

# NEWS

*from*

# ICTP

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



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**A**s speaker after speaker observed at last November's Abdus Salam Memorial Meeting, Salam was an extraordinary man living during an extraordinary time.

The post-World War II era was a golden age for scientists, particularly physicists. In the eyes of many, research on the atomic bomb helped end the war. Then, in the war's aftermath, science and technology promised unprecedented progress and prosperity.

The war's end also marked the beginning of the end for European colonialism. As a result, vigorous independence movements were launched throughout the developing world.

Beyond all of these sweeping historical trends it didn't hurt to have Albert Einstein touted as the world's most intelligent person—a scientist-celebrity who made the dishevelled appearance of theoretical physicists seem stylish and appealing.

Salam brilliantly took advantage of all these trends: the unquestioned status of scientists, particularly physicists; the willingness of the global community to aid developing countries in their quest for independence; and the public's unwavering belief that scientific research would improve their lives.

Today, the Centre confronts new challenges created by a global community that barely resembles Salam's. Scientists, and particularly theoretical physicists, are no longer held in unquestioned esteem. The willingness to help the developing world has diminished. And the public's absolute faith in science has faded.

In the face of these changes, many theoretical physicists have been compelled to apply their knowledge beyond the traditional boundaries set by teaching, research, and science administration. Some have achieved considerable success. Javier Solana, a Spanish-born solid-state physicist, now heads the North Atlantic Treaty Organization (NATO), and Rexhep Meidani, a professor of theoretical physics and frequent visitor to the ICTP, recently became president of Albania.

As for the ICTP, a changed world has nudged it into new disciplines even as it continues to fulfil its traditional mandate in theoretical physics and mathematics. The summer conference on the "dynamics of complexities" and fall meeting on the "chemical origins of life" represent two examples of the ICTP's broadening fields of interest.

Next August, the ICTP takes an even more dramatic step into the future when it offers its first-ever School on the Mathematics of Economics. The month-long program is designed to introduce scientists to a subject beyond their immediate fields of interest and to explore how the principles of theoretical physics can be applied to the world of economics.

ICTP's efforts to reposition itself in the face of these historic changes is the greatest tribute it can pay to its founder, Abdus Salam. Such efforts will help ensure that the Centre remains relevant for both scientists and society as we approach the dawn of the next century.

*Daniel Schaffer*

**Gabriele Veneziano**

is a scientist at CERN (European Laboratory for Particle Physics) in Geneva, Switzerland.

COMMENTARY

Did our universe—and time itself—begin with the Big Bang? Or, is our universe even older and more mellow than we have imagined? A noted physicist offers an alternative view of the origins of the heavens beyond.

## Before the Big Bang Banged

**E**ver since scientists have concluded that the universe is an ever-expanding mass of matter and energy, they have also assumed that its origins can be traced to a micro-moment in time popularly known as the Big Bang that took place some 10 billion years ago. Theorems—and popular writings—by physicists Stephen Hawking and Roger Penrose have lent weight to this construct.

Now some scientists, led by a group of string theorists and cosmologists, are questioning the Big Bang theory. They are suggesting that the universe may have begun its "life" long before the Big Bang banged. In fact, these scientists suggest that the origins of our universe may lie in an environment that was as bone-chilling and empty as the current environment found in our distant heavens.

Two distinctive properties of string theory are driving this alternative to the standard Big Bang theory: the presence of a new particle/field—the so-called dilaton—and the interrelated existence of new symmetries, referred to as dualities.

Peeling away the complexities that surround these two competing theories, the core of the argument is this: Under the Big Bang theory, what ultimately generated densities and pressures that produced an unfathomable explosion is left without scientific explanation—possibly, to religion.

Under the new model, our "pre-Big Bang" universe consisted of a "mirror"—or "dual"—image of our current

universe. Thus, at the very beginning, the universe resembled the present one with a notable exception: all forces were much much weaker than they are now.

Put more simply, string theorists and cosmologists, who support the "dual" phase construct of the universe,

claim that its current properties did not originate with an explosion that took place some 10 billion years ago. As Penrose points out in his book, *The Emperor's New Mind*, an explosion would have been an unlikely event. Instead, he and other like-minded theorists claim that the present properties of the universe naturally originated from its long pre-Big Bang history.

Such a model, if verified, could have considerable scientific and philosophical consequences. For physicists, the pre-Big Bang scenario provides new sources of cosmic gravitational waves and primordial magnetic

fields. For other scientists—and even everyday citizens—who rarely think about the origins of the universe, this new theory could alter the way they think about both our past and future. One implication of the model appears to be that the universe, rather than recollapsing, will keep expanding forever.

Additional research and analyses may yet undermine this new theory. For the moment, however, it is fascinating to consider that our universe may be much older than the 10-billion year estimation made by physicists and cosmologists just a few years ago. □



Gabriele Veneziano

**Adnan Badran, UNESCO's Deputy Director General, has been involved with the ICTP for three decades. Today, he's working with ICTP administrators and staff to complete plans to place the Centre on a solid foundation for the 21st century.**

## The ICTP in the Post-Salam Era

**J**ordanian-born Adnan Badran, Deputy Director General of the United Nations Educational, Scientific and Cultural Organization (UNESCO), joined UNESCO nine years ago. Trained as a biologist in America's "heartland"—at Oklahoma State University and Michigan State University—Badran was a driving force behind the dramatic expansion in Jordan's university system during the 1970s. In the 1980s, he served as Jordan's Minister of Agriculture and Minister of Education. He is currently the number-two official at UNESCO and a close advisor to Federico Mayor-Zaragoza, UNESCO's Director General. His position makes him a key point of contact for the ICTP.

Badran recently visited the Centre to speak at the Salam Memorial Meeting. While here, he met with the editorial staff of *News from ICTP* to discuss the Centre's past and future.

### **When did you become acquainted with the ICTP?**

After receiving my university degrees and working several years in the United States, I returned home to teach biology at the University of Jordan in Amman. I soon became involved in university administration, helping to establish Yarmouk University and Jordan's University for Science and Technology in the late 1960s, which was about the same time that Abdus Salam was launching the ICTP. Each year we sent two young physicists to Trieste to study at the Centre. That program marked the beginning of my relationship with Salam. We corresponded continuously. But I didn't actually get to meet Salam in person until 1980, when I invited him to give a keynote address to university graduates and receive an honorary doctorate before His Majesty King Hussein. From then on, we saw each other quite often. I would go to the ICTP while Salam would frequently come to Jordan to visit our universities.

