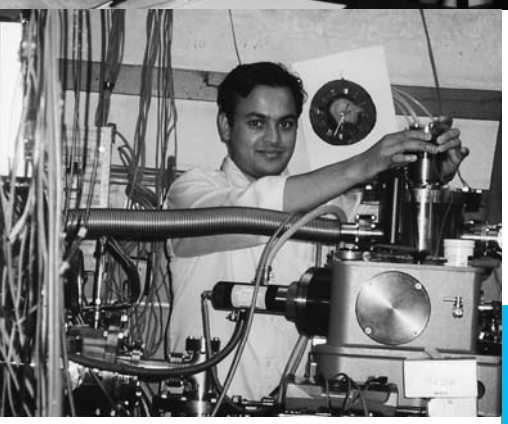


NEWS from ICTP

the
abdus salam
international centre for theoretical physics

WINTER
2000

#91

M.S. Narasimhan
ICTP Mathematics Group

An agreement signed between ICTP and India's Department of Science and Technology offers an important example of the evolving relationship between the Centre and the countries ICTP serves.

India's Enhanced Co-operation

On 25 November, a delegation from India's Department of Science and Technology (DST), led by secretary V.S. Ramamurthy, visited the ICTP campus in Trieste. Ramamurthy and members of the delegation, including Sadhana Relia, director of DST's International Division, and B.A. Dasannacharya, chairperson of DST's Expert Committee for Beamlines Utilization at *Elettra* (Trieste's synchrotron facility), visited the Centre to meet the section heads and tour the library and computer facilities.

V.S. Ramamurthy and M.S. Narasimhan

Each year, several high-level delegations from the developing countries visit the Centre to learn more about its training and research activities and facilities. But this visit was different. In many ways, it symbolises the Centre's evolving relationship with the developing world's more advanced countries.

The main purpose of the visit was to sign a five-year agreement of "enhanced co-operation" between India's Department of Science and Technology and the Centre in which the DST agreed "to support 20 study visits of Indian mathematicians and theoretical physicists every year to participate in ICTP activities."

The agreement, similar to those that the Centre has with Brazil and China, will cost India between US$25,000 and US$30,000 annually. The funds will be used to cover the expense of airline tickets for young researchers travelling to and from the Centre. While I cannot fully convey how thankful we are for the Indian government's generosity, I think we also should highlight the decision's symbolic value.

In fact, I believe the agreement carries two important messages. First, that developing countries such as Brazil, India and China are committed to training a critical mass of well-trained scientists. And, second, this commitment is transforming their relationship with ICTP into a true partnership that promises to be of great benefit to ICTP and, more importantly, to the future well-being of scientific communities throughout the developing world. During recent years, more and more visitors coming to ICTP from developing countries have obtained their travel funds from their home countries.

The text of the agreement illustrates the role that ICTP has played over the years in training a large number of Indian mathematicians and theoretical physicists. It also acknowledges that continued progress toward this shared goal will depend on the ability of Indian scientists to gain access to world-class research facilities where they can exchange scientific information and ideas with their peers.

And that's where the partnership with ICTP is likely to prove so critical. The Centre offers a place where scientists from India and countries throughout the developing world can meet researchers from both the South and North to hear more about the most recent advances in their fields.

ICTP owes much of its success to the generosity of the Italian government, which has been the Centre's primary source of funding since its inception some 35 years ago. Now, several developing nations have become not just recipients but contributors to ICTP's efforts to build scientific expertise in the developing world. We welcome the expanded participation of these nations both as an affirmation of the impact of our efforts and as an opportunity to accelerate the pace of change in the future. □

Thomas Odhiambo

COMMENTARY

Last October, ICTP celebrated its 35th anniversary. Thomas Odhiambo recently spoke about Salam's vision at the Third World Academy of Sciences' 7th General Conference in Senegal, where he received the 1999 Abdus Salam Medal for Science and Technology.

Honouring Salam

The International Centre for Theoretical Physics (ICTP) and the Third World Academy of Sciences (TWAS) are monuments to the institution-building genius of Abdus Salam. One of the great minds of international science in the 20th century, Salam still made time to mobilise his entrepreneurial spirit to construct bridges across the chasms of centuries-old isolation that have kept developing countries from sharing and comparing knowledge and ideas, which is the essence of science.

In September 1962, at the annual General Conference of the International Atomic Energy Agency (IAEA), Salam made an impassioned plea for the creation of the ICTP, which he had proposed two years earlier. It was a brilliant move to suggest that theoretical physics should be the central theme of the new Centre, which was expected to attract the most talented scientists from the South to work closely with world-renowned physicists from the international community on scientific problems of first-order interest.

Why did Salam choose theoretical physics? Listen to him speak to conference delegates at IAEA in 1962:

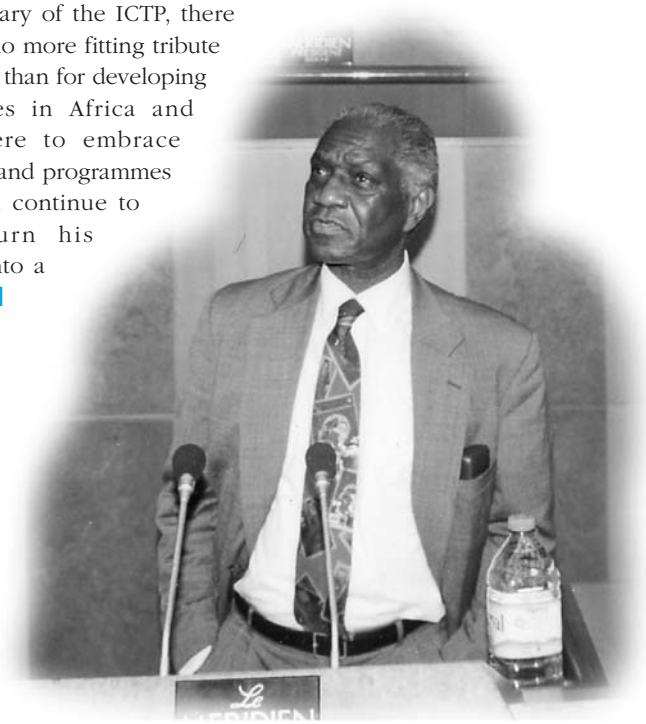
First, no costly apparatus is needed. Second, individual initiative, rather than collaborative effort, can still lead to a breakthrough. Almost invariably, theoretical physics is the first science in smaller countries which gets developed at the advanced level. History bears this out. This was the case in Japan; this was the case in India; this is happening now in Brazil, Turkey, Lebanon and Argentina. No one can reverse the historical process of the order in which science grows in rich or poor soils. But in spite of the ambitions of these scientists, they…suffer from one fatal disability—isolation. After an initial period of brilliant work, they are faced with a cruel choice: either leave their countries or ossify and become scientific administrators.

