NEWS from ICTP

the
abdus salam
international centre for theoretical physics

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1998

#86

WHAT'S NEW

Just before the summer of 1997—a little more than a year ago—financiers were hailing the "Asian tigers" as economic miracles. From South Korea to Thailand, sustained annual growth rates sometimes exceeded 10 percent. Then in early autumn the bottom fell out. The economies in these countries went into a tailspin from which they have yet to recover. In fact, the impact of Asia's severe economic downturn has rippled across the entire globe, sapping economic growth in Latin America, adversely effecting an already desperate situation in Russia and even piercing holes in what experts thought was a bullet-proof economy in the United States.

Could this mess, which now threatens the global economy, have been foreseen? The answer may be yes—if we can develop more sophisticated models that rely on high-powered mathematics and theories of chaos and complex systems rooted in the study of physics.

The ICTP's School and Conference on the Mathematics of Economics, held between 31 August and 25 September, were not designed to address today's headlines. But the theories and models on the behavior of financial markets that were presented certainly had "an air of currency" that the organizers could not have anticipated.

As ICTP Director, Miguel Virasoro, recently noted: "The stock market is a non-linear system with an untold number of independent parameters. That makes it extremely difficult to model. Although the particulars are different, nature also consists of complex phenomena. Yet, scientists have not been shy about modelling those systems. Indeed models have long been accepted as legitimate tools for understanding everything from the micro-behavior of subatomic particles to macro-alterations in the biosystems. If we can build mathematical models for physics and biology, why can't we use similar skills to build similar models for economics?"

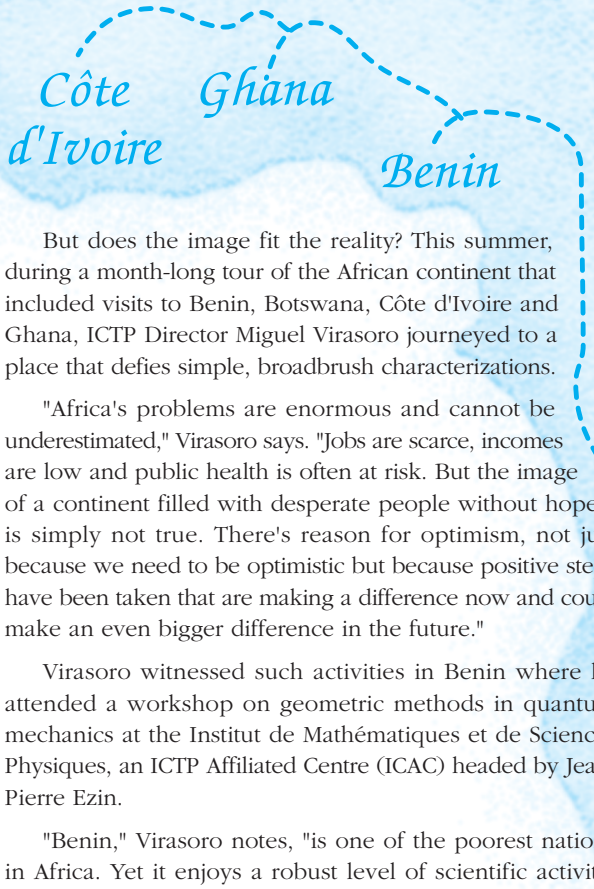
Brazilian-born economist José Alexandre Scheinkman, former chairperson of the Department of Economics at the University of Chicago and opening lecturer at the ICTP's Economics School, is somewhat less optimistic: "Although many aspects of stock market behavior resemble a chaotic system, I'm not convinced that a simple model can describe that system. One must bear in mind that stock market participants are constantly trying to learn the market's dynamics. And as they learn the dynamics, they change their behavior. This in turn changes the dynamics."

Regardless of the outcome of this discussion, the ICTP's School and Conference on the Mathematics of Economics have raised serious questions about the role that abstract tools and theories previously applied to complex natural phenomena may play in enhancing our understanding of financial systems, where very down-to-earth concerns for profit and loss are the driving force. In the process, fields once thought to be worlds apart—physics and economics—may have more in common than experts in either discipline ever thought possible. □

Last summer, ICTP Director Miguel Virasoro embarked on a one-month journey across Africa. What he witnessed was a continent earnestly seeking to harness science and technology to build a better future for its people.

An African Journey

In a world marked by breathtaking change, one place unfortunately seems to have remained remarkably the same. Through colonial rule and independence, hot and cold wars, tribal conflict and political reform, Africa has continued to be a portrait of poverty. At least that's been the prevailing image presented by much of the media both in the North and South.



But does the image fit the reality? This summer, during a month-long tour of the African continent that included visits to Benin, Botswana, Côte d'Ivoire and Ghana, ICTP Director Miguel Virasoro journeyed to a place that defies simple, broadbrush characterizations.

"Africa's problems are enormous and cannot be underestimated," Virasoro says. "Jobs are scarce, incomes are low and public health is often at risk. But the image of a continent filled with desperate people without hope is simply not true. There's reason for optimism, not just because we need to be optimistic but because positive steps have been taken that are making a difference now and could make an even bigger difference in the future."

Virasoro witnessed such activities in Benin where he attended a workshop on geometric methods in quantum mechanics at the Institut de Mathématiques et de Sciences Physiques, an ICTP Affiliated Centre (ICAC) headed by Jean-Pierre Ezin.

"Benin," Virasoro notes, "is one of the poorest nations in Africa. Yet it enjoys a robust level of scientific activity, especially at ICAC. Jean-Pierre Ezin deserves much of the credit for this success story, which is slowly emerging as a model for other research institutions throughout Africa."

"I was also impressed by the level of scientific activities in Ghana," Virasoro remarks. Although harsh conditions have forced many of Ghana's younger, more promising, scientists to leave the country, those remaining are determined to succeed. ICTP will continue to help them through our Visiting Scholar programme, an expanded Diploma Programme and a new proposed Shared Ph.D. programme."

The LAM Network (African Network on Lasers, Atoms and Molecules) offers another counterpoint to the pessimistic assessments of Africa's future. Supported by ICTP Office of External Activities, LAM focuses on research issues related to laser physics, and now cooperates extensively with other institutions throughout the region.

"Those fortunate enough to be involved with the LAM network enjoy a privileged environment. That privilege," Virasoro adds, "has been earned by both the institutions and their participants. In fact, the network's most important lesson may be that it's possible to overcome the chronic problems of understaffing and isolation that affect many African research institutes."

In the Côte d'Ivoire, Virasoro also visited research facilities pursuing wide-ranging activities that defy prevailing stereotypes of the continent's scientific institutions. As Virasoro observes, "Agriculturalists and foresters at the National Research Center in Agriculture are seeking to create a scientific foundation for sustainable growth." Such efforts should prove of critical importance to both Côte d'Ivoire and other nations in West Africa struggling to improve their economies without damaging their environments."

