

Leadership transition at ICTP

P-2, 4 After leading ICTP for seven years, Katepalli R. Sreenivasan stepped down in November as ICTP director to return to academia in the US. In this final newsletter of his tenure, Sreenivasan reflects on his directorship. Fernando Quevedo, a Guatemalan national from the University of Cambridge, began as new director on 5 November . . .

Regional climate change models

P-6 Global warming projections such as those published in IPCC reports rely on data collected from hundreds of scientists, who in turn have used sophisticated climate models to determine temperature trends. One such model is the Regional Climate Model (RegCM) developed and maintained by ICTP's Earth System Physics (ESP) section . . .

Focus on ICTP Diploma Programme

CENTREFOLD Recognising that talented young science students in developing countries were sometimes limited in achieving their full potential by the absence of advanced training at a postgraduate level, ICTP instituted an intense 12-month programme in the main research fields of the Centre, with the aim of filling this gap. Some 20 years later, nearly 500 students have earned diplomas through the Diploma Programme . . .

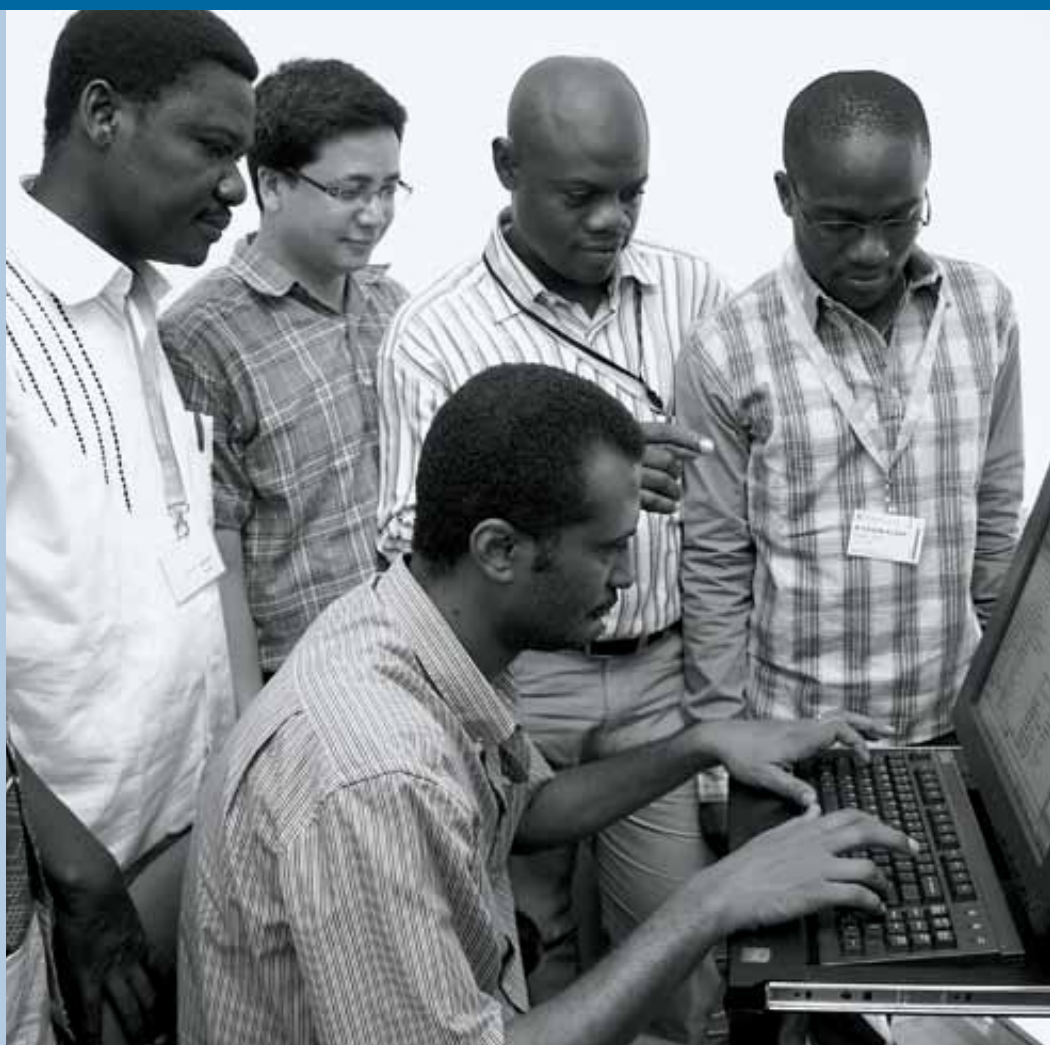
NEWS

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from ICTP



A changing of the guard

ON THE EVE OF LEAVING OFFICE, KATEPALLI R. SREENIVASAN REFLECTED ON HIS 7-YEAR TERM AS ICTP DIRECTOR AND SPOKE CANDIDLY ABOUT HIS CHALLENGES AND SUCCESSES

What was the most important element behind your successes at ICTP?

There would have been no substance to my work without that of the ICTP staff—scientific and administrative—and of the numerous scientists and well-wishers from outside ICTP. They nudged me beyond my limitations and guided me through tough times by their advice and institutional loyalty. I express my immense gratitude to them. I made many friends and my life is the richer for it.

While ICTP is now a more substantial institution than it was only 20 years ago, personal attention should remain as a principal trait of ICTP.

CHANGING GUARD

What set your agenda for your term at ICTP?

Two things were immediately clear when I first considered accepting the director's position. The Centre should maintain its pursuit of scientific excellence lest its quality degenerate, and its openness and commitment to diversity.

ICTP's impact is made primarily through the recruitment of the best scientists possible and by inducing them to take serious interest in enhancing the quality of science in the developing world. When making scientific appointments to the Centre, ICTP should make no compromise on quality by dwelling on nationality or pedigree of the candidate or even the sub-field of physics. Essentially everything I have done is directed towards enhancing the inner core of ICTP. I also used the attractive character and mission of ICTP to draw in as many of the best scientists as possible to run our programs, in as many areas as possible.

On the other hand, not all scientists who need us are accomplished. As long as their interest is genuine, they are willing to work hard, can benefit from our programs and are willing to act as seeds of excellence in their own countries, ICTP should open itself up to them without any prejudice. Be open but demand accountability. We should provide avenues for visiting scientists to explore their potential to the fullest. A line of prayer I was taught says: Let noble thoughts come to us from all directions. That seemed like a good idea.

What accomplishments as director are you most satisfied about?

ICTP recruited 14 scientists during my term (and some more positions will soon be filled). They are first-class people with excellent promise and pedigree, and came with glowing recommendations from great schools such as Princeton, Harvard and Imperial College. What makes me especially pleased is that they all appreciate the value and importance of ICTP's mission and are devoted to it.

I brought ICTP to the attention of a very wide community. I never tired of speaking about its mission and its value to diplomats, policy makers and scientists alike.

During my tenure, Trieste came closer to ICTP, not just the city through common events such as the Open Day but also the scientific institutions on whose goodwill ICTP depends. For instance, it was a shock to learn that, while the University of Trieste and ICTP had common ties since 1964, not a single educational program linked them together. We were able to start new joint programs at the Masters and Ph.D. levels.

