The Abdus Salam
International Centre for Theoretical Physics

United Nations
Educational, Scientific
and Cultural Organization

International Atomic
Energy Agency

NEWS from ICTP

World Year of PHYSICS 2005

SPRING
2005

#112

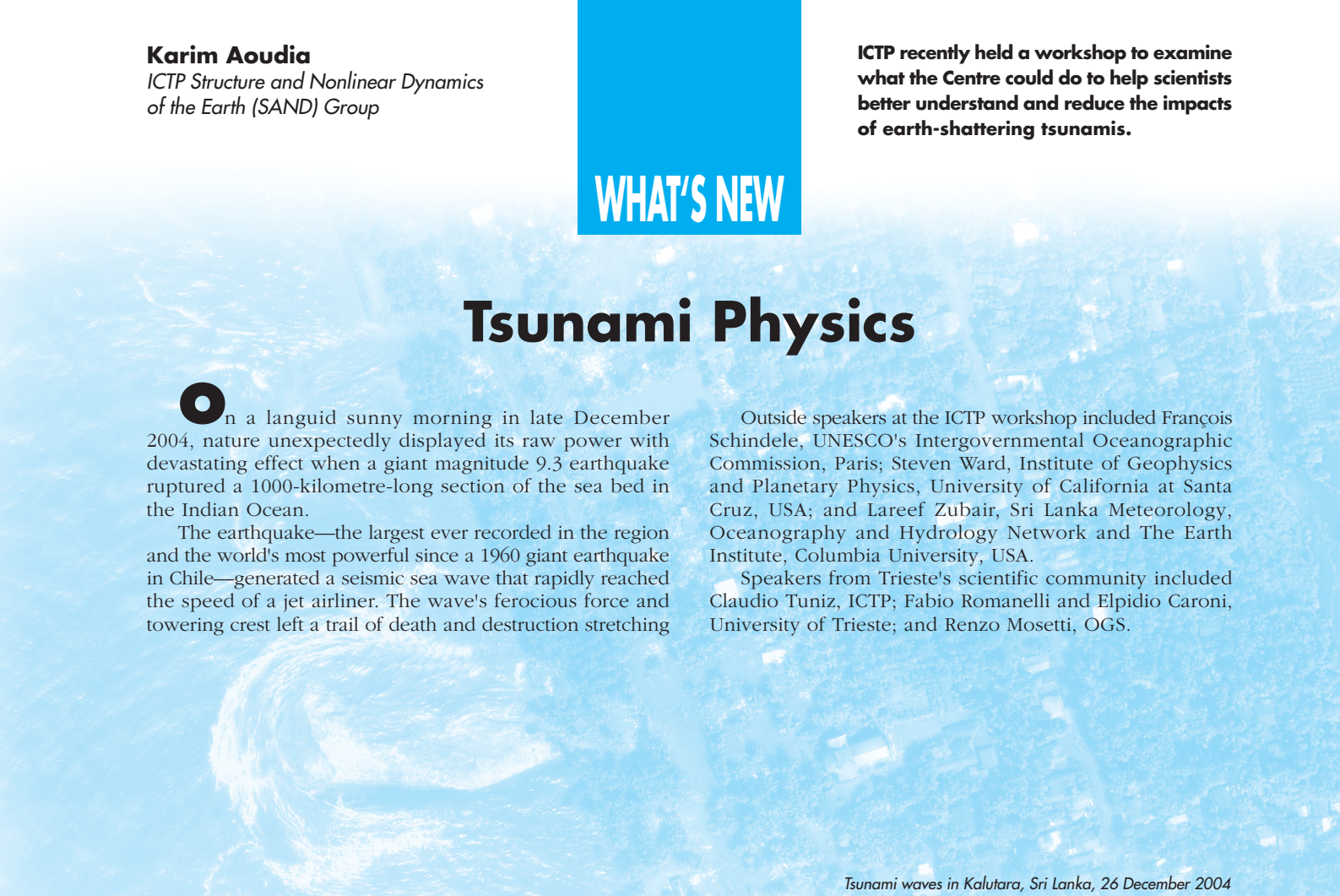
Karim Aoudia
ICTP Structure and Nonlinear Dynamics of the Earth (SAND) Group

ICTP recently held a workshop to examine what the Centre could do to help scientists better understand and reduce the impacts of earth-shattering tsunamis.