Virasoro acknowledges that "The future of Africa in general—and science in Africa, in particular—remains uncertain. The problems are immense. Poor pay and antiquated equipment not only hinder research efforts but sap the enthusiasm of both faculty and students. The small number of staff at many universities often means that researchers work in isolation with too few opportunities to interact with their colleagues. Higher salaries and better facilities in the North continue to lure a large portion of the continent's most promising young scientists. And, unlike many other developing regions—for example, South America—women are virtually absent from science classrooms and laboratories."

"Yet, you can't ignore the efforts of the institutes and universities that I visited. Scientists throughout Africa, despite the obstacles they face, are doing good work in teaching, training, research and community outreach. Their initiatives are making a difference."

"ICTP—through, for example, its Associate Scheme, Diploma Programme, Office of External Activities, Training and Research in Italian Laboratories—is proud of the contribution it has made to these efforts. At the same time, the African officials and researchers to whom I spoke are thankful for ICTP's involvement. It's a partnership we intend to build on in the future." □

From J. Robert Oppenheimer to Robert J. Schrieffer, ICTP's Scientific Council has proven instrumental in shaping the Centre's research priorities and programs. This year, the Council welcomed a new chairman, its sixth. Praveen Chaudhari presided over his first Council meeting this June.

New Directions Old Values

Praveen Chaudhari, the new Chairman of ICTP Scientific Council, has enjoyed a career in science marked by moments of dramatic change followed by long periods of stability. He was born and raised in India. He received his undergraduate degree from the Indian Institute of Technology and his Master and Ph.D. degrees from the Massachusetts Institute of Technology. He worked at IBM for more than 30 years, where he rose to the position of Vice President for Science. His personal research interests have focused on condensed matter physics, particularly investigations into the structure and properties of solids, superconductivity and magnetism. While in Trieste to attend this year's Scientific Council meeting, Chaudhari sat down with the Editor of *News from ICTP* for a wide-ranging discussion on the current state of scientific research. What follows is an excerpt of their hour-long talk.

The nature of scientific research has changed dramatically over the past two decades. What do you think is driving these fast-paced changes?

There are many factors: new theoretical techniques, discoveries, instruments, computational power, ease of communication and unprecedented interactions between different disciplines of science and, sometimes, technology. Let me elaborate on the last point using condensed matter physics as an example. Twenty years ago, condensed matter physicists explained the behavior of solids in terms of their atomic structure. As a result, much effort was being directed at undercovering the location of atoms. Today, in contrast, we play with atoms. Put another way, instead of accepting the system for what it is and trying to understand it in terms of its electronic and atomic structure, we can now assemble atoms in specific ways and subsequently examine how the system responds. Such an approach has broad implications for the practitioners of science. For example, university-based disciplines—biology, chemistry and physics—are now more seamlessly connected through the study of atomic assemblage of matter. As a result, researchers increasingly view themselves not as biologists, chemists or condensed matter physicists, but as members of a team "playing" with atoms and molecules. In a culture that has evolved over the centuries into a discipline-based system, this represents a radically new approach.

When ICTP Director Miguel Virasoro spoke at the opening of the Scientific Council meeting, he said that Abdus Salam believed science's highest calling and most important contributions involved understanding the laws of nature. What you're describing goes well beyond this view.

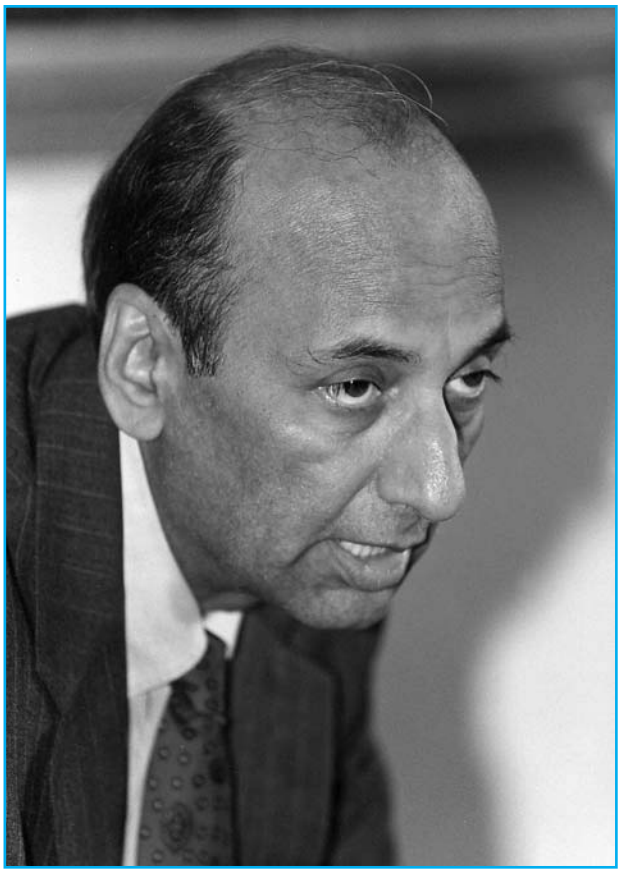
Yes, it appears to do that. Yet, the truth is we never go beyond nature because everything ultimately is a part of nature. Scientists, however, are moving beyond the traditional boundaries of their disciplines. For example, geneticists are manipulating DNA and so are physicists who view DNA as a long-chained carbon-based molecule. The point is that condensed matter scientists no longer passively rely on what nature gives; instead, they are modifying the physical world in an effort to achieve desired outcomes.

How do you respond to those who speak about the end of science?

In my view, anyone who talks about the end of science has run out of ideas. That can certainly happen to an individual, but science, as a collective enterprise, never ends. Whenever someone makes such comments, they're telling me more about their own state of mind than they are about the state of science. The fact is that we have yet to answer many of the fundamental questions of science. Let me take just two examples from current research to illustrate my point. We are still struggling to unify the forces of nature, and our understanding of the evolution of the universe—and of the matter in it—remains incomplete. By the same measure, our knowledge of the life sciences is, at best, primitive. In saying this, I am not even referring to profound issues like: What is life or consciousness? How do they arise? How do you measure them? Science is an enterprise that will never end.

The Centre is now more than 30 years old. What changes do you see taking place within it?

