportunity to learn about if their classroom work and studies were restricted to institutions within their home countries.

Second, the Centre's Diploma Course and sandwich programmes provide more in-depth knowledge in research areas that students may subsequently choose as the focal point of their scientific careers. If these students return home—as Damdinsuren plans to do after his year of study in Trieste—then people like him could become the first in a long line of teachers and researchers in these fields. In the process, subjects once absent would be added to the curriculum and subdisciplines once weak would become strong. That, in essence, is how the long-discussed desire for capacity building could become a reality.

While in Trieste, Damdinsuren has devoted his time to the study of fundamental laser-optics theories and to basic experiments involving ultrashort laser-pulse generation and measurements. Such efforts could lead to a better understanding of the complex nature of protein behaviour. In fact, deciphering a protein's behavioural patterns—and, more importantly, how such behaviour affects a protein's structure and function—requires both textbook theoretical knowledge as well as an ability to manipulate the diamond tips found on atomographic micromachines. Put more simply, it requires both intellectual insight and manual dexterity.

The classroom experience at ICTP, complemented by the laboratory experiments conducted at *Elettra*, is enabling Damdinsuren to meet his goals by deepening both his scientific understanding and honing his experimental techniques—a blending of knowledge and know-how that should prove valuable throughout his entire career.

As for the future, Damdinsuren hopes that his acquired skills will help convince funding agencies that the construction of a small educational and research laser laboratory at the Mongolian University of Science and Technology. He estimates such a facility would cost about US\$100,000 (if it was built largely with equipment and parts salvaged from existing laboratories in Europe or the United States).

"Providing access to such a machine in Mongolia," Lhagva

notes, "would bring both ICTP's and Mongolia's scientific community one step nearer their shared goal: To create a self-sustaining community of homegrown scholars with the knowledge and experience necessary to interact with like-minded colleagues from around the world." □



Natsagyn Bagabandi, President of Mongolia, at ICTP in 2000



Tuvshintugs Damdinsuren

SANDWICHING FOR SUCCESS

The ICTP 'sandwich' programme, launched in 1995 with funding from the International Atomic Energy Agency (IAEA) in Vienna (IAEA remains the programme's major benefactor), has provided fellowships to about 10 young researchers each year, mostly in the field of laser and atomic physics. The primary aim of the programme, which requires participants to remain enrolled in their home universities while taking a one-year course of study in Trieste, is to encourage students to pursue their careers in their home countries once they have earned their doctorates. The programme seeks to promote state-of-the-art training without encouraging multi-year visits abroad, a factor that many experts believe has contributed to the 'brain-drain' problem in the past. For additional information about the ICTP 'sandwich programme,' contact the Office of External Activities at oea@ictp.trieste.it.

Appointments

World renowned economic theorist **Kenneth J. Arrow**, Nobel Laureate in economics (1972) and professor emeritus at Stanford University (USA), has been appointed to the ICTP Scientific Council. He is the first member of the Council to be trained in economics and the



social sciences. Arrow has used a variety of mathematical tools and models to examine the economics of information and organisation, collective decision-making and theories of justice, and ecological economics. The Nobel Prize, which he shared with Sir John Hicks, All Souls College, Oxford University, UK, was awarded for "pioneering contributions to general economic equilibrium theory and welfare theory." Arrow's diverse areas of expertise and unique applications of mathematics should prove particularly helpful to ICTP's new research fields, especially the recently launched ecological economics programme.



Vladimir Kravtsov has been appointed the new head of the ICTP Condensed Matter Physics group. Kravtsov joined ICTP in 1993 as a visiting scientist and has remained with the Centre ever since. He was made staff associate in 1995 (splitting his time between ICTP and the

Landau Institute for Theoretical Physics in the Russian Federation) and a full-time staff member in 1998. Earlier in his career, Kravtsov held posts as a research fellow at the Institute of Spectroscopy in the Russian Federation and the Humboldt Foundation and the University of Heidelberg in Germany. He received his undergraduate and advanced degrees in physics from the Moscow Institute of Physics and Technology. Kravtsov's major fields of interest are disordered quantum systems and Anderson localisation. He also served as a pioneer in the field of physics of mesoscopic systems (see "Connected Clusters," *News from ICTP*, Winter 2000, pp. 4-5). Kravtsov assumes the post from Yu Lu, long-time head of the Condensed Matter Physics group, who has retired.