Tsunami Physics

On a languid sunny morning in late December 2004, nature unexpectedly displayed its raw power with devastating effect when a giant magnitude 9.3 earthquake ruptured a 1000-kilometre-long section of the sea bed in the Indian Ocean.

The earthquake—the largest ever recorded in the region and the world's most powerful since a 1960 giant earthquake in Chile—generated a seismic sea wave that rapidly reached the speed of a jet airliner. The wave's ferocious force and towering crest left a trail of death and destruction stretching across 12 coastal nations (including Tanzania, some 6000 kilometres from the earthquake's epicentre near the island nation of Sumatra). Nearly 300,000 people died.



Tsunami waves in Kalutara, Sri Lanka, 26 December 2004

While knowledge of science and technology continues to increase at an accelerated rate, the tsunami showed that when it comes to primal forces, nature, not humankind, still rules.

Earthquake detection centres in Hawaii and Japan did detect a sizeable shock that fateful morning. But scientists at these centres and elsewhere could not determine the full force of the event. And even those few scientists who feared that a disaster was about to strike were handicapped by poor communications with their counterparts in southeast Asia.

In the aftermath of the tsunami tragedy, seismologists have gathered in a variety of fora across the globe to assess what happened and, equally important, examine what measures the scientific community could take to help ensure that the next tsunami does not wreak such deadly havoc.

On 24 March, ICTP, in cooperation with the University of Trieste and Italy's National Institute of Oceanography and Experimental Geophysics (OGS), hosted a one-day workshop titled Tsunami Physics and Preparedness.

The purpose of the workshop was twofold: first, to examine what scientists know about the physical forces that drive tsunamis and to explore the warning and mitigation measures that have been—or will soon be—put in place to help reduce the potential risks posed by the next tsunami. And second, to discuss the state of knowledge and expertise concerning tsunamis here in the Adriatic region.

While giant tidal waves are rare occurrences everywhere—and particularly in the seas surrounding Italy—they do happen. In 1511, for example, a tidal wave swept across Venice's lagoons causing water levels in the canals to rise above the first floors of the city's homes and shops, leaving a pathway of destruction in its wake.

Outside speakers at the ICTP workshop included François Schindele, UNESCO's Intergovernmental Oceanographic Commission, Paris; Steven Ward, Institute of Geophysics and Planetary Physics, University of California at Santa Cruz, USA; and Lareef Zubair, Sri Lanka Meteorology, Oceanography and Hydrology Network and The Earth Institute, Columbia University, USA.

Speakers from Trieste's scientific community included Claudio Tuniz, ICTP; Fabio Romanelli and Elpidio Caroni, University of Trieste; and Renzo Mosetti, OGS.

At the conclusion of the workshop, participants issued a communiqué calling on international organisations "to make use of ICTP's facilities and expertise for the purposes of mitigating all aspects of tsunami disasters, particularly through research, prediction enhancement, hazard assessment, preparedness, detection and warning." These organisations include both UNESCO's Intergovernmental Oceanographic Commission, which has taken the lead in seeking to develop a global multipurpose warning system, and UNESCO's member states involved in the Indian Ocean Tsunami Warning and Mitigation System, which are seeking to develop a regional tsunami warning system in the area that was devastated by the December tsunami.

For its part, ICTP pledged to organise a targeted training activity tentatively titled "The Physics of Tsunamis: Warning and Mitigation," beginning in 2006. The activity, which will be coordinated with UNESCO's Intergovernmental Oceanographic Commission, will seek to keep researchers abreast of the most recent scientific advances in the understanding, prediction and mitigation of tsunamis and their impacts. The activity is expected to last two to four weeks and, like other ICTP activities, will consist of lectures, laboratory exercises and project work. The individual and institutional networks that are ultimately created will help nurture future generations of scientists interested in studying tsunamis.

As last December's disaster in the Indian Ocean tragically showed, there is a great need for scientists worldwide to share advanced research findings, knowledge and information on the risks posed by tsunamis, and to develop in-depth assessments of initiatives designed to mitigate such risks. ICTP with its world-class research facilities and internationally recognised experience in the training of scientists from the developing world stands ready to assist global efforts to thwart the devastating wrath of the next tsunami.□

Rajendra K. Pachauri
Chairman
Intergovernmental Panel
on Climate Change (IPCC)

COMMENTARY

A September 2004 ICTP workshop marked the launch of the fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC). IPCC's chairman, who attended the workshop, explains what lies ahead.