The Centre realizes that it cannot take on every aspect of science. Clearly, if the Centre had more money it could do more. But budget considerations have forced it to choose areas largely in line with its historic strengths in high energy physics, mathematics and condensed matter physics. The Centre also realizes more clearly than it did 30 years ago that the level of scientific and technological expertise in developing countries varies substantially and that one strategy cannot apply to all. As a result, ICTP has begun to devise a specialized approach depending on which country it's dealing with. For example, countries in sub-Saharan Africa not only need to acquire on-the-shelve science and technology but must develop sustainable strategies allowing science and technology to grow. Conversely, India and China have enjoyed long histories of scientific research—and have much to show for their efforts. The Centre must interact with these nations in different ways if it hopes to remain effective. That's exactly what the Centre is doing by tailoring its approach. Time and again at the Scientific Council meeting, we heard the Director and staff members say, "*This* is what we need for *this* group of developing countries and *here* is what we need for *that* group." With its reforms now in place, the Centre is at the threshold of a new stage of operation. It's saying, "With the experience we've acquired and the changes we've made, what new areas of inquiry should we become involved in?" One area that has been identified is the physics of climate and weather. Research in this field does not involve fundamental science in the same way that research in high energy physics or mathematics does. But it does require the application of fundamental laws of nature to explain very complex systems. It's a research area that requires a great deal of computer modelling and thus blurs distinctions between theory and experimentation. It's also multidisciplinary. And it's a science that interests the public. In short, the physics of weather and climate embodies all of the current trends in scientific research.



Praveen Chaudhari

What changes do you foresee in the Centre's relationship with the developed world?

The developed world is as important to the Centre as the developing one. I know it's often been said that ICTP should have more representation from the developing world. But I'm not convinced that such a strategy would be the right one. I realize that when you're thinking about training you should target the developing world because that's where training is needed. However, if you're seeking to explore the frontiers of science, you need outstanding people from all points of the compass. For this reason, setting arbitrary quotas on participation may be counterproductive. In fact, an unusual and enduring strength of the Centre has been to serve as a meeting place for scientists from all parts of the world. The ICTP offers a very rich set of research and training activities throughout the year and it's the quality of these activities that makes them special.

Your responses have focused on the blurring of boundaries—between disciplines, nations, regions and even the developed and developing worlds. Are these boundaries fading and, if they are, what does this mean for the Centre?

I have emphasized multidisciplinary research because that's where our conversation began. However, I believe just as passionately that basic knowledge in high energy and condensed matter physics and mathematics, which is pursued at the ICTP and which remains at the core of Abdus Salam's living legacy, has proven indispensable in providing a solid bedrock for the Centre. That bedrock has served—and continues to serve—talented scientists from every corner of the Earth. □

With the arrival of its first head, ICTP's Weather and Climate Group expects to rapidly expand its activities. The group plans to focus on long-term regional climate patterns and rely on sophisticated computer models to analyze these trends.

Change in Climate at the Centre

Mudslides in southern Italy, prompted by torrential rainstorms, bury nearly 200 people. A searing heat wave in India leaves thousands dead. Tornadoes in the United States cut a destructive path across America's heartland killing hundreds of people and disrupting the lives of many more.

What's going on? Do these dramatic events represent random occurrences, or are they symptomatic of long-term alterations in global and regional climate patterns?

That's one of the critical issues that Filippo Giorgi and his colleagues will address in the years ahead. Giorgi joined the ICTP in May as the first head of the Centre's Weather and Climate Group.

"Our name reflects our broad areas of interest," says Giorgi. "Our research, however, will focus largely on climate."

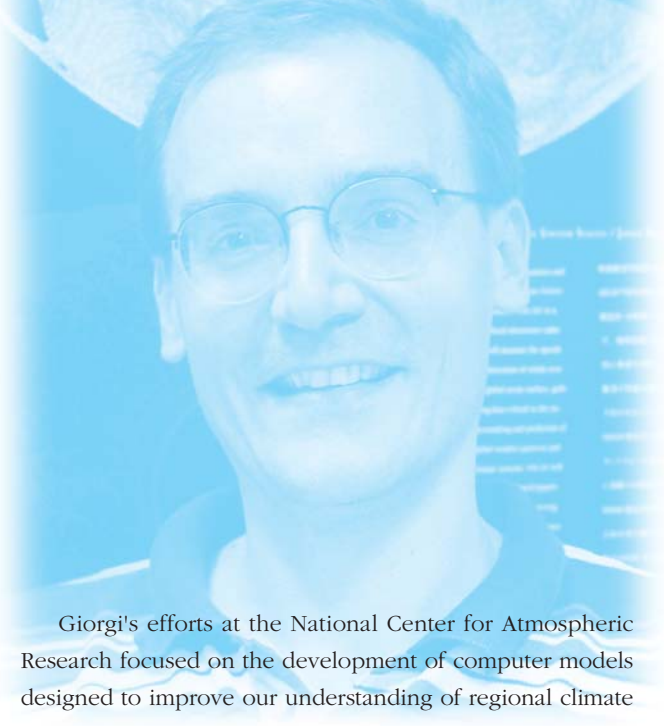
For scientists, a clear distinction exists between weather and climate. Weather forecasting involves scientifically based predictions of temperatures, precipitation and cloud patterns over the next few days. Will it rain tomorrow? Will the weekend be sunny? When will the heat wave end? Climate studies, on the other hand, seek to explain long-range changes in global and regional climate patterns. Will average global temperatures rise in the future? What role do human activities play in the process? Must we prepare ourselves for more extreme weather events?

Giorgi notes that "The ICTP Weather and Climate Group won't be focusing its research on forecasting if it will rain on Tuesday. Instead, it will be studying the physical processes that affect our atmosphere, biosphere and oceans—and ultimately our climate and weather."

"I like to explain the distinction between weather and climate in this way," Giorgi adds. "Weather is something that farmers in the southern United States must pay attention to in order to see if they will need to protect their crops against an unexpected cold snap. Climate, on the other hand, is studied by atmospheric scientists trying to determine how long-term meteorological patterns will affect annual farm yields in Argentina and Ukraine."

Giorgi first became interested in climate and weather as a student at the University of L'Aquila in Italy. "I was born and raised in the small town of Sulmona about 120 kilometres east of Rome," notes Giorgi. "After my undergraduate studies, I was accepted to graduate school at Georgia Institute of Technology in the United States. After receiving my doctorate, I was hired by the National Centre for Atmospheric Research in Boulder, Colorado, where I worked for the 14 years before joining the ICTP."

"Our ability to forecast the weather in the short term—say the next three to five days—is now fairly accurate," explains Giorgi. "At the same time, although we have made some progress in our ability to predict if next spring will be relatively wet or warm, we still have a long way to go. And, when it comes to understanding potential climate changes over several decades, we've just touched the surface."



Giorgi's efforts at the National Center for Atmospheric Research focused on the development of computer models designed to improve our understanding of regional climate patterns.

"Until the late 1980s, scientists used global models of the atmosphere, which they labelled General Circulation Models (GCMs), to study the Earth's climate," Giorgi explains. "Such models have been instrumental in advancing our knowledge of the forces behind phenomena like global warming and El Niño. But they require tremendous computational resources and, as a result, their resolution is often coarse. Relatively small geographical areas—for example, islands, peninsulas and narrow mountain chains—are inadequately represented."

"To overcome this limitation," Giorgi says, "my colleagues and I turned to Limited Area Models (LAMs). These regional models attain much higher resolutions than GCMs. For this reason, they provide more detailed information on local and regional climate patterns. Put another way, LAMs zoom in and enhance the information provided by GCMs, allowing scientists to examine local and regional weather patterns that they may find of particular interest."

