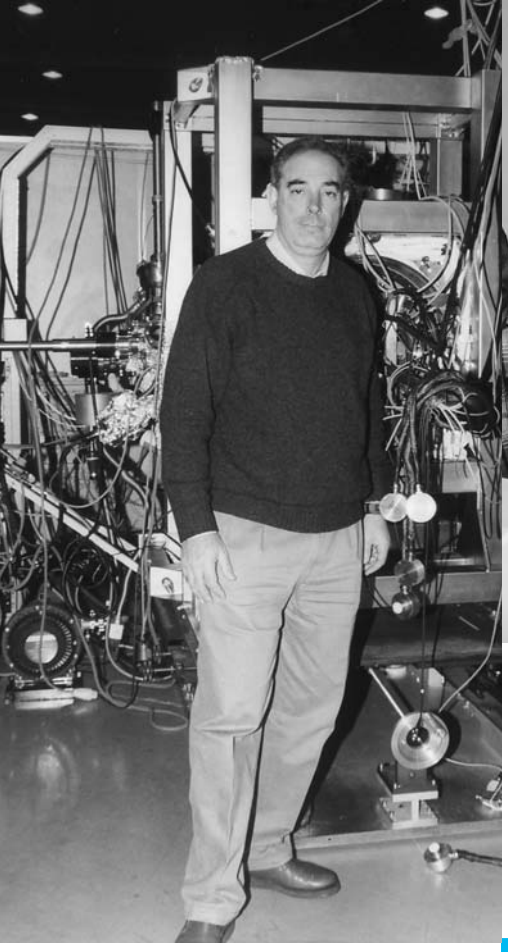


# NEWS from ICTP

the
**abdus salam**
international centre for theoretical physics




SPRING
1999

#88

# WHAT'S NEW

Visiting scientists meet many of ICTP's in-house staff scientists during their research activities. But another segment of ICTP's workforce—the administrative staff—often finds itself working 'behind the lines.' Within this group is ICTP's Administrative Computer Section (ACS).

Created in 1987, the four-person ACS staff offers nonscientific computer support for Centre staff, consultants and contractors. Put another way, when it comes to number crunching and modelling, Centre scientists turn to the Scientific Computer Section. But when it comes to setting up databases or upgrading word processing programmes, the ACS is the Centre's service center.

The number of PCs at the Centre has grown from a dozen units at the dawn of ICTP's computer age in the 1980s to more than 200 networked PCs and 100 printers today. ACS staff maintain both the hardware and software for this equipment, and assist and train the Centre staff members who use it. The Section, in fact, responds to more than 1,000 requests annually. In addition, each year, ACS staff replace on average 20 percent of the Centre's hardware.

On another front, ACS has been computerizing ICTP's internal procedures—everything from the receipt of applications to the updating of visitor statistics—since 1988. The Centre's central electronic database deals with information related to most of the ICTP scientific activities. The database, which contains more than 300,000 records dating back to 1983, can be accessed through the internet.

Other databases—for example, information about visas, room bookings and medical insurance—have been put on the system to make the nonscientific aspects of a visitors' stay as unruffled as possible.

Because the Centre has been given more administrative autonomy under the United Nations Educational, Scientific and Cultural Organization (UNESCO), ACS has been assigned the task of implementing software solutions for the computerization of payroll, attendance, procurement, inventory and administrative procedures. A state-of-the-art system is expected to be in place by the end of the year.

The Centre's growing computer needs, combined with endless advances in computer hardware and software, pose constant challenges for ACS.

For these reasons, anticipating the future has become a necessity as we seek to ensure that the Centre keeps pace with the opportunities that computers offer for improved efficiency and productivity. After 11 years of service (an eternity in the world of computers), ACS plans to replace ICTP's central database and to computerize such additional areas as travel reimbursement. At the same time, the Section has begun offering computer training courses to staff to increase computer literacy and facilitate work activities.

For more than a decade, ACS has been there for Centre staff and scientists alike: When submitting an application, receiving an invitation letter, or processing your visa, medical insurance or identification badge, the staff of ICTP's Administrative Computer Section is working for you 'behind the lines.' □

*Giorgio Terdina*
*Head*
*Administrative Computer Section*

COMMENTARY

**Discussions of international copyright laws usually are reserved for court briefs and judicial hearings. But in the age of the internet, such laws could determine whether all scientists share the most current information in their fields.**

# Copies and Rights

*More than 10,000 physicists attended the 1999 Centennial Meeting of the American Physical Society, held in Atlanta, Georgia (USA), from 20-26 March 1999. The meeting marked the largest gathering of physicists in the history of the profession. Representing, the ICTP/Third World Academy of Sciences Donation Programme was Hilda Cerdeira.*

At the conference, Hilda Cerdeira participated in a panel discussion examining an issue of critical importance to the future well-being of scientific research in the South—namely, national and international copyright laws as they pertain to electronic publications. Other session speakers included Martin Blume, American Physical Society; Ian Butterworth, formerly with the British Institute of Physics; Jean-Marc Quilby, EDP Sciences in France, and Sukekatsu Ushiodo, Japan Physical Society.

In her presentation, Cerdeira noted that two conflicting principles, both recognised by the United Nations Universal Declaration of Human Rights, have complicated the dissemination of scientific information at a time when new information technologies make such dissemination more rapid and cost-effective than ever before.

On the one hand, the UN Declaration states that every individual deserves access to scientific information. On the other hand, the Declaration states that every individual also has the right to receive legal protection—largely in the form of copyright laws—for the scientific knowledge that he or she creates.

Many observers maintain that relatively rapid and largely cost-free distribution of information has been a critical factor behind scientific progress since the time of Isaac Newton. Now, new information technologies—most notably, the internet—have created unprecedented opportunities for even more rapid and lower cost information dissemination. In the years ahead, such opportunities are likely to reach even the most remote corners of the developing world as scientific institutions throughout the South acquire the necessary hardware and software.

However, to take full advantage of these new technologies, information will have to be downloaded (in effect, electronically copied), a process that puts these new methods of information dissemination on a collision course with national and international copyright laws.

In light of these trends, Cerdeira's talk focused on this critical question: How can we retain a delicate balance between an individual's right to enjoy access to scientific information and the equally important right for researchers to receive protection for their findings and discoveries? Both rights must be secured for scientific progress to continue in the future, especially in the developing world.