One of my strengths is my inclusiveness while sparing no effort in performing at the highest level possible. I don't remember ever letting things go without asking, "Can't we do them better?" This is the reason that we could make

a difference to a large number of needy scientists throughout the world. In some instances, we created new centres of excellence; in some others, we nudged them in such directions. The statistics and indicators of enhanced quality speak for themselves.

At ICTP I learned that an administrator can bring good ideas to fruition if he is open and supportive, while demanding unstinted effort at the same time. Great satisfaction came when I saw the results directly, whether they concerned a Physics Program in Congo Brazzaville, or a Centre in Romania, or the way some STEP students matured in the span of a few years. What else is there beyond making a difference to some deserving people whose scientific lives would have shriveled up for lack of opportunities?

Were there disappointments?

I was unable to forge better ties among Trieste institutions so as to bring a much higher level of recognition to Trieste as the City of Science; we have a long way to go in comparison with Boston and Silicon Valley. I could not appoint enough women scientists. I was able to raise only modest amounts of additional money for the Centre. And many more.

But I regret not one iota of my term at ICTP, and, despite some agonizing moments, would do it again. This speaks for ICTP's greatness.

What dangers could ICTP face in the future?

ICTP is a miracle that cannot be repeated in today's "what's-in-it-for-me" culture. It has to be sustained

at a high level. The ICTP staff, particularly its scientists, should not lose the sense of its special role; ICTP is a scientific institution run by a few scientists for the benefit of many. One cannot be too draconian in imposing this culture of altruism for fear of stifling individual creativity, but one cannot be too loose and let the institution act with diffuse purpose. If ICTP acts in a way that invites the distrust of its scientific community, whether from developed or the developing worlds, it cannot maintain its respect or moral authority; indeed, much of what ICTP does derives from this moral authority. Only steadfast commitment to quality, openness and diversity will help us maintain it. The Centre must avoid, at all costs, becoming inward looking and bureaucratically complex.

What are your thoughts on the change in leadership at ICTP?

Fernando is a marvelous person with just the right temperament and experience. I am unreservedly enthusiastic about him and believe that ICTP will grow stronger under his leadership.

What will you be doing after ICTP?

I will retain my title as "Abdus Salam Honorary Professor" and

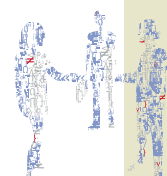


+ K.R. Sreenivasan speaking at the Open Day in 2006

will maintain connections to ICTP without intruding, and will work for it as required. I will be teaching and doing research in New York University's (NYU) Department of Physics as well as its Courant Institute. In addition, I will spend half the time in NYU's Provost's Office as senior vice provost, helping to get research off the ground at the new NYU campus in Abu Dhabi. No doubt I will get engaged in other tasks that pose plenty of challenges ahead.



+ K.R. Sreenivasan awarding Diploma student C.L. Daleu a special prize as best student in her field in 2009



New ICTP Director appointed

PARTICLE PHYSICIST FROM CAMBRIDGE BECOMES ICTP DIRECTOR

Fernando Quevedo of the University of Cambridge, UK, a Guatemalan national, has been appointed as the new director of ICTP. He succeeds Katepalli R. Sreenivasan, who has led the institute since 2003. Sreenivasan has returned to the US to pursue his interests in research and teaching.

Quevedo is a well-known theoretical particle physicist with wide-ranging research interests in string theory, phenomenology and cosmology. He was awarded the 1998 ICTP Prize in recognition of his important contributions to superstring theory.

He was born in 1956 in Costa Rica and obtained early education in Guatemala. He obtained his Ph.D. from the University of Texas at Austin in 1986 under

the supervision of Nobel Laureate Steven Weinberg. Following a string of research appointments at CERN, Switzerland, McGill University, Canada, Institut de Physique in Neuchâtel, Switzerland, and the Los Alamos National Laboratory, US, as well as a brief term as professor of physics at the

UNAM (Mexican National Autonomous University), Mexico, Quevedo joined the Department of Applied Mathematics and Theoretical Physics at the University of Cambridge, UK, in 1998, where he is currently Professor of Theoretical Physics and Fellow of Gonville and Caius College.

Asked about the importance of the appointment, Quevedo declared, "I am deeply honoured to have been selected for this highly prestigious position at an institution that is very close to my heart. The founder of ICTP, Abdus Salam, has always been a role model for me since, more than any other scientist, he dedicated his life to scientific research of the highest quality while at the same time helping to improve the level of science in the developing world."

He added, "As a scientist from a developing country, I look forward to following Professor Salam and my predecessors' footsteps; to lead and further advance ICTP through these exciting times in which science is of greatest importance for the world's culture, development and survival."

Sreenivasan added that the choice of Quevedo as the next director is in keeping with the spirit of ICTP, which is to do first-rate research while acting as the anchor for scientific capacity building in developing countries.

In addition to receiving the ICTP Prize, Quevedo has received various honours including Doctorates Honoris Causa from the Universidad del Valle de Guatemala



+ New ICTP Director Fernando Quevedo

and the Universidad de San Carlos de Guatemala, the Royal Society Wolfson Merit Award and the John Simon Guggenheim Foundation Fellowship. He is the founder and coordinator of the International Network of Guatemalan Scientists.

NEW
DIRECTOR

ICTP Dirac Medallists 2009 announced

ICTP AWARDS PRESTIGIOUS DIRAC MEDAL TO SIMULATION EXPERTS

ICTP has awarded its 2009 Dirac Medal to Roberto Car and Michele Parrinello for their revolutionary “molecular dynamics” numerical simulation method for condensed matter.

Their work, known as the Car-Parrinello method, combines quantitative electronic energy calculation, via a theory known as Density Functional Theory (DFT), with Newtonian molecular dynamics simulation of the mechanical motion of atoms and molecules in real time. That method has provided an all-important quantitative understanding of the properties of matter, while also allowing scientists and laypeople alike to visualise atoms in motion during physical and chemical processes.

“With this year’s Dirac Medal, ICTP acknowledges the enormous impact the Car-Parrinello method has made on the creation of molecular simulations,” said former ICTP Director Katepalli R. Sreenivasan. He added: “This is the first time that the Dirac Medal recognises computational physics properly,

the Car-Parrinello method being a major milestone in that area.”

“Up to the 1980s, molecular dynamics simulation was mostly a game. Because it was so very time consuming to calculate the electronic forces that act on atoms, scientists just could not do it fast enough to use them on the fly. So, the simulations were done using invented forces,” said Erio Tosatti, former Acting Director of ICTP and a condensed matter researcher who brought Car and Parrinello to the University of Trieste and to the International School for Advanced Studies (SISSA, next door to ICTP) in the late 1970s.

Car and Parrinello’s clever and elegant trick around the problem treats the DFT electronic parameters as fictitious additional atomic coordinates, and applies Newtonian mechanics to their motion. They published a paper on their method in the November 1985 issue of the journal *Physical Review Letters*; the paper now ranks sixth among the journal’s top cited articles, with a total of 5027 citations. The work created a new paradigm, now an indispensable tool of every computational condensed matter physicist, chemist, and even biologist.

Born in Trieste, Roberto Car is a professor in the Chemistry Department at Princeton University.

Michele Parrinello, who was born in Messina, Italy, is a professor at the Swiss Federal Institute of Technology (ETH Zurich).



+ Dirac Medallists Roberto Car and Michele Parrinello

ICTP’s Dirac Medal is given in honour of P.A.M. Dirac, one of the greatest physicists of the 20th century and a staunch friend of the Centre. It is awarded annually on Dirac’s birthday, 8 August, to scientists who have made significant contributions to physics. The Medallists also receive a prize of US \$5,000.