The ICTP, thanks to Salam's tireless efforts, was established in October 1964. Within the very first year of its existence, the Centre was flourishing. The ICTP's success gave Salam an opportunity to frequently reflect on what made the institution function so magnificently and what was required to allow it to continue to glow brightly in the firmament of world science. In October 1979, some 15 years after ICTP's founding, and four days after he was awarded the Nobel Prize in Physics, Salam addressed the Executive Board of the United Nations Educational, Cultural and Scientific Organization (UNESCO). He took advantage of the occasion to urge oil-rich Arab countries to use part of their new-found wealth to fund excellence in science, as their progenitors had done at the beginning of the second millennium:

To some of you, Allah has given a bounty and income of the order of US$60 billion. On the international norms, these countries should be spending US$1 billion on science and technology. It was their forebearers who were the torch bearers of scientific research in the eighth, ninth, tenth and eleventh centuries. It was their forebearers who started the academies of sciences in Baghdad and Cairo. Be generous once again. Spend the billion of dollars on international science, even if others do not. Create a talent fund…Let the talent fund be available, not only to Islamic countries, not only to Arab countries, but to all developing countries.

It is this kind of visionary effervescence that has carried some of the countries of the South—for example, Brazil, China, India and South Korea—to near-First World status in science and technology. And it is this kind of future-oriented revolutionary thinking today that is impelling several African leaders to talk about an African Renaissance.

Science-based development was at the heart of Salam's strategy for improving conditions for both scientists and society in the developing world. It's why he is remembered so fondly today and why his ideas have spanned both decades and geographical boundaries. On the occasion of the 35th anniversary of the ICTP, there can be no more fitting tribute to Salam than for developing countries in Africa and elsewhere to embrace policies and programmes that will continue to help turn his vision into a reality. □



Thomas Odhiambo

Thomas Odhiambo is honorary president of the African Academy of Sciences and managing trustee for the Research and Development Forum for Science-Led Development in Africa (RANDFORUM), headquartered in Kenya.

Vladimir Kravtsov
ICTP Condensed Matter Group

As the study of physics becomes increasingly specialised, the profession risks being divided into an endless series of subfields. Russian-born Vladimir Kravtsov calls on the physics community to rededicate itself to the study of broad issues to avoid intellectual fragmentation.

Connected Clusters

In physics, disorder is often a state of mind. The reality is that physical systems are in perfect harmony. It's our limited knowledge that prevents us from seeing the true elegance of a system's structure and behaviour. In fact, the primary task of physicists is to discover the order that exists under the veil of disorder.

In the physics of disordered systems, researchers have developed the concept of 'connected clusters'—parts of systems that are linked together to enable the continual transfer of mass, charge and energy.

Think of an endless sea where the only recognisable point of reference is the horizon. Now think of a sea dotted with islands. The larger and more numerous the islands, the more likely you are to be able to navigate the sea. Now think of the islands being connected by bridges. Navigation can take place continuously without being hampered by the unpredictability of weather. In brief, bridges not only shorten the journey but alter the means of travel in ways that fundamentally change the islands' relationship to one another.

The latter transformation is what comes to my mind each time I think about physics as a whole, a profession to which I have devoted many years of study. I am convinced that physics can progress only when it enjoys an environment marked by many islands connected by many bridges. Such connected clusters of intellect, tied together by research and education, offer endless opportunities for the transfer of data, ideas and insights.

Today, my profession, I am sorry to say, is heading in the opposite direction: decomposing connected clusters into small, isolated islands of research and study. The major force behind this process is the increasing complexity of physics itself, which requires physicists to study narrower and narrower subject areas to gain deeper and deeper understanding.

As a result of such trends, some members of the physics community believe that it has become impossible to explore physics as a whole. What does the field of optics have to do with the study of disordered solids? And how can a better understanding of both enhance our understanding of computational algorithms? These fields seem completely disconnected. Right? Below I will try to convince you that such a notion is wrong.

Let us consider the development of mesoscopics—a branch of condensed matter physics that surfaced about 15 years ago. Before then, condensed matter physicists believed that to predict the behaviour of a large disordered system, it sufficed to examine the average behaviour of many analogous disordered systems. Researchers refer to this as the law of self-averaging, a fundamental principle of physics for more than a century.

For this law to work, the subsets of the system must operate as independent entities. Conversely, when the subsets are correlated (that is, not independent but related to one another), the law of self-averaging fails, and fluctuations between the average and specific become significant. That's exactly what happens to impure metals at low temperatures.

According to quantum mechanics, in the absence of interaction, electrons in metals behave like light waves and will follow a self-replicating pattern forever. Such behaviour allows us to predict the amplitude of the wave at one point if we know the amplitude of the wave at another point. In short, it means that the electron waves within the metals are correlated or coherent.

This coherence collapses when the temperature rises above absolute zero due to the interaction of the electrons. However, if the temperature is low and the sample size is small enough, the coherence is preserved over the whole sample.

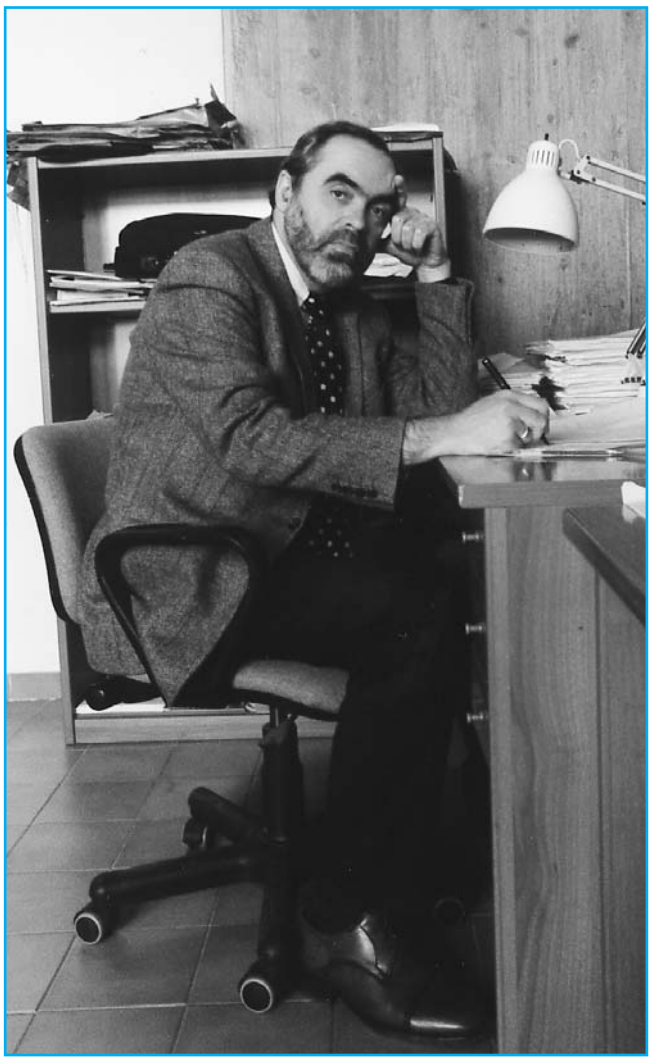
Here we enter the fascinating world of mesoscopic physics in which a system's physical quantities may visibly fluctuate from sample to sample. Such mesoscopic fluctuations, which defy the law of self-averaging, were so surprising that it took about 3 years for most condensed matter physicists to be convinced that the perceived phenomenon was neither a theoretical miscalculation nor experimental mistake.

Yet, a similar phenomenon had been known in optics for decades. So-called 'speckles'—bright dark spots—can be observed when coherent monochromatic light passes through a scattering medium (such as milky glass) that possesses many scattering points. Although the positions of the speckles are random, they do not change over time. In fact, the positions can be changed only by altering the frequency of light or shifting the scattering medium.

