NEWS from ICTP

the
abdus salam
international centre for theoretical physics

SUMMER
1998

#85

"Neutrinos: they are very small / they have no charge; they have no mass; / they do not interact at all." These verses, written by the well-known American author John Updike, may now have to be revised in light of a recent discovery by physicists in Japan.

Filling the Void

"The Universe May Never Be the Same."

That was the front-page headline in the *New York Times* and hundreds of other newspapers around the world in early June.

The same level of excitement took place in scientific centres and laboratories across the globe, including at the ICTP, where several of our scientists now have an opportunity to see the experimental confirmation of their theories.

What's behind the headlines and excitement? A team of 120 scientists from the United States and Japan announced that the Super-Kamiokande experiment in Takayama, Japan, showed that neutrinos oscillate. This means they may periodically convert from one form into another. Such behavior is a tell-tale sign of mass.

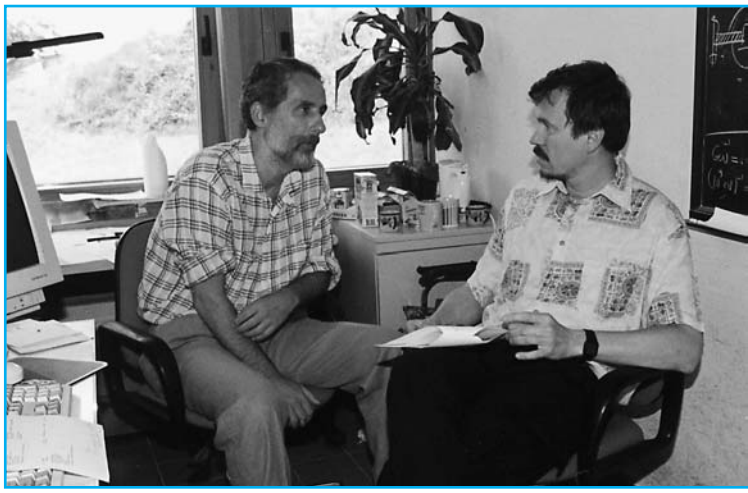
The topic of neutrino oscillation has interested ICTP staff scientist, Alexei Smirnov, for more than a decade. In 1985, he proposed an elegant solution for the so-called neutrino solar deficit. Scientists know that the number of neutrinos arriving on Earth is too small to account for the number of neutrinos created by nuclear reactions that take place in the centre of the Sun. The unanswered question has been what happens to these neutrinos.

Following the concept first proposed by the Italian physicist Bruno Pontecorvo, Smirnov developed a model explaining why solar-created neutrinos may oscillate on their journey from the Sun to Earth. That is, why neutrinos are transformed from one type into another and thus become difficult to detect. Neutrinos, in fact, exist in three different forms or flavours: electron, muon, and tau (there may also be a fourth flavour, sterile).

Now Smirnov's theory appears on the verge of confirmation. Nevertheless, much work remains to be done because the parameters of the observed oscillations, uncovered in experiments, still must compare to the parameters proposed in theories. Moreover, if neutrinos oscillate, they must have mass. The experiment in Japan offered indirect proof of neutrino mass.

Goran Senjanovic, also a staff scientist at the ICTP, has studied the origin of neutrino mass since the late 1970s, when with Gustavo Branco he published the first paper on the issue of neutrino mass in the context of modern gauge theories. Soon after, with Rabindra Nath Mohapatra, he coauthored a paper on the so-called see-saw mechanism of neutrino mass.

And why is the experimental discovery so important? Because such a finding, if confirmed, would not only require us to add new chapters to textbooks on particle physics but could have a dramatic impact on how we view the expansion of the Universe.



Goran Senjanovic and Alexei Smirnov

More specifically, if neutrinos have mass, it will cause us to rethink—and modify—one of the fundamental pillars of modern physics, the Standard Model, which describes the interactions of elementary particles and assumes that neutrinos have no mass. And, although neutrinos may have a mass billion times less than electrons, they have emerged as the most likely candidates for so-called "dark matter" because they fill every corner of the Universe.

As a result, understanding the properties of the Universe's lightest particles could help explain the behavior of the Universe's deepest void. That's the kind of finding that brings headlines to newspapers around the world and raises the level of excitement among scientists. For physicists, the finding that neutrinos have mass could well be a dream come true, which allows the rest of us to dream about the Universe in ways that we could have never dreamed before. □

Rod Serling, creator of The Twilight Zone, spoke of a fifth dimension—imagination. Today, string theorists speak of 11 dimensions. If the latter's theories prove correct, our view of the physical universe will be altered in ways that only the likes of Rod Serling could imagine.

The Spirit of the Strings

> **"There are times when mathematical beauty should take priority over agreement with experiment, Nobel Laureate Paul A.M. Dirac observed many decades ago."**

It is only fitting that the awarding of the ICTP Dirac Medal, which is named in his honour, should reflect the sentiments found in this statement. Since 1985, the medal has been given each year to noted theoretical physicists and mathematicians. Many of the winners have made their mark in string theory—a relatively new area of research that has been largely driven by the "beauty" of mathematical calculations. Indeed, ICTP's Director, Miguel Virasoro helped to launch the study of string theory some 25 years ago when he devised a number of inter-related math equations that ultimately bore his name: Virasoro algebra.

Mathematical elegance is one factor that has made string theory such a unique area of inquiry for physicists. In the past, the frontiers of physics were driven largely by abstract perceptions: the ability of the world's most renowned physicists—from Newton to Einstein—to see elements of the physical world that no one else could. Equations and experimentation came later, either confirming or denying the theories that had been proposed.

The study of string theory has turned this conventional thought process on its head. String theory's initial goal was to explain the concept of duality in strong interactions. The real excitement, however, came when scientists realized that string theory provided the only consistent way to unify the two great discoveries of physics in the 20th century–Einstein's theory of gravitation and quantum mechanics. This unification, in turn, revealed the elegant mathematical structure behind the theory.

As a result, string theory–born from a desire to more clearly explain our physical universe–has been largely driven by mathematics. And that's likely to remain the case in the decades in the decades ahead. As Edward Witten, the world-renowned Princeton physicist and 1985 winner of the Dirac Medal, wryly notes: "String theory requires applying bizarre math to physics."

The second aspect of string theory that has excited physicists around the globe is the continual element of surprise that accompanies the research. "We will be looking for one thing and the math will lead us in an entirely new direction. String theory seems to have a mind of its own and scientists are often left in the position of letting the math speak for itself," says Peter Goddard, Master of St. John's College at the University of Cambridge who with David Olive, a physicist at the University of Wales, shared the 1997 Dirac Medal.