### **How did your relationship with the ICTP evolve over time?**

Until I joined UNESCO in 1989, my ties with the ICTP were similar to those of other university scientists and administrators throughout the developing world. The Centre was a haven for our faculty and students—a place where, as one of the speakers at the Salam Memorial Conference said, scientists from the Third World could conduct first-class research without feeling like third-class citizens.

As Assistant Director General for Science—and then Deputy Director General—I became ICTP's main point of contact within UNESCO. I worked closely with Salam, especially during the Centre's financial crisis in the early 1990s. At the time, an extended delay in the Italian

government's annual contribution to the ICTP placed the Centre at risk. I remember Salam coming to me and saying that he didn't have enough money to pay his staff. He wondered whether he could keep the doors of the Centre open.

ICTP's unmatched reputation among scientists in the Third World compelled UNESCO to help the Centre in any way that it could. In January 1991, we advanced ICTP its 1991 and 1992 annual contributions. That amounted to several hundred thousand dollars. We helped, but it was Iran's \$3-million loan that finally eased the crisis. And only when the Italian government released its funds for the Centre in September did the situation truly stabilise.

### **What impact did the financial crisis have on the ICTP?**

No organization likes to experience a life-and-death crisis. Yet the dire situation the Centre faced in the early 1990s ultimately helped to set the stage for more stable funding. As many ICTP staff members know, before the crisis, funding from the Italian government was reviewed every four years. After the crisis, the Italian government signed a bill into law that made Italian funding for the Centre open-ended. The Centre's future became more secure than at any point in its history.

### **You helped spearhead the move of the ICTP from the International Atomic Energy Agency (IAEA) to the United Nations Educational, Cultural and Scientific Organization (UNESCO). What prompted this effort?**

By the late 1980s, Salam had come to believe that the ICTP's activities had moved beyond physics—particularly nuclear physics—into a variety of scientific disciplines.

As this evolution took place, Salam ultimately concluded that UNESCO would be a better fit than IAEA for the Centre's broadening efforts to improve university-based scientific education and training in the developing world. He reasoned that the IAEA's mandate largely focuses on issues related to nuclear energy. The IAEA, particularly the agency's Director General Hans Blix, agreed with this assessment.

Both agencies worked closely together over a two-year period to ensure a smooth transition. We focused on three major concerns. First, that the Centre staff not be penalised by the transition. Second, that IAEA's contribution to the Centre would continue at its current level and UNESCO would increase its contribution. And, third, that the ICTP would remain autonomous. I believe we have succeeded in our efforts. The ICTP has been firmly placed within the UNESCO framework while maintaining its association with the IAEA. The final step in the process will be the approval of ICTP staff procedures, which we hope to accomplish over the next few months.

### How would you assess ICTP's current status?

In many respects, the financial status of the Centre has never been healthier. The Italian contribution, which amounts to about \$12.2 million a year, is secure; the IAEA has continued its annual grant of \$1.7 million; and UNESCO, whose current annual contribution is about \$375,000, will seek to match the IAEA's funding level gradually within the coming years. Other funding sources—the Kuwait Foundation for Science and the Swedish International Development Cooperation Agency—also appear likely to continue. In short, Salam's creation is a thriving reality. The Centre is here to stay.

### What future challenges is the Centre likely to face?

There are those who believe that the Centre should expand its mandate into areas, particularly in the applied sciences, currently favoured by both individual

governments and international funding agencies. And, there are those who believe that the Centre should seek to excel in subject areas on which it has focused in the past—namely, theoretical physics and mathematics. I find myself in the second camp. The ICTP budget is adequate. But it is by no means lavish. An institution always runs the risk of spreading itself too thin if it moves into areas that will require substantial investments to succeed. If a funder comes along and says it will give the Centre several million dollars for a new program in basic or even applied science, the ICTP would be foolish to turn its back on the opportunity. But I don't think it

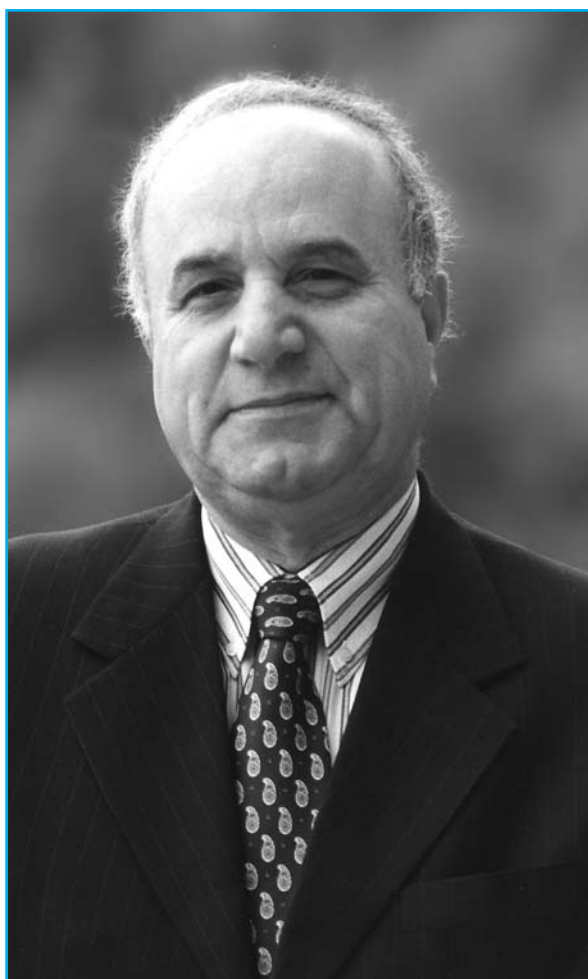
should use existing funds to launch new initiatives. ICTP's current mandate is broad enough and the issues it now addresses are sufficiently complex to warrant the Centre's full attention.

### How do you think the world views the ICTP?

I agree with the speaker at the Salam meeting who said that the ICTP may be the best post-World War II example of international cooperation designed to improve conditions in the developing world. It is undoubtedly the most important organization for the promotion of science in the Third World. Having said that, I must add that we still have a long way to go and that the ICTP—and its offshoots in Korea, for example—will play a pivotal role in any future progress.