DIRAC
MEDAL



Understanding global climate change, one region at a time

ICTP CLIMATE MODEL TAKES A REGIONAL APPROACH

Policymakers will meet in Copenhagen this December to plan a new global climate change treaty that will replace the Kyoto protocol, which expires in 2012. A new international framework needs to address the stringent emission reductions proposed by the Intergovernmental Panel on Climate Change (IPCC) in its series of climate change reports. IPCC projections of global warming and regional climate changes have relied on data collected from hundreds of scientists, who in turn have used sophisticated climate models to determine temperature trends and other climate changes. One such model is the Regional Climate Model (RegCM) developed and maintained by ICTP's Earth System Physics (ESP) section.

The RegCM provides a close-up glimpse of climate changes at regional scales.

The model uses specific equation-based codes that simulate the Earth's climatic conditions at regional scales to produce regional climate projections from decades to centuries.

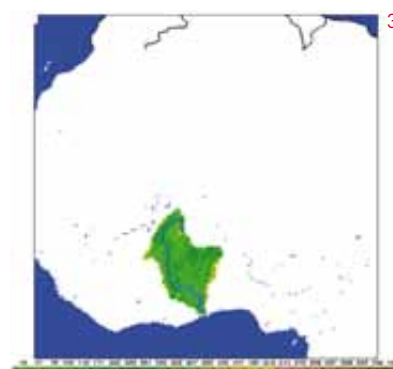
"The RegCM enables us to zoom in on specific regions and obtain fine-scale information," said Filippo Giorgi, head of the ESP group. With the RegCM3, the latest

version of the software, researchers can obtain a resolution of approximately 15 to 20 km. "This is important because climate, as we know, varies drastically from region to region or even within the same region," explained Giorgi.

Giorgi started developing the RegCM while working at the National Center for Atmospheric Research, Colorado, USA, bringing the model with him when he came to ICTP. Since then, the model has evolved substantially. Xunqiang Bi, assistant research scientist in ESP, maintains the code and ensures that the interface remains user-friendly.

ESP scientists use the model mainly for climate projections in Europe, the Mediterranean region and Africa. However, the model can easily be adapted to any region of the globe and is being used outside ICTP for climate projections in all continents. In fact, Giorgi said that the RegCM3 is one of the most widely used regional climate models in the world.

There are many factors that influence climate, and the RegCM takes a number of these into consideration when making projections: the model includes atmospheric, hydrological, agricultural and vegetative components. Erika Coppola, a visiting scientist with the ESP group, has developed the hydrological model that is coupled with the RegCM, and says that the feature has practical applications for developing countries.



+ Simulations of the
 1. Western Africa river network
 2. The Niger river basin
 3. The Volta river basin
 by RegCM's hydrological model CHyM

CLIMATE
CHANGE

“Some countries in Africa, for example, face severe drought conditions followed by periods of heavy rain,” said Coppola. “The problem of drought can be solved if water can be harvested during the wet season, but for this they need accurate projections of precipitation and runoff patterns. The RegCM’s hydrological component can make these projections,” she explained. In addition, the hydrological model is currently used for real-time flood forecasting in some areas of central Italy.

Another feature unique to the RegCM is a chemistry/aerosol component, which is coordinated by Ashraf Zaakey, a visiting scientist with the Egyptian Meteorological Authority. Zaakey said that one of the major factors affecting regional climate change is the effect of aerosols of natural and anthropogenic origins. “Aerosols and gases can be either long- or short-lived. While the short-lived aerosols absorb and reflect radiation and decrease temperature, the long-lived gases trap the radiation and cause an increase in temperature,” said Zaakey.

The latest version of the RegCM incorporates chemistry and aerosol data of both anthropogenic and natural origins, including aerosols arising from desert dust, sea spray and biomass burning. “These natural aerosol sources that modulate the regional climate are now coupled with the RegCM so that we can get more up-to-date and accurate climate simulations,” said Zaakey.

To ensure that the RegCM finds practical use around the world, ICTP has been organising a regular series of workshops and conferences for researchers and students, particularly from developing countries. The aim is to educate them about using climate models for their regions. Coppola was an organiser of one such workshop, titled “Water Resources in

Developing Countries: Planning and Management in a Climate Change Scenario”. The next workshop of this series is planned for spring 2010.

ICTP has also organised workshops in countries where the model is being used so that local researchers can operate the model themselves. “Last year, ICTP organised a workshop in Egypt titled ‘Climate Chemistry Interaction,’” said Zaakey. In the last several years other regional workshops were organised in Pakistan, Nepal, China, Ghana, Ethiopia, Syria, Turkey, and South Africa.

“Students from developing countries not only got a chance to learn from the workshop’s expert speakers but also received hands-on training in using the regional climate, hydrological and impact models,” said Coppola.

There is more on the RegCM’s plate than workshops and conferences. With the aim to promote climate research and build better communication channels for climate researchers from developing countries, ICTP has established the Regional Climate Network (RegCNET), which currently includes over 500 researchers



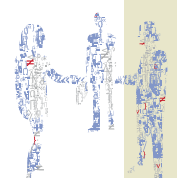
+ Filippo Giorgi and Erica Coppola

worldwide and operates telematically through an email discussion list. In addition, the RegCM3 plays an important role in a number of European projects, which provide important funding sources for model development and application.

Last but not least, while the RegCM3 continues to provide a research tool for the scientific community, a more advanced version is being developed: the RegCM4. The newer version will be released during the biennial Earth System Physics workshop to be held at ICTP in 2010. The researchers hope that the advanced model can provide increasingly accurate and detailed regional projections up to the end of the 21st century.



+ Participants of the workshop “Water Resources in Developing Countries: Planning and Management in a Climate Change Scenario”



A world connected without wires

ICTP'S WIRELESS TRAINING NARROWS DIGITAL DIVIDE

"Give a man a fish and you feed him for a day. Teach a man to fish and you feed him for a lifetime." ~ Chinese proverb

The Chinese adage could well be one that researchers from ICTP's Aeronomy and Radiopropagation Laboratory (ARPL) follow. ARPL's radiocommunications section has been providing wireless technology to developing countries and is now training trainers as well.

The goal is to ensure that local researchers can successfully develop and manage sustainable wireless technology projects in their own countries and impart training to others there. ARPL has been developing wireless technology kits that will be a part of the new training package. These kits can be used for wireless networking and bandwidth management.

Marco Zennaro, an ARPL researcher who is involved in the training activity, said that the kits will "enable training activities to be held outside ICTP—in countries where the technology will be applied." Zennaro hopes to have the first batch of kits ready by the end of this year, in time for a first test-run

at the International Institute of Information Technology (I²IT) in Pune, India.

Harnessing wireless technology in developing countries to make them a part of the "communicated world" has been the aim of ICTP's radiocommunications section, said Sandro Radicella, the head of ARPL. "Apart from the 'train the trainers' initiative, our current research focusses on new technologies for long-distance links—which can connect places that are at distances of more than 50 km—and wireless sensor networks," he said.

Bharat Chaudhari, an associate at ICTP and a faculty member at I²IT, said that wireless technology in developing countries is crucial for many reasons. "It does not need expensive infrastructure like fibres or cables, it gives mobility, it enables faster communication and, most importantly, it can be low-cost," he explained.