Making Sense of Climate Change

In the summer of 2003 a scorching three-month heat wave in Europe left more than 34,000 dead. In early 2002, a chunk of ice 3200 square kilometres in size (that's larger than the island of Bali) broke off the Larsen ice shelf and slid into the Southern Ocean. In the summer of 2004 a series of hurricanes—four in six weeks—swept across the Caribbean and the southern United States. More than 2000 people in Haiti alone fell victim to the storms' wrath.

Rajendra K. Pachauri

Are these extreme weather-related events due to climate change? No scientist can say for sure although many have predicted that rising global temperatures are making our weather and climate not only warmer, wetter and windier but more unpredictable and violent.

This much we do know. Over the past 150 years the average global mean temperature has risen 0.6 degrees Celsius. At the same time, the amount of carbon dioxide in the atmosphere has risen from 280 parts per million to 380 parts per million.

Coincidence or correlation? The vast majority of scientists think the latter and recent trends seem to confirm their concerns: the 1990s were the warmest decade since the mid 1800s and 1998 the warmest year on record. The size of the snow pack on Kilimanjaro has melted by 80 percent since 1912 and Arctic sea ice has retreated some 10 percent each decade since the mid 1970s. Average global sea levels have risen 20 centimetres over the past 100 years. Evidence of global climate change and its impact now stretch from the Arctic to the tropics to Antarctica—and to all points in between.

Since 1990, the Intergovernmental Panel on Climate Change (IPCC), a joint project of the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO), has issued a series of assessment reports—three in all—that have provided an extensive review of the latest climate change research. I think it's fair to say that what the public and public officials worldwide know about this phenomenon has been largely conveyed to them through IPCC publications, which have marshalled the talents and energy of many hundreds of scientists, most of whom are the most eminent researchers in their fields.

In September 2004, members of the IPCC working group I, focusing on the physical science of climate change, met at ICTP to launch the fourth assessment. Some 150 climate scientist from more than 30 countries got together to begin the long and difficult process of examining the current state of scientific knowledge of climate change. The other two working groups in this latest IPCC effort will examine issues related to climate change impacts, adaptation and mitigation.

The first IPCC reports were published in 1990 with subsequent reports coming out in 1995 and again in 2001. Together, they rank among the most influential scientific reports of the past half century, bringing the issue of climate change to the forefront of public concern and enabling both public officials and the public at large to gain important insights into the state of scientific knowledge of what is arguably the most critical environmental issue of our times.

The IPCC initiative has become more sophisticated with each new round of study. Databases have become increasingly comprehensive and computer models more exacting and precise. The fourth assessment, whose reports are scheduled for publication in 2007, will likely continue to make progress on the scientific front by filling gaps in our knowledge and enabling experts to convey their scientific findings with greater confidence.

The assessment will include many more scientists from the developing world than previous assessments. In fact, we estimate that about 40 percent of the authors of the reports will be from the South. The reports themselves will focus a great deal of attention on the impact of climate change at the regional and local levels.

Growing scientific expertise throughout the developing world and the increasing sophistication of computer technology will enable us to explore climate change over broader areas and at smaller scales than in the past. That's good news for both the developing and developed worlds. After all, climate change is a global issue and the more scientists know about this phenomenon, the more policy makers will be able to respond effectively to an issue that is likely to affect us all—now and for generations to come.□

For additional information about IPCC, see www.ipcc.ch.

K.R. Sreenivasan
ICTP Director
Abdus Salam Honorary Professor

The World Year of Physics 2005 offers an opportunity for physicists to illustrate the central role that physics plays in our world. ICTP director K.R. Sreenivasan explains why.

Today's Physics Tomorrow

As the recent tsunami disaster illustrated, we live in an interconnected world.

The earthquake that triggered the tsunami originated in the Indian Ocean, 350 kilometers off the northwestern tip of the island of Sumatra, Indonesia. The wave thrusts that the earthquake generated barreled quickly and silently across the Indian Ocean, killing some 300,000 people along an eight-nation coastline in southeast Asia and ultimately reaching as far away as east Africa where 200 people fell victim to its wrath.

But it's also important to remember that the impact of the tsunami was felt well beyond the range of its fast-moving waves. Citizens from more than 30 countries fell victim to the wave thrusts. Sweden alone lost more than 550 citizens who were unfortunate enough to be vacationing or working in southeast Asia at the time of the earthquake.