Erio Tosatti, professor of physics at the International School for Advanced Studies (SISSA) and a long-time consultant to ICTP's Condensed Matter Physics group, has been appointed ICTP acting director. The six-month appointment is subject to renewal. Tosatti takes on his temporary assignment from Miguel Virasoro who retired on 31 May.



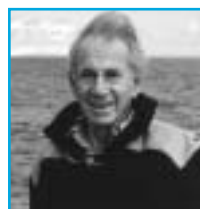
Awards

Franco Molteni, staff scientist with the ICTP Physics of Weather and Climate group, has received the Buchan Prize of the Royal Meteorological Society (RMS) for 2002.



Molteni will share the prize with Roberto Buizza, researcher with the European Centre for Medium-Range Weather Forecasting, Reading, UK. The prize is awarded to RMS fellows who, in the past 5 years, have published articles in *Quarterly Journal*, *The International Journal of Climatology* or *Atmospheric Science Letters* that are deemed to be the most important and original contributions to the field. Molteni and Buizza's most noteworthy contributions have centered on the so-called ensemble prediction, a methodology that aims to quantify uncertainties in forecasts that are inherent in numerical simulations.

Walter Munk, one of the first scientists to be associated with ICTP, has become the first-ever recipient of the Prince Albert I Medal given by the International Association for the Physical Sciences of the Oceans (IAPSO). IAPSO has recognised him "for a half century



of superb science and discoveries in physical oceanography." Munk is currently professor of geophysics at the University of California's (San Diego campus) Scripps Institution of Oceanography.



Sriram Ramaswamy, researcher at the Indian Institute of Science in Bangalore and course director and lecturer of ICTP condensed matter physics activities, has been awarded the Shanti Swarup Bhatnagar prize in the physical sciences. The prize, instituted by the Indian Council of Scientific and Industrial Research (CSIR) in the name of its founder director general, is given annually to Indian scientists under 45 years of age.

Sudeshna Sinha, former ICTP Regular Associate (1995-2000) and postdoc in the Condensed Matter Physics group, has received the B.M. Birla Science Award in physics. The prizes are given by the B.M. Birla Science Centre in Hyderabad, India,



to outstanding Indian scientists under 40 years of age. Sinha is a researcher at the Institute of Mathematical Sciences in Chennai, India.

Tatyana Yanovskaya, physics professor at St. Petersburg State University, Russian Federation, and collaborator with the ICTP Structure and Non-linear Dynamics of the Earth (SAND) group since 1990, has been awarded the Beno Gutenberg Medal by the European Geophysical Society. The medal, which honours the memory of seismologist Beno Gutenberg (long-time director of the California Institute of Technology's seismology laboratory), is given to outstanding seismologists. Yanovskaya is being recognised for developing "new methods for solving the tomography problem" and for investigations "of the Earth's lithosphere structure." Giuliano F. Panza, head of the SAND group, had been awarded the Beno Gutenberg Medal in 2000 (see "Dateline," *News from ICTP*, Spring 2000, p. 9).



Chela-Flores on Astrobiology

ICTP biophysicist **Julian Chela-Flores**, co-director of the Trieste conferences on chemical evolution, is the author of *The New Science of Astrobiology*, recently published by Kluwer Academic Publishers. The book covers a broad spectrum of topics at a level accessible to non-specialists. Issues include the origin of life in the universe, the formation of macromolecules on Earth, the possibility of biological evolution on Mars and Europa (Jupiter's moon), and philosophical implications associated with the search for extraterrestrial civilisations. The book is part of an international series devoted to the cellular origin of life and life in extreme habitats.



New Scientific Posts

ICTP has announced more than a dozen openings for scientists in the fields of condensed matter physics, high energy physics, mathematics and physics of weather and climate. The posts have been made possible as a result of increased funding from the Italian government. For further information, please see the ICTP home page www.ictp.trieste.it and click on *Job Opportunities*.