Economic and social globalisation will bring many benefits. But it will also create

problems, particularly for scientists in the developing world who must run faster than ever to keep pace with advances in their fields. For many, the ICTP is not only a second home but one of the few places where they can continue to conduct state-of-the-art research. When Salam first broached the idea of an international centre for theoretical physics, he was viewed by many as a wild-eyed physicist. You only have to visit the ICTP—or talk to the thousands of scientists whose lives have been touched by the Centre—to realise how practical and level-headed he was. □



*Adnan Badran*

**Luciano Bertocchi spent virtually his entire career—some 30 years—at the ICTP. Last October, he retired from the Centre and returned to the University of Trieste. Bertocchi recently spoke to *News from ICTP* about his years of service to the institution.**

## Bertocchi Looks Back

I remember travelling back from the International Atomic Energy Agency in Vienna with Abdus Salam in October 1990, carrying resignation letters for each of the Centre's staff members.

That's how Luciano Bertocchi recalls his worst moment at the Centre, an institution to which he has devoted 30 years of his life. Bertocchi, who retired last October, served as the Centre's Deputy Director for more than a decade.

"Salam and I decided not to sign the letters. Fortunately, we were able to receive a US\$3-million bridge loan from Iran. The Italian government's annual contribution came through later that year, ending what was without doubt the most difficult period in ICTP's history."

Fortunately, for both Bertocchi and the Centre, the number of good times have far exceeded the number of bad times during his long and fruitful career.

Bertocchi's association with the Centre actually predates the creation of the ICTP. As a physicist, he attended the initial organizing conference that took place in June 1960 near the Castle of Miramare, a few hundred meters from the current location of the Centre.

"I remember encountering Salam for the first time. He was a young man with a striking accent and dark moustache. Although only in his mid thirties, he was already a well-known figure among physicists from around the world."

"I had received my degree from the University of Bologna just a few years before and was finishing my stint in the army. In fact, my uniform was still in my bag. During the meeting, I spoke to Salam only for a few moments but I was immediately impressed by his approachability, enthusiasm and determination."

It would take another four years of unflagging effort on the part of Salam to create the International Centre for Theoretical Physics, which set up shop in Trieste in 1964.

Three years later, Bertocchi rekindled his relationship with Salam after taking a teaching position with the Department of Physics at the University of Trieste.

"I chose Trieste instead of Bologna not only because it was closer to home—I was born and raised in Ugovizza, near Italy's border with Austria, about 2 hours from Trieste—

but because I had faith in Salam's Centre. I just felt this city was the place to be if you wanted to pursue a career in theoretical physics in Italy."

Bertocchi initially worked at the Centre as a consultant, giving lectures and organising conferences. "At the time, the ICTP's permanent staff consisted of some 10 people. Abdus Salam, Paolo Budinich and John Strathdee were the only three in-house scientists. The rest of us were consultants."

"The ICTP was so small then that the staff often went to lunch as a group. At noontime, we would hike down to a seaside *trattoria* in Grignano overlooking the Adriatic Sea, have fresh fish and a salad, play a little table football and then return to work."

From those modest beginnings, the Centre has grown into an organization with a \$20-million annual budget and 140 staff members. It now serves some 3,500 scientists from around the world each year.

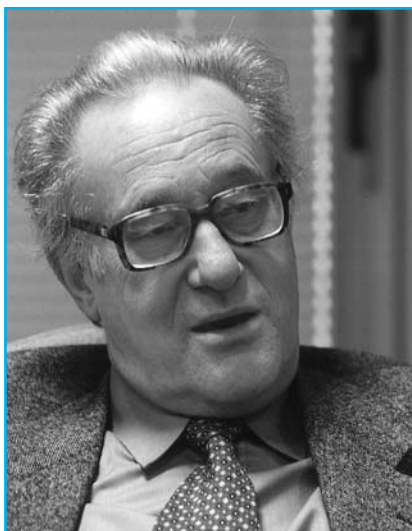
Bertocchi was there to witness the Centre's most dramatic period of growth during the 1980s. It was under his supervision as the Centre's Deputy Director that much of the current administrative structure was put into place.

The Centre's enduring strengths, Bertocchi believes, have been built on three factors.

First, its ability to serve the needs of scientists from the developing world has given the ICTP an unique identity. At the same time, it has created an army of goodwill ambassadors from around the world who are always eager to praise the ICTP for the contributions that the institution has made to their careers.

Second, over the years, the Centre has developed an efficient system—and acquired an experienced staff—for overseeing workshops and conferences. As a result, ICTP is able to administer its research activities at a cost that is much cheaper than other institutions.

Third, the ICTP has always been willing to move quickly into new research areas as existing Centre topics have grown more mature and others have emerged as critical areas of study.



Luciano Bertocchi

"The earliest example of this risk-taking attitude," Bertocchi notes, "took place in the late 1960s when the ICTP decided to shift a portion of its resources and staffing into condensed matter physics. That subdiscipline subsequently became one of the main research areas at the Centre along with high energy physics and mathematics."

"Later," Bertocchi observes, "the Centre explored opportunities in biophysics, medical physics, physics of the environment and physics and technology. The latter helped set the stage for the Centre's successful workshops and training activities in microprocessing. It also helped lay the groundwork for similar scientific activities in optics and lasers, which became some of the more popular programs at the ICTP during the late 1980s and early 1990s."

Bertocchi also notes that through the years, "It's been a difficult task for the Centre to maintain a delicate balance between research and training."

"I earnestly hope that we can continue to pursue both paths in the future," he adds. "After all, I don't think there's another institution anywhere in the world that has been able to organize training courses and workshops with the same efficiency and effectiveness. Both our sponsors in Rome and our visiting scientists from around the world—particularly those from the South—have found these activities to be enormously valuable."

As for himself, Bertocchi plans an active retirement. He has returned to the Department of Theoretical Physics at the University of Trieste, where he will again be a full-time professor. At the same, he will continue to offer his expertise and advice to the ICTP as a consultant for both the Director's Office and the Library.