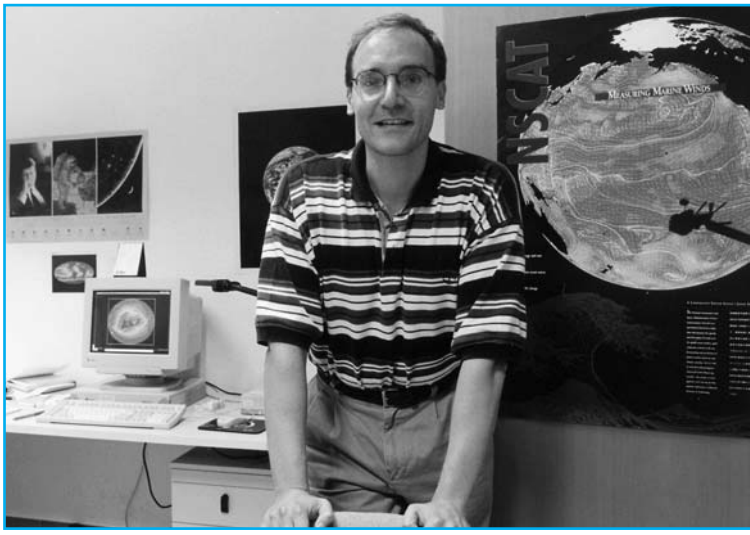
From the beginning, LAMs were used to predict short-term weather patterns and trace the path of such phenomena as cyclones and hurricanes. "My group in Colorado," notes Giorgi, "subsequently pushed LAMs onto a regional scale to develop what have come to be known as Regional Climate Models (RCMs)."

RCMs have helped fill the gap between local and global models. In effect, RCMs offer higher resolutions than global models and lengthier climatic time scales than their local counterparts. They have proven to be instrumental in regional studies examining the potential impact of such phenomena as climate change and El Niño. They have also been useful in analyzing the interactions of various aspects of the climate system, including the atmosphere and oceans.

And because RCMs focus on regions and require far less computing power than global models, they have proven to be particularly useful tools for scientists from developing countries who are interested in studying regional climate patterns and related environmental problems. "Our group," Giorgi observes, "will make LAMs available to scientists from developing countries and, more importantly, will provide the training and know-how necessary to use and understand these models."

"Geographically," says Giorgi, "ICTP's Weather and Climate Group will focus its attention on three areas of historic interest to the Centre: the Mediterranean; sub-Saharan Africa; and central and eastern Asia. These study areas are designed to allow us to make contributions to climate-related issues in both developing and developed countries. The Mediterranean is particularly interesting because it straddles a transition zone between arid and temperate climates."

Giorgi intends to pursue his goals through a variety of strategies. In addition to research and modelling activities, the group will host a summer school each year consisting of a two-week colloquium followed by a week-long conference. The group also plans to hold two annual workshops. Giorgi adds that his group will seek to create close ties with such leading meteorological research organizations as the Intergovernmental Panel on Climate Change (IPCC) and Global Change System for Analysis Research and Training (START). And it will pursue opportunities for outside funding to support research visits by young scientists from developing countries.



Filippo Giorgi

It's an ambitious agenda. To help him in his efforts, Giorgi has begun to put together his staff, which will consist of two senior scientists (including himself); a part-time senior visiting scientist (Serbian-born Fedor Mesinger who works with the U.S. National Weather Service); two post docs; and two support scientists. "The unfilled positions have already been advertised and a number of excellent candidates have applied," Giorgi says. "We hope to have all staff members in place by the end of the year."

"What makes the study of climate more interesting—and more complicated—than ever," observes Giorgi, "is that we have come to realize that meteorology entails more than enhancing our understanding of the atmosphere. Weather and climate are effected by land use patterns, vegetation, topography, pollution, radiation, ocean currents and a whole host of factors that not too long ago never entered into our analyses. That's why scientists increasingly talk about climate systems and not simply climate."

"No pun intended, weather and climate are hot topics," Giorgi notes with a sly smile. "Regional Climate Models, which stand at the juncture between Global Circulation Models and Local Area Models, are viewed as one of the most promising areas of study for improving our understanding of climate patterns. The ICTP has an opportunity to make important contributions to this effort. And that's what we hope to do in the months and years ahead." □

DATELINE

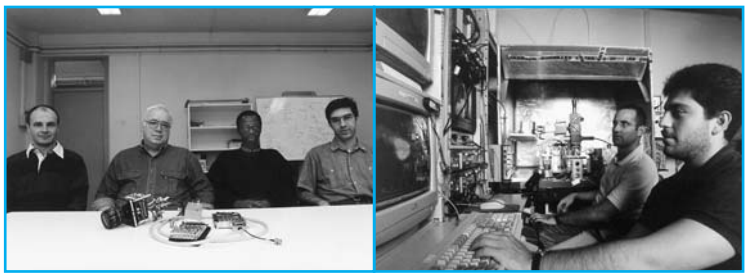
Graduation Time at ICTP

The 1997 - 1998 Diploma Class

This September, 26 students in mathematics, condensed matter and high-energy physics graduated from ICTP's Diploma Courses. Most of the graduates will now seek advanced degrees in other countries, largely in the United States. Here are some of the places they came from: Algeria, Benin, Ethiopia, Madagascar, Senegal, Syria and Viet Nam. Here are some places they will be going to: Syracuse University, Texas A&M University, University of Georgia in the United States, and Kaiserslautern University in Germany. Of all the graduating Diploma students, Mosab Rbah Nasser of Gaza may be making the greatest leap of all—geographically speaking. Raised on the parched desert lands of the Middle East, he's heading for the frosty tundra in the Auroral Observatory University of Tromsø, Norway, located beyond the Arctic Circle. At the same time that the ICTP wished a fond farewell to its 1997-1998 Diploma Class, the Centre welcomed a new batch of students. On 1 October, 32 Diploma students from around the world began their studies in Trieste.

In the Blink of an Eye

The ICTP Microprocessor Laboratory, under the direction of Alberto Colavita, has announced that its fast-moving imaging system, under development for the past two years, has acquired its first customer. The U.S. National Institutes of Health (NIH) in Bethesda, Maryland, has agreed to purchase the system to enhance its research efforts on hearing disorders. The system's key elements consist of a modified digital camera, equipped with 12 bits of memory, and computer board or "frame grabber." The latter provides an interface between the data storage and retrieval capabilities of the host computer and the images captured by the camera. The project is a joint venture between ICTP and the Scuola internazionale superiore di studi avanzati (SISSA), which is located adjacent to the Centre's campus. The research staff include ICTP's Gabriele Capello, project engineer; SISSA's Fabio Mammano, a biophysics researcher, and SISSA's Marco Canepari, a biophysics doctorate student. The value of the fast-camera system lies in its ability to provide on-screen still images of fast-moving objects and activities. It can, for example, freeze-frame the motion of butterfly wings in flight. The NIH plans to use the system to study how ear membranes—tiny fluttering fibers that play a critical role in our ability to hear—react to electronic stimuli. Colavita hopes that the sale of the system to the prestigious NIH will spark interest from research institutes and research centres worldwide. The National Institute of Medical Research in the United Kingdom has recently inquired about the system's availability. And an Italian company specializing in the sale of "turn-key" imaging equipment has made preliminary inquiries about partnering with the Laboratory in its manufacture and distribution.