CLAF at 40

The **Latin American Center of Physics (CLAF)** in Rio de Janeiro, Brazil, which celebrated its 40th anniversary on 22-27 March, recently renewed its memorandum of agreement with ICTP for another five years. CLAF's activities have included support for meetings and conferences, graduate programmes, regional research collaborations, and the nurturing of institutional co-operation across Latin America.



Miguel Virasoro and Luis Másperi

NEWS FROM ASSOCIATES

ICTP Regular Associate (1998-2003) **Mohammed Musa Shabat** has been appointed vice president for administrative affairs at the Islamic University in Gaza,



Palestine. A condensed matter physicist by training, Shabat's major fields of interest include laser physics, computational physics and optoelectronics.



A paper by ICTP Senior Associate **Edison Z. da Silva**, "How Do Gold Nanowires Break?" was featured on the cover of the 17 December issue of *Physical Review Letters*. Da Silva, professor of physics at *Universidade Estadual de Campinas* in Brazil, was appointed an ICTP Senior Associate in condensed matter physics in 1998. His main fields of research are electronic and structural properties of solids, molecular dynamics, superconductivity and thermodynamic fluctuations.

**ADVANCED COURSE ON SYSTEM SIMULATION AND
HARDWARE SYNTHESIS USING VHDL, held in Lima, Peru**

28 January - 15 February

Director: A.A. Colavita (ICTP). Head of laboratory exercises: A. Cicutín (ICTP).

Local Organiser: J.F. Tisza Contreras (*Universidad Tecnológica del Perú*, UTP, Lima, Peru).

The Course introduced Latin American scientists and engineers to the most up-to-date efforts in the design and simulation of large computer systems using VHDL, a hardware description language. Taught in Spanish, the Course consisted of 16 hours of theory and 40 hours of assisted laboratory work, with an additional 64 hours of independent design exercises. Discussions and laboratory work concentrated on programming and simulation using VHDL and the design cycle, including implementation of designs using FPGAs and standard cells.



Participants in Advanced Course on System Simulation and Hardware Synthesis Using VHDL

**JOINT ICTP-INFM SCHOOL IN HIGH
PERFORMANCE COMPUTING ON
LINUX CLUSTERS**

31 January - 15 February

Directors: S. Cozzini (International School for Advanced Studies, SISSA, Trieste, Italy) and A. Nobile (ICTP).

The School examined the skills needed to benefit from the new generation of high-performance computers. Specifically, it conveyed basic knowledge for programming, administering and purchasing or building Linux-based clusters. Lectures focussed on interconnective

solutions; parallel programming; cluster optimisation and profiling; issues related to operating systems; and system administration for Linux clusters. Hands-on lab sessions allowed participants, working in small teams, to build their own clusters. During the first half of the School, participants assembled, configured and tested clusters. During the second half, participants were given a series of tutorials on representative parallel codes in computational condensed matter physics, engineering and weather forecasting. In the laboratory sessions, participants installed, analysed and profiled the cluster codes that they built.

**SCHOOL ON RADIO USE FOR DIGITAL AND
MULTIMEDIA COMMUNICATIONS**

11 February - 1 March

Co-sponsor: International Union of Radio Science (URSI, Gent, Belgium).

Directors: S.M. Radicella (ICTP) and R.G. Struzak (Radio Regulation Board of the International Telecommunication Union, ITU, Geneva, Switzerland).

The School consisted of lectures and laboratory exercises focussing on computer networking and radio techniques for digital communications. International experts lectured on the impact of information technology and telecommunications on emerging and developing economies; radio's role in modern information technology and telecommunications, including mobile communications; radiopropagation issues related to modern radiocommunications; and digital radiocommunications, including FDMA, TDMA and CDMA (spread spectrum). Laboratory work simulated the planning and implementation of a local area computer network utilising simple multimedia facility radio links, including mobile systems. Laboratory exercises concentrated on applications of radio technologies for digital communications; computer networking using radio links, including mobile systems; and intranet multimedia campus networks. Technical experts from telecommunication firms joined participants in discussions and analyses of selected case studies.