When two inherent rights of equal importance come in conflict, solutions become difficult. Yet, if we fail to find a way to achieve a balance between the public and private good, scientists in the developing world are likely to find themselves information-deprived in the age of information. Such a trend would have untold adverse consequences for scientists from the South and, perhaps even more importantly, for the five billion people living in the developing world, who are banking on science and technology to secure a better future for both themselves and their children.□

*Following the session, Cerdeira was asked to become part of an International Union of Pure and Applied Physics (IUPAP) Working Group on Communication in Physics that will examine the difficult and delicate issues surrounding international copyright laws and regulations at a time when electronic communications is emerging as the driving force behind the exchange of scientific information.* News from ICTP *will keep you posted on the committee's progress.*

*Graphic: Poster of the APS Centennial Conference*

**As Chief Executive Officer and Science Director of the Elettra synchrotron light source and Head of ICTP's Synchrotron Radiation Theory Group, Massimo Altarelli hopes to bring the work of theorists and experimentalists closer together. Here's how.**

# Following the Light

Throughout his distinguished career, Massimo Altarelli has followed the light—that is, the bright light generated by synchrotron radiation facilities. His career path, often illuminated by this light, has led him to positions in the United States, Germany and France. This January, Altarelli brought his diverse talents to Trieste, where he hopes to advance the research agendas of both the ICTP and the Elettra synchrotron light source.

"I am Italian by birth and graduated from the University of Rome in 1969 with a degree in physics," explains Altarelli. "I spent an additional two years on a fellowship at the same university and then received a post-doc at the University of Rochester in the United States. After that, I was a faculty member in the department of physics at the University of Illinois at Urbana-Champaign. All together, I spent almost a decade in the United States during the early part of my career."

In 1980, Altarelli returned to Europe, first as a staff member of the Max Planck Institute in Stuttgart, Germany, and then at the High Magnetic Field Laboratory in Grenoble, France, which is operated jointly by the French National Research Council (CNRS) and the Institute.

"In 1987, I was asked to become the Science Director for Physics at the European Synchrotron Radiation Facility, which was just starting up in Grenoble. I remained in that position for seven years and then stepped down to become the Head of Theoretical Physics, where I stayed from 1994 until last December."

That's when Altarelli decided to move again—this time to lead the Elettra synchrotron light source in Trieste, which is a research facility operated by a consortium headed by AREA Science Park and financed by the Italian government. He explains the decision in this way.

"The European Synchrotron Radiation Facility is doing extremely well. The scientific productivity there is high, and from a personal point of view I could have glided into retirement without much effort."

"Elettra, on the other hand, presents more of a challenge because it is still in a developmental stage. In fact, only half of the beamlines have been built. That provides a unique opportunity to shape the facility's future research agenda."

"Moreover, my affiliation with the ICTP will enable me to pursue activities that join theory and experimentation and, at the same time, offer training opportunities for scientists from the developing world. For example, synchrotron facilities have been built in Brazil, China, and India, and one is planned for Thailand. Scientists in these countries will need proper training to take full advantage of this equipment. The ICTP, especially with its ties to Elettra, can play a leading role in this effort."

Elettra, which was completed in 1993, currently has 11 beamlines in operation. What makes it unique is the intense, coherent light generated by the electrons as they whirl through the facility's 280-metre tunnel at the speed of light, completing one million revolutions each second.

Some of the light is channelled into the beamlines that have been inserted into the main tunnel at select intervals, much like exit ramps on a highway. At the end of these 'light ramps' are the facility's 'research reststops'—where the scientific and data-collection equipment that enables scientists to conduct their investigations is located.

"Synchrotron radiation is a versatile research tool with important applications in physics, chemistry and biology," Altarelli explains. "For example, spectroscopy allows researchers to study the composition of high-temperature superconducting materials. Microscopy enables us to examine microscopic biological images. And crystallography reveals the intricate structure of proteins."

Many of the subject areas that provide fertile ground for experimentation at Elettra are also closely rooted to theoretical physics. That's why Altarelli is so optimistic about the prospects for collaboration between ICTP and Elettra.

"I plan to encourage people who have been awarded time on our beamlines to talk to ICTP's theoretical physicists. ICTP scientists could not only help Elettra's experimentalists look for factors they may otherwise ignore but could provide valuable assistance in their calculations. The latter is one of the strengths of the ICTP."

Altarelli recognises that several obstacles—some mundane, others more profound—stand in the way of success.

"Elettra and the Centre are some 10 kilometres apart. Difficult bus connections and heavy traffic mean that it takes about half an hour at minimum to get from one facility to the other. As a result, scientists interested in co-operative projects must make major expenditures in time. In addition, the distance between the facilities makes informal interactions at the coffee bar or lunch table less likely."

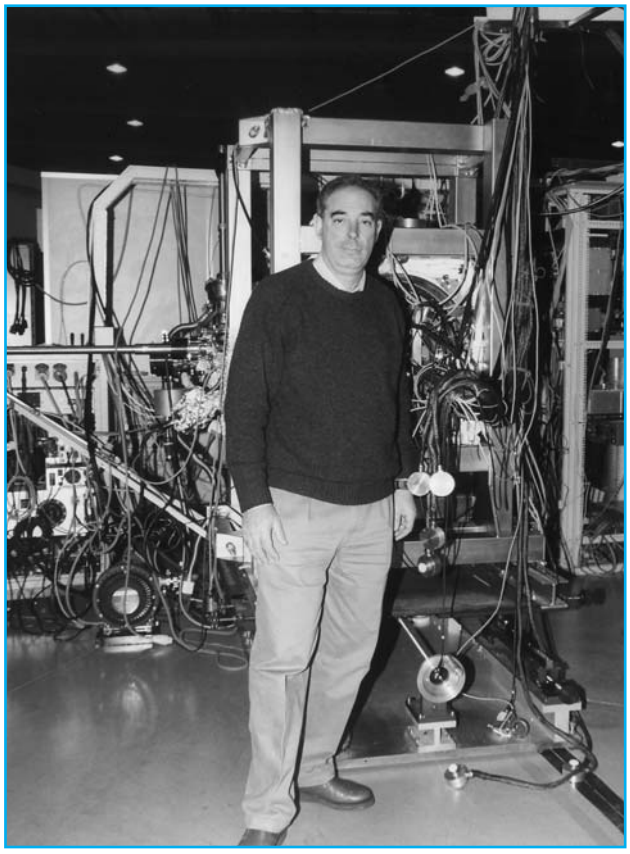
Altarelli acknowledges that "We won't be able to fix this problem completely but perhaps a regularly scheduled shuttle bus could ease the burden." At the same time, he hopes "to have ICTP post-docs working in the field spend at least one or two days a week at Elettra."