"The Centre has been the focal point of my worklife since I began my career. It now begins a new era and I would like to help in any way I can to ensure its continued success." □

## A Life of Lasers...

And More at ICTP

by Gallieno Denardo

A fleeting moment: that's how I view my 10 years at ICTP's Office of External Activities (OEA).

I first became acquainted with the ICTP as a student in the mid 1960s just a few months after Abdus Salam had launched the Centre. Like so many others, I found it a wonderful and stimulating experience to discuss my research with scientists from around the world.

Then, some 20 years later during ICTP's unprecedented years of expansion in the early 1980s, I worked closely with Giuseppe Furlan on the creation of the Programme for Training and Research in Italian Laboratories (TRIL) and with Mohamed Hassan on the Third World Academy of Sciences (TWAS).

In 1988, my involvement with the ICTP increased substantially when I became the head of the OEA. The position offered me a unique opportunity to broaden the Centre's wide-ranging scientific and humanistic activities largely through cooperative initiatives with a global network of scientists.

I'd like to mention two examples. A group of physicists from Asia working on metal alloys met at an ICTP workshop. They subsequently sought to pursue their common interests and submitted a joint proposal to the OEA for the creation of a network. Like many others, this cooperative effort was conceived at the ICTP and owes its success to the fruitful interaction of OEA programmes with other Centre activities.

In a similar vein, in sub-Saharan Africa, there's a system of ICTP affiliated centres carrying out joint research programs in optics and lasers. That systems would not exist without the helping hand lent by the Centre.

Closer to home, in 1985, I became the local organizer for ICTP's colleges and courses on lasers and optics. That led to the creation of a laboratory focusing on lasers and optical fibres in 1990.

The laboratory, which has matured over time, moved last year to the Synchrotron Radiation facility, which is located on the Carso about 10 kilometres from the Centre. There, researchers—largely from the ICTP—interact with other scientists working on similar research problems. This will allow the ICTP's original laser and optics network to evolve into a larger sphere of activity.

Now, after more than a decade at the ICTP, I've returned to the University of Trieste to resume my duties as physics professor on a full-time basis.

As I begin a new phase of my life, I'm confident that the sense of international and cultural cooperation that has been the hallmark of the ICTP since its inception will continue to shape my work. And I remain ready to help the Centre in any way that I can. □



## Whole Lot of Shaking

Charles F. Richter often said that "only charlatans and fools predict earthquakes." You would think that Richter would know. After all, he's the one who created the Richter scale in the 1930s, which is still used by most seismologists to measure the magnitude of earthquakes.

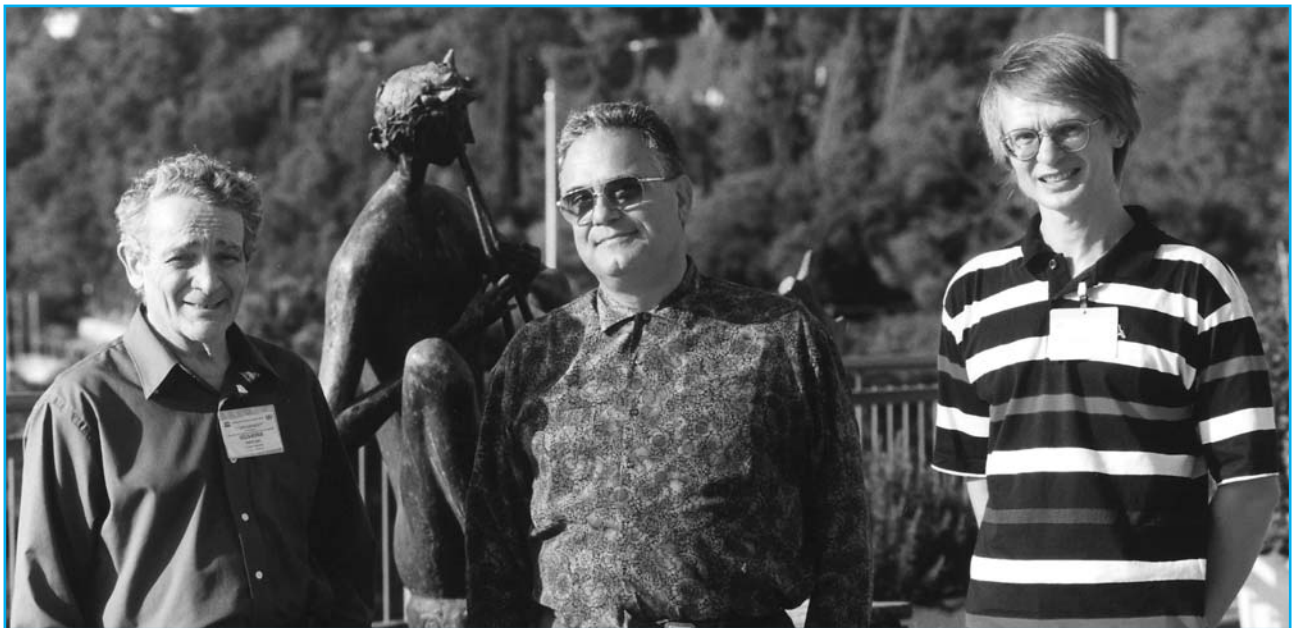
Yet, the scientists who convened last October at the ICTP for the Fourth Workshop on Non-Linear Dynamics and Earthquake Prediction, despite their enthusiasm for earthquake predictions, didn't seem to fit Richter's profile at all.

In fact, Giuliano Francesco Panza, who teaches seismology at the University of Trieste and serves as the local organizer for these workshops, thinks that earthquake forecasting is no longer a foolish dream but an emerging reality.

Moreover, less than 10 years ago these same Russian geophysicists predicted a major earthquake in the San Francisco Bay Area, which took place in the fall of 1989.

After the event, the U.S. National Science Foundation, headquartered in Washington, D.C., decided to finance Moscow's upstart earthquake predictors.

The method developed by Keilis-Borok and Kossobokov is based on an empirical analysis of anomalies in weak seismic activities that take place each day. If a significant variation in the seismic background occurs, it means something is happening deep inside the Earth. These variations can then be placed into a mathematical formula that provides important indicators concerning local earthquake risks.