Long distance link between Galileo Guesthouse and downtown Trieste

WINTER COLLEGE ON ULTRAFAST NON-LINEAR OPTICS

18 February - 1 March

Directors: S. De Silvestri (*Politecnico di Milano*, Italy), G. Korn (*Max-Born-Institut*, Berlin, Germany) and O.E. Martinez (*Universidad de Buenos Aires*, Argentina).

Local Organiser: G. Denardo (ICTP and University of Trieste, Italy).
The College exposed participants to the most recent advances in the field of ultrafast laser sources. The activity consisted of lectures by international experts, group discussions and laboratory demonstrations. The College aimed to provide the background needed to understand the most up-to-date literature. Main topics included generation and measurement of ultrafast pulses; phase control of few-optical cycle pulses; generation of highly intense ultrashort pulses; non-linear fluorescence microscopy and applications to biology; ultrafast optical non-linearities in semiconductors, organic and photonic band gap materials; uses of ultrashort pulses in coherent control and chemical reactions; and applications of ultrafast technology to micromachining, optical communications and optical coherence tomography. The programme included demonstrations and laboratory exercises.



Oscar Martinez and Gallieno Denardo

WORKSHOP ON NUCLEAR REACTION DATA AND NUCLEAR REACTORS: PHYSICS, DESIGN AND SAFETY

25 February - 28 March

Co-sponsors: International Atomic Energy Agency (IAEA, Vienna, Austria) and *Ente per le Nuove tecnologie, l'Energia e l'Ambiente* (ENEA, Rome, Italy).

Directors: A. Gandini (ENEA), M. Herman (IAEA), A. Koning (Netherlands Energy Research Foundation, Petten, The Netherlands), J. Kupitz (IAEA) and A. Trkov (IAEA); with the assistance of N. Paver (Italian National Institute of Nuclear Physics, INFN, and ICTP).

The Workshop is a unique international forum in which scientists and engineers receive up-to-date information on the 'know-how' behind nuclear reactor calculations. The Workshop aims to train scientists and engineers from developing and developed countries in nuclear reaction theory, data production and use. Particular emphasis was placed on applications in nuclear reactor physics, design and safety. Participants were familiarised with the use of modern computer codes relevant to these topics as well as with the applications of rapidly advancing information technology for retrieval of nuclear data. Participants also examined new trends in advanced nuclear systems for energy generation.



Workshop on Nuclear Reaction Data and Nuclear Reactors: Physics, Design and Safety

RESEARCH WORKSHOP ON STATISTICAL MECHANICS OF PLASTIC DEFORMATION

4 - 7 March

Co-sponsor: VolkswagenStiftung (Hannover, Germany).

Directors: E.C. Aifantis (Michigan Technological University, Houghton, Michigan, USA), A. El-Azab (Pacific Northwest National Laboratory, Richland, Washington, USA), P. Hähner (Joint Research Centre - Institute for Advanced Materials, Petten, The Netherlands), H. Neuhäuser (University of Edinburgh, UK), A. Vespignani (ICTP), M. Zaiser (*Max-Planck-Institut für Metallforschung*, Stuttgart, Germany) and S. Zapperi (Italian National Institute for the Physics of Matter, INFN, and University of Rome *La Sapienza*, Italy).

The Workshop sought to create a forum dedicated to the exchange of information and insights among material scientists working in plasticity and statistical physicists interested in materials problems. Topics included statistical mechanics of single/many dislocation systems: depinning, pattern formation, internal stresses and long-range interacting lines; collective dislocation dynamics and plastic instabilities: avalanches, intermittency, non-linear oscillations and waves; plasticity of non-crystalline solids, including cellular and amorphous materials, granular media and polymers; and advanced experimental and simulation techniques.