At a different level, Altarelli realises that when it comes to research, Elettra and ICTP scientists have led largely separate lives. As a result, drawing their work closer together will take some coaxing and encouragement. For this reason, Altarelli notes that he "plans to articulate a research agenda that is compatible with the interests of scientists in both institutions."

One subject area likely to receive careful consideration is strongly correlated electron systems. The field raises theoretical issues that have been of particular interest to researchers in ICTP's Condensed Matter Group. At the same time, it lends itself to experimental explorations in photoemission and X-ray scattering spectroscopies.

Magnetic systems represent another area where theory and experimentation are increasingly crossing paths. The laser-like quality of the Elettra light source also makes it ideal for the study of X-ray holograms that could be used to examine the internal structure of both chemical and biological materials.

In the immediate future, Altarelli hopes to build up his staff, which at full force he projects will total six people. He also will be busy helping to organise the upcoming VUV 13 Conference, which is scheduled to take place in 2001 in Trieste. The VUV Conference is now the world's flagship conference for researchers exploring vacuum ultraviolet radiation physics. The previous conference, held in the United States at the University of California at Berkeley, attracted more than 350 experts from around the globe. A similar number of participants are expected in Trieste.



*Massimo Altarelli*

Over the long term, Altarelli plans to continue to push Elettra to the forefront of synchrotron radiation experimentation and, with the help of ICTP, draw experimentalists and theorists closer together in the never-ending quest to gain a greater understanding of our physical, chemical and biological worlds.

"I have been very impressed with the quality of the research and administration at both institutions, and I plan to remain in Trieste until I retire—unless the people here kick me out before," Altarelli says with a wry smile.

The truth is that Altarelli's proven skills as a scientist, combined with his successful track record as an administrator, have convinced everyone associated with Trieste's research community that his tenure here will be both long and productive.

As for Altarelli, he will be doing what he has always done throughout his distinguished career: following the light—this time, the bright light generated by the Elettra synchrotron laboratory. □

**Erio Tosatti**
*is a professor of physics at the International School for Advanced Studies (SISSA) and a long-time consultant with ICTP's Condensed Matter Group.*



**Theoretical research in the Trieste SISSA/ICTP Condensed Matter Group is shedding new light on the behaviour of molecular matter under extreme conditions. It is all part of a larger effort to better understand the forces that shape our Universe.**

# Extreme Measures

We all know what water does under 'normal' conditions—that is, normal for us. Heat water to 100 °C and it begins to boil into a gaseous state. Chill water to 0 °C and it freezes into ice.

But how would water behave under 'extreme' conditions—for example, the very high temperatures and intense pressures found deep within the Earth's crust or at the core of large, remote planets?

Such conditions thankfully don't exist on the Earth's surface. (If they did we wouldn't be here.) But they are commonplace elsewhere.

In fact, conditions found at the cores of the Earth and the giant planets of our solar system are so extreme that they cannot be replicated in laboratories except under 'shock-wave' experiments that take place under difficult-to-create explosive conditions. As a result, scientists have turned to an alternative, more sedate, strategy based on a combination of theoretical physics and modelling. The latter benignly simulates the conditions created by shock-wave experiments at researchers' desks and computer terminals.

These simulations have advanced our basic understanding not only of Earthly matter but of matter on other planets. What would the 'solar' brew of water, ammonia and methane found in the deep, hot 'ice layers' of Neptune and Uranus look like if we could see it? Would the brew be solid or liquid? Would it mix or separate, insulate or conduct? Would the molecules hold together or fall apart? Would they be transformed into something else?

The only certainty we can count on is that this brew would behave differently there than it does in our everyday world under 'normal' pressures and temperatures. That's because the water, ammonia and methane in these remote places experience physical conditions radically different than conditions on or near the Earth's surface.

For example, higher pressures found inside the planets of our solar system would push the nuclei of these materials closer together, accelerating the quantum movement of electrons into a frenzy of kinetic energy. Changes in crystal structure would follow as the materials sought to relieve this pent-up energy.

High temperature, on the other hand, would ultimately cause the newly created crystal structures to melt. Inside the giant planets, the protons of water and ammonia may melt on their own and run loose in a 'superionic state' before the heavyweight constituents—oxygen and nitrogen—melt too. High-temperature molecular dissociation could cause the formation of plasmas with high conductivity, which is a precondition for the creation of planetary magnetic fields.

Research and modelling to date have helped scientists foreshadow some of the likely responses to such conditions. But much remains to be learned because as the saying goes "the devil is in the details." Recent desktop explorations into condensed matter theory, relying on sophisticated calculations of electronic structures and computer simulations of matter at the atomic and molecular level, are now beginning to fill some of the gaps in our knowledge.

Such explorations are based on what physicists call density functional theory, whose principles were first articulated by Walter Kohn, Pierre Hohenberg and Lu Sham in the 1960s. Some 30 years later, in 1998, Kohn received the Nobel Prize in Chemistry for his efforts.

Under this theory, the properties of most solids can be accurately calculated when the material's nuclear positions are known. The problem is how to pinpoint the nuclear positions, especially under conditions of extraordinarily high temperatures and pressures.

In the mid 1980s, Roberto Car and Michele Parrinello, researchers with the SISSA/ICTP Condensed Matter Group in Trieste, illustrated how accurate theoretical simulations could be used to help overcome this problem. Their technique—so-called "first-principles molecular dynamics simulations"—subsequently came to bear their names and is now known as the Car-Parrinello Molecular Dynamics Method.

Applications of this method to ultra-high pressures began in earnest about five years ago, again largely conducted by a Trieste research team comprised of Marco Bernasconi, Guido Chiarotti, Paolo Focher, Parrinello and myself. Sandro Scandolo and Jorge Kohanoff joined our efforts early on, while Carlo Cavazzoni and Alessandro Laio became part of the team somewhat later.

Initially, the theory helped to expand our understanding of high pressure transformations in such elements as silicon and carbon (the latter involving the transformation of

graphite into diamond); such molecular crystals as hydrogen and oxygen; and such carbon-based systems as acetylene and carbon monoxide.

With these early successes in hand, researchers embarked on more difficult problems, including examinations into the theoretical underpinnings driving the molecular transformations of matter in the interior environments of planets.

Under the extreme conditions found there, we determined that methane would first associate into hydrocarbons and only at higher pressures dissociate into hydrogen plus diamond. We speculated that the initial association may explain Neptune's excess ethane—a hydrocarbon—first detected in that remote planet's atmosphere by the spaceship *Voyager 2* during its 1989 'close-approach' mission. Our reasoning went like this: Under high pressure, the ethane is synthesized from the methane and diffused into the atmosphere where it becomes visible.