What are we to make of this new theory of the strings that is driven by "bizarre" math and follows an "unpredictable logic" of its own? What difference does it make if the atoms of our physical world consist of loops instead of dots or if we live in 11 dimensions instead of four, especially if seven of those dimensions are so compacted that they remain completely removed from observable reality?

The simple answer would be this: Virtually every fundamental breakthrough in theoretical physics has ultimately found its way into applications that have changed the world. Einstein's theory of relativity helped unlock the keys to nuclear energy. Quantum physics led to the development of semiconductors and lasers.

But to tout theoretical physics' practical impacts is to do it an injustice. Mind-bending breakthroughs in theoretical physics have forever altered the way we view our world—and that has had untold effects on how we lead our lives and think of our place in the universe. At its highest order of thought, the pursuit of theoretical physics touches the core of our beliefs, which may be precisely what makes the study of string theory worthwhile. □

GianCarlo Ghirardi
is professor of physics at the University of Trieste and head of ICTP's Associate and Federation Schemes.

Hailed as its greatest success, the Associate Scheme has been at the core of Centre efforts since the ICTP's inception. Now changes are underway to ensure that the programme continues to fulfil its mandate in the face of a rapidly changing world.

Youth to be Served at ICTP

There have been several thousand worldwide-accomplished scientists largely working in developing countries with careers that may have been short-circuited if not for the Centre's Associate Scheme.

Over the past three decades, the programme has provided a refuge for scientists from the South by enabling them to keep abreast of the latest developments in their fields without having to permanently leave their native countries. ICTP Associates, in turn, have often become the Centre's most earnest supporters—goodwill ambassadors who spread the word about the ICTP across the globe.

To ensure that the programme continues to play a vital role in upgrading the skills of scientists throughout the developing world, ICTP Director Miguel Virasoro has launched a series of wide-ranging reforms. What's behind these changes?

For one thing, the average age of the Associates has been inching up over the years and now stands at 48.

At one level, this trend reflects the programme's success. Most applications for the Associate Programme have come from mid-career scientists in the South who have developed an extensive list of publications. The emphasis on publications has served us well in the past, but it now threatens to undermine one of the programme's major goals: to assist young scientists from the developing world during the earliest stages of their careers.

That's why the Centre has revised its criteria for membership in ways that are intended to reduce the average age of our Associates (see "Scheme for the Ages"). Our goal is to provide promising young scientists—many of whom are long on potential and short on publications—with an

First Young Student

Horacio German Casini, a theoretical physicist from Argentina, is the first Young Student to visit the ICTP under the Centre's new Associateship Scheme. Nominated by ICTP Regular Associate Cesar Fosco, Casini arrived the second week of June. He remained in Trieste until 20 July to attend the Introductory School on String Theory and the Summer School in High Energy Physics and Cosmology.

Horacio German Casini

Several days before his arrival, a team of Japanese/American experimental physicists, working in Takayama, Japan, announced tests at their facility showed that neutrinos oscillate—and therefore have a mass. The finding, which carries wide-ranging implications for physics, thrilled Casini because neutrinos are his major field of research.

"The finding may lay to rest one of the most perplexing questions facing physics today, but that's not the end of the story," Casini says. "Experimental physicists may now have shown that neutrinos oscillate, but theorists are still trying to figure why they oscillate. The latter is a fundamental question requiring both an intense examination of basic principles and the use of computer models."

Casini, who was born in San Nicolas, near Buenos Aires, presently works at the Institute Balseiro, part of the Atomic Centre of Bariloche in Northern Patagonia, in southern Argentina. Besides his interests in neutrinos, he has published several research papers on astrophysics addressing such topics as the Big Bang and the neutron stars.

What's the situation for young physicists in Argentina today? "Money is always an issue," says Casini. "But the most serious problem is that the average age of our researchers is increasing. For example, at Argentina's National Commission for Scientific and Technical Research (CONICET), it's more than 45. As a result, young people have great difficulty securing permanent employment."

"Coming to Trieste has been a wonderful opportunity," Casini says. "I 've been able to learn more about my field from accomplished teachers and to meet people from many different cultures. It was great fun to have a beer in the evening with my colleagues while watching the World Cup. The memories will last a lifetime–and I hope the friendships will too."

Scheme for the Ages

To meet the needs of younger scientists and to expand research opportunities for all our Associates, the Centre has made the following changes in its Associate Scheme:

• **Junior Associates** may be no more than 35 years old at the time of their six-year appointment. In addition to a book and journal allowance of L. 700,000 a year that they have received in the past, they will now be entitled to the same privileges as Regular Associates. That means they may visit ICTP on three different occasions over a six-year period. The Centre will pay their airfare and provide them with a daily stipend of L. 65,000. Each visit may last from six weeks to three months. The total length of their visitation during their appointment may not exceed 270 days.

• **Regular Associates** may range in age from 36 to 45 at the time of their appointment. Their privileges will remain the same as in the past, including the right to visit ICTP on three different occasions over a six-year period. To counteract the impact of inflation, they will receive a modest increase in their daily stipend.

• The most significant change for Regular Associates—and perhaps for the entire Associate Scheme—is the creation of a new category of participation for young students. Regular Associates will now be able to nominate three **Young Students**. These young students, who must be 32 or younger, may visit the Centre to attend an activity or to accompany the Regular Associate who has nominated them. The ICTP will pay for the student's airfare and provide each student with a daily stipend.

• **Senior Associates**, who may range in age from 46 to 62, will have their total allocation rise from L. 8,000,000 to L. 11,000,000. Their daily stipend will increase to take account of inflation.

opportunity to join the ranks of our Associates. In effect, the programme will increasingly become a pathway for professional growth among youthful scientists in addition to a destination for mature and accomplished ones.

At the same time that the Centre seeks to attract younger scientists into its fold, ICTP is also "inviting" research institutions from the North to become partners in its Associate Scheme. Our new "Partners" will be asked to "host our Associates and make training programmes and research facilities available to them." The arrangement will take the form of a Memorandum of Understanding that will outline the responsibilities of both ICTP and its partners, including provisions for cost-sharing.

We're convinced that our "partnership" initiative will enlarge opportunities for our Associates by providing them with access to worldclass facilities where research directly related to their fields is taking place. It's a "win-win" situation that will broaden the reach of the ICTP while improving the depth of its instruction.