Moreover, wireless technology has wide applications, from academics to medicine to environmental protection. The sensors that Chaudhari is working on, for example, can transmit information about the quality and availability of water. In 2008, the radiocommunications staff established a long-distance wireless link between two hospitals and medical colleges in Malawi. Zennaro said, "This has enabled faster communication between the institutions and is crucial in medical cases where time is of the essence."

WIRELESS WORLD



+ The team that deployed the wireless network in Malawi. From left: Carlo Fonda, Ermanno Pietrosemoli, Rob Flickenger, Anthony Muyepa, Fabio Beraldin, Marco Zennaro and Steve Okay



+ Ermanno Pietrosemoli giving a hands-on lecture

A scholarly journal for the developing world

INTERVIEW WITH K. TAHIR SHAH, MANAGING EDITOR

What makes a quality science journal? “Excellent research papers, a board of editors comprising eminent people from the field, and a first-class institution to support the venture,” said K. Tahir Shah, managing editor of *The African Physical Review*, a peer-reviewed, open-access and free electronic journal published by ICTP.

The idea for *The African Physical Review*, which is dedicated to publishing in all branches of experimental and theoretical physics, was born in 2006 when some African scientists visiting ICTP suggested that a high-quality journal accessible to African researchers be published. ICTP, in keeping with its tradition of aiding, highlighting and encouraging research in developing countries, started publishing the journal in 2007.

“There are many science journals published in Africa, but very few succeed in attracting high-quality research papers. Lack of management skills and publishing experience are the major barriers toward achieving excellence in journal publishing. Moreover, publishing papers in top-notch

journals is not easy for researchers from developing countries, mainly because of the high costs involved. *The African Physical Review* is a top-quality journal that is accessible to these researchers. It is free, and authors retain the copyright for their papers,” said Shah.

The journal maintains a strict emphasis on the quality of the articles published. The rigorous vetting process starts at Shah’s desk. He checks for relevance and quality, and if suitable, sends the submission for peer-review either through the board of editors or directly to well-known experts if the submission falls outside the domain of board members’ expertise. All members of the board are eminent physicists, including Nobel Laureate Sir Anthony Leggett and former ICTP Director Kathepalli R. Sreenivasan.

“Appropriate presentation and writing of scientific ideas is a very serious and important aspect of publishing,” Shah said, adding that the main aim is to ensure that “we publish material that is easily comprehensible and accurate, given that many researchers whose mother tongue is not English face difficulties expressing their ideas in a proper way. We help them with multiple revisions in order to improve the presentation as much as our resources permit. However, maintaining the fine balance of quality in science and language while ensuring that research from all parts of the world is highlighted is no easy task.”



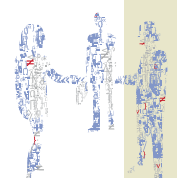
About the research culture in some parts of the world, Shah said, “There is a need to inculcate an empirical science culture. We at *The African Physical Review* hope to impart a certain level of scientific mentality and maturity to researchers from developing countries.”

As it enters its third year, *The African Physical Review* aims to keep growing and compete with top physics journals. “We hope to add to the board younger and highly motivated physicists who share the journal’s philosophy,” Shah said, adding, “We need to keep updating ideas on how the journal should proceed in light of developments and challenges. Publishing is both an art and science of knowledge dissemination.”



+ *The African Physical Review*’s managing editor K. Tahir Shah

AFRICAN
JOURNAL



Focus on the ICTP Diploma Programme



Stephane Happi Kwemo
Cameroon

UNIQUE GRADUATE-LEVEL PHYSICS AND MATHS PROGRAMME BROADENS EDUCATIONAL AND CULTURAL HORIZONS FOR STUDENTS FROM DEVELOPING COUNTRIES

Recognising that talented young science students in developing countries were sometimes limited in achieving their full potential by the absence of advanced training at a postgraduate level, late ICTP founder and Nobel Laureate Abdus Salam instituted, in 1991, an intense 12-month programme in the main research fields of the Centre, with the aim of filling this gap.

Some 20 years later, nearly 500 students have earned diplomas through the ICTP programme, which offers four specialised fields that reflect core research activities of ICTP: condensed matter physics, earth system physics, high-energy physics, and mathematics. In 2007, ICTP started a programme in basic physics, designed for students from Sub-Saharan Africa to provide an intense and comprehensive revision of advanced undergraduate-level physics.

"I had the chance to travel a lot in Italy, to Bologna, Padua, Milan, etc. It was also incredible to share the whole ICTP experience with my classmates, my roommates who all came from different countries. My life changed during the two years I spent here, many things are clear: science, life, or how to behave."

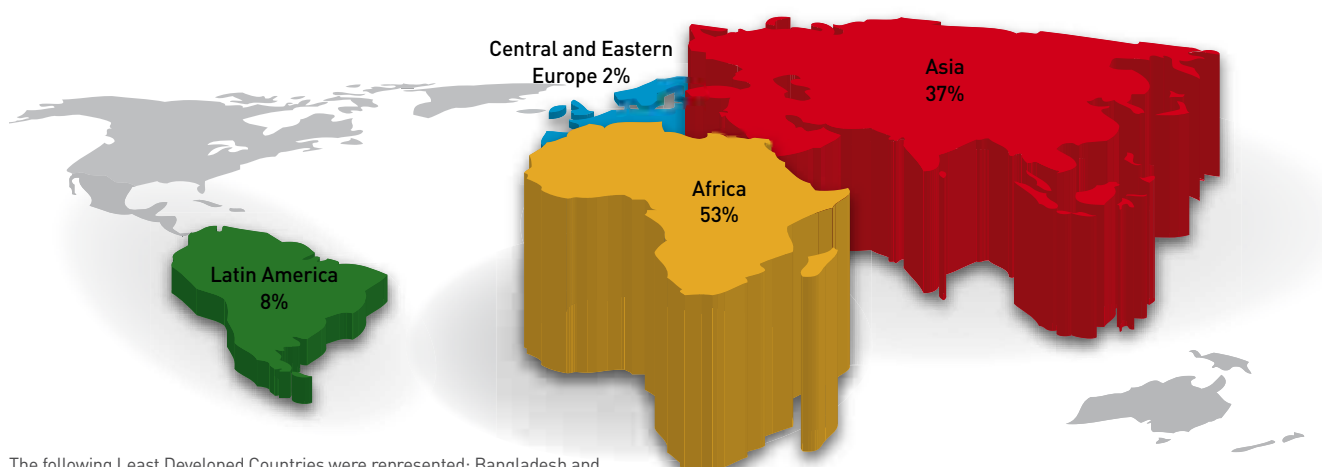
"We are proud to offer a special training course in basic physics to help students reach a level so that they are adequately prepared to embark on postgraduate study," said ICTP Assistant Director and Head of the Diploma Programme Seifallah Randjbar-Daemi. He added that a number of students in this year's basic physics programme have been accepted into ICTP's more advanced Diploma Programme and in a joint ICTP-University of Trieste Programme.

Twenty of the Diploma students have been accepted to universities in Europe and the United States and have begun their studies this autumn.

For more details, visit the Diploma Programme website (<http://diploma.ictp.it/>).

DIPLOMA

Distribution of Diploma Students by Regions



The following Least Developed Countries were represented: Bangladesh and Nepal in Asia; Ethiopia, Madagascar, Malawi, Senegal and Sudan in Africa.