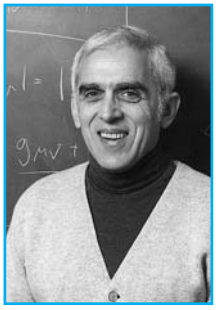
Fast-camera teams: Microprocessor Laboratory and SISSA

Cape Town Travels

Faheem Hussain, Head of the ICTP Office of External Activities (OEA), visited Cape Town, South Africa, in early July to attend the 43rd Annual Conference of the South African Institute of Physics (SAIP). Discussions during the visit focused on possibile future collaborations in physics and mathematics between scientists in the region and ICTP. OEA provided SAIP with US$4,000 to enable physicists from neighbouring, less scientifically advanced African countries to attend the conference. During his five-day journey, Hussain had extensive talks with SAIP officials. He also met with physicist Rob Adams, Deputy Directory General of the Foundation for Research and Development (FRD), the government of South Africa's main agency for the development of science and technology.

Medals and Prizes

The ICTP Dirac selection committee has announced the winners of the **1998 Dirac Medal**. The recipients are Stephen Adler, a professor at the Institute for Advanced Study in Princeton, New Jersey (USA), and Roman Jackiw, a professor at the Massachusetts Institute of Technology in Boston, Massachusetts (USA). Adler and Jackiw are being honoured for their contributions to quantum field theory. Their individual research efforts crossed paths with their studies of the triangular anomaly, a complex theory based on physics and mathematics that helps explain the decay of such elementary particles as pions, while placing severe restrictions on grand unified theories involving the fundamental forces of nature. The award, which carries a US$5,000 cash prize, is named in honour of the late Nobel Laureate Paul A.M. Dirac, one of the fathers of quantum mechanics and staunch friend of the ICTP.



Stephen Adler

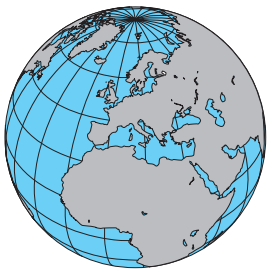
Roman Jackiw

Winners of the **1998 ICTP Prize** have also been recently announced. They are Fernando Quevedo of the Universidad Nacional Autónoma de Mexico and Anamaria Font of the Universidad Central de Venezuela. Both are being recognized for their contributions to the field of string theory, particularly for their theoretical work on compactifications, mirror symmetries and dualities. The prize, which includes a US$1,000 cash award, is granted annually to young scientists living and working in the developing world. This year's ICTP Prize will be given in the name of C.N. Yang. A world renowned physicist, Yang received the Nobel Prize in 1957 and has been a driving force behind the Asia Pacific Centre for Theoretical Physics (APCTP). Modelled after the ICTP, the Asia Pacific Centre officially began operations last year.

NEWS FROM ASSOCIATES

Prosper Mpawenayo, an ICTP Regular Associate Member since 1993 and Fellow in the Programme for Training and Research in Italian Laboratories (TRIL) since 1985, has been named the new Minister of National Education and Scientific Research in Burundi in central Africa. Thanks to his TRIL fellowship, Mpawenayo visited the Politecnico di Torino in northwestern Italy on several occasions during the 1980s and 1990s, including earlier this year. His major field of research is semiconductor physics.

On 14 August, the 51st anniversary of Pakistan's independence, President Rafiq Tarar conferred civil awards on 120 citizens for their pursuit of excellence in fields ranging from literature to arts to sciences. Five ICTP Associates were among the award winners, including **Muhammad Masud Ahmad** (Pakistan's Atomic Energy Commission), who received the Hilal-i-Imtiaz or Crescent of Distinction. Other ICTP Associates receiving recognition were **Abdul Waheed Khan** (Gomal University, Dera Ismail Khan), **Mujahid Kamran** (University of the Punjab, Lahore), **M. Zafar Iqbal** (Quaid-i-Azam University, Islamabad) and **Khawaja Yaldram** (Pakistan Institute of Nuclear Science and Technology, Islamabad). Each was granted a President's Award for Pride of Performance. The official ceremony is scheduled to take place next March.



1997 Associate Members

APPOINTMENTS...	Regular	Senior	Junior
Total number of Associates	479	98	99
New appointments	75	16	43
Extensions and renewals	126	12	1
Countries represented (for the appointments)	76	36	49
THEIR VISITS...			
Number of Associates	181	24	–
Person-months	359	38	–
Average duration of stay in days	60	48	–
Preprints issued	84	3	–

The Associateship Scheme, which has been a core programme at the ICTP since the Centre's inception in 1964, provides an opportunity for Associate Members to spend 270 days at the Centre during a 6-year period. Changes have recently been put in place to increase the number of young scientists who are eligible for participation in the program. For additional information on the Associateship Scheme, please see the Summer 1998 issue of *NEWS from ICTP*, pages 4-5, or e-mail the secretariat at assoc@ictp.trieste.it.

Design: G. Gamboz/ICTP

REPORT ON REPORTS

CONFERENCE ON HYPERFINE INTERACTIONS IN THE SOLID STATE: EXPERIMENTS AND FIRST-PRINCIPLES ELECTRONIC STRUCTURE CALCULATIONS

2 - 4 July

Directors: P. Blaha (Technische Universität Wien, Vienna, Austria), J. Kohanoff (ICTP), A. López García (Universidad Nacional de La Plata, Argentina), R.C. Mercader (Universidad Nacional de La Plata), C.O. Rodriguez (IFLYSIB, La Plata) and W. Steiner (Technische Universität Wien).

The conference appealed to experimental physicists who use hyperfine interactions as a critical research tool. The goal was to acquaint experimentalists with the newly available theoretical calculations. The conference also enabled theoretical physicists to meet experimentalists and gain first-hand knowledge of the key laboratory problems that they face.

ADRIATICO RESEARCH CONFERENCE ON ORGANIC SEMICONDUCTORS

7 - 10 July

Directors: H. Bässler (Philipps-Universität, Marburg, Germany), P.N. Butcher (University of Warwick, Coventry, UK) and R.H. Friend (University of Cambridge, UK).