The origins of both speckles and mesoscopic fluctuations in electronic systems are one and the same. Both are created by interferences in the coherent waves. Only when this connection was understood, however, did the new field of mesoscopic physics become widely accepted.

Such an example shows that 'understanding' physical phenomena largely involves establishing connections between different subfields of knowledge—in this case, between condensed matter physics and optical physics. These intricate ties can only take place in an intellectual environment that nurtures the development of connected clusters through research and educational systems designed to encourage and reward a broad understanding of physics.

But the story does not end here. New ideas and methods developed in condensed matter physics have prompted advances in the optics of disordered media, which involve the search for the localisation of light and the restoration of images using statistical methods. By applying these methods it's possible to see through such strongly scattering media as 'milky glass' or human tissue.



Vladimir Kravtsov

Here we have an example of the relationship between fundamental and applied science. Abstract knowledge dealing with self-averaging leads to knowledge pertaining to mesoscopic fluctuations in condensed matter and analogous insights in optics of disordered media. It turns out that these insights could prove useful in screening cancerous tumours in humans, which would make applied science a by-product of fundamental science.

Connections like these again illustrate that we should not bother fundamental scientists with such questions as "How will your research improve our lives?" Researchers never know. Let them follow their instincts. That's the best way to achieve breakthroughs that may ultimately improve our lives.

Here's another example of a story with the same conclusion. In mesoscopic physics, the dephasing of the electron wave function limits the phase coherence length and thus sets the upper boundary for sizes of mesoscopic systems. The existence of mesoscopics is based on the fact that dephasing is effectively switched off at very low temperatures. That is why mesoscopic phenomena can happen only at temperatures as low as 0.01-0.1 degrees Kelvin and for samples of micrometer size.

During 15 years of development, mesoscopic physicists have acquired a lot of 'know-how' in dealing with very low temperatures and very small samples. In the process, they have gained vast knowledge of the fundamentals of dephasing in different systems. Your response may be: So what? Haven't these efforts been a waste of money and talent?

The answer is no. Several years ago, computer scientists launched an effort to build a 'quantum computer' relying on quantum interference instead of classical 0-1 bit sequences. If realised, this effort could revolutionise computational physics because tasks requiring exponentially long computation time with conventional 0-1 bit sequences would require much less time with quantum algorithms.

A critical aspect of success in this effort depends on the ability to preserve quantum phase coherence for sufficient periods. Such knowledge will also be crucial for the creation of small but macroscopic (and thus technological) quantum devices. That's where 'abstract experience' earned in the field of mesoscopic physics can be put to work for improving our lives. Yet it's important to keep in mind that a physicist's understanding of such abstractions is derived largely from an ability to place his or her research into the larger intellectual currents within the discipline.

Examples like these illustrate how misguided it is for physicists to box themselves into narrow research fields. All physicists belong to the larger physics community and all should seek to transfer ideas from their own subfields to others as integral parts of their work. This requires a broad understanding of the basic fields of physics and an ability to generalise results. Such integration is the only way to overcome the intellectual fragmentation that now threatens the future of physics. □

Francis Allotey

Efforts to ally African mathematicians with mathematicians of African heritage living and working outside of Africa could help ease the continent's long-standing 'math crisis.'

Math Across the Oceans

This past October, 30 African-born mathematicians, including 17 who live and work in Africa and 13 who have moved to developed countries (11 to the United States and 2 to France), participated in a two-day forum organised by the ICTP Office of External Activities (OEA). During the first day of the forum, they examined the state of mathematics in Africa. During the second day, they explored possible areas of North-South collaboration.

This is not the first time that ICTP has brought together African-born scientists, who share a common heritage but now live and work oceans apart, to discuss issues of common concern.

In fact, the roots of this latest meeting date back to the spring of 1989 when the Centre organised an international conference that spurred the creation of the Edward Bouchet-ICTP Institute. The institute, named after Edward Bouchet, a late 19th century Yale University graduate who became the first black physicist in the United States, is designed to promote collaboration among black physicists working in Africa and the United States. Over the past decade, the institute has sponsored a series of scientific conferences—most recently, the 3rd Edward Bouchet-Abdus Salam ICTP International Conference held in Botswana in July 1998.

Francis Allotey

During the same summer, ICTP director Miguel Virasoro embarked on a one-month journey across Africa, not just to attend the Botswana conference but to participate in the ICTP-sponsored Edward Bouchet-Abdus Salam Regional College on Functional Analysis and Differential Equations, another by-product of the Bouchet-ICTP Institute, in Accra, Ghana. As part of his itinerary, the director also visited an ICTP affiliated centre in Benin and research facilities in Côte d'Ivoire to take a first-hand look at the state of scientific and mathematical research and training in Africa and to discuss ways ICTP could help address some of the most critical issues currently facing Africa's mathematics and scientific communities (see *News from ICTP* #86, Autumn 1998). The director's observations led him to call for a roundtable discussion among expatriate and in-country African mathematicians. That, in turn, led to the October forum.

Africa's mathematics community faces two critical problems. The first problem is that Africa's educational and research infrastructure is not strong enough to graduate a sufficient number of mathematicians with advanced degrees. Consequently, African-born mathematicians with master's and doctorate degrees have been educated in universities in the North. The second problem is that many of these mathematicians, after receiving their degrees, choose not to come back to their native countries.

In Ghana, for example, not one of the 20 young mathematicians sent to the United States for doctoral training over the past two decades has returned home. As a result, the average age of a Ghanaian mathematics professor is now 54—an alarming figure that is expected to climb even higher in the years ahead. The problem created by this 'generational void' is not confined to mathematicians. Indeed a recent study by the United Nations Educational, Cultural and Scientific Organization (UNESCO) estimates that 30,500 Africans who have earned doctorate degrees in a wide range of fields currently live and work in developed countries. Sub-Saharan Africa has about 950 doctorates employed by universities and research centres located on the continent.

As ICTP's director has noted, the problem of the brain drain is something that African nations may have to live with for some time. For example, long after Argentina and Brazil in Latin America and South Korea in Asia had launched aggressive government-sponsored programmes to build their scientific and technological infrastructure, these countries continued to lose a disproportionate percentage of their young scientists and mathematicians to Northern institutions offering higher pay and better working conditions. Only recently have an increasing number of young Argentinean and Brazilian students with advanced degrees decided to remain in the countries of their birth to pursue their careers.

Africa is likely to experience the same trend as it seeks to create a critical mass of mathematicians and basic scientists. In today's international job market for skilled and talented professionals, national boundaries cannot impede the movement of basic scientists and mathematicians as their careers unfold and take off. The only effective response for developing countries is to upgrade their research facilities, working conditions and pay to the point that native-born scientists and mathematicians come to believe that their countries can offer them a future.

It was within this context that ICTP hosted the October forum. The goal was to explore ways of improving mathematics research and education in Africa and examine possible strategies for curbing the brain drain over the long term.

Among the specific topics discussed were how African expatriate mathematicians could help nurture the growth of mathematical research in Africa and the role that such international organisations as ICTP and UNESCO could play in such efforts.