Prosper Ahmed Amuquandoh
Ghana

“Interacting with people from different cultural and social backgrounds, with value and belief systems different from mine, has developed me socially and widened my horizon. This experience is equally vital to the academic experience because, in any field of endeavour, one’s ability to interact with different kinds of people is crucial. Coming to ICTP has been one of the greatest and most important decisions I have made in my life.”



Norbert Tambe Ebai
Cameroon

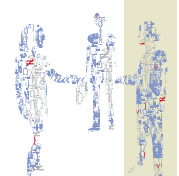
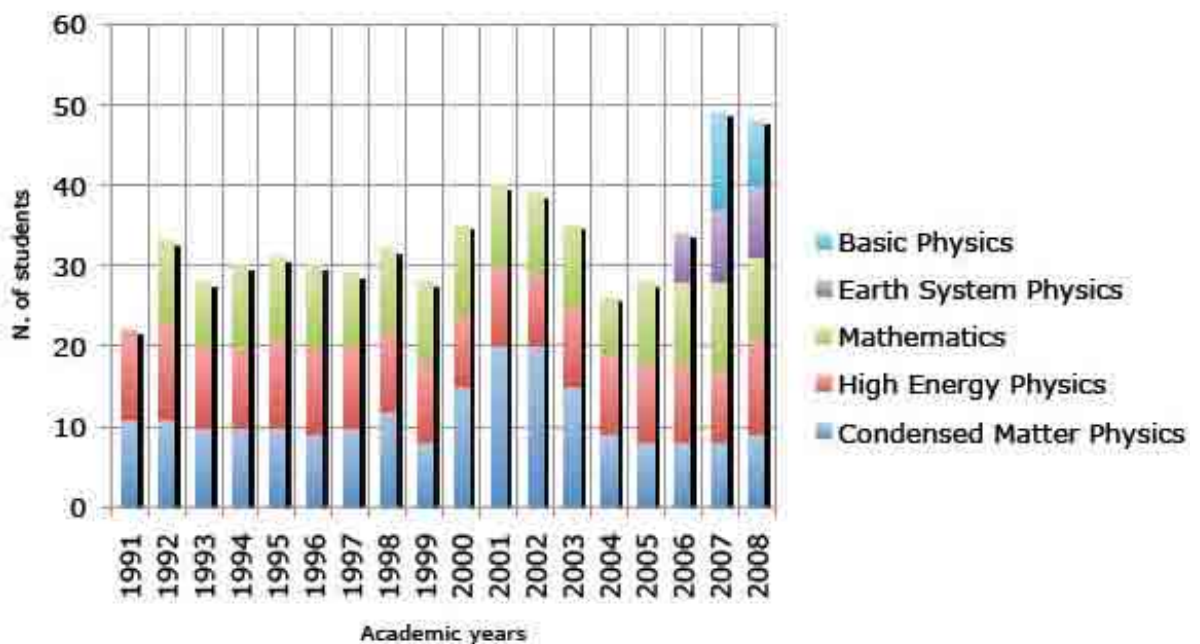
“At ICTP, I realised how I can apply even the most fundamental elements of my studies to think critically and come up with several solutions for complex problems. I also learned to think positively to believe that there was a solution or there was a better solution to issues. It started to make sense why I was studying and what my goals were.”



Chimene Laure Daleu
Cameroon

“Within only one year I have learned a lot, really a lot. At ICTP, all facilities are available, while this is not the case in a developing country such as Cameroon. Even professors are very accessible. If you have questions they are able to provide you with an answer even if you meet them in the corridor. All this made me feel very comfortable.”

Diploma Programme 1991–2008
Number of students by field



ICTP workshop addresses computing capacity in Africa

TRAINING OFFERED IN HIGH-PERFORMANCE COMPUTING

In an effort to improve research infrastructure in Africa, ICTP recently held an intensive, three-week workshop on the installation and maintenance of High-Performance Computing (HPC) equipment. The African participants—comprising a mix of computer professionals and researchers from universities across the continent—will take their knowledge back to Africa to set up their own HPC centres and to train others.

HPC uses clusters of computers to solve complex scientific computational problems. Sub-Saharan African researchers have few options for HPC on their continent, with most relying on shared connections with clusters in Europe and elsewhere. As Clement Onime of ICTP's Information and Communication Technology Section (ICTS) and programme leader for the

HPC training explained, “Apart from South Africa and some North African countries, there is little to no HPC capacity in Africa. Many institutes are trying to get it, but none have up-to-date equipment.

Another problem, affecting not only Sub-Saharan Africa, is the lack of trained

personnel who are capable of maintaining HPC installations and providing high-level support to the users (researchers). ICTP is addressing these two issues by ensuring that workshop participants work together as a core of experts to assist one another and others in Africa to set up HPC equipment. ICTP is training the trainers. I expect to see an HPC human network grow in Africa out of this workshop.”

Workshop participants came from African institutes that have clearly defined needs and users for the equipment. “It's important to understand the demands for these resources, demands that are driven by scientists,” said Stefano Cozzini, ICTP's consultant on HPC and a staff member of Democritos, the International School for Advanced Studies' (SISSA) interdisciplinary forum for computational materials science. “We have seen instances where HPC equipment has been donated to African universities that had no clear definition of needs and users; subsequently, the equipment never gets used,” he added.

ICTP hosted the three-week workshop at its campus in Trieste, in collaboration with Democritos and SISSA. The training was made possible by funding from the Italian Foreign Ministry, through cooperation with UNESCO, to build scientific capacity in Africa.



+ Workshop participants gained hands-on experience with HPC equipment and programming



HPC



+ Participants summarised what they learned during the workshop's final seminar

Research News Briefs

TOWARD THE LHC ERA

ICTP hosts workshop on topical issues in LHC physics

The world's largest and most powerful particle accelerator, the Large Hadron Collider (LHC) at CERN, resumed functioning in November. In anticipation of this, ICTP hosted a conference this summer in collaboration with the International School for Advanced Studies (SISSA) and the Italian National Institute of Nuclear Physics (INFN) titled "Topical Issues in LHC Physics".

"The aim of the four-day workshop was to get together physicists focussing on useful and topical issues as we enter the LHC era," says Bobby Acharya, the conference organiser from ICTP's High Energy, Cosmology and Astroparticle Physics (HECAP)

section. "We also wanted the conference to be a catalyst for the exchange of knowledge between the theoretical, experimental particle physics and astrophysics research groups in Trieste," says Acharya.

The conference's 55 participants included theorists and experimentalists who have been studying the main physics challenges of the LHC experiments. "The LHC is expected to produce particles of dark matter and the Higgs Boson," says Acharya. "Since most of the billions of recorded collisions will not produce these particles, it is a bit like finding a needle in a haystack, and at the conference we summarised the efforts that have gone into finding them," he adds. "We focussed on the most challenging aspects of this programme and tried to present some ideas on improving the discovery reach."

One workshop speaker, Mirko Boezio from INFN, presented what Acharya describes as "possibly the first indirect evidence of dark matter". Boezio is a member of the PAMELA project, based partly in Trieste. PAMELA is a small particle detector mounted onboard a satellite in space; it measures high-energy particles and anti-particles in the cosmos ●

NOBEL LAUREATE AT ICTP CONFERENCE

Centre hosts conference on research frontiers in ultra-cold atoms

Scientists from around the world came together for a five-day "Conference on Research Frontiers in Ultra-Cold Atoms" at ICTP that commenced with a lecture by Sir Anthony James Leggett, 2003 Nobel Laureate for his pioneering work on superfluidity. Knowledge about superfluid liquids can give us deeper insight into the ways in which matter behaves in its lowest and most ordered state.