Research efforts in Trieste may also help us better understand Neptune's planetary magnetic field observed by *Voyager 2* during the same flight. The high-pressure, high-temperature water found deep inside the planet is predicted by Car-Parrinello computer simulations to form a conducting plasma capable of sustaining the dynamo currents necessary to generate the field.

Most recently, the planetary aims of condensed matter theorists in Trieste have moved closer to home to calculate the state of the Earth's solid iron core—and, more specifically, the temperature at which the iron would melt deep inside the Earth. Such calculations could help determine the temperature of the inner boundary of the Earth's core, and thus the temperature of the centre of the Earth (our calculations indicated that it is a 'cool' 5100°C).

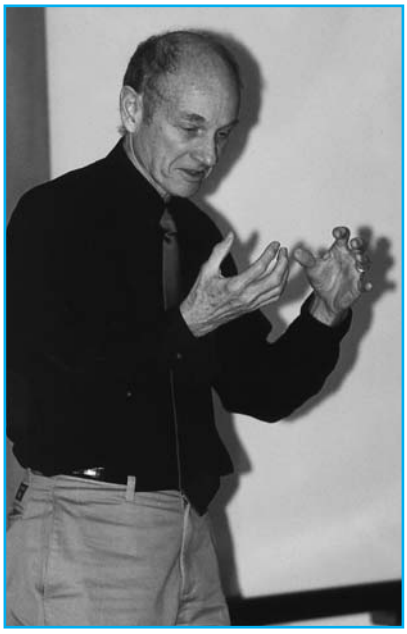
All in all, the molecular dynamics simulation methods pioneered by the Trieste researchers promise to shed light and reason on the behaviour of matter subject to extreme conditions. In the process, we may be able to anticipate the behaviour of water on Neptune or iron at the Earth's core with the same confidence that we now enjoy each time we light the gas under a pot of water to prepare a spaghetti dinner. □

*For more detailed information about this research, see the technical reports written by the SISSA/ICTP condensed matter team in* Science *(28 February 1997 and 1 January 1999).*

*Sandro Scandolo, Carlo Cavazzoni, Guido Chiarotti, Erio Tosatti*

# DATELINE

## The Hunt for Cosmic Rays



*James W. Cronin*

The hunt is on for the universe's highest energy cosmic rays and Nobel Laureate **James W. Cronin** (Physics 1980), Professor of Physics at the Enrico Fermi Institute of the University of Chicago, is leading the charge. Last February, Cronin outlined the next steps in the 'hunt' in front of more than 150 people at a high energy seminar in ICTP's Main Lecture Hall. He told the audience that this year, the world's most sophisticated detector, located in Mendoza, Argentina, will begin scanning the skies for these powerful, yet distant, rays. Another detector, at a yet-to-be-determined site in the northern hemisphere, will be built in the future. The Pierre Auger Project, named in honour of the late French physicist who discovered cosmic ray showers in 1938, serves as the driving force behind these efforts, which now include scientists from some 18 nations. Cronin is one of the two project leaders; the other is Alan A. Watson, Professor of Physics at the University of Leeds, UK. The cosmic-ray hunt received a boost in the early 1990s when scientists detected two of the highest energy cosmic ray events ever: one in the western United States in 1991 and the other in Japan in 1993. With the completion of a state-of-the-art detector in Argentina and plans for another, Cronin has good reasons to believe this 'cosmic safari' will become even more active—and more fruitful—in the future.

## Keilis-Borok Honoured

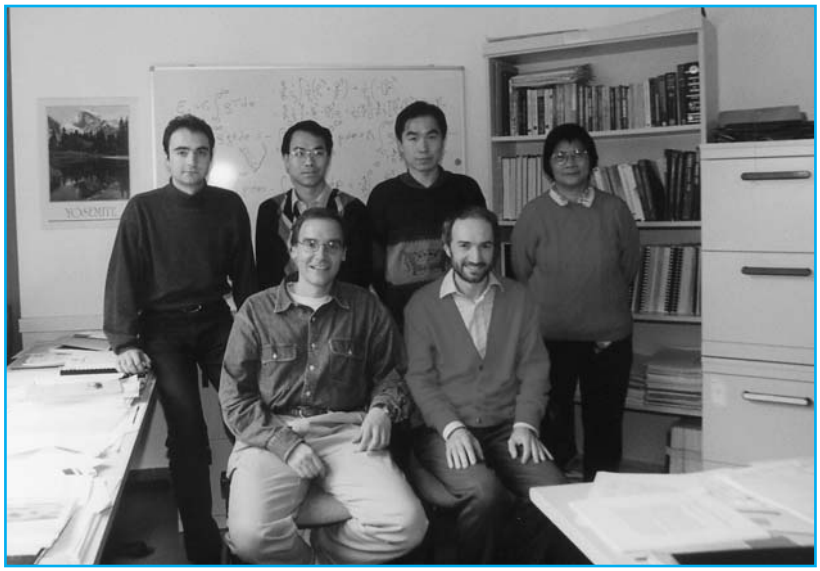
**Vladimir I. Keilis-Borok**, a long-time organiser of ICTP training and research activities, was awarded the Lewis Frey Richardson Medal by the European Geophysical Society. He was honoured for his contributions to the study of nonlinear geophysics. Keilis-Borok, a researcher at the Russian Academy of Sciences' International Institute of Earthquake Prediction Theory and Mathematical Geophysics, has been course director of ICTP's training activities on earthquake prediction since 1983. He shared the medal with **Raymond Hide,** a researcher at Oxford University's Clarendon Laboratory, UK, who has also lectured at the Centre. The award's ceremony took place on 19 April in The Hague, The Netherlands, during the European Geophysical Society's XXIV General Assembly.

*Vladimir I. Keilis-Borok*

## Steering Committee Meets

On 19 March, the ICTP Steering Committee held its bi-annual meeting at the headquarters of the International Atomic Energy Agency (IAEA) in Vienna. The Italian government was represented by **Nicola Cabibbo**, Professor of Physics, University of Rome *La Sapienza*; the United Nations Educational, Scientific and Cultural Organization (UNESCO) by **Maurizio Iaccarino**, Assistant Director-General for Natural Sciences; and the IAEA by **Sueo Machi,** Deputy Director General, Department of Nuclear Science and Applications. The Committee tentatively approved the Centre's budget for the year 2000; voiced support for ICTP's three-year draft plan; and urged UNESCO's upcoming evaluation of ICTP to focus on the Centre's overall mission and responsibilities. The Committee's next meeting is scheduled to take place in the fall.