Conference participants acknowledged that they must overcome a host of difficult obstacles if they hope to advance their goals. First, African nations must address many urgent economic and social problems, and mathematical research is not high on the list of priorities. Second, international aid agencies have come to view the basic sciences as a low priority, placing greater emphasis and resources on the applied sciences and technology transfer. Third, mathematicians, like most basic scientists, have not been adept at conveying the value of their work to their political leaders. As a result, calls to improve research and training in mathematics and the other basic research are often drowned out by discussions focusing on other critical issues.

That is why the October forum could prove so valuable. Given the trends outlined above, it's unlikely that much progress will be made in advancing mathematical research and training in Africa unless the African mathematics community itself finds a way to effectively air its concerns both at home and abroad. And given their small numbers, difficult working conditions and isolation, these concerns are likely to remain muted unless mathematicians in Africa work in concert with their colleagues in the North to advance their shared goals.

For this reason, forum participants established several committees to explore funding opportunities both in the United States and Africa for the promotion of mathematics research and education in Africa.

Whether the committees' efforts prove successful remains to be seen. In the meantime, efforts to promote mathematics and physics in Africa will be advanced by such programmes as ICTP's Diploma Course, which provides one year of additional training for students with advanced degrees in high energy physics, condensed matter physics and mathematics (the 1999 class included 11 Africans) and ICTP's Joint Ph.D. Programme, which enables students to begin their studies at a university in the North and conclude their studies at a university in Africa (in 1999, five African students participated).

Mathematicians and, more generally, basic scientists often like to think that their research speaks for itself. And to a large degree they are right. But as we enter the next century, it has become increasingly clear that no country will be able to address the critical problems it faces without having a strong foundation in mathematics and the basic sciences.

One of the main tasks of the participants will be to convince decision-makers and funders that mathematics research is not simply a luxury only developed countries can afford but an indispensable tool for all nations seeking to improve the material conditions of their people. In our knowledge-based world, there is no substitute for a workforce skilled in mathematics, which is after all the language of science and technology. □

Francis Allotey, professor of mathematical physics at the University of Science and Technology in Kumasi, Ghana, is a member of the ICTP Scientific Council and Adviser at the Permanent Delegation of Ghana to the International Atomic Energy Agency (IAEA) in Vienna, Austria. In 1998, he was among the first five recipients of the World Bank-International Monetary Fund Africa Club Award.

Round Table "Forum on Mathematics in Africa: Problems and Solutions"

DATELINE

Nobels '99

The 1999 Nobel Laureates in physics and chemistry are no strangers to ICTP. Dutch-born **Martinus J.G. Veltman**, co-recipient of the Nobel Prize in physics, was awarded the ICTP Dirac Medal in 1996. **Gerardus 't Hooft**, a one-time student of Veltman who shared the prize with his mentor, took part in the ICTP Symposium on Perspectives in Particle Physics in 1986 and lectured at the Spring School and Workshop on String Theory, Gauge Theory and Quantum Gravity in 1993. Veltman, professor emeritus at the University of Michigan (USA) and 't Hooft, professor at the University of Utrecht (The Netherlands), were honoured for their discovery of a mathematical concept that has advanced our understanding of theoretical particle physics. Egyptian-born **Ahmed H. Zewail**, winner of the 1999 Nobel Prize in chemistry, lectured at the ICTP College on Lasers, Atomic and Molecular Physics in 1985. He is also a fellow of the Third World Academy of Sciences (TWAS). Founded by Abdus Salam in 1983, the TWAS secretariat is headquartered in the Fermi Building on the ICTP campus. Zewail, who was honoured for his development of a laser technique capable of detecting the behaviour of atoms during a chemical reaction, is a professor at California Institute of Technology (USA). He is the first Arab and second Muslim scientist (Abdus Salam was the first) to win the Nobel Prize.

Martinus J.G. Veltman

Gerardus 't Hooft

Ahmed H. Zewail

Sailing Towards Success

Since the Centre's opening in 1964, scientists eager to participate in the Centre's research and training activities have journeyed to ICTP in a variety of ways.

Most of our visitors have come by plane. Others, however, have chosen more unusual modes of transportation. In the 1970s, for example, several Chinese students boarded the Transiberian Express for a week-long, 12,000-kilometre train ride to Trieste. More recently, several Moroccan students crossed the Strait of Gibraltar by ferry and then purchased a bus ticket in southern Spain for a 2500-kilometre ride to Northern Italy.

But no Centre scientist has ever sailed the high seas to come to the Centre. That is, no scientist until **Sandra Liliana Sautú**, a visiting researcher with the ICTP High Energy Physics Group.

Sautú, a researcher at the *Centro de Pesquisas Físicas* and an Associate Professor of physics at *Universidade Federal do Rio de Janeiro*, left port in Rio de Janeiro on March 15. On the way, she and her friend Axel Julie set anchor in Recife, Brazil; Antigua; the Azores; Cádiz, Spain; and Sardinia and Sicily, Italy, before arriving in Trieste on 27 August.

Her sailboat, which measures 8 metres in length, is now docked at a local yacht club near Piazza Unità, which is the main square in Trieste. Sautú plans to call the boat her home throughout her stay in Trieste. In fact, the boat has been her home for more than 2 years, ever since she purchased it from a fellow-sailor in Rio de Janeiro. "I've added a small heater to get through the winter," she notes.

Sautú loves the sea's tranquillity as well as the challenges and sense of personal satisfaction it affords. "Sailing is an experience that brings you close to nature," she notes. "When I gaze at the horizon from the bow of my ship, the sea and wind engulf me. There's nothing else and nothing else is needed. That's why the ocean has become such a focal point of my life."

Sandra Liliana Sautú

While at the Centre, Sautú will conduct research in astrophysics and cosmology. Then, come early spring, she will set sail again, returning to Brazil the same way she came: swept along by the ocean winds of the Atlantic.

Donation Programme

B. Ananthanarayan, assistant professor of physics at the Centre for Theoretical Studies (CTS), Indian Institute of Science (IISc), Bangalore, India, recently wrote a brief note to express his thanks to the ICTP-TWAS Donation Programme. "At the Centre for Theoretical Studies we are maintaining a departmental library primarily in the areas of particle physics, field theory and mathematical physics. We acknowledge the kind assistance of the ICTP-TWAS Donation Programme in handling shipping costs for journals given by libraries in Switzerland, France, Belgium and elsewhere, which has enabled CTS to expand its journal collection in these areas. ICTP Associate Members visiting Bangalore under the ICTP-IISc-JNCASR (Jawaharlal Nehru Centre for Advanced Scientific Research) Associateship Programme, and others, may wish to visit CTS and its departmental library and benefit from the resources available here."

Frog Physics

"It all began with an eye-catching research position advertised on the internet: "Work with levitating frogs." That's how former ICTP Diploma student **Marius Boamfa** explains his first encounter with 'frogs in flight.'

Romanian-born Boamfa, who graduated from the Diploma Programme in 1997, admits that the advertisement initially made him laugh. "But on closer reading," he says, "I realised that the position could be challenging."

His curiosity landed him at the University of Nijmegen's High Field Magnet Laboratory in the Netherlands. He's been there for the past two years working on a doctorate in physics, which he expects to receive in 2002.

Boamfa acknowledges that frog levitation does have 'entertainment value.' But he quickly adds that the research is serious. "It not only sheds light on the behaviour of organisms and materials subject to zero gravity but holds promise for practical applications in scientific areas ranging from astrophysics to plant biology."