Our partnership initiative is being driven by the realization that scientific research is becoming increasingly globalized and now is the time for the Centre to reach out to institutions in the North. By providing Associates with opportunities to work in state-of-the-art research facilities in their fields, we will be providing an invaluable service to our scientists.

The bottom line is this: The world of science has changed and the ICTP Associate Scheme must change to keep pace with the new challenges and new opportunities that have emerged since the programme was put in place more than 30 years ago.

All these efforts will literally put a new, younger face on the ICTP. In particular, the expanded privileges afforded our Junior Associates, the age limits placed on our Regular and Senior Associates and the launching of our Young Student initiative will create a more youthful pool of Associates. At the same time, our "partnership" programme will extend the borders of our Associate Scheme to scientific research centres and university campuses around the world.

These changes are the most significant alterations in the Associate Scheme since its inception in 1964. The central role that the Associate Scheme plays within the ICTP means that virtually all aspects of Centre activities—from housing to travel to library use—will be effected.

Change represents not only challenge but opportunity. The Associate Scheme's new provisions are driven by a simple, yet lofty, goal: to allow the programme to remain at the forefront of global efforts designed to help scientists in the developing world. □

Charles Chidume
is Co-ordinator of the ICTP Diploma Programme in Mathematics.

Math professors in Africa have become an "endangered species." Unless immediate steps are taken to reverse this trend, Africa may not be able to develop an adequate pool of skilled workers to meet the challenges of the 21st century.

Africa's Future Discounted by Math Crisis

> **You can't expect students to do math for the fun of it. In fact, math's not much fun when you have few resources while in school and limited job prospects afterwards that offer only low pay and bad working conditions.**

That's Charles Chidume's shorthand explanation of what is driving the crisis in mathematics currently afflicting universities across sub-Saharan Africa.

For the past five years Nigerian-born Chidume, who coordinates the Diploma Programme for the ICTP's Math Group, has led a campaign to reverse the declining fortunes of mathematicians in Africa. Some of the statistics he has uncovered are startling. Zimbabwe, a nation of 11 million people, has only three fully trained mathematics professors. The same number holds true for Kenya, a country of 27 million people. And Ghana, with 17 million people, has none at all.

"The situation is disastrous," laments Chidume. "Universities throughout sub-Saharan Africa are starving for competent math lecturers. Their absence means that students in all fields of endeavour are not receiving the skills they need to succeed in our highly competitive and complex world."

"The problem is compounded by the fact that mathematics departments in Africa no longer attract the best and brightest students. In fact, math has become the major of last resort and often serves as dumping ground for our worst university students."

With teachers in such short supply and marginal students roaming the hallways, it should not be surprising to learn that other disciplines—most notably, engineering and computer science—have become more attractive for African students seeking to major in technical fields.

"The sad truth is that mathematics is no longer considered a worthwhile profession," Chidume adds. "The only jobs awaiting students when they complete their doctorates is teaching. And everyone knows working conditions in African universities are bad and the pay is pitiful."

Although the problem has become particularly acute over the past decade, Chidume notes that the root causes of the crisis lie in a series of events that have unfolded over a long period of time.

"Africa's chronic instability has adversely effected universities in general and mathematics departments in particular," Chidume notes. "Tribal warfare in Rwanda, for example, has shredded the social fabric of that nation and left universities in a state of chaos. Political unrest in Liberia has had a similar effect. It's virtually impossible to acquire adequate resources in such an environment or to create a nurturing atmosphere that's so crucial for learning," Chidume says.

The end of the Cold War, moreover, has made it even more difficult for African universities to receive much-needed funding from the North. International aid for the developing world has declined precipitously since the late 1980s and universities have not been exempt from this distressing trend.

The rise of other scientific fields—for instance, computer science and biotechnology—has added to the woes of university mathematics in Africa. As Chidume observes, "such trends do not mean that math is no longer valued but it does suggest that other technical fields are valued more, especially when majoring in these fields usually leads to better paying and more secure jobs."

So, what's to be done? Surely, African nations themselves must devise more effective strategies for encouraging their better students to pursue careers in mathematics. At the same time, they must take steps that encourage those who earn advanced degrees in mathematics—whether in Africa or elsewhere—to pursue their careers in their native countries.

Chidume notes that "boosting salaries and providing a more hospitable environment would help ease the crisis. Such measures would likely encourage African mathematics

professors currently working abroad to return home. At the same time, these measures would help attract better students, making teaching more enjoyable and more rewarding."

Yet, Chidume adds that "the problem is so immense that the North's help must be solicited if we have any chance of meeting the challenge."