## Climate Group at Full Strength



ICTP's Physics of Weather and Climate Group

Four scientists have joined ICTP's newly created Physics of Weather and Climate Group. Their arrival means that the group is now at full strength—ready to meet the challenges posed by an ambitious research agenda for this year and next. Senior Scientist **Franco Molteni**, whose expertise includes research on climate variability and predictability, comes to the Centre from the Interuniversity Computer Centre of Northeast Italy (CINECA), headquartered in Bologna, where he specialized in regional meteorological and climatic models. Support scientist **Bi Xunqiang** comes from a more distant location, having worked previously at the Chinese Academy of Sciences' Institute of Atmospheric Physics in Beijing, where he served as an associate scientist. His colleague, **Dusan Jovic**, also coming to the Centre as a support scientist, was last employed as a teaching assistant at the University of Belgrade's Department of Meteorology. Filling out the group's roster of researchers is post-doc **Yun Qian**, who was a fellow with the START Programme at the Institute of Atmospheric Physics of the Chinese Academy of Sciences. Qian was educated at Nanjing University in Nanjing, China. They join Italian-born **Filippo Giorgi,** who arrived in Trieste last May as the first head of the Physics of Weather and Climate Group. Like other research groups at ICTP, the Physics of Weather and Climate Group plans to hold a series of seminars throughout the year focusing on issues related to its work. The group's first seminar took place on 8 April when **William L. Chameides**, Smithgall Chair and Regents Professor of Earth and Atmospheric Sciences at Georgia Institute of Technology in Atlanta, Georgia, USA, spoke on the chemical and radiative effects of atmospheric aerosols. The group's first big research and training activity will be the Summer Colloquium on the Physics of Weather and Climate, which will examine the issue of climate change from a regional perspective. The Colloquium, which is expected to draw some 100 scientists and students from around the world, will take place 7-25 June. Meanwhile, **Oreste Reale**, Visiting Scientist in Climatology since 1995, will soon leave the ICTP to join the Centre for Ocean-Land-Atmosphere Studies in Calverton, Maryland, in the USA. We wish him well in his endeavours. All ICTP staff and visitors will undoubtedly miss his weather forecasts.

## ICTP, More News

This spring, the work of ICTP scientific staff and visitors was again featured in a number of publications. *Scientific Computing World* offered its readers a profile of the Centre's Physics of Weather and Climate Group, based on an interview with group head **Filippo Giorgi**. *Physics Today* printed an article on "security and arms control" issues in India and Pakistan in the aftermath of last year's nuclear tests in both countries. The article drew on the opinions of seven ICTP lecturers and former Associates. *CERN Courier* included a research article, written by ICTP Staff Scientist **Alexei Smirnov** and post-doc **Amol Dighe**, focusing on discussions at the Centre's Workshop on the Physics of Relic Neutrinos held last fall. A full-page article in *The Sunday Times* examined the surprising success of **Brian Greene**'s monograph, *The Elegant Universe*, an examination of string theory that is the most widely discussed science book since the publication of Stephen Hawking's *A Brief History of Time*. Greene visited the Centre last month as a lecturer in the Spring Workshop on Superstrings and Related Matters (see page 12). Finally, the "Science Section" of *Corriere della Sera,* Italy's leading newspaper, included a feature article on teleportation spurred by discussions that took place at ICTP's Third Adriatico Research Conference on Quantum Interferometry. The article contained observations by **Francesco De Martini**, **Anton Zeilinger** and **GianCarlo Ghirardi** (see page 11).

## NEWS FROM ASSOCIATES

Distinguished theoretical physicist **Riazuddin**, a Pakistani by birth who has worked for many years at King Fahd University of Petroleum and Minerals in Dhahran, Saudi Arabia, was recently appointed director of the new National Centre for Physics (NCP) at Quaid-i-Azam University, Islamabad, Pakistan. He was an Associate (1969-1970), a Senior Associate (1972-1992) and is now an Honorary Associate (1994-1999).

# REPORT ON REPORTS

## NINTH INTERNATIONAL WORKSHOP ON COMPUTATIONAL MATERIALS SCIENCE: ELECTRONIC STRUCTURE THEORY AND SIMULATIONS

14 - 16 January

**Co-sponsors:** International School for Advanced Studies (SISSA, Trieste, Italy) and Department of Theoretical Physics of the University of Trieste.

**Directors:** S.G. Louie (University of California at Berkeley, USA) and M. Methfessel (Institute for Semiconductor Physics, Frankfurt an der Oder, Germany).

**Local Organiser:** R. Resta (University of Trieste).

*The Workshop is the latest in a series that began in Oxford in 1983, continued in Braunschweig in 1984, and then in Trieste in 1987, 1989, 1991, 1993, 1995 and 1997. Like those that preceded it, the Workshop was devoted to recent advances in computational condensed matter physics. Topics included density-functional molecular dynamics; large-scale electronic structure calculations; linear-scaling methods; density-functional theory beyond the local-density approximation; Quantum Monte Carlo; empirical tight-binding; and effective medium theory. Studies related to potential applications included transition states and rates; chemical reactions in condensed phases; non-equilibrium and non-adiabatic processes; electron dynamics and excited states; new materials; catalysis; surfaces and other low-dimensional systems; phase transitions; and polarisation, fields and currents. As in the past, the Workshop consisted of invited talks and discussions.*

## SECOND ICTP-URSI-ITU/BDT SCHOOL ON THE USE OF RADIO FOR DIGITAL COMMUNICATIONS IN DEVELOPING COUNTRIES, INCLUDING SPECTRUM MANAGEMENT

1 - 19 February

**Co-sponsors:** International Union of Radio Science (URSI, Gent, Belgium) and Telecommunications Development Bureau of the International Telecommunication Union (BDT-ITU, Geneva, Switzerland).