For example, Boamfa notes that diamagnetism—an energy-free magnetic force created by the internal motion of atoms—may help astrophysicists better understand the effects of zero gravity on living organisms. "Until now, such experiments have taken place in space crafts orbiting above the atmosphere," he explains. "Research costs exceed US$1 million an hour and there's a waiting list of four years. We can reproduce similar conditions in our laboratory at a cost of about US$1500 a day and there's no waiting list at all."

The conditions that make levitation possible are created through an intense magnetic field some 400,000 times more powerful than the magnetic field found on Earth. The diameter of the tube in which these forces operate is just 3 centimetres. Yet that hasn't prevented Boamfa and his colleagues from

Marius Boamfa

levitating a wide range of animals, plants and objects—frogs, flies, strawberries, hazelnuts, even small slices of pizza.

"The most beautiful object of all has been a globule of water, which remains perfectly spherical and perfectly still. It's like observing a three-dimensional rain drop suspended in mid air."

The entertaining aspects of his research have captured the attention of international media. Since Boamfa's arrival, CNN and BBC have done segments on the laboratory's flying frogs and levitating pizza. The publicity has helped the laboratory secure funding for the construction of a new high magnetic field facility that will rank among the best in the world.

"As far as we can tell, the magnetism does no harm to the frog," Boamfa notes. "As soon as the magnetic force dissipates the frog goes about its business as if nothing has happened."

And that's the way Boamfa feels about his research as well: He is delighted to have pursued what has become an unusual research opportunity, and is now anxious to build a career in physics based in part on the knowledge and experience he has gained from his strange encounter with 'frogs in flight.'

Iran Opens Scientific Meetings Office

Iran's Ministry of Culture and Higher Education has opened an **International Scientific Meetings Office (ISMO)**. The Office represents in part the outgrowth of a memorandum of agreement that the ministry signed with ICTP in December 1998. ISMO's main responsibility will be to organise international and regional scientific research and training activities in the basic and applied sciences. Such activities will range from two- or three-day workshops to six-week schools. The Office is located in the Department of Physics at Sharif University of Technology in Tehran. ISMO's day-to-day responsibilities will be directed by Reza Mansouri, professor of physics at the university, while the institute's broad direction will be approved by a scientific committee. The following research topics are under consideration for 2000: dynamical systems and turbulence; electrostatics and its applications; fiber optics and optical devices; and training for writing proposals to international scientific centres. Additional information about ISMO may be obtained via e-mail: ismo@physics.sharif.ac.ir, or phone/fax: +98 21 6022711.

ICTP Prize '99

Daniel Domínguez, professor of physics from *Instituto Balseiro* in Bariloche, Argentina, has been awarded the 1999 ICTP Prize, which is being given in the field of condensed matter theory. Domínguez has been honoured for his studies of vortex dynamics in superconducting materials and Josephson junction arrays. His contributions have made him one of the leading international experts working in these cutting-edge fields. In addition to his professorship at the Institute, Domínguez is a staff member of the solid state theory group at *Centro Atómico Bariloche* and a researcher with *Consejo Nacional de Investigaciones Científicas y Técnicas* (CONICET) in Argentina. He was a post doc at the Centre from 1992 to 1994 and is now an ICTP Associate Member. The 1999 ICTP Prize is named in honour of Stig Lundqvist, a long-time supporter of ICTP who helped launch ICTP's condensed matter activities in the 1970s and subsequently served as the chairman of the Centre's Scientific Council from 1983 to 1992. The awards ceremony will take place in the summer 2000.

Daniel Domínguez

REPORT ON REPORTS

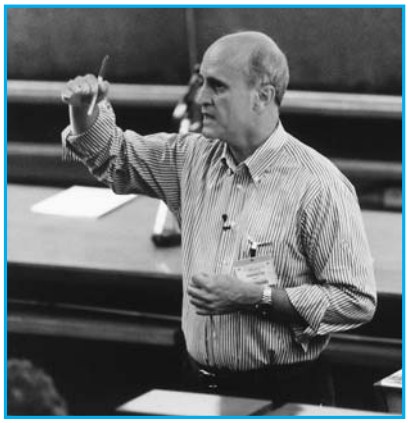
SCHOOL ON MODERN STATISTICAL METHODS IN MEDICAL RESEARCH

6 - 24 September

Directors: E.J.T. Goetghebeur (University of Ghent, Belgium), J.L. Hutton (University of Newcastle, UK) and P.J. Solomon (University of Adelaide, Australia), in co-operation with the International Centre for Mathematical Sciences (ICMS, Edinburgh, UK).
Local Organiser: C.E. Chidume (ICTP).

The School brought together international experts in the rapidly developing field of biostatistics to examine statistical methods for AIDS analyses, epidemic modelling and survival studies. The first two weeks included lectures, tutorials and workshops. The third week focused on state-of-the-art research in genetic epidemiology, environmental epidemiology and medical imaging.

Peter B. Gilbert



David Harrington

SECOND AUTUMN TRAINING ACTIVITY ON NETWORKING AND RADIOCOMMUNICATIONS

6 September - 29 October

Director: G. Pau (Information Science Department of the University of Bologna, Italy).
Local Organisers: A. Nobile and S.M. Radicella (ICTP).

The Activity, organised with Nigeria's National Universities Commission (NUC), introduced 10 National Universities Network (NUNet) engineers to current trends in radio networking and system administration. The Activity was divided into tracks dedicated to local area networking (LAN), wide area networking (WAN) and information content. The last three weeks were dedicated to projects designed to put into practice theories previously discussed in the classroom.

CONFERENCE ON UNIFYING CONCEPTS IN GLASS PHYSICS

15 - 18 September

Directors: S. Franz (ICTP), S.C. Glotzer (National Institute of Standards and Technology, Gaithersburg, USA) and S. Sastry (Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India).

The Conference focused on theoretical studies of glass transition (both equilibrium and dynamic theories), computational studies of dynamics in supercooled liquid and glassy states, and related aspects of other glassy systems.

Marc Mezard

COLLEGE ON MEDICAL PHYSICS AND WORKSHOP ON NUCLEAR DATA FOR SCIENCE AND TECHNOLOGY: MEDICAL APPLICATIONS

20 September - 15 October

Co-sponsor: Kuwait Foundation for the Advancement of Sciences (KFAS), in co-operation with the International Atomic Energy Agency (IAEA, Vienna, Austria).
Directors: P. Andreo (IAEA), A. Benini (ICTP), M. Herman (IAEA), S. Qaim (*Forschungszentrum Jülich*, Germany) and P. Sprawls (Emory University, Atlanta, USA).
Local Organiser: L. Bertocchi (ICTP).

The College, designed for medical physicists in the developing world, consisted of lectures and discussions on imaging modalities of radiography, mammography, fluoroscopy, computed tomography, and ultrasound and magnetic resonance imaging. Emphasis was placed on issues of patient and staff radiation exposure and safe use of radiation.