The conference focussed on the analysis of novel quantum phases and nonequilibrium phenomena that have direct connection to problems found in condensed matter physics, astrophysics and nuclear physics. The conference programme also included poster sessions.

The event, co-sponsored by the MIT-Harvard Center for Ultra-Cold Atoms, ran from 4 to 8 May ●

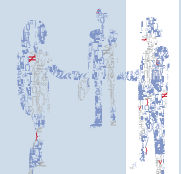


+ Bobby Acharya at CERN, in front of the ATLAS detector

RESEARCH



+ Sir Anthony James Leggett



LOOKING BEYOND THE OBSERVABLE

A workshop on eternal inflation at ICTP

A workshop organised by ICTP's HECAP section provided a guide to understanding universes that can never be observed. The "Eternal Inflation" workshop that ran from 8 to 12 June looked at "understanding the phenomena of continually expanding universes that lie beyond our own observable universe", said HECAP scientist Paolo Creminelli, one of the workshop organisers.

While our local observable universe also underwent inflation—a violent and rapid acceleration that occurred right after the Big Bang—the process has now stopped. However, the multiverse theory suggests that there exist several other universes, beyond the local observable one, that are currently inflating. As a universe expands rapidly, it creates 'nuclei bubbles' for new universes, which again will expand and create more of these 'nuclei bubbles'. "In that sense, the process of inflation is eternal," said Marcello Musso, also a workshop organiser from HECAP.

The workshop's 47 participants included experts, such as Raphael Bousso (University of California, Berkeley) and Alexei Starobinsky (Landau Institute for Theoretical Physics, Moscow), and non-experts, all who came to increase the understanding of this highly theoretical and intriguing topic ●



+ Raphael Bousso



+ Alexei Starobinsky

QUANTUM MEETS CLASSICAL

Summer college reviews latest experiments and theories in nonequilibrium physics

A new frontier was explored at the "College on Nonequilibrium Physics from Classical to Quantum Low Dimensional Systems", organised by ICTP's Condensed Matter and Statistical Physics (CMSP) section.

An experimental breakthrough in 1995—producing the ultra-cold atoms that conformed to the theoretically predicted properties of the Bose-Einstein condensate—made it possible for researchers to fabricate systems with cold atoms. This also meant that researchers from the field of nonequilibrium quantum physics needed fresh tools to manipulate the systems and had to reconcile new concepts with some of the older concepts from nonequilibrium classical physics.

The ICTP-hosted college, which ran from 6 to 24 July, brought together physicists from both fields.

"This was perhaps the first activity of its kind where the two communities came together on one platform to exchange ideas," said Alessandro Silva, one of the organisers from ICTP's CMSP section.

The college had 135 participants, including students and researchers, theorists and experimentalists from around the world. "The speakers were leading experts in nonequilibrium physics," said Silva.

In order to understand correlated systems, quantum physics needs to borrow some of the tools developed to describe classical physics. "At this college we tried to develop a common language to describe both quantum physics out of equilibrium and nonequilibrium classical physics," said Silva ●

FOCUS ON AFRICAN GEOHAZARDS

ICTP to establish Sub-Saharan geohazards network

ICTP's summer workshop on "Evaluating, Monitoring and Communicating Volcanic and Seismic Hazards in East Africa" aimed to have two ambitious outcomes: the establishment of a Sub-Saharan African geoscience network focussed on seismic and volcanic hazards; and a strategy on the effective communication of hazards information to governmental officials and policy makers in the region.

"Eastern Sub-Saharan Africa is one of the most hazardous places on the continent, as it is prone to both volcanic and earthquake hazards" said Abdelkrim Aoudia, a researcher with ICTP's Earth System Physics (ESP) section and one of the organisers of the workshop. He pointed out that the past few years have seen an unprecedented amount of volcanic and seismic activity in the East African Rift, including a volcanic eruption in the Congo that forced the evacuation of 500,000 people.

"ICTP, with its scientific capacity building experience in Africa, can address the region's urgent need for modern methods



RESEARCH

for evaluating, monitoring and communicating volcanic and seismic hazards,” said Aoudia.

The two-week workshop, co-funded by the International Association of Seismology and Physics of the Earth’s Interior, the International Association of Volcanology and Chemistry of the Earth’s Interior, the US National Science Foundation, the University NAVSTAR Consortium and the US Agency for International Development, attracted more than 50 participants, the majority of whom were from Africa. After a week of lectures from top earthquake and volcano experts, attendees had a week of hands-on training to gain experience using space geodetic techniques and modelling software.

ICTP then coordinated a network of trained African participants who were encouraged to share seismic and geodetic data across political boundaries. “This network will hopefully lead to the creation, in the near future, of an ICTP affiliated centre acting as an African earthquake and volcano observatory,” said Aoudia ●



+ Participants of the workshop

EXPERTS DISCUSS NEUTRINO TECHNOLOGIES

ICTP workshop highlights detection, possible uses of neutrinos

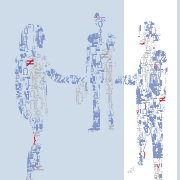
The idea of harnessing neutrinos for various applications has now become a possibility, and that was the focus of ICTP’s “Workshop Towards Neutrino Technologies”, held this summer in Trieste. The workshop, which attracted leading experts, was the “first on neutrino applications to include such a breadth of topics,” according to organiser Alexei Smirnov of the ICTP’s HECAP section.

The main goal of the workshop was to review existing achievements and efforts and to consider areas of neutrino physics that can potentially lead to the development of neutrino technologies.

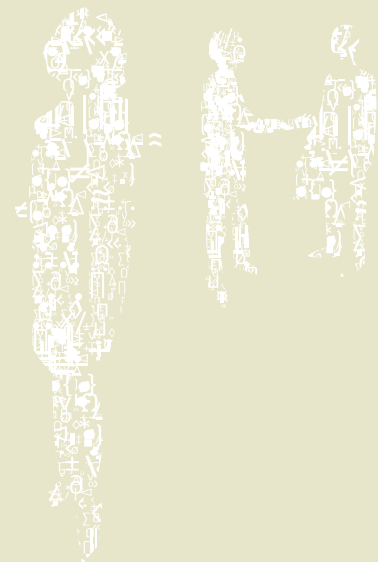
Among the topics were:

- **Detection of geo-neutrinos:** Geo-neutrinos are those produced by the Earth, and they can be used for probing the Earth’s crust, mantle and possibly core. “Physicists can discover the various processes in the Earth’s interior by detecting geo-neutrinos, which could add to our understanding of the Earth’s evolution and of the problem of heat production inside the Earth,” said Smirnov. Studies on this application are underway in Japan, Italy and the US.
- **Control of atomic reactors:** Atomic reactors are a source of enormous fluxes of neutrinos; monitoring these neutrinos can determine whether a reactor is being used for purposes other than power generation, e.g., weapons production. “The idea is to create reasonably small-sized movable devices and place them near reactors,” said Smirnov.
- **Applications to geology:** Physicists are capable of producing a tomography of the Earth using high-energy neutrinos. “High-energy neutrinos do not penetrate the Earth freely,” explained Smirnov. “Therefore, it is possible to flash a beam of neutrinos, see how the beam is attenuated, and based on this, create a tomography of the Earth.” Low-energy neutrinos can also be used for tomography studies. “When low-energy neutrinos are used for this, the oscillation of neutrinos is the property that is used,” said Smirnov. “In this case, the total flux remains the same but the neutrinos change their flavour, i.e., they change their type and based on this change one can detect the changes in the density profiles of the Earth.”
- **Detection of relic neutrinos:** The dream of generations of scientists to detect relic neutrinos could be realised through developments of new detection methods reported at the workshop. Relic neutrinos are low energy neutrinos that were generated about one second after the Big Bang. “They are rich in information about our universe,” said Smirnov. Studying these could improve our understanding of the universe’s evolution.