**Director:** R. Struzak (Radio Regulation Board of ITU).

**Local Organiser:** S.M. Radicella (ICTP).

*Sandro M. Radicella and Ryszard Struzak with the School participants*

*The School, organised under the terms of a Memorandum of Understanding signed in 1993 by ICTP, URSI and BDT-ITU, was a follow-up to the First ICTP-URSI-ITU/BDT School on the Use of Radio for Digital Communications in Developing Countries, held in 1998. The School included two weeks of tutorial lectures and reports by participants and one week of laboratory work. The tutorial lectures focused on the following topics: modern communication potential and needs in developing countries; spectrum utilisation and management; digital modulation, channelling and source coding; spread spectrum systems; computer networks, the internet and world wide web; information infrastructure in rural/remote areas; and the future of mobile and personal wireless communication systems. Laboratory-related case study analyses and discussions took place on the following issues: radio channel and ITU propagation models; SHF point-to-point links; digital personal communications; radio fixed access and the wireless local loop; digital HF systems; and software for spectrum management and radio system planning.*

## WINTER COLLEGE ON SPECTROSCOPY AND APPLICATIONS

8 - 26 February

**Co-sponsor:** International Centre for Science and High Technology (ICS, Trieste).
**Directors:** W. Demtröder (Universität Kaiserslautern, Germany), S. De Silvestri (*Politecnico di Milano,* Italy) and A. Wagué (University Cheikh Anta Diop, Dakar, Senegal).
**Local Organiser:** G. Denardo (ICTP and University of Trieste, Italy).

*The College had two goals: to examine the most recent advances in basic fundamental research in laser spectroscopy and to explore how such findings might be applied to practical problems. Topics included techniques and instrumentation in modern spectroscopy; ultrafast spectroscopy and applications; quantum continued systems (multiple quantum wells, polymer light emission properties, metal and semiconductor nanoparticles and semiconductor quantum dots); new methods of laser spectroscopy diagnostics (for environmental monitoring, diagnostics and control of chemical reactions, bio-medicine, and combustion processes). The programme included demonstrations and laboratory exercises. In addition, an internal Laser, Atomic and Molecular Physics (LAMP) Conference was organised in which participants gave 20-minute seminars.*

## III ADRIATICO RESEARCH CONFERENCE ON QUANTUM INTERFEROMETRY

1 - 5 March

**Co-sponsor:** Italian National Institute of Nuclear Physics (INFN).
**Directors:** F. De Martini (University of Rome *La Sapienza*) and L. Hardy (Clarendon Laboratory, Oxford), in co-operation with the Italian National Research Council (CNR), Italian National Group for Quantum Electronics and Plasma, and INFN.
**Local Organiser:** G. Denardo (ICTP and University of Trieste).

*Like the Adriatico Research Conferences on Quantum Interferometry I and II, held at ICTP in 1993 and 1996 respectively, this third Conference examined critical interdisciplinary methods for understanding quantum interference. Specifically, the Conference analysed the results of the most recent experiments involving photons, neutrons, electrons, excitons and atoms. Much attention focused on the interference properties of extended multiparticle systems—for example, in the contexts of quantum computation, Schrödinger-cat zoology, and Bose-Einstein atom condensation. As a result, discussions centred on such key words as quantum nonlocality, entanglement, teleportation, decoherence, quantum entropy and thermodynamics.*

*Charles Bennett*

*Anton Zeilinger and Francesco De Martini*

*III Adriatico Research Conference on Quantum Interferometry: experimental work at Elettra's laser laboratory*

## THIRD WORKSHOP ON THIN FILM PHYSICS AND TECHNOLOGY

8 - 26 March

including

## TOPICAL CONFERENCE ON MICROSTRUCTURE AND SURFACE MORPHOLOGY EVOLUTION IN THIN FILMS

24 - 26 March

**Co-sponsor:** International Union for Vacuum Science, Technique and Applications (IUVSTA).

**Director:** P.B. Barna (Research Institute for Technical Physics of the Hungarian Academy of Sciences, Budapest, Hungary).

**Local Organiser:** M. Sancrotti (TASC Laboratory of the Italian National Institute for the Physics of Matter-INFM, Trieste, Italy).

*The relationship that thin films have to advanced material structures has made thin films an increasingly important topic in many fields of research and application. Indeed thin films are now widely applied in high technologies and industrial products serving everyday needs. While an increasing portion of industrial thin film production is taking place in the Third World, most thin film research and new developments occur in the developed countries. Given this trend, the activity sought to provide up-to-date overviews on general topics related to thin films science and technology and to offer information on selected topics expected to impact future applications. Specifically, the Workshop focused on the problems of structure evolution of single and multicomponent films, structure-property relationships, and problems of thin film applications.*

## SPRING WORKSHOP ON SUPERSTRINGS AND RELATED MATTERS

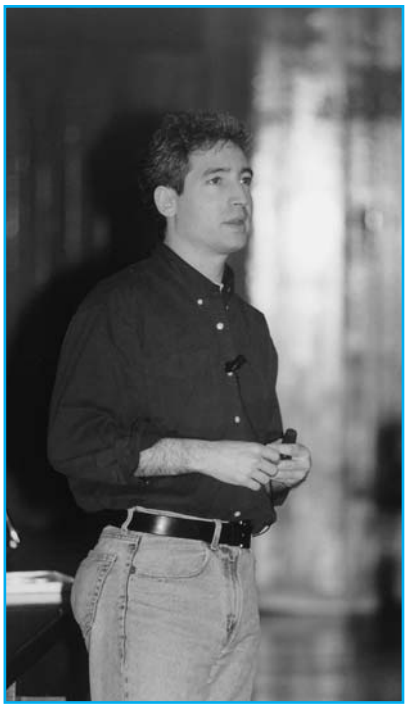
22 - 30 March

**Co-sponsors:** Italian National Institute of Nuclear Physics (INFN) and International School for Advanced Studies (SISSA, Trieste, Italy).