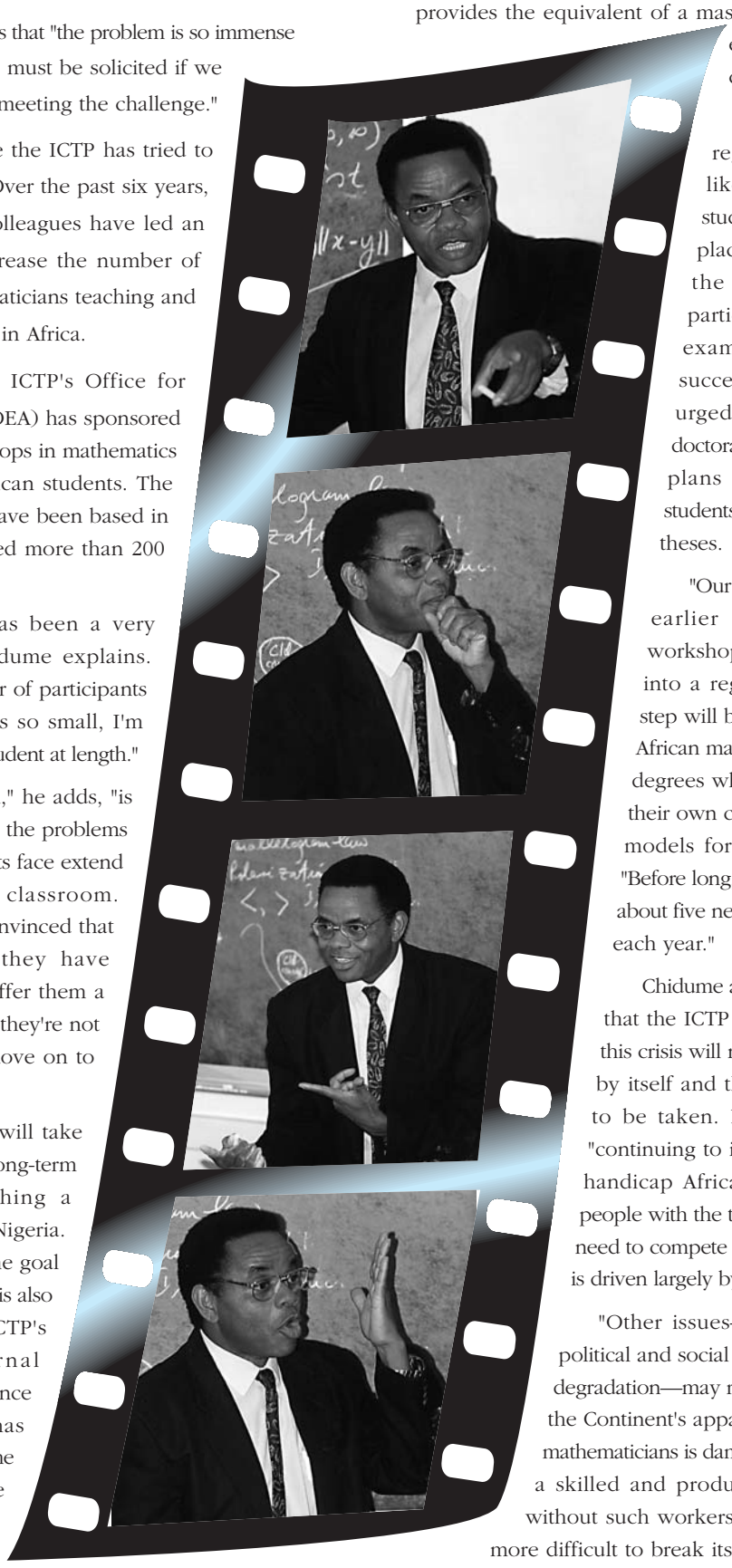
And that's where the ICTP has tried to make a difference. Over the past six years, Chidume and his colleagues have led an effort to slowly increase the number of well-trained mathematicians teaching and conducting research in Africa.

Since 1995, the ICTP's Office for External Activities (OEA) has sponsored four regional workshops in mathematics for sub-Saharan African students. The workshops, which have been based in Ghana, have attracted more than 200 participants.

"The process has been a very personal one," Chidume explains. "Because the number of participants in each workshop is so small, I'm able to talk to each student at length."

"Such interaction," he adds, "is often critical because the problems workshop participants face extend well beyond the classroom. Students must be convinced that the career paths they have tentatively chosen offer them a reasonable future. If they're not convinced, they'll move on to other fields."

This year, ICTP will take a second step in its long-term strategy by launching a regional college in Nigeria. Chidume says that the goal of the college, which is also being funded by ICTP's Office of External Activities, "is to advance the progress that has been made through the workshops. At the college, the most promising workshop participants will be given ongoing opportunities to exchange ideas and learn from one another. In addition, the best African math students in ICTP's Diploma Programme, which provides the equivalent of a master's degree, will also be encouraged to attend the college."



Charles Chidume

The first session of the regional college, which is likely to include some 15 students, is scheduled to take place in December 1998. At the college's conclusion, participants will be given an examination and the most successful candidates will be urged to enroll in university doctorate programmes. The ICTP plans to further assist these students in the preparation of their theses.

"Our math-crisis initiative began earlier this decade with our workshops. Now it has expanded into a regional college. The final step will be to produce well-trained African math lecturers with doctorate degrees who are eager to remain in their own countries and serve as role models for others," Chidume says. "Before long, we hope to be graduating about five newly minted Ph.D.s in math each year."

Chidume acknowledges "the strategy that the ICTP has devised to deal with this crisis will not overcome the problem by itself and that other steps will have to be taken. But he also warns that "continuing to ignore the issue will only handicap Africa's efforts to provide its people with the training and skills that they need to compete in a world where progress is driven largely by science and technology."

"Other issues—nutrition, health care, political and social unrest and environmental degradation—may receive more attention, but the Continent's appalling shortfall in qualified mathematicians is damaging its ability to develop a skilled and productive labour force. And without such workers, Africa will find it much more difficult to break its chronic cycle of poverty and hopelessness." □

DATELINE

Scientific Council

Miguel Virasoro and Praveen Chaudhari

The ICTP's Scientific Council held its 27th meeting on 3-4 June to discuss the Centre's accomplishments during the past year and its plans for the coming year. Director Miguel Virasoro opened the meeting with an hour-long discussion of the changes that have taken place within the Centre since the Council last met. He highlighted the Centre's "Call for Proposals," which he noted was designed to expand the range and scope of ICTP's research activities. He also pointed to the expansion of ICTP's Weather and Climate Group, headed by Filippo Giorgi, who recently joined the Centre's scientific staff, and the imminent launch of the ICTP's Synchrotron Radiation Group, which will be a joint venture with ELETTRA Synchrotron Laboratory in Trieste. Virasoro also cited the physical improvements that have been made—and will continue to be made—to the Centre's guesthouses and offices. Such improvements, Virasoro noted, will allow the Centre to treat its visiting scientists with "the respect and dignity" that Abdus Salam believed would be a key to ICTP's success. Praveen Chaudhari, former Vice President of Science for IBM's Thomas J. Watson Research Centre, in Yorktown Heights, New York (USA), presided over his first Council meeting. Chaudhari replaced J. Robert Schrieffer, professor at Florida State University's National Magnetic Field Laboratory in Tallahassee, Florida (USA). Schrieffer, a Nobel Prize winner, had chaired the Council since 1993.

The Scientific Council

Winds of Change

Filippo Giorgi

Italian-born Filippo Giorgi, who has worked at the U.S. National Center for Atmospheric Research in Boulder, Colorado, for the past 14 years, has returned to Italy, to become the first director of ICTP's Physics of Weather and Climate Group. At the same time, Fedor Mesinger, a Serbian-born scientist, who is currently a senior researcher with the U.S. National Weather Service, will join the group as a visiting scientist. Their addition will set the stage for an expansion of weather- and climate-related research and training activities at the Centre, a goal which the Scientific Council has urged the ICTP to take. By fall, the group hopes to be fully staffed with the addition of one full-time senior scientist, two support scientists and two postdocs. A major focus of the group will be the development and application of Regional Climate Models (RCMs) used to forecast and analyze climate change at such regional scales as the Mediterranean and sub-Saharan Africa.