The directors of the workshop included Gianni Fiorentini (University of Ferrara), John Learned (University of Hawaii), Manfred Lindner (Max Planck Institute, Heidelberg) and Alexei Smirnov ●



ICTP News Briefs



ICTP AT G8 FOREIGN MINISTERS' SUMMIT

Focus on Afghanistan highlights science opportunities

Science could help lift Afghanistan's standing in the world community, but only with strong support from its government and with a little help from its friends, said former ICTP Director Katepalli R. Sreenivasan in remarks made during the G8 foreign ministers' summit held in Trieste from 25 to 27 June.

"Science transcends national and religious boundaries," said Sreenivasan, adding, "In addition to leading to improved standards of living, science can lift the spirit of an individual and of a nation." He remarked that in order for scientists to succeed they need full governmental support. "Every country needs to have a good culture of doing science at a high level," he said. Sreenivasan spoke during a side event to the G8 meeting organised by the Italian Ministry of Foreign Affairs and the Academy of Sciences for the Developing World (TWAS). The event, titled "Conference on Afghanistan and its geographical context: Development of a regional network of cultural and scientific cooperation", was held on 26 June ●



• Minister plenipotentiary F.M. Greco and K.R. Sreenivasan at G8 Summit in Trieste

NEWS

ICTP, IRAQ COLLABORATION

New agreement provides training and advice for physics, mathematics

ICTP has signed two agreements with the Iraqi Ministry of Higher Education and Scientific Research (MOHESR) to collaborate on physics and mathematics training for Iraqi scientists.

Under one agreement, up to 15 Iraqi scientists may visit ICTP annually to participate in ongoing and relevant activities. ICTP will also assist Iraqi scientists in their plans to build a centre for physics and mathematics in Baghdad, culminating in an ICTP affiliated centre in the next five years. ICTP will offer scientific and organisational advice to the centre once it is created.

The second agreement establishes a programme of fellowships in physics and technological research. Within the framework of ICTP's programme for Training and Research in Italian Laboratories (TRIL), ICTP will establish grants in the fields of lasers, optical communications, renewable energies, Earth and environmental sciences, medical physics and technological research for Iraqi scientists. The grants will allow Iraqi researchers to work in selected Italian laboratories that participate in the TRIL programme. The agreements were signed by former ICTP Director Katepalli R. Sreenivasan and Professor A. M. Taleb, who represented MOHESR ●

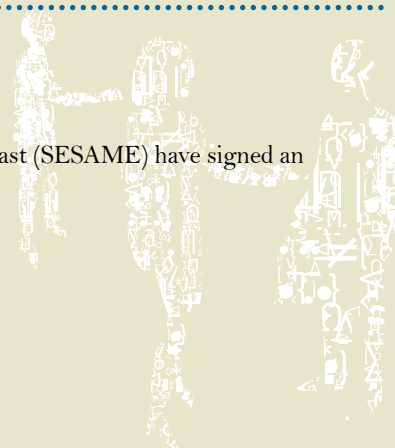


• Professor A.M. Taleb and K.R. Sreenivasan signing the ICTP-MOHESR agreement

ICTP, SESAME AGREEMENT

Collaboration aims at scientific capacity building

ICTP and the Synchrotron-light for Experimental Science and Applications in the Middle East (SESAME) have signed an agreement aimed at strengthening scientific collaboration between the two institutes.



SESAME, located at Allam, Jordan, is the Middle East's first major international research centre. Its mission—to build scientific capacity and contribute to economic development in the Middle East, the Mediterranean region and surrounding areas by enabling a wide range of excellent applied science, and to build bridges between different peoples through scientific and technical collaboration—will be boosted by the implementation of the agreement.

The agreement, which was signed on 20 July at the SESAME council meeting in Istanbul, calls for joint and collaborative activities that contribute to the missions of ICTP and SESAME. It is expected that the activities will include developing and organising research and training programmes and scientific events taking advantage of the existing schools and training programmes at ICTP.



+ Bottom, from left: Sir Christopher Llewellyn-Smith, president, SESAME; Julio M. Montalvao e Silva, president, Instituto Tecnológico e Nuclear, Portugal; Albin Wrulich, chair, SESAME, also representing Paul Scherrer Institute (PSI), Switzerland; Claudio Tuniz, assistant director, ICTP. Top, from left: Hafeez R. Hoorani, scientific director, SESAME; Khaled Toukan, director, SESAME; Amor Nadji, technical director, SESAME; Mohamed Yasser Khalil, administrative director, SESAME

ICTP, WMO JOINT CLIMATE ACTION

WMO Secretary General, former ICTP Director launch South Asian Climate Outlook Forum

Nearly half of the world's population is affected by the South Asian monsoon, which brings severe storms and flooding every year to wide swathes of Asian countries. But climate change is now making things worse, strongly impacting the region's agriculture, health and economy.

Improved climate predictions could help the region with disaster risk reduction, agriculture and economic planning, and are at the heart of an agreement signed by ICTP and the World Meteorological Organization (WMO) on 6 August. The goal of the agreement is to have countries in South Asia work together to produce better seasonal climate forecasts.

The monsoon is essential for South Asia's agriculture, but poor infrastructure and poverty have left communities increasingly ill-equipped to cope with the impact of weather disasters. Flooding and landslides claim lives, destroy property and crops and increase the prevalence of diseases such as malaria and dengue fever. Climate and weather predictions can help increase society's resilience to climate change and how it affects South Asian societies.



+ K.R. Sreenivasan and WMO Secretary General Michel Jarraud

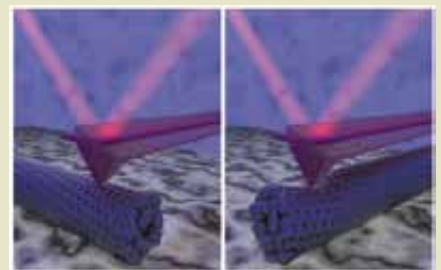
ICTP RESEARCH PUBLISHED IN *NATURE MATERIALS*

An experiment to measure nanofriction has surprising results

In a joint experimental and theoretical study of frictional forces on carbon nanotubes, ICTP researcher Erio Tosatti, along with an international team of physicists, discovered a difference in friction depending on which way the tube was stroked by an atomic force microscope (AFM) tip. A motion perpendicular to the nanotube produced much more friction than a parallel motion. The research appeared in the 13 September advanced online publication of *Nature Materials*.