Demonstrations that molecular and polymeric semiconductors can be used in a wide range of semiconductor devices—for example, transistors, light-emitting diodes and photocells—has led to new application-driven research in both basic physics and chemistry. The purpose of this meeting was to determine the most promising intersections between physics and chemistry. The programme was divided into three broad areas: electronic energy calculations for polymers and macromolecules; transport and optical properties control device properties; and the assembly of large molecules.

X TRIESTE WORKSHOP ON OPEN PROBLEMS IN STRONGLY CORRELATED ELECTRON SYSTEMS

20 - 31 July

Directors: G. Baskaran (Institute of Mathematical Sciences, IMS, Chennai, India), A. Georges (Ecole Normale Supérieure, ENS, Paris, France), G. Kotliar (Rutgers State University, Piscataway, USA), E. Tosatti (Scuola internazionale superiore di studi avanzati, SISSA, Trieste, Italy, and ICTP), A. Tsvelik (University of Oxford, UK) and Yu Lu (ICTP and Academia Sinica, Beijing, China).

The 10th edition of this workshop sought to foster interactions between experimentalists and theorists with similar research interests. Topics included disorder and strong correlations; correlated electron physics in mesoscopic devices; non-Fermi liquid physics; cuprate physics; old and new puzzles in heavy fermion physics; and new phenomena in transition metal oxides.

WORKSHOP ON OPTICAL PROPERTIES OF MICROCAVITIES

6 - 12 August

Directors: F. Beltram (Scuola Normale Superiore, Pisa, Italy), A. Quattropani (Ecole Polytechnique Fédéral de Lausanne, EPFL, Lausanne, Switzerland) and Yu Lu (ICTP and Academia Sinica, Beijing, China).

Recent developments in fabrication techniques make it possible to tailor semiconductor structures—in which both optical photons and electrons are confined—to their respective wavelengths. The resulting control of the photon density in inorganic and organic semiconductors is attracting a great deal of interest among researchers. These structures could pave the way for fundamental studies of cavity electrodynamics and use of novel photonic and optoelectronic devices.

EXTENDED RESEARCH WORKSHOP ON DISORDER, CHAOS AND INTERACTION IN MESOSCOPIC SYSTEMS

27 July - 18 September

Directors: B.L. Altshuler (NEC Research Institute, Princeton, USA), V.E. Kravtsov (ICTP and Landau Institute, Moscow, Russia), C.M. Marcus (Stanford University, USA) and B.D. Simons (Cambridge University, UK).

Giulio Casati

Recent theoretical and experimental developments in small mesoscopic systems have increased the synergy in three different research fields: disordered systems, quantum signature of chaos and electron-electron interaction. The workshop sought to create an environment conducive to the exchange of ideas among both mature and young scientists—from both the developing and developed world—working in these three fields.

1998 NORDIC - TRIESTE WORKSHOP ASTROPHYSICAL TESTS FOR STRONG GRAVITY

9 August - 9 September

Co-sponsors: NORDITA (Nordic Institute for Theoretical Physics, Copenhagen, Denmark), Chalmers University of Technology (Gothenburg, Sweden) and SISSA (Scuola internazionale superiore di studi avanzati, Trieste, Italy).

Directors: M. Abramowicz (Chalmers University of Technology) and A. Lanza (SISSA).

One of the most interesting problems in observational high-energy astrophysics involves the properties of matter very close to black holes. The workshop conducted research on the theory of QPO and accretion disk seismology, and the emission line profiles from fast rotating matter very near black holes.

REGIONAL WORKSHOP ON THE USE OF RADIO FOR COMPUTER NETWORKING, Cape Coast, Ghana

31 August - 11 September

Regional workshop lab exercise

Co-sponsors: United Nations University (UNU, Tokyo, Japan), University of Cape Coast (UCC), Council for Scientific and Industrial Research (CSIR, Accra, Ghana) and Ghana Atomic Energy Commission.

Advisory Board: K.A. Hughes (International Telecommunications Union, ITU, Geneva, Switzerland), S.M. Radicella (ICTP) and R. Struzak (ITU).

Directors: V.P.Y. Gadzekpo (UCC) and A. Nobile (ICTP).

Directors of Laboratory: D. Obuobi (UCC) and F. Postogna (ICTP).

Countries without electronic global links run the risk of being information-poor in the information age. In the light of this concern, the workshop consisted of tutorial lectures and laboratory sessions designed to increase the knowledge and skills of the participants. Topics included introductions to radiopropagation and radio spread spectrum; narrow band (HF, VHF and microwaves) technologies for data transfer, e-mail and full internet connectivity; and spread-spectrum (microwaves) technologies for data transfer. Laboratory work focused on experiments using point-to-point and point-to-multipoint radio links.

WORKSHOP ON DYNAMICAL SYSTEMS

31 August - 18 September

Co-sponsor: European Commission (Brussels, Belgium).

Directors: M.S. Narasimhan (ICTP), J. Palis (Instituto de Matemática Pura e Aplicada, Rio de Janeiro, Brazil), Ya. Sinai (Princeton University, USA, and Landau Institute for Theoretical Physics, Moscow, Russia) and J.-C. Yoccoz (Collège de France, Paris).

Workshop topics included chaotic systems, strange attractors, invariant measures; bifurcations; homoclinic and singular cycles; variational methods in Hamiltonian and Lagrangian systems; elliptic and nonuniformly hyperbolic behaviour; and one-dimensional real and complex dynamics.

Jean-Christophe Yoccoz

SCHOOL ON THE MATHEMATICS OF ECONOMICS—A PRIMER IN ECONOMICS FOR PHYSICISTS AND MATHEMATICIANS

31 August - 18 September

and

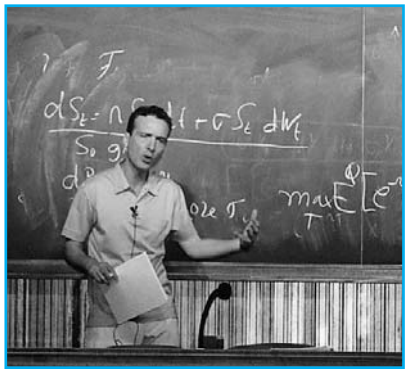
CONFERENCE ON ECONOMIC MODELS OF EVOLUTIONARY DYNAMICS AND INTERACTING AGENTS

21 - 25 September

Partha Dasgupta

Directors: M. Boldrin (Universidad Carlos III, Madrid, Spain), A. Mas-Colell (Universitat Pompeu Fabra, Barcelona, Spain), J.A. Scheinkman (University of Chicago, USA) and R. Zecchina (ICTP).

The school and topical conference mark the beginning of a new research activity in the field of applied mathematics at ICTP. The school consisted of introductory and tutorial lectures that emphasized the multidisciplinary nature of the subject. The topical conference concentrated on a subject in which ideas originating from statistical physics are expected to play a critical role. *(See "What's New," page 2)*



José Alexandre Scheinkman

AUTUMN TRAINING ACTIVITY ON NETWORKING AND RADIOCOMMUNICATIONS

14 September - 4 December

Directors: A. Nobile (ICTP) and G. Pau (Università di Bologna, Italy).