Call for Proposals

The ICTP has issued a “Call for Proposals” that has been published in some of the world’s most prestigious scientific journals and newsletters, including *Physics Today*, *CERN Courier* and *Europhysics News*. Broadly speaking, the announcement urges scientific institutions and individual scientists to join the Centre in its ongoing efforts to aid scientists in the developing world. More specifically, the announcement invites scientific institutions in the North to become "partners" in the ICTP’s Associate Scheme (see "Youth to be Served", page 4). It urges Northern institutions to join the Centre’s networks. It encourages researchers from the developed world to teach at ICTP’s affiliated centres. And it solicits submissions for the organization of Centre schools, conferences and workshops. The proposals are expected to be submitted over the course of 1998. The partnerships will begin in January 1999. For additional information, please contact proposals@ictp.trieste.it or browse the Centre’s WEB page at http://www.ictp.trieste.it/proposals/.

Scoop on Soil

ICTP's involvement in soil science research began in 1983, when the Centre hosted its first College on Soil Physics. The most recent session, which took place in April, focused on the critical importance of improving our understanding of soil properties and processes—not only as chemical and geological phenomena but also as matters of physics. Such knowledge should prove particularly important to the developing world as it seeks to meet the challenges of feeding its rapidly growing populations.

Lectures and seminars at the College, attended by more than 50 researchers from 25 countries in Africa, Asia, Latin America and Eastern Europe, explored the impacts that erosion, fertilizers, drainage, pesticides and pollution have on soil quality worldwide. Particular attention was paid to the roles played by instrumentation, measurement and modelling.

In addition, the College focused on two geographical areas—the tropics and the Mediterranean—where the quality of the soil is at risk. Human deforestation, which is a recent phenomenon, and intense storms, which have occurred since the beginning of time, are causing serious erosion problems in tropical regions, particularly in the developing world. Excessive irrigation in the Mediterranean, on the other hand, has caused a rapid rise in the salinity levels of soil throughout the region. Unless these trends are reversed, agricultural productivity in both places will decline dramatically.

Soil, which has been studied for some 4000 years, will undoubtedly remain a critical object of scientific inquiry for thousands of years to come. Like the air we breath and the water we drink, there are few other global resource issues that warrant more serious attention.

Tragedy in Campania

The tragic mudslides that struck the Italian region of Campania, on 4 May, killing 161 people, were caused by a small-scale, but unusually intense storm that began two days earlier in Algeria and then swept northeastward across the Mediterranean, picking up punch all along the way. That's the conclusion of Oreste Reale, a scientist with the ICTP Physics of Weather and Climate Group.

"Mediterranean weather systems," he says, "often spawn small-scale, hurricane-like cyclones that can only be detected by the most sophisticated satellite and computer equipment." Reale goes on to note that the state-of-the-art model at the National Center for Environmental Predictions in the United States had forecast dangerous weather conditions for Campania. However, staff members at weather stations and meteorological research centres closer to the site failed to recognize the full extent of the risk.

Reale, one of the first scientists to analyze small-scale, hurricane-like, cyclones in the Mediterranean region, was asked to assess the weather conditions that led to the tragedy by Italy's National Research Council (CNR) and National Council for Hydrologic Disasters (GNDCI). He concluded that unlike a few years ago, "the sophisticated technology now available makes it possible to predict these dangerous events. To take advantage of this progress," he adds, "we must now build the technical facilities and provide the appropriate meteorological training within the region. Such measures will reduce the risk of repeating this tragedy in the future." A full text of the report may be obtained by contacting Reale via e-mail at reale@ictp.trieste.it.

Statistics OEA 97

OFFICE OF EXTERNAL ACTIVITIES (OEA) 1997

The ICTP Office of External Activities (OEA), established in 1985, seeks to promote scientific cooperation in the South through its suport of scientific meetings, networks, affiliated centres and visiting scholars. OEA activities are initiated by scientists and scientific institutions in the developing world and carried out at sites located within the region.

A major portion of the funding for OEA Office comes from the Department of Research Cooperation (SAREC) of the Swedish International Development cooperation Agency (SIDA).

For additional information about OEA, please contact the secretariat at oea@ictp.trieste.it

OEA ... by the numbers

78 Scientific meetings in 37 countries
10 Networks
12 Affiliated Centres
7 Visiting Scholars/Consultants

Design: G. Gamboz/ICTP

REPORT ON REPORTS

TRIESTE CONFERENCE ON SUPERFIVEBRANES AND PHYSICS IN 5+1 DIMENSIONS

1 - 3 April

Directors: M.J. Duff, C.N. Pope, E. Sezgin (Texas A&M University) and G. Thompson (ICTP).

This Conference, a follow-up to Trieste Conference on "Supermembranes and Physics in 2+1 Dimensions," examined the most recent developments in the six-dimensional models of M-theory. The Conference was designed for theoretical physicists and mathematicians knowledgeable in quantum physics, string theory and relativity. Main topics included M-theory fivebranes, fivebranes and self-dual strings, anomalies and new theories in six dimensions, matrix models and Seiberg-Witten theory.

COLLEGE ON SOIL PHYSICS

14 - 30 April

Directors: D. Gabriels (Department of Soil Management and Soil Care, University of Ghent, Belgium), G. Ghirardi (University of Trieste and ICTP), D. Nielsen (Department of Land, Air and Water Resources, University of California, Davis), I. Pla Sentis (Facultad de Agronomia, Universidad Central de Venezuela, Maracay) and E. Skidmore (U.S. Department of Agriculture, Manhattan, Kansas).

The College—part descriptive, part analytical—offered participants detailed data on physical properties and behavior of soil. The goal was to relate general information about soil to issues involving agronomy, engineering and the environment. Specific topics focused on drainage, irrigation, erosion, fertilization and soil pollution. Attention was given to practical applications, instrumentation, measurement techniques and modelling. *See "Scoop on Soil", Page 9.*

MECO 23 (MIDDLE EUROPEAN COOPERATION IN STATISTICAL PHYSICS)

27 - 29 April

Directors: A. Maritan (International School for Advanced Studies, SISSA, Trieste), C. Micheletti (SISSA, Trieste), A. Rigamonti (Università di Pavia, Italy) and V. Tognetti (Università di Firenze, Italy).

In cooperation with SISSA.