WORKSHOP ON PLASMA DIAGNOSTICS AND INDUSTRIAL APPLICATIONS OF PLASMAS

11 - 13 March

Co-sponsor: International Atomic Energy Agency (IAEA, Vienna, Austria)

Directors: R. Amrollahi (Khaje Nassir-Al-Deen Toosi University of Technology, Tehran, Iran), R. Miklaszewski (Institute of Plasma Physics and Laser Microfusion, Warsaw, Poland) and A. Wootton (Lawrence Livermore National Laboratory, Livermore, California, USA).

The Workshop fostered an exchange of ideas and experiences between large and small plasma physics programmes. Participants reviewed and discussed (1) industrial applications of plasmas for small programmes in developing nations, including diagnostics, analysis tools and techniques, and (2) possible diagnostic research and development programmes that might prove beneficial to the entire plasma physics community. Topics included plasma coating technology, computational methods in plasma science, and diagnostics. The Workshop consisted of presentations and discussion groups examining future directions and possible collaborative activities.

IV CONFERENCE ON QUANTUM INTERFEROMETRY

11 - 15 March



Francesco De Martini's unique explanation of teleportation with the help of Disney characters

Co-sponsor: Italian National Institute for the Physics of Matter (INFN).

Directors: F. De Martini (University of Rome *La Sapienza*, Italy) and W. Schleich (*Universität Ulm*, Germany).

Local Organiser: G. Denardo (ICTP and University of Trieste, Italy).

The Conference, part of an ongoing series that includes previous conferences held in 1993, 1996 and 1999, explored interdisciplinary approaches to the concept of 'quantum interference,' including assessments of the most recent experiments in the field involving photons, neutrons, electrons, excitons and atoms. Much attention was devoted to the interference properties of extended multiparticle systems in the context, for example, of quantum computation, 'Schrödinger-cat' zoology and Bose-Einstein atom condensation. Quantum nonlocality, entanglement, teleportation, decoherence, quantum entropy and thermodynamics were the watchwords of the Conference.

SPRING SCHOOL ON SUPERSTRINGS AND RELATED MATTERS

18 - 26 March

Directors: C. Bachas (*Ecole Normale Supérieure*, Paris, France), E. Gava (Italian National Institute of Nuclear Physics, INFN, Italy), J. Maldacena (Institute for Advanced Study, Princeton, New Jersey, USA), K.S. Narain (ICTP) and S. Randjbar-Daemi (ICTP).

The School examined such topics as gauge theory and gravity duality; tachyon condensation in string theory; mirror symmetry; strings in RR background; G2 manifold; string phenomenology; and cosmology. The School, which centered on a series of lectures, was intended for theoretical physicists and mathematicians with a knowledge of quantum field theory, general relativity and string theories.



PROFILE

ICTP Diploma Course graduate **Cristine Villagonzalo** has pursued a lifetime of learning with one major goal in mind: to become the best teacher that she can.

Learning to Share

"As long as I can remember," says Cristine Villagonzalo who graduated from the ICTP Diploma Course in 1997, "I've wanted to be a teacher. When I was a child in the Philippines, just before going to sleep, I would often take a few moments to puff up my pillows at the head of my bed for the lesson of the day. The pillows were my students—not too bright but never disrespectful."

A life-long quest for learning has turned Villagonzalo's childhood games into a postdoctorate position in the department of physics at West Virginia University (USA), where she pursues theoretical studies on the interface of cobalt/copper multilayers—materials whose resistance to electrical currents changes dramatically in the presence of a magnetic field. According to condensed matter physicists, such giant magnetic-resistance (GMR) behaviour could serve as the basis of important improvements in information storage technologies.

Because Villagonzalo has always pursued education with teaching in mind—in her own words, she has always wanted to "learn in order to share"—she has pursued a variety of subjects related to condensed matter physics and material science throughout her university training.

As an undergraduate at the University of the Philippines, she concentrated on the characterisation and production of polycrystalline films in plasma; as a master's degree student at the university, she studied anisotropic potential scattering; as an ICTP Diploma Course student, she explored neutron scattering of helium; and as a doctoral student at Chemnitz University of Technology in Germany, she focussed on issues related to thermoelectric transport at the metal-insulator transition in disordered systems, which laid the groundwork for her current research on cobalt/copper multilayers at West Virginia University.