This activity in both basic and advanced networking focused on the use of radiocommunications technology. Local institutions, wanting to develop their own computer networks, chose the participants. Countries represented included Angola, Burundi, Côte d'Ivoire, Morocco, Nigeria, Romania and Senegal.

WORKSHOP ON PHYSICS OF RELIC NEUTRINOS

16 - 19 September

Organising Committee: A. Dighe (ICTP), A. Dolgov (Theoretical Astrophysics Center, Copenhagen, Denmark), M. Fukugita (University of Tokyo, Japan), E. Kolb (Fermi National Accelerator Laboratory, Batavia, USA), G. Raffelt (Max-Planck-Institut für Physik und Astrophysik, Munich, Germany), D. Sciama (Scuola internazionale superiore di studi avanzati, SISSA, Trieste, Italy), G. Senjanovic (ICTP) and A. Smirnov (ICTP).

The role of neutrinos, likely the Universe's most abundant components, is still not well understood. Increasing our knowledge of the nature of neutrinos will be a primary challenge facing physicists and astrophysicists in the next century. The goal of this workshop was to summarize current understanding of the role of neutrinos in baryogenesis, nucleosynthesis and the formation of the Universe. Possible manifestations of relic neutrinos and problems of their detection were discussed.

Joseph Silk, Dennis Sciama, David Cline, Joel Primack

INTERNATIONAL WORKSHOP ON THE OCEANOGRAPHY OF THE ADRIATIC SEA

21 - 25 September

Co-sponsors: Office of Naval Research (Arlington, USA, and London, UK), Osservatorio Geofisico Sperimentale (Trieste, Italy) and Istituto Sperimentale Talassografico-CNR (Trieste, Italy).

Directors: B. Cushman-Roisin (Thayer School of Engineering, Dartmouth College, Hanover, USA), G. Furlan (ICTP and University of Trieste), M. Gacic (Osservatorio Geofisico Sperimentale), P.-M. Poulain (Naval Postgraduate School, Monterey, USA) and R. Purini (Istituto Sperimentale Talassografico-CNR).

Mira Zore-Armanda

The workshop sought to assess current knowledge of the oceanography of the Adriatic Sea; obtain a better understanding of mesoscale variability; discuss the implications for 3D-modelling; create synergy between observations and models of the Adriatic in anticipation of the development of a Mediterranean forecasting system; examine specific subregions (for example, Dalmatian coast, Po river delta and Gulf of Trieste) to determine if they deserve additional attention; devise a blueprint for Adriatic oceanography during next decade; and discuss the integration of national and European weather and climate research programmes.

EUROCONFERENCE EMERALD ON MEDICAL RADIATION PHYSICS TRAINING

25 - 26 September

Co-sponsor: European Commission (Brussels, Belgium).

Directors: L. Bertocchi (University of Trieste and ICTP) and S.D. Tabakov (King's College London, UK).

European Medical Radiation Learning Development - EMERALD is a European pilot project, developed co-operatively by King's College London (UK), University of Lund (Sweden), University of Florence (Italy), Portuguese Oncological Institute Francisco Gentil and ICTP. The objective of the project is to develop and deliver three common transnational vocational training modules in medical radiation physics (physics of diagnostic radiology, physics of nuclear medicine, and physics of radiotherapy).

4TH WORKSHOP ON 3-DIMENSIONAL MODELLING OF SEISMIC WAVES GENERATION, PROPAGATION AND THEIR INVERSION

28 September - 9 October

Co-sponsor: European Commission (Brussels, Belgium).

Directors: S. Das (Oxford University, UK), A.L. Levshin (University of Colorado at Boulder, USA) and G.F. Panza (University of Trieste).

Director of Laboratory: B. Bukchin (Russian Academy of Sciences, Moscow, Russia).

Seismic records offer critical information about the Earth's internal structure and physical properties. To make effective use of this information requires an understanding of the physics of seismic wave generation by natural and artificial sources and the propagation of these waves through complicated Earth structures. The workshop focused on theoretical and computational issues related to this multidisciplinary research area.

PROFILE

From soccer to science, after years of isolation, Iran is sending signals that it wants to rejoin the world community. A youthful ICTP Diploma student talks about the impact that these changes may have on his life and the lives of millions of other Iranians.

Fields of Dreams

> **People danced in the streets of Tehran all night long. Dancing is illegal in Iran, but the government did not interfere. For the first time in decades, people were allowed to enjoy themselves in public.**

That's how Peyman Khorsand, an ICTP Diploma student in the high energy physics, describes events in Iran's capital city following his soccer team's victory over the United States in this year's World Cup. For Khorsand, the image hints at the changes that he would like to see take place in the years ahead.

"Iranians are dedicated to their culture and religion. But they don't want to be isolated from the rest of the world and they certainly enjoy celebrating their accomplishments. What the majority of people want, I believe, is balance in their lives and now for the first time in a long time, there are some small signs that my nation is willing to move in new directions."

Change and balance have also been major themes in Khorsand's life since he arrived at the Centre in October 1997.

"I'd never been outside of Iran until then. It was both an exciting and difficult decision. My mother was particularly sad because it meant that one of her two sons was leaving her household and wouldn't be returning for a long time. But she knew it was something I had to do."

Khorsand's journey began about a decade earlier in secondary school when his talents in physics first surfaced. "I was not much of a student during my early schooling. I liked playing soccer more than I liked studying," Khorsand recalls. "But when I moved from primary to secondary school, I became fascinated with physics. Excellent teachers helped nurture my interest."

At 17, Khorsand became one of 40 teenagers nationwide—out of a pool of 12,000—honoured as top science students in the selection process for the Physics Olympiad. When the list was pared to 7 he was still on it. Only when it was reduced to the final 5 did he fail to make the cut.

"My teachers had always been encouraging, but I didn't think I was good enough to excel among students nationwide," says Khorsand. "The competition helped build my confidence and make me realize that I wanted to pursue a career in physics." Equally important, as one of Iran's top 7 science students, Khorsand was allowed to enter the university of his choice. He selected Sharif University of Technology in Tehran, which has the nation's best physics department.

"Iranian universities offer excellent teaching, especially for undergraduates," Khorsand explains. "There's often a small group of dedicated professors who spend a great deal of time with their students. Since travel is limited and publication opportunities restricted, teaching takes precedence over research."

Yet, what works on the undergraduate level, carries serious liabilities for those seeking more advanced degrees. "Like the nation itself, scientists working in Iran are isolated from the rest of the world. Communication and interaction are the lifeblood of science. When these forces are short-circuited, research becomes impossible."

For these reasons, Khorsand was delighted to be accepted to ICTP's Diploma Course last autumn. "A poster about the programme had been tacked onto a university bulletin board and a friend of mine urged me to apply. Within a couple of months, I was on an airplane headed toward Trieste. No one was more surprised than me by the turn of events."