COSMO-99

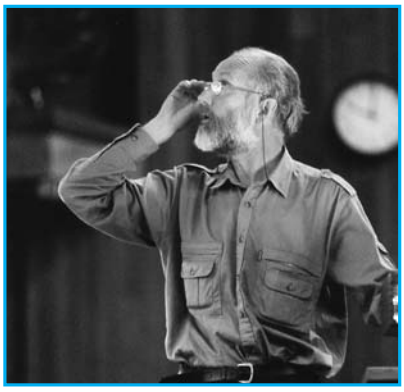
27 September - 2 October

Alvaro De Rujula

Organising Committee: G. Dvali (New York University, New York, USA, and ICTP), E. Kolb (Fermi National Accelerator Laboratory, Batavia, USA), G. Senjanovic (ICTP), M. Shaposhnikov (University of Lausanne, Switzerland), A. Smirnov (ICTP) and N. Turok (Cambridge University, UK).
Local Organisers: G. Dvali, G. Senjanovic and A. Smirnov.
Scientific Secretariat: U. Cotti (International School for Advanced Studies, SISSA, Trieste, Italy, and *Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional*, CINVESTAV, Mexico City, Mexico) and R. Jeannerot (ICTP).

This was the third meeting in the COSMO series, which focuses on the field of astroparticle physics. Previous meetings took place in the United Kingdom and United States. The Conference consisted of parallel sessions examining the interplay between particle physics and the cosmology of the early Universe. The following topics were discussed: dark matter; baryogenesis; neutrino physics and astrophysics; inflation; topological defects; cosmic ray physics; and cosmological implications of grand unification, supersymmetry, superstrings and higher dimensions.

Andrei Linde



Brandon Carter

WORKSHOP ON MODELLING REAL SYSTEMS: A HANDS-ON FIRST ENCOUNTER WITH INDUSTRIAL MATHEMATICS

27 September - 22 October

Directors: H. Neunzert (*Universität Kaiserslautern*, Germany) and H.W. Engl (*Johannes-Kepler-Universität Linz*, Austria).

Local Organiser: M. Marsili (Italian National Institute for the Physics of Matter, INFM, and ICTP).

The Workshop introduced participants to the new world of industrial mathematics. Nine real-world problems were presented in non-mathematical terms. Participants, working in small groups, transformed these problems into mathematical formulations and then devised computer algorithms for their solutions.

FIFTH WORKSHOP ON NON-LINEAR DYNAMICS AND EARTHQUAKE PREDICTIONS

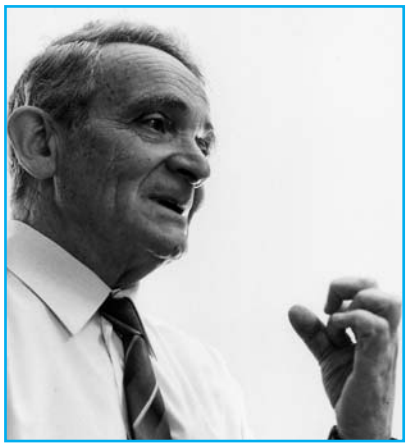
4 - 22 October

Co-sponsors: Training and Mobility Researchers Program of the European Commission, and Kuwait Foundation for the Advancement of Sciences (KFAS). In co-operation with the International Institute of Earthquake Prediction Theory and Mathematical Geophysics, Moscow, Russia, and the Department of Earth Sciences of the University of Trieste, Italy.

Directors: V.I. Keilis-Borok (International Institute of Earthquake Prediction Theory and Mathematical Geophysics, Russian Academy of Sciences, Moscow, Russia) and G.F. Panza (Department of Earth Sciences, University of Trieste, and ICTP).

Local Organiser: G.F. Panza.

The Workshop, the fifth in a series, examined applications of non-linear dynamics for understanding the instability of the Earth's lithosphere. Emphasis was placed on the interface between geophysical observations and mathematical models of chaotic systems. The accuracy of earthquake prediction methods and error rates also was discussed. Lecturers included experts in geosciences and non-linear dynamics.



Vladimir Isaak Keilis-Borok

SCHOOL ON EXPLORING THE ATMOSPHERE BY REMOTE SENSING TECHNIQUES

18 October - 5 November

Directors: R. Guzzi (Institute for the Study of Atmospheric and Oceanic Sciences of the Italian National Research Council, ISAO-CNR, Bologna, Italy), G. Giovanelli (ISAO-CNR) and K. Pfeilsticker (*Institut für Umweltphysik*, Heidelberg, Germany).

Local Organiser: G. Furlan (University of Trieste and ICTP).

The School offered state-of-the-art information on remote sensing—a rapidly growing field linked to new ground-based instruments and spectral aircraft and satellites operating in the UV-IR spectral range. The School provided a general description of the subject and then offered in-depth examination of several case studies. Laboratory and field exercises took place in Bologna at the Italian National Research Council's Institute for the Study of Atmospheric and Oceanic Sciences.

Visit to the ERSA meteorological station near Trieste

SECOND WORKSHOP ON FUSION RELATED PHYSICS AND ENGINEERING IN SMALL DEVICES

20 - 22 October

Directors: A. Wootton (Lawrence Livermore National Laboratory, Livermore, USA) and R. Amrollahi (K.N. Toosi University of Technology, Tehran, Iran).

The Workshop sought to foster co-operation among large established plasma and fusion programs and smaller programs, especially those from developing countries. Topics focused on the physics of turbulence and transport, tokamak disruptions, diagnostic and data analysis development, and engineering.

WORKSHOP ON BROAD-BAND SEISMIC OBSERVATIONS AND THE GEODYNAMICS OF THE SCOTIA SEA REGION, ANTARCTICA

25 - 26 October

Local Organiser: G.F. Panza (Department of Earth Sciences, University of Trieste, and ICTP). In co-operation with Experimental Geophysical Observatory (OGS, Trieste, Italy).

This Workshop included 22 scientists involved in the study of the Scotia Sea region in Antarctica. Participants discussed recent advances in understanding neotectonic evolution and associated geodynamic processes employing data from broad-band seismographic stations operating in the area since 1992. Workshop results confirm the usefulness of seismological investigations conducted in this tectonically varied region and the value of co-operation among geologists and seismologists in enhancing our understanding of the Scotia Sea region.

AUTUMN COLLEGE ON PLASMA PHYSICS

25 October - 19 November

Directors: B. Buti (California Institute of Technology, Pasadena, USA), S.M. Mahajan (University of Texas at Austin, USA), P.H. Sakanaka (*Universidade Estadual de Campinas*, Brazil) and Z. Yoshida (University of Tokyo, Japan).

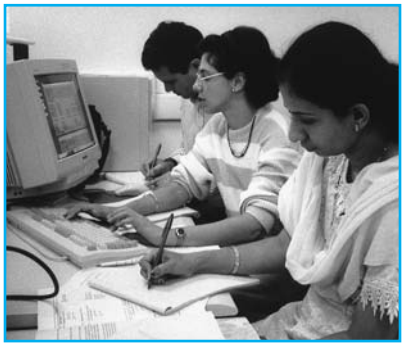
Many-body physics is dominated by collective modes in which a large number of particles coherently participate. A collisionless plasma, due to its ability to sustain an endless variety of such motions, represents systems defined by collective interactions. Recent technology has uncovered new regimes for collisionless plasmas, particularly in the domain of semiconductor physics. This interdisciplinary College studied the collective phenomena both in conventional and emerging plasmas. Lectures and work sessions focused on theories, experiments and computer simulations.

WORKSHOP ON WEB ENABLING: TECHNOLOGIES AND AUTHORING TOOLS

8 - 19 November

Local Organisers: G. Pastore (University of Trieste, Italy) and E. Canessa (ICTP).