*Vladimir Keilis-Borok, Giuliano Francesco Panza and Vladimir G. Kossobokov*

In 1992, two distinguished Russian scientists who work with the ICTP, Vladimir Keilis-Borok and Vladimir G. Kossobokov, of the International Institute of Earthquake Prediction Theory and Mathematical Geophysics of the Russian Academy of Sciences in Moscow, developed a model that has gone five-for-five in predicting earthquakes with a magnitude eight or more. The earthquakes occurred along the Pacific rim in an area stretching from Japan to New Guinea.

The model has since been tested independently in three research centres in Moscow, Menlo Park, California, and Boulder, Colorado.

Keilis-Borok and Kossobokov admit that many more confirmations will be necessary before the model gains the full confidence of the scientific community. They also recognise the limits of their methods. "Until now, our predictions anticipate potential activities within a geographic range of 200 to 400 kilometres. Moreover, all these predictions carry an uncertainty from several months to a couple of years."

Despite these limitations, the Russian researchers believe that their "forecasts could prove useful in helping to increase public awareness of the earthquake risks in their localities."



## Nobel Ties

Two of the three scientists sharing the 1997 Nobel Prize for Physics—William D. Phillips, of the U.S. National Institute of Standards and Technology in Gaithersburg, Maryland, and Claude Cohen-Tannoudji, of Collège de France and École Normale Supérieure in Paris—have visited the ICTP on several occasions. Cohen-Tannoudji attended Centre workshops in the early 1970s and Phillips was last here in 1992 for the ICTP's winter college in optics.



William D. Phillips

Together with Steven Chu, of Stanford University in California, Phillips and Cohen-Tannoudji received the Nobel Prize for the development of methods to trap and cool atoms by bombarding them with laser light.



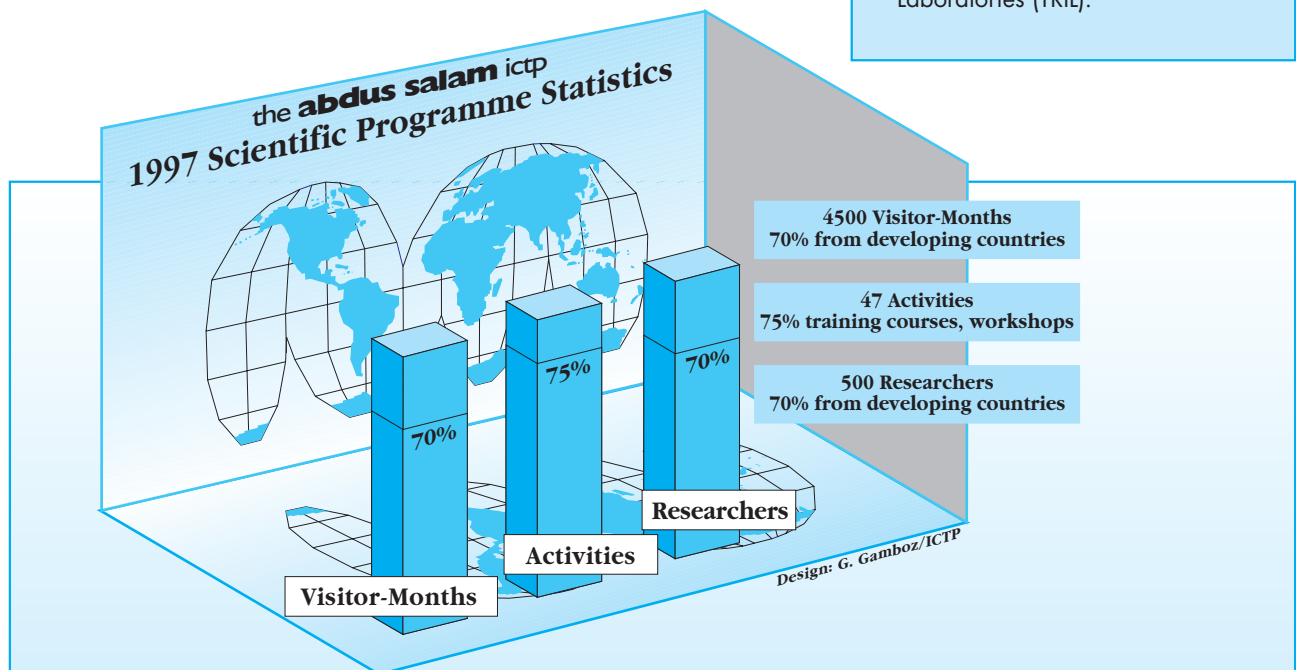
Claude Cohen-Tannoudji

The process "freezes" atoms in one spot, robbing them of their motion and ultimately their capacity to generate heat.

Laser cooling, in fact, can bring atoms to within one-thousandth of a degree above absolute zero, the theoretical temperature at which all atomic motions cease.

## NEWS FROM ASSOCIATES

**Abdul Waheed Khan**, an ICTP Regular Associate since 1985 and Senior Associate since 1991, has been appointed Vice Chancellor of Gomal University in Pakistan. The university, which was founded in 1974, is located in the city of Dera Ismail Khan in Pakistan's North-West Frontier Province. Khan, who is a specialist in high energy physics, has focused his research on such topics as medical physics, ultra-relativistic heavy ion reactions, and quark-gluon plasma. In 1987-1989 and 1996-1997, Khan was awarded fellowships at the Istituto Nazionale di Fisica Nucleare (INFN) in Padua, Italy. His INFN appointment took place under the ICTP-directed Programme for Training and Research in Italian Laboratories (TRIL).



The ICTP 1997 Scientific Programme included 35 training courses, 3 diploma courses, 8 research activities and the programme for training and research in Italian laboratories. Four of the training courses were held in Argentina, Morocco, Nepal and the Republic of Korea. Each research visit at the Centre averages one month in duration.