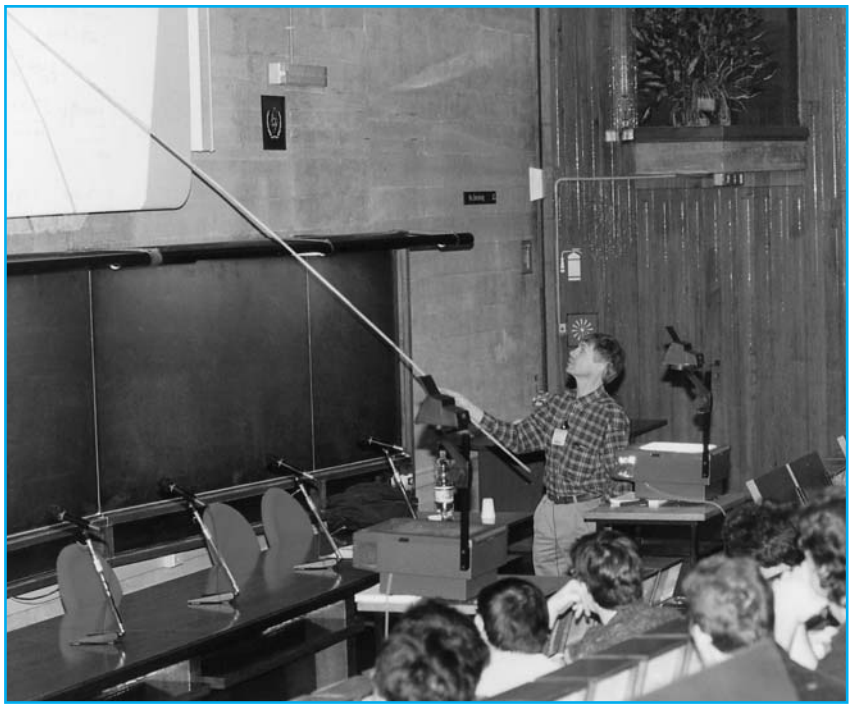
**Directors:** B. Greene (Columbia University), R. Iengo (SISSA) and J. Louis (Martin-Luther-Universität Halle, Germany).

**Local Organisers:** K.S. Narain (ICTP) and S. Randjbar-Daemi (ICTP).

*Topics included: duality in string theory, supergravity and supersymmetric gauge theories, F-theory, AdS/CFT correspondence and black hole physics. The aim of the activity was to provide broad pedagogical treatment of these topics through a series of lectures by experts in the field.*



*Brian Greene*



*Bernard de Wit*

PROFILE

**China's government has recently launched new policies to strengthen its scientific institutions and encourage its young researchers to pursue their careers at home. For former ICTP post-doc Wang Wei, such initiatives mean new and exciting challenges.**

# Making the Grade in China

When the Chinese government speaks about providing a nurturing environment for its young scientists, physicist Wang Wei, 37, is undoubtedly the kind of person they have in mind.

Born in 1962 in Changsha, a city of some 3 million people that serves as the provincial capital of Hunan province in south China, Wang graduated from middle school in 1978, just as China's Cultural Revolution was fading into history.

"During the Cultural Revolution, local educational offices selected students for universities located in their provinces," Wang noted in a recent interview. "Moreover, at the beginning of the revolution, the national government cut the total number of university students in half."

Not surprisingly, these policies created a backlog of qualified students eager to begin their university studies. As a result, the government's nationwide competitive examinations in 1978 were taken by millions of young people—not only Wang's fellow classmates but many others who had graduated during the previous 10 years. Despite the competition, Wang did well enough on the examination to gain acceptance into Nanjing University (NU).

Since then, Wang's career as a student, professor and researcher has been characterised by a steady rise in both skill and prominence. In 1982, he received an undergraduate degree in theoretical physics, and in 1985, a master's degree. During the mid 1980s, in addition to his studies, he also taught and lectured—all at NU.

In 1987, Wang's talents were again rewarded when he was selected for a joint doctorate program in experimental physics at the University of Sussex in the United Kingdom. Upon his arrival at the university, however, the experimental equipment that was to serve as the basic tool for his experiments was not working. To fill his time, Wang again turned his attention to theoretical physics—in his own words, "picking up where I had left off in China. I was not disappointed by this turn of events because in truth I was more interested in theoretical physics than I was in experimental physics."

*Wang Wei*

In 1990, Wang returned to NU to resume his teaching and research responsibilities. As an associate professor, he quickly advanced through the ranks of academia before reaching his thirtieth birthday. Then, in 1991, Wang attended ICTP's Summer Workshop on Condensed Matter Physics.

One of the organisers there was ICTP staff scientist Hilda Cerdeira, who encouraged Wang to apply for a post-doc position at the Centre, which he was awarded in 1992.

While a post-doc at ICTP, Wang also published an article on the dynamical behaviour of neurons in *Physical Review E*. "At the time," he says, "the article was outside my main research area, but the effort drew my attention to the field of biophysics. Little did I know then that it would lay the groundwork for a career change just a few years down the road."

Wang again returned to China in 1994, where he resumed his teaching and research responsibilities at NU. In 1995, Wang's experience at ICTP and, more specifically, the article on neurons that he had published several years before proved major factors in his appointment to lead a new university group involved in biophysics.

"The initiative," he acknowledges, "posed major risks. Not only did researchers in my group have to shift fields but we had to teach ourselves about biology while maintaining our teaching and research responsibilities. In effect, we had to learn new material and apply it simultaneously."

The group, which now consists of four full-time researchers plus eight undergraduate and 15 graduate students, has proven worthy of the challenge. "Since our inception three years ago," Wang observes, "we have graduated two classes in biophysics. Some of our students are now at New York University and the University of Kansas in the United States, earning master's and doctorate degrees."

With his new group gaining both presence and strength, and two recent grants from China's National Science Foundation worth some US$120,000 in hand, Wang notes that "the future looks good." Although conditions have improved, he quickly adds that "China's researchers still need outside help if they hope to continue to make progress."

"That's where institutions like ICTP come into play," he says. "Such institutions offer sound training and a stimulating research environment, encouraging people like me to pursue careers in science that are both personally rewarding and of long-term value to our home countries." □

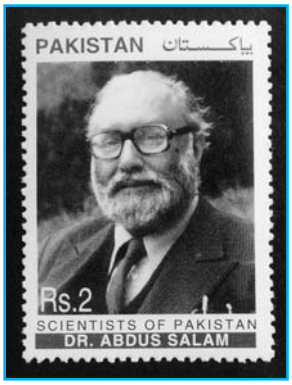
## TRIBUTE

**Ines Wesley-Tanaskovic**, former Council President and Programme Co-ordinator at the United Nations University (UNU) in Tokyo, died this March. During her 20-year tenure at UNU, Wesley-Tanaskovic helped to foster co-operation between UNU and ICTP. Her efforts proved particularly fruitful for ICTP's Microprocessor Laboratory which, thanks to her help, was able to launch and sustain successful regional courses in microprocessors, real-time processing, very large scale integration, telematics and parallel processing. Born in Yugoslavia, in 1921, Wesley-Tanaskovic received a medical degree during World War II. She then worked as a Professor of Medical Informatics at the University of Belgrade before joining the UNU. Among her many accomplishments, she was the first chairperson of UNESCO's World Science Information Programme (UNISIST) and, in 1992, organised the UNU Kyoto Symposium on the Role of Information Technologies for Expanding Access to Science and Technology. Wesley-Tanaskovic wrote three books and more than 100 articles and lectured on communication issues around the globe in a life dedicated to putting information to work for a better world.