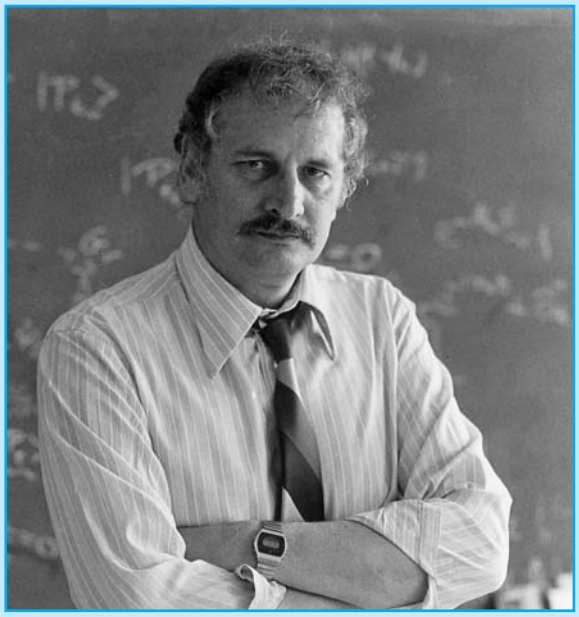
Khorsand has made good use of his time at the ICTP. Seifallah Randjbar-Daemi, head of the Centre's High Energy Section, says that he has been one the Diploma Programme's top students—in fact, the only student in his class to graduate with a straight 4.0 grade point average. Khorsand, who has completed a thesis on string theory, has been accepted to Northeastern University in the United States where he plans to pursue a doctorate degree in physics beginning this autumn. "That's where I'll go, if visa arrangements can be worked out."

Peyman Khorsand receiving the Diploma of the ICTP

"Right now, more Iranian-born physicists with advanced degrees work in foreign countries than in their homeland," says Khorsand. "Most, I believe, would come back if they were assured of reasonable working conditions. That's what I would like to do when I complete my studies."

"Perhaps what happened on the World Cup soccer field in France and then the streets of Tehran this summer will mark the beginning of changes that will slowly ripple across Iran and allow people to pursue lives that don't require them to make uneasy choices between their families and careers. I know I echo the sentiments of many Iranians when I say that's the hope for the future." □

TRIBUTE



Luciano Fonda, 1931-1998

Luciano Fonda, 67, a well-known Italian theoretical physicist and a driving force behind the ICTP since its inception, died on 21 July. He suffered a fatal heart attack while boating along the Adriatic Sea's Dalmatian coast southeast of Trieste. Born in Pula (then part of Italy, now part of Croatia), Fonda received his graduate degree in physics from the University of Trieste in 1955. He then spent several years in the United States at Indiana University in Bloomington and the Institute for Advanced Study in Princeton. After brief stints at the universities of Palermo and Parma in Italy, he became a professor at the University of Trieste, where he also headed the Faculty of Sciences. A long-time consultant to the ICTP, Fonda's name will remain forever associated with the synchrotron laboratory "Elettra," located in Trieste's Area Science Park. After being its most ardent promoter, he served in a number of administrative capacities, including the facility's vice president. GianCarlo Ghirardi, who knew Fonda for more than 35 years, offers the following tribute to his friend and colleague.

I first met Luciano in the early 1960s after he returned to Italy to teach physics at the University of Palermo and then the University of Parma. You couldn't help be impressed by his boundless enthusiasm and capacity for hard work. I remember spending hours talking about physics and jotting down formulas on either scraps of paper in our office or napkins on the dining tables where we ate. Our collaboration began in Parma and moved north when we both took positions with the University of Trieste in 1963.

Luciano's fields of interest ranged from nuclear to solid state to particle physics. He was a master at quickly acquiring the skills necessary to use complex mathematical tools for addressing difficult problems in physics. After moving to Trieste, Luciano and I worked together for a little more than a decade. During that time, we wrote some 30 papers and collaborated on a textbook, Symmetry Principles in Quantum Theory. *The book has been adopted for use in Ph.D. courses in universities worldwide.*

In the mid 1970s, our careers went separate ways. Nevertheless, both we and our families remained close. By the early 1980s, Luciano was devoting a great deal of time to launching the synchrotron laboratory "Elettra," which virtually everyone agrees is largely a product of his wisdom, energy and commitment. A quarter century after I was fortunate enough to meet him, Luciano's enormous talents as a scientist and administrator were again on display. The truth is, these talents were always self-evident to those who befriended and worked with him. He was a moving force in the emergence of Trieste as one of Italy's prime scientific research centres. In fact, he served as director and then president of the University of Trieste's Consortium for the Development of the Physics Departments, the administrative body that owns the buildings which house ICTP's offices.

Despite all of his accomplishments, Luciano possessed uncommon warmth and humility. A man of inexhaustible vitality, his death came as a shock to all who knew him. I am sure that I speak for the entire scientific community in Trieste and throughout the world when I express my sorry for his loss, yet my delight for having been his friend and colleague for so many wonderful years.

GianCarlo Ghirardi
Director, Department of Theoretical Physics,
University of Trieste
Head, ICTP Associate and Federation Schemes

Visiting Ambassadors

Hedayatzadeh Rozavi, Iran's Ambassador to Italy, recently visited the ICTP to discuss the possibility of wider cooperation between the Centre and the government of Tehran. The Ambassador told ICTP Director, Miguel Virasoro, that Tehran would like to increase the number of young researchers coming to study in Trieste through additional fellowships sponsored by the Iranian government. The arrangement would be similar to those the Centre currently enjoys with several other countries, including Argentina, China and India. About 50 Iranian scientists presently come each year to study at the ICTP.

Kalarickal Pranchu Fabian, India's Ambassador to Italy, also recently met with ICTP Director and the Head of ICTP Mathematics Section, M.S. Narasimhan, to discuss present and future partnerships between the ICTP and India's scientific community. The Ambassador was particularly interested in the role that the Centre has played in the training of young Indian scientists and how that role may be expanded in the future. Since 1986, some 250 Indian scientists on average have visited the Centre each year. That represents one of the largest national contingents of scientists within the ICTP.

7 - 9 October

Workshop on Fusion Related Physics and Engineering in Small Devices

12 - 30 October

Third School on Nonlinear Functional Analysis and Applications to Differential Equations

12 October - 6 November

Fifth College on Microprocessor-Based Real-Time Systems in Physics

19 October - 6 November

Experimental Workshop on High Temperature Superconductors and Related Materials (advanced activities), to be held in Bariloche, Argentina

2 - 20 November

Course on Mediterranean Sea(s) Circulation and Ecosystem Functioning

9 November - 4 December

ICTP-UNU-Microprocessor Laboratory Fifth Course on Basic VLSI Design Techniques

16 - 20 November

Workshop on Reactor Simulation Training and Utilization

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.

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