## REPORT ON REPORTS

### TRIESTE CONFERENCE ON PHENOMENOLOGICAL ASPECTS OF SUPERSTRING THEORIES

2 - 4 October

**Directors:** C. Bachas (University of Paris), L. Ibanez (University of Madrid), R. Mohapatra (University of Maryland), G. Senjanovic (ICTP), A. Smirnov (ICTP) and T. Yanagida (University of Tokyo). *Researchers agree that superstring theories may shed light on some of the most fundamental unanswered issues related to theoretical physics, including those involving the unification of nature's four forces, the origin and expansion of the universe, particle couplings, and fermion masses and mixings. It is equally important, however, to turn to experimental physics to confirm the validity of superstring theories. In recent years, physicists have sought to do just that: a great deal of effort has been devoted to forging links between the theoretical and experimental aspects of this growing subfield in physics. The conference, which attracted 50 researchers from around the world, highlighted the progress that has been made in developing these links. It also examined the future steps that should be taken to bring the work of superstring theorists and experimentalists closer together.*

### 4TH WORKSHOP ON NON-LINEAR DYNAMICS AND EARTHQUAKE PREDICTION

6 - 24 October

**Co-sponsor:** European Commission.  
**Directors:** V.I. Keilis-Borok (International Institute of Earthquake

Prediction Theory and Mathematical Geophysics, Moscow) and G.F. Panza (University of Trieste and ICTP). *The workshop sought to merge on-the-ground seismological observations with abstract mathematical models that explore the "logic" of chaotic systems. Despite its academic nature, the conference concentrated on a very practical issue: how to improve the reliability of earthquake predictions and transfer that knowledge to appropriate authorities so people may be forewarned. The workshop's main goal was to stimulate both theoretical and observational research that may ultimately improve earthquake predictions. ICTP researchers focused on nonlinear dissipative (that is, chaotic) systems; nontheoretical researchers examined the current state of data collection and analysis. Emphasis was placed on the integration of theories, data and observations. Such integration is critical for the development of more accurate methods of earthquake predictions. Why? Because it is impossible to directly measure earthquakes at the depths where they originate. The program included lectures, seminars and computer exercises.*

### AUTUMN COLLEGE ON PLASMA PHYSICS

13 October- 7 November

**Directors:** B. Buti (National Physical Laboratory, New Delhi, and California Institute of Technology, Pasadena), S.M. Mahajan (University of Texas at Austin) and P.H. Sakanaka (Universidade Estadual de Campinas, Brazil). *The college offered participants a journey*

*into the large class of non-standard "plasma" systems: for example, electron-positron plasmas, collision-less plasmas in semiconductors and non-electromagnetic plasmas. Specifically, the college explored plasma physics' concepts and methodologies related to linear and nonlinear stability, wave-particle interactions and mode coupling. The programme, which had a strong interdisciplinary character, consisted of lectures and workshops, that engaged participants in theoretical analyses and discussions, experiments and computer simulations. The program strongly encouraged interaction among its attendees—96 physicists from 31 different countries.*

### EXTENDED WORKSHOP ON HIGHLIGHTS IN ASTROPARTICLE PHYSICS

15 October- 15 December

**Directors:** A. Masiero (University of Perugia, Italy), G. Senjanovic (ICTP) and A. Smirnov (ICTP). *This two-month workshop, which focused on astroparticle physics—particularly as it relates to high energy physics and cosmology—consisted of 45 participants from 22 different countries. Discussion was encouraged by dividing the total number of participants into informal groups, each consisting of three or four people. These groups were then encouraged to continue their dialogues for several hours. Interaction was also facilitated by bringing mature and young scientists together. Specific topics under discussion included cosmic rays, monopoles, neutrinos, baryogenesis, and leptogenesis.*



Abdus Salam Memorial Meeting

**ABDUS SALAM  
MEMORIAL MEETING**

19 - 22 November

**Organising Committee:** N. Cabibbo (ENEA, Italy), J. Ellis (CERN), F. Hussain (ICTP), T. Kibble (Imperial College), C. Llewellyn-Smith (CERN), L. Maiani (INFN, Italy), R. Schrieffer (University of Florida at Tallahassee), G. Thompson (ICTP), M. Virasoro (ICTP) and S. Weinberg (University of Texas at Austin). Participants came from more than 50 countries—colleagues, students, dignitaries, family members and friends—to honour the memory of a man who touched their lives in so many ways. Those who attended the Abdus Salam Memorial Meeting witnessed a remarkable outpouring of emotion for

*the person who, more than any other, was responsible for the creation and success of the International Centre for Theoretical Physics. As an expression of deep appreciation, on 21 November 1997 the ICTP assumed the name of its founder. Among the dignitaries participating in the ceremony marking the Centre's change in name were Rexhep Meidani, President of Albania; Hans Blix, Director General Emeritus of the International Atomic Energy Agency (IAEA); and Adnan Badran, Deputy Director General of the United Nations Educational, Scientific and Cultural Organization (UNESCO). Representatives from the Italian government, which provides the major source of funding for the ICTP, included*

*Gioacchino Fonti, Ministry of University and Scientific & Technological Research; Aniello Izzo, Treasury; and Eugenio Campo, Ministry of Foreign Affairs. Conference participants were also treated to some world-class science. The technical presentations—some 20 in all—showcased the current state of string theory, a topic that fascinated Salam during the last years of his life. Among the prominent theoretical physicists who participated in the conference were Michael Green of the University of Cambridge; Nathan Sieberg of Princeton University; Cumrun Vafa of Harvard University; Gabriele Veneziano of CERN; and Spenta Wadia of the Tata Institute of Fundamental Research.*



Paolo Budinich



Salam families



## SCHOOL ON THE USE OF SYNCHROTRON RADIATION IN SCIENCE AND TECHNOLOGY: "JOHN FUGGLE MEMORIAL"

3 November - 5 December

**Co-sponsors:** Sincrotrone Trieste and Società Italiana Luce di Sincrotrone (Trieste).

**Directors:** A. Craievich (National Laboratory for Synchrotron Radiation, LNLS, Campinas, Brazil), C.S. Fadley (Lawrence Berkeley Laboratory, Berkeley, California), L. Fonda (University of Trieste and ICTP), A. Fontaine (Laboratoire Louis Néel, Grenoble, France), A. Savoia (Sincrotrone Trieste) and H. Wiedemann (Stanford Synchrotron Radiation Laboratory, Stanford, California).