We do indeed live in an interconnected world where we travel far, communicate easily, conduct business with distant customers and, yes, share the tragedies of disasters.

But even as the tsunami revealed our interconnectedness, it also cast a cold deathly pale over our divisions as well. The death and destruction that it left in its wake was due in part to the absence of warning systems in the countries that were affected and partly due to the poor construction and planning that characterises housing and land-use in the impoverished isolated areas that were struck.

But we don't need a tsunami to tell us how divided the world is. The average per capita income in developed countries is US$27,000 per year; the average per capita income in developing countries is US$2040. Life expectancy in the developed world is approaching 80 years of age, while life expectancy in several developing countries is slipping towards 40. Literacy rates approach 100 percent of the adult population in developed countries; in half of the developing countries, it is less than 50 percent. Internet connections, while rising virtually everywhere, remain widely disparate between rich and poor nations—and between rich and poor people in all countries.

All of this has led Jeffrey D. Sachs, director of Columbia University's Earth Institute and special advisor to UN Secretary-General Kofi Annan on the Millennium Development Goals, to refer to the 'silent tsunamis' that afflict the world's least developed countries—endless tragedies created by poverty, disease, environmental degradation and, yes, lack of access to science and technology.

The rich nations of the world—and the scientific communities within rich nations—must seek to mitigate this imbalance not merely as a moral imperative, as ICTP's founding director Abdus Salam often said, but also as a practical necessity. This imperative is driven by the reality of the world in which we live and by global trends that are intensifying at an ever-accelerating pace.

The simple yet compelling fact is this: A large part of our globe belongs to the developing countries, which means that everyone must be involved in devising solutions to sustainable development. From a more ominous perspective, if we leave a sizeable portion of the world too far behind, we are all likely to suffer adverse consequences.

What is the role of science in all of this? In a word, it is 'central.' Science, of course, cannot solve all of humanity's problems, and not all scientific advances have been beneficial to society. Yet, on balance, science's contributions to society have been both fundamental and significant.

What accounts for the positive role that science has played? First, the pursuit of science, to a large extent, is devoid of political, economic, religious and other divisive issues. Therefore, science's proposed solutions, unadorned by ulterior or hidden motives, have the power to forge consensus. Only science, moreover, can give an authoritative assessment of which technologies are appropriate for solving a particular problem in a particular place. Finally, great ideas in science have had an enormous impact on culture and humanity's perception of its place in the universe. In other words, science's most significant findings have the ability of transforming our spiritual sensibilities. Think of Newtonian determinism, quantum mechanics, or relativity.

At a more practical, down-to-earth level, science—and, particularly, physics—has laid the foundation for the 'transforming technologies' of the past two centuries. The advent of electricity in the early 20th century would not have

been possible without the breakthrough experiments on electrolysis conducted by Michael Faraday. The computer and internet revolution of the past few decades rests on a broad swatch of theoretical studies and experiments in condensed matter and statistical physics. And now what many view as the next great thing in science—nanotechnology—is based, in some measure, on our understanding of quantum mechanics.

But science—with physics sometimes as the lead player and sometimes in concert with such disciplines as biology, chemistry and computer science—is impacting the full range of critical human activities: agriculture, communication, electronics, advanced materials, pharmaceuticals and public health.

Here are just a few examples.

- When the Bt gene is incorporated into corn and cotton, the new plants are resistant to many harmful insects, enabling farmers to reduce pesticides use.
- The spread of telemedicine links—created in part by the US National Aeronautics and Space Administration (NASA) satellite system—has brought advanced health-care services to remote areas of the developing world.
- Radiogenic isotope 'fingerprints', championed by the International Atomic Energy Agency (IAEA), have helped villages and regions in the developing world trace sources of contaminated water to their points of origin—an essential first step in addressing the problem.
- Nylon and silicon filters have helped bring safe drinking water to places where water was once polluted and electricity-generating solar panels to remote areas where electricity did not exist. And now advances in nanotubes and nanocoatings promise to make both water-filtering systems and solar panels more efficient and less expensive.

The point is that the demands placed on science—and, more specifically, physics—have grown as the demands on our planet and global resources have grown.

This suggests that society will continue to depend on science—and, more specifically, physics—as problem-solving forces in the years and decades ahead, a dependency that is likely to intensify.