The history of Middle European Cooperation in Statistical Physics (MECO) dates back to 1974 when the group's first conference was organized in Vienna. Since then, MECO has held conferences virtually every year at various sites across Europe. The goal of the organization and, more specifically, of the conferences is to bring together theoreticians and experimentalists working in the fields of statistical physics, phase transitions and critical phenomena. This Conference was open to scientists from the European Union (EU) and EU Associated Member countries. The three-day programme consisted of invited talks and poster sessions dealing with non-equilibrium phenomena, soft condensed matter, protein folding, complexity, low-dimensional magnetic systems and reaction-diffusion.

SPRING COLLEGE ON STATISTICAL MECHANICS AND DYNAMICS OF SOFT CONDENSED MATTER

4 May - 5 June

Directors: S. Ramaswamy (Indian Institute of Science, IISC, Bangalore), M.E. Cates (Edinburgh University), N.V. Madhusudana (Raman Research Institute, Bangalore) and A. Vespignani (ICTP).

The field of soft condensed matter crosses paths with many other subjects, including suspensions, surfactant solutions, emulsions and foams, liquid crystals, polymers and membranes. Soft condensed matter is not only a rapidly developing field that touches many other disciplines, but it involves a close interplay between theory and experimentation. Lectures presented at the College introduced participants to the most recent developments in the field and offered comprehensive training in the physics of soft condensed matter and complex fluids. In addition to the lectures, the College included seminars on a variety of related research topics.

Andrea J. Liu

SECOND ANTONIO BORSELLINO COLLEGE ON NEUROPHYSICS: 'PLASTICITY OF SENSORY-MOTOR SYSTEMS'

18 May - 5 June

including

MINI-SYMPOSIUM ON NEW APPROACHES TO THE PLASTICITY OF SENSORY-MOTOR SYSTEMS

3-5 June

Directors: J. Chela-Flores (ICTP and Instituto Internacional de Estudios Avanzados, Caracas), M. Diamond (International School for Advanced Studies, SISSA, Trieste), J.H. Kaas (Vanderbilt University, Nashville, Tennessee) and W.C. Hall (Duke University, Durham, North Carolina).

The College explored the relationship between sensory information and motor systems, which scientists concur plays a critical role in behavior. The following topics were highlighted: visual processing of space and motion; auditory coding; taste and smell; attention, memory and learning; motor control and brain processing; and development, plasticity and imaging. The College attracted scientists specializing in neurology, psychology and psychophysics as well as researchers and technicians involved in neuroimaging.

SUMMER COLLOQUIUM ON THE PHYSICS OF WEATHER AND CLIMATE: "THE EFFECT OF TOPOGRAPHY ON THE ATMOSPHERIC CIRCULATION"

8 - 19 June

and

CONFERENCE ON "THE ROLE OF TOPOGRAPHY IN MODELING REGIONAL WEATHER AND CLIMATE"

22 - 26 June

Co-sponsor: International Research Institute for Climate Prediction (IRI), Palisades, New York State.

Organizing Committee: F. Giorgi (ICTP), F. Mesinger (National Center for Environmental Prediction, NCEP, Camp Spring, Maryland), I. Orlanski (Geophysical Fluid Dynamics Laboratory, GFDL, Princeton, New Jersey), G. Sommeria (CNRM/Meteo-France, Paris) and S. Tibaldi (ARPA—Servizio Meteorologico Regionale, Bologna, Italy).

Directors: G. Furlan (ICTP and University of Trieste), F. Giorgi (ICTP) and I. Orlanski (GFDL/NOAA, Princeton University, New Jersey).

The Colloquium, designed for scientists and graduate students working in meteorology, oceanography, physics and applied mathematics, attracted scientists interested in the modeling and assessment of weather and climate on a regional scale. It provided participants with useful background information for the Conference held one week later. The Conference itself focused on recent developments in weather forecasting and climate change in mountainous regions. Specifically, conference participants examined limitations of both Global Climate Models (GCM) and Local Area Models (LAM) for weather forecasting and climate simulation in high terrains. Among the topics discussed were atmospheric circulation and surface climate in mountain ranges; effects of topography on different scales of atmospheric circulation; success of GCMs and LAMs in simulating weather and climate in high altitude areas.

ADRIATICO RESEARCH CONFERENCE ON "COMPLEX FLUIDS FAR FROM EQUILIBRIUM"

9 - 12 June

Directors: S. Ramaswamy (Indian Institute of Science, IISC, Bangalore), M.E. Cates (Edinburgh University), N.V. Madhusudana (Raman Research Institute, Bangalore) and A. Vespignani (ICTP).

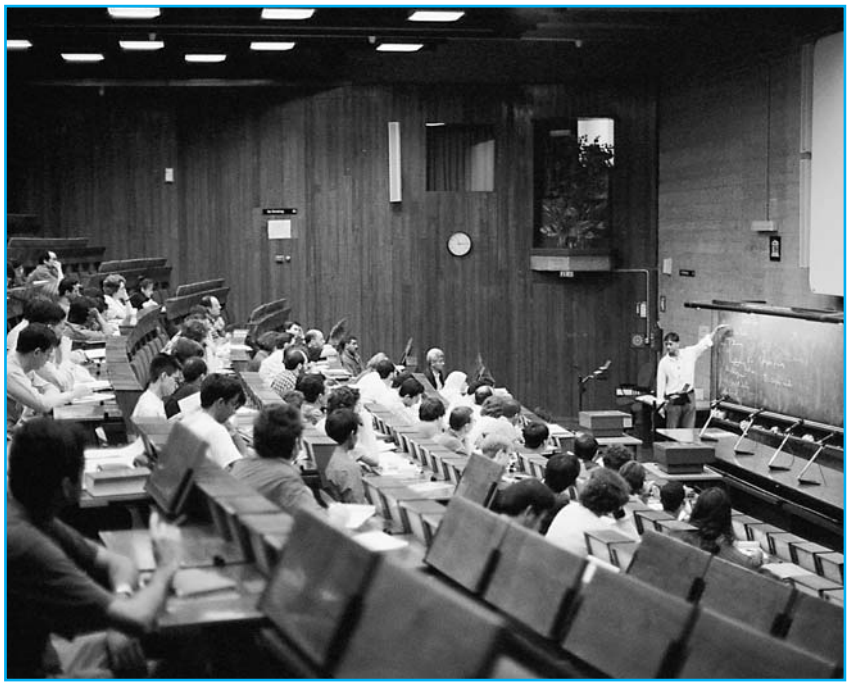
Soft condensed matter provides ideal laboratories for the study of strongly nonequilibrium phenomena. Over the years, scientists have discovered many new effects, including shear-melting of colloidal crystals, giant fluctuations in

INTRODUCTORY SCHOOL ON STRING THEORY

8 - 19 June

Directors: E. Gava (Italian National Institute of Nuclear Physics, INFN, Trieste), K.S. Narain (ICTP) and S. Randjbar-Daemi (ICTP).