"While much of my work has been theoretical, 'pen-to-paper,' work," notes Villagonzalo, "I've also periodically turned to experimental investigations. I think that it is important for professors to develop a broad research agenda over time, not only to keep your research fresh and interesting but also to assist you in your teaching. During my career, I plan to spend a good deal of time in the classroom. I believe I can be more responsive to the varied interests of my students if I have experience in a variety of fields."

Villagonzalo first learned about ICTP in 1993 while working on her master's degree at the University of the Philippines under the supervision of Christopher and Maria Victoria Bernido, husband and wife physicists who were both ICTP Associates. Two years later, while putting the finishing touches on her master's thesis, she completed an application to the ICTP Diploma Course and was accepted on her second try.

"When I first arrived in Trieste," Villagonzalo recalls, "I thought I knew virtually everything. However, I soon discovered that I had a lot to learn. My first few months were not easy and I had to work hard to keep pace with the others. Thanks largely to the help of Stefano Fantoni, a physics professor at SISSA (International School for Advanced Studies) who later served as my dissertation advisor, and Subodh Shenoy, ICTP Diploma Course coordinator, by the time the winter break rolled around in December, I felt I could hold my own."

Cristine Villagonzalo

After receiving her Diploma Course certificate in 1997, Villagonzalo went on to Chemnitz University of Technology, earning a doctorate in July 2001. Since last August she has been a postdoc in physics at West Virginia University.

"I have enjoyed my studies and travels," notes Villagonzalo. "But I have now been on leave for five years from the University of the Philippines, where I served as an instructor from 1992 to 1996 and was appointed deputy director of academic affairs in 1996."

"I am looking forward to returning there within a year or two. In contrast to declining student enrolments in physics departments at universities across the globe, the University of the Philippines has experienced a growth spurt over the last decade as job opportunities have increased for students with physics degrees. When I was an undergraduate, the physics department had just 50 undergraduates—10 in my class. Today there are more than 100."

"The Philippines," says Villagonzalo, "is where I want to be and, as recent trends indicate, that is where I am most needed." □

Primo Rovis Prize

Two distinguished scientists from the Russian Academy of Sciences, **Evgeny Pavlovic Velikhov** (left) and **Dmitry V. Rundqvist** (right), have been awarded the Primo Rovis International Prize for their contributions to public understanding of science and technology. Velikhov is a leading authority in such fields as plasma physics, thermonuclear fusion, and electromagnetic acoustics of the Earth's surface. Rundqvist is an internationally renowned geophysicist and director of the Vernadsky National Geological Museum in Moscow. The prize, endowed by Trieste entrepreneur **Primo Rovis** (centre), carries a US\$20,000 cash award.



Delia Gatta Retires

ICTP library clerk **Delia Gatta** has retired after 18 years of service to the Centre. Delia's career at ICTP began in 1967 in ICTP's first library in the office building on Piazza Oberdan in downtown Trieste. One year later, she moved to Canada with her husband and first child, returning to Trieste in 1985 to pick up at the Centre where she had left off. Stationed at the loan desk, she was often the first person that staff and visiting scientists encountered when entering the library. Always kind and helpful, staff and scientists alike thank Delia for her years of service and wish her the best in her well-deserved retirement.

ICTP Profiles

The ICTP Public Information Office has published *People and Places*, a collection of profiles of scientists who have visited the Centre over the past several years. Many of the profiles first appeared in *New from ICTP*. Those interested in obtaining a copy should contact sci_info@ictp.trieste.it.



I N M E M O R I A M



Zeenet Kamran Badirkhan, ICTP Regular Associate (1996-2001), recently passed away. She was 42. The Iraqi-born condensed matter physicist had a long-standing relationship with ICTP and, more generally, Trieste's international scientific community. Badirkhan earned a Ph.D. in condensed matter physics in 1990 from the International School for Advanced Studies (SISSA). She was appointed a research fellow at ICTP the following year. Badirkhan's major research areas included local ordering and thermodynamics. She taught at Al-Fateh University in Libya and Zarqa College in Jordan.