*Use of synchrotron radiation in both scientific and technological research has grown enormously during the past two decades. Today, more than 5,000 European scientists regularly use synchrotron radiation in their work. Indeed, worldwide capacity for synchrotron research currently totals 2 million beamline-hours per year, and developing countries have at least seven full-scale storage synchrotron-radiation rings either in operation or scheduled to be commissioned within a few years. The school's aim was to cover all aspects of synchrotron research—from machine physics and insertion devices to beamline design and actual applications. Course material was grouped into lectures, exercises and computerised-data handling and assessments. Topics*

*discussed included accelerator physics and applications of synchrotron radiation to physics, chemistry, materials science, engineering and the environment. Those attending the workshop visited Trieste's synchrotron radiation laboratory, Elettra.*

## INTERNATIONAL TOPICAL CONFERENCE ON PLASMA PHYSICS: NEW PERSPECTIVES OF COLLECTIVE EFFECTS

10- 14 November

**Co-sponsors:** European Union, International Union of Radio Science, in cooperation with: Ruhr-Universität Bochum (Germany), Rutherford Appleton Laboratory (Didcot, UK), and University of Umeå (Sweden).

**Directors:** R. Bingham (Rutherford Appleton Laboratory, Didcot, UK). P.K. Shukla (University of Bochum, Germany), and L. Stenflo (University of Umeå, Sweden).

*The conference, which provided a forum for scientists from Russia and Eastern Europe, as well as other researchers from a host of countries in the developing and industrialised world, represented a continuation of ICTP's biennial autumn college. A major goal was to encourage interaction and collaboration among scientists from around the globe. The conference covered a broad range of topics. Lectures and discussions emphasised cross-disciplinary research. Topics explored included waves in fluids, plasmas and optical media; wave-wave interactions and nonlinear structures; physics of non-ideal plasmas; novel*

*methods for charged particle acceleration; and nonlinear problems in astrophysics.*

## EUROPEAN WOMEN IN MATHEMATICS - 8th GENERAL MEETING

2 -16 December

**Co-sponsors:** UVO/ROSTE, ICTP, Università di Trieste, ERDISU, EMS.

**Organising Committee:** C. Bessenrod (Germany), B. Branner (Technical University of Denmark, Lyngby, Denmark), M. Demlova (Czech Republic), E. Mezzetti (University of Trieste, Italy), R.-M. Mirò Roig (Universitat de Barcelona, Spain), M. Nääätänen (University of Helsinki, Finland), S. Paycha (Laboratoire de Mathématiques Appliquées, Aubière, France), R. Piene (University of Oslo, Norway), C. Series (University of Warwick, UK) and I. Yemelyanova (Nizhnii Novgorod State University, Novgorod, Russia).

**Co-organisers:** European Women in Mathematics and ICTP.

*The meeting provided an opportunity for women mathematicians from around the world to gather and discuss problems and opportunities of mutual concern. Work-related concerns dealing with hiring practices, salaries and promotions were examined at luncheons and evening lectures. Among the research topics covered in the technical sessions were representations of groups, p-adic numbers, and symmetries.*



School on the Use of Synchrotron Radiation in Science and Technology



# PROFILE

Less than a decade ago, Lucero Alvarez Miño was finishing high school in Bogota, Colombia. Today, she's studying condensed matter at The Abdus Salam International Centre for Theoretical Physics. In between, she witnessed one of the most historic events of the late 20th century: the collapse of the Soviet Union.

## Physics on the Move

**L**ucero Alvarez Miño first encountered physics when she was a junior in high school. "My interest in physics was evident during the first few classes. I was fascinated by the mind-puzzling problems that physics presented. I knew in high school that's what I wanted to do."

In early 1987, Alvarez entered Colombia's National University in her home town of Bogota. She had every reason to believe that she would be spending the next five years commuting between home and campus earning a degree in physics.

But Alvarez's life took a sharp turn to the east six months after graduating from high school, when she learned that she had received a fellowship to study at the University of Kharkov in Ukraine, then part of the Soviet Union.

"I had never crossed the borders of Colombia. Now, I was given an opportunity to travel more than 10,000 kilometres from home. I didn't know the language, I didn't know the culture. I didn't even know what the weather was like. But I knew I had to go. So, I packed my suitcase, had a long good-bye with my parents and sister, and off I went."

When she arrived at Kharkov, an industrial city of two million people, Alvarez learned that the University's physics department was welcoming some 80 new students—71 from the Soviet Union, two from Colombia, three from Cuba, and one each from Ethiopia, India, Sri Lanka and Spain.

"It was a cultural shock. But physics provided a foundation for all the foreign students. It was a way of communicating in an environment where other forms of communication were difficult."

Within a year, Alvarez had acquired a working knowledge of Russian and had narrowed her fields of interest in physics to condensed matter. She settled into a relatively comfortable life as a foreign exchange student.

Then, in 1991, the Soviet Union collapsed and Ukraine emerged as an independent nation for the first time in more than 70 years.

"The fall of communism had a tumultuous impact on science throughout the former Soviet Union. The Department of Physics at the University of Kharkov was by no means exempt from these historic events. The situation has become even worse since I left. Today, professors go unpaid."

"Students also had a rough time. Under communism, all graduates with advanced science degrees were guaranteed jobs. After the fall of the Soviet Union, students were told they would have to fend for themselves—and there were simply no jobs."

"I thought about leaving. But I had put in three years at the University. I was afraid that I would lose credit for all of that time if I quit and went home. Besides I loved the people. The multi-culturalism that made it difficult for the Soviet Union to stay together also made it an interesting place to live."