Nanotubes are promising building blocks for future nanoelectronic devices. A major challenge to their use is positioning and manipulating the tiny tubes

The research findings could lead to improved nanotube selection for assembly in nanotube-based composite materials and devices. The title of the article is "Hindered rolling and friction anisotropy in supported carbon nanotubes"



+ Images compare an AFM tip sliding longitudinally along a carbon nanotube (left) versus sliding in the transverse direction (Image: Christian Klinke, University of Hamburg)



ACHIEVEMENTS/PRIZES

2009 ICTP PRIZE

Marcelo Barreiro from Uruguay awarded the 2009 ICTP Prize

The 2009 ICTP Prize in honour of Edward Norton Lorenz has been awarded to Marcelo Barreiro. He is currently associate professor and head of the Atmospheric Sciences Unit, School of Sciences, Universidad de la Republica, Montevideo, Uruguay.

The ICTP Prize recognises Barreiro's "contributions in the field of tropical Atlantic variability, and the exploration of dynamical mechanisms to explain the palaeo-climatic record in the last few million years". The results of his investigations have important implications for seasonal forecasting and the climate change debate.

Barreiro has been a speaker at ICTP training activities in the field of the physics of weather and climate since 2005.

The ICTP Prize, created in 1982 by the ICTP Scientific Council, is awarded to young researchers for outstanding and original contributions in physics and mathematics ●

FORMER DIPLOMA STUDENT IS GRIBOV MEDALLIST

Freddy Cachazo wins a major EPS award

Freddy Cachazo, a former ICTP high-energy physics diploma student, was awarded the Gribov Medal on 20 July 2009 at a high-energy physics conference held in Krakow, Poland, by the European Physical Society (EPS). The Gribov Medal, conferred by EPS once every two years, recognises a young physicist below the age of 35 "for outstanding work performed in the field of theoretical particle physics and/or field theory."

Cachazo, who hails from Venezuela, currently holds a faculty position at the Perimeter Institute for Theoretical Physics, Ontario, Canada. He was recognised for his contribution "to significant simplifications in the calculation of scattering amplitudes in both gauge theories and gravity ones."

Cachazo was enrolled in the ICTP high-energy physics Diploma Programme in 1996 ●

ACHIEVEMENTS

AGU AWARD FOR ISMAIL-ZADEH

Former ICTP researcher receives AGU's International Award

Alik Ismail-Zadeh, a former researcher with ICTP's Structure and Nonlinear Dynamics of the Earth (SAND) research group as well as a frequent conference lecturer, has received the American Geophysical Union's International Award. The award honours an individual scientist or a small team for outstanding contributions to furthering Earth and space sciences and using science for the benefit of society in less favoured nations. Ismail-Zadeh was cited for promoting and fostering geophysics between Eastern European scientists and their colleagues worldwide.

Ismail-Zadeh is chief scientist and head of the Computational Geodynamics section at the International Institute of Earthquake Prediction Theory and Mathematical Geophysics, Russian Academy of Sciences. He also is a senior research scientist at the Geophysical Institute, University of Karlsruhe ●



▲ Alik Ismail-Zadeh (left) with Timothy Grove (M.I.T.), AGU President

FORMER ASSOCIATE TO HEAD MINISTRY

Mauritania appoints mathematician to lead Ministry of Secondary and Higher Education

Ahmed Ould Bahya has been appointed as Minister of Secondary and Higher Education in the new Mauritanian government. Bahya was an ICTP Associate in Mathematics from 1996 to 2000.

"The appointment of a mathematician to this eminent position represents a real opportunity to develop higher education in Mauritania, especially in the domain of mathematics," said Isselkou Ould Ahmed Izid Bih, president of Mauritania's University of Nouakchott and a colleague of Bahya's ●

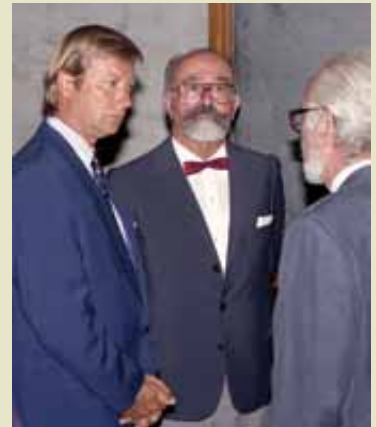
IN MEMORIAM

Luigi Stasi

1921-2009

Luigi Stasi was a longtime friend of ICTP who was instrumental in its very founding. He actively oversaw the creation of its buildings and helped to secure financial support from Italy for ICTP.

André-Marie Hamende, who was associated with ICTP from 1964 until his retirement in 1990, and who has written several books about the history of the Centre, said, “Luigi Stasi deserves a monument for all the accomplishments he achieved to benefit ICTP. He was a lawyer by training, and was indispensable in implementing the ideas of [ICTP founders] Budinich and Salam. He had contact with many public institutions in Trieste, and because of that was able to not only bring ICTP to Trieste but to ensure its permanent creation by overseeing the purchasing of land and the construction of the ICTP campus.”



+ Luigi Stasi (centre) with Prince Carlo Alessandro della Torre e Tasso (left) and Professor Paolo Budinich at ICTP in 1993

Faheem Hussain

1942-2009

Faheem Hussain was an ICTP associate from 1981 to 1986 and from 1988 to 1989. Upon creation of the ICTP Diploma Programme he was invited to become a member of the

High Energy Physics section and coordinated the section's Diploma Programme courses, a duty which he accepted with great passion and dedication. In 1997 he took up the supervision of the Office of External Activities, which he kept until 2004, the year of his retirement.

Hussain's scientific field of interest was in the area of high-energy particle physics. He wrote several important papers that were published in internationally prestigious physics journals. To his students Hussain was a teacher with a strong sense of responsibility and cordiality. He was always a strong and vocal advocate for the promotion of science in developing countries and for a just and proper treatment of all.



+ Faheem Hussain

Aage Bohr

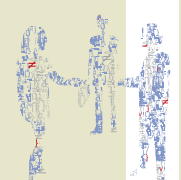
1922-2009

Aage Bohr was a Nobel Laureate in physics and an early member of ICTP's Scientific Council, serving from 1964 until 1968. He won the Nobel Prize in 1975, with Ben Roy Mottelson and Leo James Rainwater, for the discovery of the connection between collective motion and particle motion in atomic nuclei and the development of the theory of the structure of the atomic nucleus based on this connection.



+ Aage Bohr (left) with Abdus Salam in 1966

IN MEMORIAM



UPCOMING SCIENTIFIC ACTIVITIES

For more details, visit the ICTP web page: <http://calendar.ictp.it/2010/>

18 January - 5 February

Advanced School and Conference on Homological and Geometrical Methods in Representation Theory

1 - 5 February

Preparatory School to the Winter College on Optics and Energy

8 - 19 February

Winter College on Optics and Energy

22 February - 12 March

Workshop and Awareness Conference on Evolution of Wireless Technologies

22 - 30 March

Spring School on Superstring Theory and Related Topics

6 - 24 April

Second Workshop on Satellite Navigation Science and Technology for Africa

12 - 16 April

Joint ICTP-IAEA School on Internal Dosimetry for Medical Physicists Specialising in Nuclear Medicine

12 - 23 April

Joint ICTP-IAEA Advanced Workshop on Multi-Scale Modelling for Characterisation and Basic Understanding of Radiation Damage Mechanisms in Materials

19 - 23 April

Joint ICTP-IAEA Workshop on Vulnerability of Energy Systems to Climate Change and Extreme Events

26 April - 7 May

School on Synchrotron and Free-Electron-Laser Sources and their Multidisciplinary Applications

ICTP ON THE WEB: www.ictp.it

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.

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