Abdelbaki Maafi, ICTP Regular Associate (1998-2003) in the field of nonconventional energy, recently passed away at the age of 44. Algerian-born Maafi, who last visited the Centre in 2001, pursued a broad research agenda that included statistical analyses of solar radiation data and mapping, development simulation models of solar radiation, and modelling of photovoltaic systems to improve their storage capacities. Maafi, who received a doctorate in physics at *Université des Sciences et de la Technologie Houari Boumedienne* in Algiers in 1991, became one of Algeria's youngest senior researchers when he was recently appointed full professor in electronics and applied mathematics at the university where he earned his doctorate.

WHAT'S NEXT

8 April - 19 April

Spring Colloquium on the Physics of Weather and Climate: Regional Weather Prediction Modeling and Predictability

22 April - 3 May

Workshop on Theoretical Ecology: Natural Resource Management and Conservation Biology

22 April - 24 May

School of Synchrotron Radiation and Applications

13 May - 17 May

Workshop on Indicators for Sustainable Energy Development

13 May - 31 May

School and Conference on Probability Theory

20 May - 31 May

School and Conference on "Chemical Senses: Molecules to Perception"

30 May - 1 June

Workshop on Economics and Heterogeneous Interacting Agents

3 June - 14 June

Introductory School on String Theory

3 June - 14 June

Workshop and Conference on El Niño and Tropical Ocean-Atmosphere Interactions

17 June - 21 June

Workshop on "Correlation Effects in Electronic Structure Calculations"

17 June - 28 June

Joint ICTP-INFM School and Workshop on "Spectroscopic Investigation of the Collective Dynamics in Disordered Systems"

17 June - 5 July

Summer School on Astroparticle Physics and Cosmology

24 June - 5 July

Workshop on "Mesoscopic Physics and Electron Interaction"



Throughout the year, the most up-to-date information on ICTP activities may be found on the World Wide Web and via e-mail. Here's how to find out what's going on.

ON THE WORLD WIDE WEB (WWW)

Our address is <http://www.ictp.trieste.it/>

The site includes detailed information on our research groups and activities, and a listing of our preprints, awards and job opportunities.

ON E-MAIL

(1) For Yearly Calendar of Scientific Activities

Create a new e-mail message and type

To: smr@ictp.trieste.it

Subject: get calendar 2002

Leave the body of the message blank. Send it.

Your e-mail will generate an automatic reply from the ICTP server containing the most updated version of the yearly Calendar.

(2) For Information on a Specific ICTP Activity

Each activity in the Calendar has its own 'smr' code number, which is located on the last line of each activity description. The 'smr' number will enable you to obtain more information—if available—on those activities you are interested in. To receive this more detailed information, create a new e-mail message and type the smr code number that you found on the calendar:

To: smr####@ictp.trieste.it

Under the e-mail's subject, type

Subject: get index

Leave the body of the message blank and send it.

You will receive an automatic reply listing all documentation available on that particular activity—the announcement or bulletin and, in most cases, a separate application form.

To receive the full text of the announcement and/or application form, you will need to send another e-mail message to the same smr code:

To: smr####@ictp.trieste.it

Subject: get announcement application_form

Again, leave the body of the message blank, and send it.

(3) For Information on All ICTP Activities

A free online service for the dissemination of information on all ICTP activities, programmes and related announcements is available via e-mail. To subscribe, create a new e-mail message and type:

To: courier-request@ictp.trieste.it

Leave the subject line empty.

In the body of the message type
subscribe

and your e-mail address. Send the message.

Any comments or suggestions on this service are most welcome. Please address them to pub_off@ictp.trieste.it.

NEWS from ICTP

The Abdus Salam International Centre for Theoretical Physics (ICTP) is administered by two United Nations Agencies—the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Atomic Energy Agency (IAEA)—under an agreement with the Government of Italy. Miguel Virasoro serves as the Centre's director.

News from ICTP is a quarterly publication designed to keep scientists and staff informed on past and future activities at ICTP and initiatives in their home countries. The text may be reproduced freely with due credit to the source.

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