Yet society's investment in science, particularly in the developing world where arguably the investment is most needed, remains woefully inadequate. In the developed world, the percentage of the gross domestic product devoted to research and development averages between 2.5 and 4 percent; in the developing world, it is less than 0.5 percent. Indeed only a handful of developing countries—notably, Brazil, China, and India—have recently increased their investment in research and development to more than 1 percent of their GDP. For the world's least developed countries, the percentage often hovers between 0.2 and 0.3 percent.

What accounts for this disparity? The major force driving a wedge between North-South investments and capabilities in science has to do with differences in the culture of science and the governments' disparate commitments to scientific research. Specifically, too many developing countries suffer from a:

- Lack of entrepreneurship and a debilitating alienation of scientists from their societies, which too often view science as a product of the North.
- Monetary policies that are driven by regressive forms of taxation and a dependence on entitlements that undermine both investments in science and incentives to pursue scientific careers.
- Political environments that cultivate corruption, instability and exploitation by rich countries.
- Inability to appreciate the connection between science and wealth creation.

While several developing countries—notably, the large and relatively rich developing countries of Brazil, China and India—have recently taken important steps to rectify their shortcomings in investing in science (with promising results), the developing world as a whole will not be able to take advantage of what science has to offer their economic development strategies unless they address the following broad concerns.

First, developing countries must be willing to invest in promising young scientists to ensure that they fulfil their potential. The focus must be on the most talented young students regardless of their institutional affiliation, and the level of funding must be adequate and sustained. Second, developing countries must make a concerted effort to create transparent institutions that reward excellence. This effort must extend across the broad landscape of scientific institutions to include universities, research institutes, science academies and science ministries. And third, developing countries must foster active networks of institutions centered on concerns of critical importance to their nations. Such knowledge-sharing networks will help to maximise the scientific talent and know-how that exists within their borders.

As study after study has shown, sustained public investments in science generate rates of returns running between 20 and 65 percent. But even more importantly, investments in science improve people lives by addressing health and environmental concerns; by providing solutions to energy needs; by enhancing security and combatting terrorism; and by generating wealth and potentially reducing the disparities in well-being that exist between various regions of the globe.

The devastating tsunami that struck southeast Asia last December led to a call for scientists to lend their expertise to efforts intended to minimise the possibilities of a repeat of this tragic event (see "Tsunami Physics," p. 2). But science and physics play key roles in our everyday lives as well. The world knows that. It's up to physicists during the World Year of Physics 2005 to reaffirm this fact and to do so in ways that illustrate just how central the pursuit of science is to our shared desire to make the world and particularly the developing world a healthier, wealthier and more secure place in which to live.□

James D. Bjorken
Stanford Linear Accelerator Center
ICTP Dirac Medallist 2004

ICTP Dirac Medallist J.D. Bjorken contends that the way science is done depends crucially upon the presence of quality data, and especially upon the rate at which it is acquired.

Data Matters

For most of my career I have chosen to stay close to data. The 1960s was a golden age for particle physics thanks to remarkable advances in accelerator physics—progress matched by the increased power and sophistication of particle detectors. When I began my career, for example, it was unthinkable that the strong force would be so quickly understood. The weak force looked to be as big a problem. Now we are in remarkably good shape in understanding both.

What matters most for progress is a steady advance in technology. Next is steady progress in experimental techniques, along with the opportunity to carry out the experiments themselves. Theory is at the bottom of the list.

Of course, technology, experiment and theory are all essential components for the advancement of scientific knowledge and strong feedback loops among the three are vital.

What's also important is how fast things happen. When data is coming in quickly, with more in the pipeline (on a time scale of a few years at most), researchers can take a detached and objective 'scientific' viewpoint. "If such and such is measured, then I am right. But if it comes out differently, then so-and-so is right." Either way we will soon know much more.

On the other hand, if data is not going to arrive for a long time, then people tend to develop more rigid viewpoints and to be more dismissive of alternative points of view. I first saw this in the cosmic-ray community in the 1960s, where progress moved slowly before the proton-decay experiments spurred a technological revolution in the field. Before that revolution, individual events became institutionalised and created communities with fixed opinions that simply would not have taken hold if the field had been more dynamic.

Today the pace of progress in elementary particle physics has slowed. Experiments have become big, expensive and time consuming. In addition, the standard model works too well and does not provide researchers with an abundance of unanswered opportunities that are within the range of experimental investigation.