The School provided an introduction to string theory for beginning students. It opened with discussions of the quantization and compactifications of strings and then explored recent developments in the field, including string dualities, D-branes and black holes.



Introductory School on String Theory

sheared semidilute polymer solutions, "budding" of vesicles, columnar structures in bidisperse sedimentation and "onion" formation in sheared lamellar phases. The field, which is multidisciplinary, draws heavily on chemical engineering and membrane biology. The Conference brought together researchers in this field and specialists in statistical mechanics. Participants presented their latest work on the subject and reviewed the status of still unsolved problems. Topics included biophysics, powder flow, semiflexible network polymer dynamics, instabilities in nematodynamics, supercooled liquid rheology and colloids.

III TRIESTE CONFERENCE ON STATISTICAL FIELD THEORY

22 - 26 June

Directors: A. LeClair (Cornell University, Ithaca, New York), A.W.W. Ludwig (University of California at Santa Barbara), G. Mussardo (International School for Advanced Studies, SISSA, Trieste) and Yu Lu (ICTP).

The purpose of this interdisciplinary Conference was to bring together leading experts working at the interface of statistical mechanics, condensed matter physics and quantum field theory. The Conference surveyed the current status of this rapidly developing area and sought to identify promising future directions. Topics included quantum hall effect, mesoscopic systems, turbulence, quantum spins, integrable quantum field theory and exact S-matrices, boundary field theory, quenched disordered systems and lattice statistical models.

WORKSHOP ON "THE PHYSICS OF THE ELECTRONIC BEHAVIOR IN THE CORE REGION: ALL-ELECTRON LAPW ELECTRONIC STRUCTURE CALCULATIONS"

22 June - 4 July

Directors: P. Blaha (Technische Universität Wien, Vienna, Austria), J. Kohanoff (ICTP), C.O. Rodriguez (Instituto de Física de Líquidos y Sistemas Biológicas, IFLYSIB, La Plata, Argentina) and K. Schwarz (Technische Universität Wien, Vienna, Austria).

The Workshop focused on recent progress in developing density functional calculations using the Linearized Augmented Plane Wave (FP-LAPW) method as embodied in the WIEN97 code. This methodology is considered one of the most precise electronic structure tools in condensed matter physics. The Workshop provided an introduction to density functional theory (DFT) and band structure methods, in general, and LAPW method with corresponding algorithms, in particular. It also dealt with applications related to the WIEN97 code. Lecture topics included concepts and fundamentals of LAPW and the WIEN97 code; LAPW applications for phonons and optics; graphical user interface of WIEN97; calculation of spin-orbit coupling; electric field gradient calculations; LAPW applications to chemical reactions on metal and semiconductor surfaces; DFT fundamentals; and LAPW applications to perovskites.

FIFTH SCHOOL ON "NON-ACCELERATOR PARTICLE ASTROPHYSICS"

29 June - 10 July

Co-sponsor: Italian National Institute of Nuclear Physics (INFN).

Directors: R. Carrigan (Fermi National Accelerator Laboratory, Batavia, Illinois), G. Giacomelli (University of Bologna, Italy) and N. Paver (University of Trieste, Italy).

The field of non-accelerator particle astrophysics encompasses several areas, including traditional cosmic ray physics, solar neutrino physics, dark matter, proton decay, supernovae, gamma ray and neutrino astronomy, cosmology and particle physics. The School, which offered lectures on theory, experimental methods, the present status of experiments and future theoretical and experimental strategies, consisted of lectures, discussions and seminars covering the following subjects: particles and fields; experimental results from high energy accelerators; early universe; galactic dark matter; origin and composition of cosmic rays; sources of high energy gamma rays and neutrinos; searches for magnetic monopoles; extensive air shower array experiments; satellite and high altitude balloon experiments; gravitational waves; matter stability; and detectors and data acquisition. Emphasis was given to developments since the Fourth School in 1995, particularly in fields of neutrinos, gravitational waves and gamma ray bursts.

SUMMER SCHOOL IN HIGH ENERGY PHYSICS AND COSMOLOGY

29 June - 17 July

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

Organizing Committee: E. Kolb (Fermi National Accelerator Laboratory, Batavia, Illinois), A. Masiero (SISSA, Trieste), S. Randjbar-Daemi, G. Senjanovic and A. Smirnov (all from ICTP).

Advisory Committee: L. Alvarez-Gaumé (CERN, Geneva), R. Barbieri (Università di Pisa, Italy), N. Cabibbo (Ente per le Nuove tecnologie, l'Energia e l'Ambiente, ENEA, Rome), J. Ellis (CERN, Geneva), C. Jarlskog (University of Lund, Sweden), L. Maiani (Istituto Nazionale di Fisica Nucleare, INFN, Rome), J.C. Pati (University of Maryland, College Park), V. Rubakov (Russian Academy of Sciences, Institute for Nuclear Research, Moscow), A. Sen (Mehta Research Institute of Mathematics and Mathematical Physics, Allahabad, India), M. Turner (Fermi National Accelerator Laboratory, Batavia, Illinois) and C. Vafa (Harvard University, Cambridge, Massachusetts).

The School provided a stimulating environment for presentations of topics of current interest in high energy physics and cosmology. After introductory lectures on the current status of the standard model of electroweak and strong interactions and its supersymmetric counterpart, the School offered in-depth coverage of different aspects of astroparticle physics. Topics included neutrino astrophysics; high temperature field theory; baryogenesis and leptogenesis; inflation; dark matter and structure formation; cosmology and unification of particles and forces.

PROFILE

Since 1983, the first year of the ICTP Prize, only one woman has ever been honoured. She's Hong Van Le. Today, Hong Van Le lives and works in Germany, not only proud of what she has accomplished but thankful for the help that the Centre gave her.

The Prize... Before and After

Vietnamese-born mathematician Hong Van Le was the first and—for now—the only one woman ever to be awarded the ICTP Prize. She received the prize—in mathematics—in 1991.

"I'll never forget the time I spent at the ICTP," recalls Hong Van Le, who remained in Trieste for about eight months in 1991. "It was my first extended stay in Western Europe; the first time I enjoyed access to sophisticated computer equipment; and the first time I could take advantage of an outstanding library. I fondly remember Salam, his smile and encouragement, and the people of the Mathematics Section—not to mention the beauty of Trieste."