The growth of the internet in universities throughout the developing world has revealed two serious institutional problems: limited bandwidth and limited computer literacy. The first slows the flow of information; the second curbs the potential impact of the technology. The Workshop examined the most advanced techniques for optimising bandwidth use; basic tools for putting information on the web; and recent developments in internet standards and services. Technical issues focused on web servers, software, tracking and databases. Applications included page and website design, and tools for multi-lingual web pages, chat rooms, web conferencing and scientific



Workshop on Web Enabling

MICROPROCESSOR LABORATORY SIXTH COURSE ON BASIC VLSI DESIGN TECHNIQUES

8 November - 3 December

Director: (and Local Organiser) A.A. Colavita (ICTP). A. Cicuttin acted as Head of laboratory exercises.

The Course introduced scientists and engineers to the latest VLSI design techniques. Nearly 75 percent of the time was devoted to hands-on laboratory work, which relied on public domain software. Scientists were introduced to FPGA and analogue design using Spice, as well as designs for testability and a broad view of available silicon technologies. Classroom work consisted of an introduction to Linux; VLSI design using Alliance; CMOS technology; and an introduction to analogue IC design. Laboratory work focused on VLSI design using Alliance.

Microprocessor Laboratory Sixth Course on Basic VLSI Design Techniques

ICTP/ICGEB IBERO-AMERICAN SCHOOL OF ASTROBIOLOGY (IASA): ORIGINS FROM THE BIG-BANG TO CIVILIZATION, HELD IN CARACAS, VENEZUELA

29 November - 8 December

Juan Oró, Ernesto Mayz Vallenilla, Julian Chela-Flores, Guillermo Lemarchand

Co-sponsors: Chancellor's Office, *Universidad Simón Bolívar*, Caracas; International Centre for Genetic Engineering and Biotechnology (ICGEB, Trieste, Italy); SETI Institute (Mountain View, California, USA); National Aeronautics and Space Administration (Washington, USA); TALVEN, Venezuelan Delegation to UNESCO (Paris, France); *Academia de Ciencias Físicas, Matemáticas y Naturales* (Caracas, Venezuela); The Planetary Society (Pasadena, USA); and Latin American Academy of Sciences (*Fondo ACAL*, Caracas, Venezuela).

Directors: J. Chela-Flores (ICTP and Instituto de Estudios Avanzados, *Universidad Simón Bolívar*, Caracas, Venezuela), G. Lemarchand (*Instituto Argentino de Radioastronomía, CONICET*, Buenos Aires, and *Centro de Estudios Avanzados, Universidad de Buenos Aires*, Argentina) and Juan Oró (University of Houston, USA).

Local Organiser: J. Chela-Flores. Held at the IDEA Convention Center at the *Instituto de Estudios Avanzados (Universidad Simón Bolívar)* in Caracas.

The School examined the origin and evolution of life in the Universe. The aim was to analyse the transition from inert matter to cellular life as we know it on Earth. The School also discussed the possibility of life occurring elsewhere. Participants were exposed to relevant knowledge in physics, chemistry and the life sciences. Special attention was paid to our growing capacity to search for microorganisms and signals of extraterrestrial life due to technological advances in planetary science and radioastronomy.

COURSE ON THE INTRODUCTION TO XILINX VIRTEX USING VHDL

20 - 21 December

Co-sponsor: Exsultation Inc. (Montreal, Canada).

Local Organiser: A.A. Colavita (ICTP).

The Course presented an introduction to the Xilinx Virtex architecture and how to carry out VHDL-based designs using the various architectural features that have been included on this chip such as the Block RAM and the Delay Locked Loop (DLL). The Course, which included a series of labs in addition to classroom work, was taught by experts from Exsultation Inc.

PROFILE

Hem Raj Sharma, from Nepal, not only hopes to excel as a physicist but to raise the importance of physics in the country of his birth. His association with ICTP has enabled him to get off to a promising start on both fronts.

Nepal's High-Flying Physicist

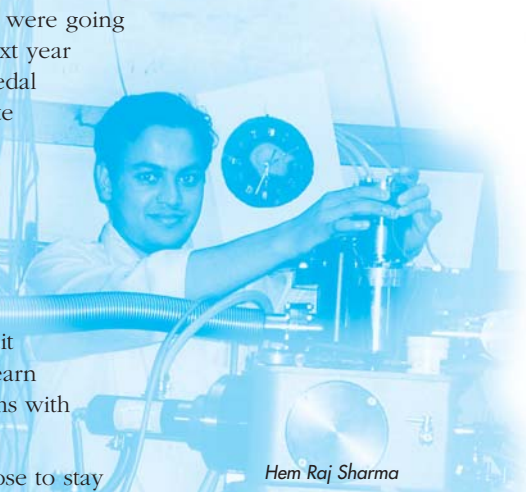
Like many other young Nepalese students, Hem Raj Sharma's first ambitions in high school leaned towards medicine or engineering, which are regarded as secure career options with good earning potential.

Despite excellent grades in his high school graduation exams in 1989, Sharma didn't quite make it into either of these extremely competitive areas and he opted to study physics at Nepal's leading Tribhuvan University, the only university in the country to offer a master of science degree. Physics, Sharma thought, would allow him to switch to engineering at some point in the future.

An alteration in career plans was not the only major change he had to make when he arrived at the university in the bustling capital city of Kathmandu. Sharma comes from a remote rural district without electricity or running water and was taught in Nepalese at his state high school, not English as in the university. Within a few weeks, Sharma had to get used to a relatively new subject, a very different way of life and an unfamiliar language.

He withstood the challenge. In fact, changing culture, country and language seem to have become mainstays of his still early career as he moves from rural to urban Nepal, Japan, Italy, Germany…following one opening after the other.

Once he arrived at Tribhuvan University, it became obvious that he and physics were going to get along just fine. In his first year, he was the top student in his class and the next year the top student in the entire college—a position he maintained, winning the gold medal for physics when he graduated with a master in science degree majoring in solid state physics. His record made him the obvious choice to represent his university on a one-year student exchange with Rikkyo University in Japan where he studied photoemission. The exchange took place in 1997.



Hem Raj Sharma

In Japan, Sharma was impressed by his colleagues' autonomy and depth of knowledge—they were left to study on their own more than he was used to in Nepal and also had access to a wider range of equipment and published material. The latter, however, proved difficult for Sharma who did not read Japanese and often had to wait weeks for English-language versions of manuals to arrive. Typically, he started to learn the new language and, by the end of his stay, he could get by, despite a few problems with hard-to-translate technical terms.

Once back in Nepal, he would have been qualified to select engineering, but chose to stay with physics. His next move was to ICTP as a Diploma Course student in condensed matter physics. That proved one of the most decisive moves of his career. Not only did it allow him to see that he was on the right track both scientifically and professionally, but it brought him in contact with scientists from all over the world and helped him to formulate and realise new plans and ambitions.

Sharma managed to combine his studies with participation in an INFM-TASC (Italian National Institute for the Physics of Matter-Laboratory of Advanced Technologies, Surfaces and Catalysis) research project on photoemission. This, he believes, helped him win a place in a Ph.D. programme at *Freie Universität Berlin* in Germany in 1999, where he will be spending the next three years pursuing research on helium atom scattering and surface physics.