This has led to more hardened institutionalised opinions than would be the case were the field more dynamic experimentally. I think weak-scale supersymmetry is much less of a sure bet than is generally assumed. Emphasis on supersymmetry has had the effect of overfocussing the search for dark matter onto WIMPs (weakly-interacting massive particles) at the expense of other alternatives, especially axions.

James D. Bjorken

Similarly, ideas that are 'string-inspired' more readily receive certification—and funding—than those that are not. Real long-shots like large extra dimensions and/or weak-scale strong gravity get more serious attention than they probably deserve.

My current interests focus on gravity and cosmology. I am a newcomer to the field. Thus far I perceive the gravitation-theory community to be fragmented into relatively isolated subcommunities, again attributable to the lack of data. But this is not universally so. For example, there are links with observational cosmology and the study of black holes as well as experimental investigations into gravitational radiation and Lorentz noncovariance. I do not have much experience with these subcommunities, but would venture the guess that they are more eclectic and inclusive than those communities dealing with the more formal or experimentally remote subfields.

Then there is the string community, which to a large extent goes its own way. It remains almost completely detached from data and dismissive of alternative approaches to the problems it proposes to address.

I frankly do not like this situation at all. The string theory community seems driven by a conviction that their basic ideology is correct, a conviction largely based on aesthetic grounds. I am very skeptical of any such ideological position, primarily because it is likely wrong. Humility should be the order of the day. Given the speculative nature of the subject, doubt and cross-fertilisation among different approaches should drive the research effort.

I find it paradoxical that ideas which are about to be tested experimentally are treated with a sense of skepticism and doubt, while much more speculative ideas—for example, string theory—are held with a greater sense of certainty. There is, however, an easy explanation for this paradox and that explanation can be conveyed in one word: fear.

In vibrant fields of observational science, practitioners cannot be too dogmatic or doctrinaire for the simple reason that their ideas will soon be put to the test. Unless there is an unusually high level of certitude, it is not a good idea to be dogmatic. There is too much to lose, whether it is just feeling bad about being wrong, being embarrassed, or even having more trouble getting a job.

It makes a big difference behaviourally when science is strongly data-driven, with the 'fear factor' front and centre. And this difference feeds back into improved sociology throughout the entire scientific community. On the other hand, when there is no fear factor, there is no penalty for dogmatism. And so dogmatism often emerges.

I do not mean to imply that science which is not data-driven is not good science. That would leave out all of mathematics. And aesthetic judgments do matter. But I do think that when practising such science one should exhibit at least as much skepticism and doubt as certainty, and as much tolerance for other points of view as is the case in a strongly data-driven environment.□

BIG STEPS AND SMALL

While scientists continue to pay a great deal of attention to such big questions as the origin of time, the boundaries of space, and the nature of the 'ultimate' theory, it is not clear that these questions are ready for serious science. As I observe in the main article, I consider it very probable that all ideologies presently addressing such questions are wrong. History is my guide in making this assessment. The great thinkers of the past, including Johannes Kepler, Isaac Newton and Albert Einstein, had plenty of ideas of what the big picture should look like. But in the light of present data, the facts simply do not fit their ideas. I think a necessary condition for presuming that the present situation is different is that there exists concrete evidence for convergence toward simplicity. Yet, neither observational cosmology, nor 'string phenomenology', nor phenomenological supersymmetry, at the electroweak scale as well as at the grand-unification scale, points the way toward a simpler big picture. There remains a clutter of poorly understood numbers no matter where one looks. Understanding the big picture, if attainable at all, is very far away.

STRING THEORY: TAKE 2

String theory deserves to be around for a long time. Putting ideological and social issues aside, string theory is a superb technology. The string theory toolkit has already supplied many new concepts and insights into particle theory and cosmology. Very probably some, if not many, of those elements will find their way into future theories. Nevertheless, I think it is a mistake to assume string theory contains the whole story. Classical textbook gravity, effective field theory, thermogravity, holography, loop gravity, and emergent gravity all deserve serious attention.

DATELINE

ICTP Director Meets India's President

ICTP director, **K.R. Sreenivasan**, met the President of India, Abdul Kalam, at the President's home on 4 March to discuss the future relationship between ICTP and India's scientific community. Issues raised at the meeting included the role that ICTP could play in improving the links between India's research centres and universities and the prospects for additional joint ICTP-Indian scientific activities that would take place in India and ICTP.