Math in Viet Nam has a brief but intriguing history that didn't truly begin until 1945, when Viet Nam proclaimed its independence from France. "Before World War II," Hong Van Le explains, "elementary mathematics was the only math taught in Viet Nam."

"In the years following the war," she notes, "Viet Nam had only one Vietnamese mathematician with a doctorate—Le Van Thiem. He graduated from the French institute Ecole Normale Supérieure and taught mathematics at the University of Zurich, in Switzerland, before leaving behind a promising career in Europe in 1948 to join the resistance movement in Viet Nam."

When Vietnamese nationals defeated the French army in 1954, the doors of Hanoi University re-opened. But the university suffered from an insufficient number of qualified faculty, especially scientists. Virtually all the professors, most of whom had been born in France, left war-torn Viet Nam for more tranquil settings. "Le Van Thiem alone continued to teach mathematics. And he gave his lectures in Vietnamese instead of French, a radical concept in a country where the native language had never been used either in universities or high schools," Hong Van Le explains. "I think it's fair to say that almost all teachers who taught mathematics to students from my generation were former students of Le Van Thiem."

"Despite 30 years of war and economic hardship," Hong Van Le says, "mathematics in Viet Nam evolved rapidly from the time independence was declared in the mid 1950s to the mid 1970s, when the war with the United States finally ended."

Hong Van Le notes that "I know almost no Vietnamese mathematician who has not studied abroad, usually in the former Soviet Union. At the same time, eminent mathematicians from many nations—both in the East and West—visited Viet Nam during this time."

Why did Hong Van Le become a mathematician? Her answer is simple: encouragement from her parents and teachers.

"I acquired my love for math from my parents. When I was 10 years old, they urged me to take part in a competition for children who showed promise in math. I did well and what followed was typical for many young Vietnamese students of my generation. In 1978, I went to Moscow State University, where I was a student of Anatolii Timofeevich Fomenko, who supervised my work in differential geometry and helped determine my career path."

After her stay at the ICTP in 1991 as a Visiting Mathematician, Hong Van Le went to the Max Planck Institute in Bonn, Germany. There, she married a German geneticist, Karsten Friztsche, whom she had originally met in Moscow. Their first child was born in 1994; their second in 1998. Hong Van Le currently works at the University of Leipzig's Institute of Mathematics.

"I returned to the ICTP in the summer of 1993 for a conference on differential geometry. Again, I was impressed by how the Centre nurtures professional exchanges among colleagues from around the world. ICTP is a truly international site, without the anti-foreigner sentiments I have often found in other countries in Eastern and Western Europe." □

Hong Van Le with Professor Abdus Salam, 1991

TRIBUTES and CHANGES

John Fennessy, ICTP's new Chief, Administration, arrived at the Centre on June 1. He comes to Trieste via the United Nations Relief and Works Agency (UNRWA) in Lebanon, where he served as the Deputy Director for the past two years. The UNRWA in Lebanon has approximately 300,000 refugees in its care and employs about 2,500 staff members. Fennessy has worked as an administrator in the United Nations for more than 20 years.

Trieste: The Tour

ICTP's visiting scientists and their family members can enjoy free bus tours of Trieste, thanks to the city's Tourism Promotion Board and the unflagging enthusiasm of Sergio Bradaschia, a retired Triestine shop owner who has helped organize the tours since their inception in 1992. This year, the number of tours has reached fourteen. Sites to be seen include Duino Castle and Rilke Path, wedged along the Adriatic Sea just northwest of the ICTP; Grotta Gigante (the Giant Cave), the world's largest single-room cave cut from the soft limestone of the Carso; the Sanctuary of Monte Grisa, the modern triangular church that sits atop the seacoast east of Barcola; plus the piazzas, monuments and churches that make Trieste one of the most intriguing in mid-sized cities in Europe.

Route Salam

CERN, the European Laboratory for Particle Physics, in Geneva, Switzerland, recently announced that the southern portion of Route Pauli, one of the facility's major crossroads, has been renamed Route Salam to honour the memory of ICTP's founding director. The road runs near the site of the Gargamelle bubble chamber where experimental physicists discovered "neutral currents" in 1973. The CERN discovery showed that the Salam-Weinberg-Glashow theoretical model corresponded to physical reality. The model successfully unified two of the four fundamental forces of nature: the electromagnetic force and the weak nuclear force. In 1979, Abdus Salam, along with Steven Weinberg and Sheldon Glashow, shared the Nobel Prize in Physics for their theory.

Viqar Husain

Viqar Husain, a young Pakistani physicist who was a postdoctoral student at the ICTP during the early 1990s, recently received the top award of US$2,500 from the Gravity Research Foundation for his essay, "Demise of the Cosmic Censor?" Each year, the USA-based Foundation awards this prize to a researcher for the best essay on the theory of gravitation. Husain currently works at the University of British Columbia in Vancouver, Canada.

Kindergarten Children

On 26 May, 50 kindergarten children from Trieste, ages five and six, visited the Centre. They came here not only to see the facilities but to thank ICTP staff members for the computers that the Centre's Microprocessor Laboratory had donated to their school. The youngsters, accompanied by their teachers, walked through the Main Building, stopped at the Library and then spent about an hour at the Microprocessor Laboratory where they were treated to super-slow images created by the Laboratory's new video camera. The camera reduces motion to such slow speeds that they could see an insect's wings flap during flight.

2 - 4 July

Conference on "Hyperfine Interactions in the Solid State: Experiments and First-Principles Electronic Structure Calculations"

7 - 10 July

Adriatico Research Conference on "Organic Semiconductors"

20 - 31 July

X Trieste Workshop on Open Problems in Strongly Correlated Electron Systems

27 July - 18 September

Extended Research Workshop on Disorder, Chaos and Interaction in Mesoscopic Systems

6 - 13 August

Workshop on "Optical Properties of Microcavities"

9 August - 9 September

1998 Nordic-Trieste Workshop: Astrophysical Tests For Strong Gravity

31 August - 18 September

Workshop on Dynamical Systems

31 August - 25 September

School on the Mathematics of Economics—A Primer in Economics for Physicists and Mathematicians

16 - 19 September

Workshop on Physics of Relic Neutrinos

21 - 25 September

International Workshop on the "Oceanography of the Adriatic Sea"

28 September - 9 October

4th Workshop on 3-Dimensional Modelling of Seismic Waves Generation, Propagation and their Inversion

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`
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`
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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