### New Look

The ICTP has been undergoing a facelift. In addition to the remodelling of the Cafeteria in the Main Building, the Main Building's interior walls have received 'plaster' surgery and a fresh coat of paint; the former Laser Laboratory in the Main Building has been remodelled into offices, training rooms and expanded computer facilities for the Scientific Computer Section; and the Informatics Laboratory on Lower Level 1 of the Adriatico Guesthouse will soon be relocated to make the facilities more comfortable and secure. In addition, rooms in the Adriatico Guesthouse have been wired to the internet and rooms in the Galileo Guesthouse will soon be connected to cyberspace as well. All these improvements are designed to make each scientist's visit to the Centre more productive and enjoyable.

### Posting Salam




The Pakistani government has issued a postage stamp featuring a picture of Abdus Salam, the founding father of ICTP. The stamp, which became available in December 1998, can be used on standard-sized letters mailed within Pakistan. The photograph was taken by Ludovico Scrobogna (see below).

### Dirac Lecture

**Roman Jackiw** delivered the 1998 Dirac Lecture on 26 March 1999 in the Main Lecture Hall of ICTP's Main Building. Jackiw, who has held the Jerrold Zacharias chair in the Department of Physics at the Massachusetts Institute of Technology (MIT) for 30 years, spoke on the "Effects of Dirac's Negative Energy Sea on Quantum Numbers." In addition to his long-time position at MIT, Jackiw has been a teacher and researcher at Harvard University, Rockefeller University, University of California at Los Angeles and Santa Barbara, and Columbia University. The Dirac Medal, which has been awarded annually by ICTP since 1985, is named in honour of the late Paul A.M. Dirac, one of the 20th century's most distinguished physicists and a staunch friend of the Centre. Princeton University's Stephen Adler, who shared the 1998 prize with Jackiw, will deliver his lecture at a later date.

### Scrobogna + Zalateo

**Ludovico Scrobogna** and **Virgilio Zalateo** have left the Centre. Although their names may not be familiar to scientists, their work certainly is. For more than a quarter century, scientists visiting the Centre have received Scrobogna's photographs as mementoes of their stay in Trieste. Meanwhile, Zalateo, also a 25-year veteran of the ICTP, has helped to put together the preprints and lecture notes associated with the Centre's scientific activities. Staff and friends wish both of them *buona fortuna* in their retirements.

**12 - 30 April**
School on Differential Geometry

**19 April - 21 May**
School on Synchrotron Radiation

**3 - 28 May**
School on Neural Information Processing

**10 - 14 May**
Second International Conference on Perspectives in Hadronic Physics

**24 - 28 May**
Meeting on Nonlinear Partial Differential Equations, Modelling and Control

**1 June - 16 July**
Extended Workshop in String Theory, including

**12-16 July**
Conference on Black Hole Physics

**7 - 25 June**
Summer Colloquium on the Physics of Weather and Climate: The Physics of Climate Change—A Regional Perspective

**7 June - 9 July**
Summer School in Particle Physics, including

**7 - 18 June**
Two-Week Training Course

**15 - 18 June**
Adriatico Research Conference on Wetting

**28 June - 2 July**
Adriatico Research Conference on Liquid State of Matter: Opportunities from Advanced Radiation Sources

**28 June - 9 July**
Workshop on Computational Techniques for Strongly Correlated Systems


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 1999`
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.

NEWS from ICTP

The 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. On 21 November 1997, the ICTP changed its name to The Abdus Salam International Centre for Theoretical Physics to honour its founder.

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

**Editor**
Daniel Schaffer

**Staff Writer**
Fabio Pagan

**Managing Editor**
Anna Triolo

**Statistician**
Giuliana Gamboz

**Photos**
Giovanni Montenero
Massimo Silvano
ICTP Photo Archives

**Layout**
Associazione Progettisti Grafici

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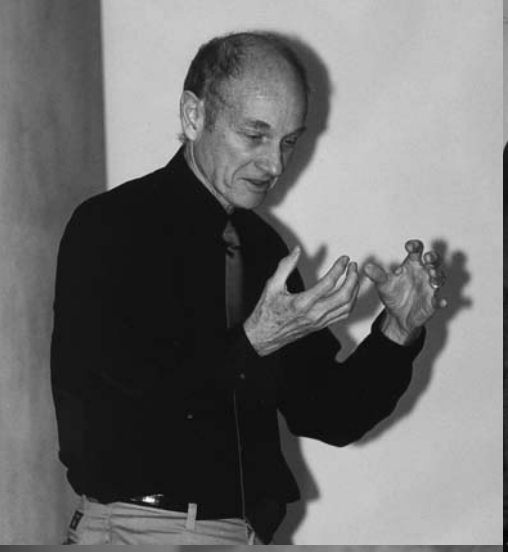

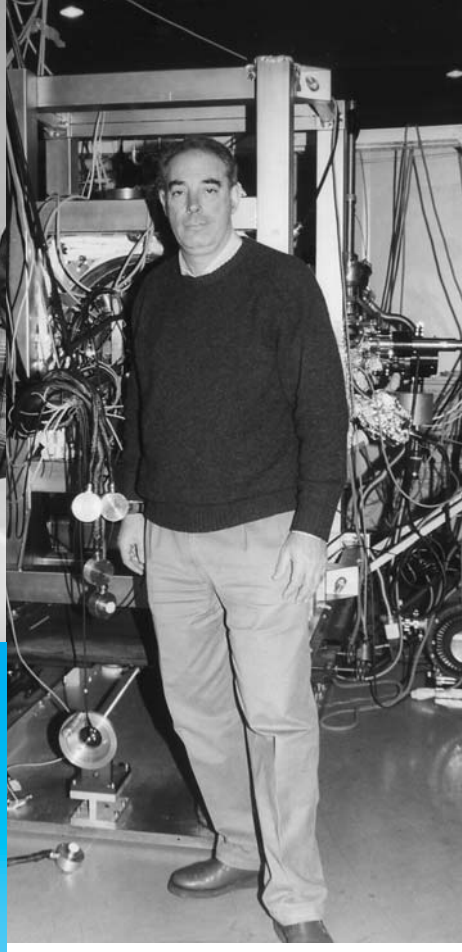


public information office

the
**abdus salam**
international centre for theoretical physics

strada costiera, 11
34014 trieste
italy
sci_info@ictp.trieste.it
fax: (+39) 0402240565
www.ictp.trieste.it