Sharma would then like to return to Nepal to help establish physics as a valid and valuable field of research in his native country. At the moment, there are few career options for physicists other than teaching and, as the son of a social sciences teacher, he can see that the underpaid and overworked life of a teacher is not enough to encourage young Nepalese to continue their study of physics beyond their first degree.

Sharma would like to change that by creating research opportunities in Nepal. He does, however, realise that such a change will likely take place only gradually in a country where government spending priorities must focus on such critical areas as food security.

Sharma, who has been in contact with several like-minded Nepalese colleagues, hopes to get something going within the next few years, possibly starting with research related to computational science before branching into other areas. In the meantime, he plans to continue his research abroad, preparing himself to bring home as much physics learning as possible when the right moment arrives. □

TRIBUTES

World-known physicist and cosmologist **Dennis William Sciama** died in Oxford, UK, on 18 December 1999, at the age of 73. Since 1983, Sciama directed the astrophysics section of the International School for Advanced Studies (SISSA) in Trieste and served as co-organiser of many ICTP workshops and conferences. Sciama will be remembered for his provocative theories on the role of neutrinos in cosmology and for his many-universes hypothesis. He also was a brilliant lecturer and wrote several books for popular audiences, including *The Unity of the Universe*, *The Physical Foundations of General Relativity* and *Modern Cosmology*. His legacy will continue through the large number of students he taught and inspired at Cambridge, Oxford and Trieste, among them John Barrow, George Ellis and Stephen Hawking.

Former Tanzanian president **Julius Nyerere**, father of Tanzanian independence and symbol of Africa's post-colonial hopes, died in London on 14 October. He was 77. Nyerere, a close friend of ICTP founder Abdus Salam, served as Tanzania's prime minister and then president from 1961, the year of Tanzanian independence, until 1985. Throughout his time in office, Nyerere focused his energies on improving education and health care, particularly for Tanzanians living in small rural villages. A scholar as well as a politician, he wrote several books examining development issues in Africa and translated Shakespearean plays into Swahili. Nyerere also launched and then served as chairperson of the South Commission, which evolved into the South Centre, an organisation he also chaired. Both the Commission and Centre have been dedicated to narrowing the science and technology gap between the North and South through South-South co-operation. Nyerere visited ICTP in June 1989 to express his personal appreciation for Salam's role in promoting science in the developing world.

Math Exchange

The 10-person **Commission on Development and Exchange (CDE) of the International Mathematical Union (IMU)** held a one-day meeting at ICTP on 6 November to discuss the Commission's future directions and goals. CDE is one of three standing commissions of IMU, which is the largest organisation of professional mathematicians in the world. IMU's current president is Jacob Palis, a member of the ICTP Scientific Council, whose involvement with the Centre dates back some 30 years. CDE's past chairperson is M.S. Narasimhan, who is a member of the ICTP Mathematics Group.

European Science Journalists

Between 15 and 18 December, a group of 20 science reporters from 12 European countries visited ICTP and other prominent research organisations in Trieste and the surrounding area. The group was led by Paola De Paoli, president of both the **European Union of Science Journalists' Associations (EUSJA)** and the **Italian Union of Science Journalists (UGIS)**. At the Centre, the journalists were welcomed by the director Miguel Virasoro, who highlighted ICTP's broad-ranging research and training activities and discussed the Centre's involvement with scientists from developing countries. On the final day of their visit, the journalists traveled to Slovenia to tour Ljubljana Technology Park.

Centre's Gallery

An exhibition featuring 15 graphics by **Lucio Saffaro** opened on 26 November at the Centre's Art Gallery, located in the Adriatico Guesthouse. Before the opening, a roundtable discussion by art critics and scientists—among them, GianCarlo Ghirardi, head of ICTP Associates and Federation Schemes—examined the career of Lucio Saffaro, an artist and mathematician from Trieste who died in 1998. More than 100 people were in attendance. The exhibition remained at the Centre until 5 December.

Turra Retires

Ondina Turra retired from ICTP at the end of 1999. Ondina began working at ICTP in early 1969 as secretary to the Deputy Director. In 1978, she became assistant to the Administrative and Scientific Information Officer. While holding that post in the early 1980s, she assisted in setting up the Programme of Training and Research in Italian Laboratories (TRIL). In 1983, she became head of the Office of Associates and Federation Schemes, a post she held until 1997 when she took lead responsibility for the ICTP Central Archives. Centre staff join the numerous former and current ICTP Associate Members in wishing Ondina a pleasant retirement.

WHAT'S NEXT

1 - 11 February

Joint INFM-The Abdus Salam ICTP School on Magnetic Properties of Condensed Matter Investigated by Neutron Scattering and Synchrotron Radiation Techniques

7 - 25 February

School on Data and Multimedia Communications Using Terrestrial and Satellite Radio Links

7 - 25 February

Winter College on Optics and Photonics

28 February - 3 March

Joint ICTP-ICS Training Course on Optical Design and Optimization

28 February - 24 March

Fifth Course on Mathematical Ecology, including an Introduction to Ecological Economics

1 - 4 March

Research Workshop on Self-Organized Criticality and Phase Transitions in Driven Systems

13 March - 14 April

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

27 March - 4 April

Spring Workshop on Superstrings and Related Matters

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 2000`
Leave the body of the message blank. Send it.
Your e-mail will generate an automatic reply from the ICTP server containing the most updated version of the yearly Calendar.

(2) For Information on a Specific ICTP Activity
Each activity in the Calendar has its own 'smr' code number, which is located on the last line of each activity description. The 'smr' number will enable you to obtain more information—if available—on those activities you are interested in. To receive this more detailed information, create a new e-mail message and type the smr code number that you found on the calendar:
To: `smr####@ictp.trieste.it`
Under the e-mail's subject, type
Subject: `get index`
Leave the body of the message blank and send it.
You will receive an automatic reply listing all documentation available on that particular activity—the `announcement` or `bulletin` and, in most cases, a separate `application_form`.
To receive the full text of the announcement and/or application form, you will need to send another e-mail message to the same smr code:
To: `smr####@ictp.trieste.it`
Subject: `get announcement application_form`
Again, leave the body of the message blank, and send it.

(3) For Information on All ICTP Activities
A free online service for the dissemination of information on all ICTP activities, programmes and related announcements is available via e-mail. To subscribe, create a new e-mail message and type:
To: `courier-request@ictp.trieste.it`
Leave the subject line empty.
In the body of the message type
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and your e-mail address. Send the message.
Any comments or suggestions on this service are most welcome. Please address them to `pub_off@ictp.trieste.it`.

NEWS from ICTP

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

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

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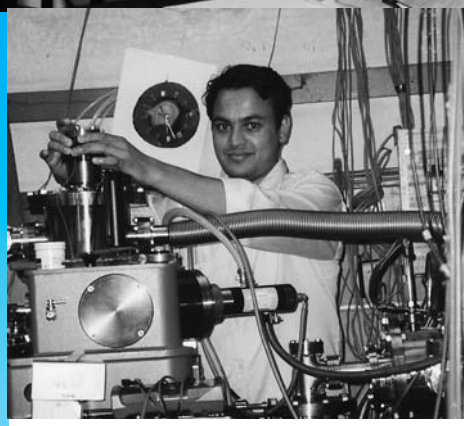

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