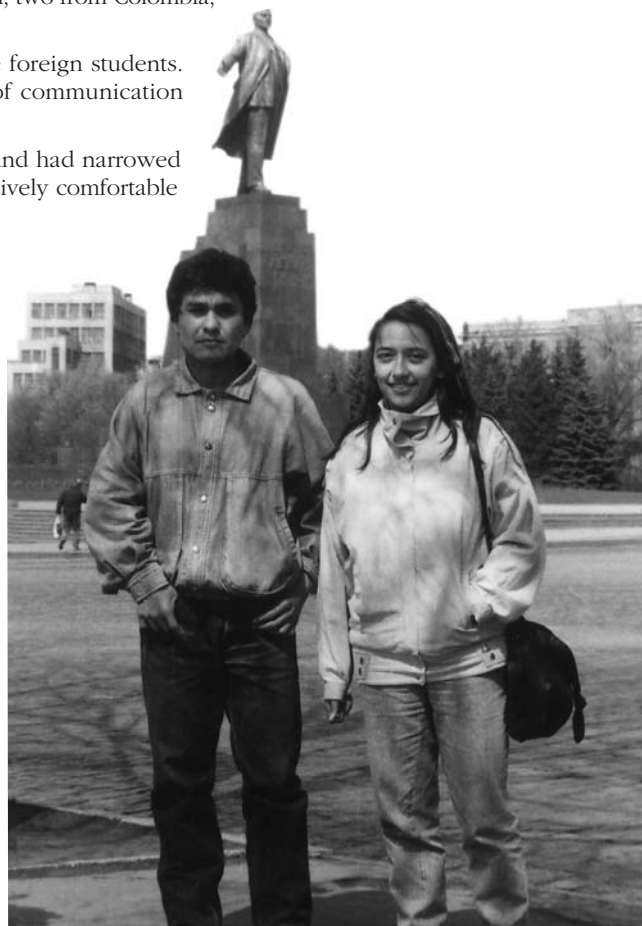
So, Alvarez stuck it out—a young Latin American physics student living in exile in Ukraine during a period of revolutionary change. Only in 1994, with her degree in hand, did she return to Colombia.

Now, after spending the last two years teaching physics to prospective engineers in her home country, she's on the road again. The setting is different but the goal remains the same: to earn a doctorate in physics that would give her an opportunity to teach full-time at a university.

Alvarez will graduate from ICTP's Diploma Course next October. She will then be off to a university—perhaps in the United States—to earn a doctorate in physics.

"A doctorate in physics has been a dream of mine since high school," says Alvarez, "and I've been fortunate enough to pursue that dream in some unusual places."

"Who knows what's next. I'm certain, however, that I will eventually return to Colombia as a full-time physics professor at the National University. I've seen the world, but I hope to spend most of my career in the country of my birth." □



Lucero Alvarez Miño with fellow student at University of Kharkov, Ukraine

## TRIBUTES and CHANGES

After serving eight years as the Centre's Senior Administrator, **Gianfranco Guerriero** has left the ICTP to rejoin his family in Rome. "For the past few years, I've been leaving for Rome on Friday evening and returning to the Centre on Monday morning. I just decided that I've had enough of the grind." On 4 December, one week before Guerriero left, the Italian Ministry of University and Scientific & Technological Research announced that it released an additional 12 billion lire (US \$7 million) allocated to the Centre's 1996 and 1997 budget and that it would provide 26 billion lire (US \$15 million) in 1998. The decision, which stabilizes the ICTP's annual budget, will allow for more careful planning of the Centre's activities. Miguel Virasoro, the ICTP Director, called the Italian government's announcement "the crowning achievement" of Guerriero's efforts and he extended Guerriero best wishes for the future on behalf of the ICTP.

**Hilda Cerdeira**, a scientist in the Condensed Matter Group who has been with the Centre since 1986, has agreed to assume responsibility for the ICTP-TWAS Donation Programme. Cerdeira is replacing Hassan Dalafi, a 30-year veteran of the ICTP who has left the Centre to work with UNESCO in Venice. The Donation Programme is designed to distribute books and journals to financially strapped libraries and research centres in the developing world.



**Faheem Hussain**, a physicist with the High Energy Group and a coordinator of the Diploma Programme, has become the head of the Office of External Activities. He is replacing

Gallieno Denardo who retired from the Centre in October (see page 7). Hussain has been with the ICTP for 7 years. The Office of External Activities, established in 1985, promotes scientific research in the developing world through the sponsorship of affiliated centres, networks, and meetings.

### Albanian President Assails "Cafetarians"

Like the other 100-plus scientists who came to the Centre in late November, Rexhep Meidani was here primarily to honour the memory of Abdus Salam. However, during his visit, he took time out to address some critical issues related to his new job as President of Albania. Meidani held a press conference at the ICTP's Main Building attended by about a dozen representatives from Italy's print and broadcast media. He lamented that his countrymen had fallen victim to a nationwide financial pyramid scheme. Many Albanians, he noted, had come to believe that "work was unnecessary." "My people," Meidani wryly observed, "had become 'cafetarians' deluded by the belief that they could become rich while sitting around all day drinking coffee."

### Astronauts Touch Down

In August, they orbited the Earth for more than a week, travelling some seven million kilometres in space. In November, they visited the ICTP as part of a week-long tour of Germany and Italy designed to thank scientists in both countries for their contributions to the success of



*Discovery's* summer-time mission. On-board the U.S. National Aeronautics and Space Administration (NASA) spaceship was an ultraviolet spectrograph telescope built jointly by the University of Trieste and University of Arizona. *Discovery's* crew, headed by Lt. Colonel Curtis L. Brown of the U.S. Air Force, consisted of five men and one woman. Among the questions asked by ICTP staff and scientists were these: What's it like to be in space and do you ever suffer from claustrophobia? The answers were "wow" and "no."

### New ERA Returns

The ICTP once again participated in ERA, *Esposizione di ricerca avanzata*, a biennial scientific exhibition held in Trieste's conference centre. This marked the third ERA exhibition, which is designed to showcase the activities of scientific institutions in the Friuli-Venezia-Giulia region and major Italian and European scientific organizations. The Centre's scientific staff also offered six public lectures, largely for high-school students attending the exhibition. In all, the two-week ERA exhibition attracted about 10,000 people. ERA events are organised by *Globo Association for Science Popularisation* in Trieste.



## 12 - 30 January

ICTP-URSI-ITU/BDT School on the Use of Radio for Digital Communications in Developing Countries, Including Spectrum Management

## 23 February - 27 March

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

## 23 - 31 March

Spring School on Non-Perturbative Aspects of String Theory and Supersymmetric Gauge Theories

## 9 - 27 February

Winter College on Optics

## 16 - 27 March

Workshop on the Structure of Biological Macromolecules

## 1 - 3 April

Trieste Conference on Superfivebranes and Physics in 5+1 Dimensions

## 14 - 30 April

College on Soil Physics

## 27 - 29 April

MECO 23 (Middle European Cooperation in Statistical Physics)



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/>

### ON E-MAIL

#### (1) For Yearly Calendar of Scientific Activities

Create a new e-mail message and type

**To:** [smr@ictp.trieste.it](mailto:smr@ictp.trieste.it)

**Subject:** get calendar 1998

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](mailto: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](mailto: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.

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