Medical Physics Award

The European Commission's Directorate General for Education and Culture has given the first-ever Leonardo da Vinci Award to the European Medical Imaging Technology (EMIT) Consortium for its pioneering e-learning materials on the use and applications of magnetic medical imaging and medical ultrasound scanning for the diagnosis of cancer, neurological, obstetric and cardiovascular diseases. ICTP is a member of EMIT, which is coordinated by King's College in the United Kingdom. The Centre has hosted several of the Consortium's activities, including a training session in November 2003 and a workshop in September 2004, where EMIT's e-learning materials were discussed and tested. The awards committee described the materials, currently used by hospitals and medical research institutions in 79 countries, as "unmatched in their innovation, breadth and depth." The official awards ceremony took place in Maastricht, The Netherlands, on 14 December at a summit attended by the European ministers of education.

Imaging Physics

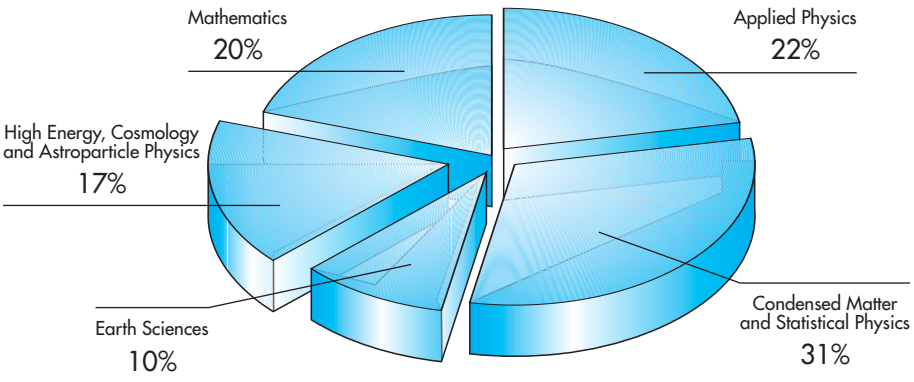
Representatives from *Elettra* Synchrotron Radiation Laboratory, the University of Trieste, the Italian National Institute of Nuclear Physics (INFN), Monash University, Melbourne, and CSIRO, Australia's national research agency, met on 11 February at ICTP to discuss a proposal for the establishment of an International Consortium for Advanced Imaging Physics (ICAIP). The Consortium would seek to build an international collaborative framework for bringing scientists together under the auspices of ICTP. It would also incorporate the expertise of other local institutions, particularly INFN, *Elettra* and the University of Trieste.

Einstein in Space

ICTP has resumed its public lecture series which began last year to celebrate ICTP's 40th anniversary. The new round of lectures has been dedicated to the World Year of Physics 2005. On 14 March, the date of Albert Einstein's birth, "Einstein in Space" was the subject of a public lecture by **Ignazio Ciufolini**, an associate professor of physics at the University of Lecce, Italy. Ciufolini spoke about his successful efforts to experimentally verify the anticipated effect of general relativity that he described in a 2004 article in *Nature*. Other lectures in this series will focus on teleportation and the search for life on Mars and Titan, Saturn's moon.

Scientists at work at ICTP: research and training activities 2004

Research and training activities at ICTP are carried out by staff scientists, consultants, long- and short-term visitors, post-doctoral fellows and ICTP associates. The following is a breakdown of the major fields of study.



L'Oréal-UNESCO Award Winners 2005

The L'Oréal-UNESCO for Women in Science Award for 2005 has been given to five women scientists. This year's awards, which coincide with the World Year of Physics 2005, are devoted to material sciences. Of the five winners, three are well-known to ICTP:

• **Zohra Ben Lakhdar**, *Université de Tunis, Laboratoire de Physique Atomique Moleculaire*, Tunis, Tunisia. Ben Lakhdar, who is an ICTP Associate, has participated in the colleges on optics since 1999.

• **Myriam Sarachik**, City University of New York, USA. Sarachik spoke at the Third Stig Lundqvist Conference on Advancing Frontiers in Condensed Matter Physics and served on the Advisory Committee of the Tenth Hopping and Related Phenomena Conference (HRP 10) in 2003.

• **Fumiko Yonezawa**, Keio University, Kawasaki, Japan. Yonezawa participated in the Conference on 'Wetting' in 1999.

The other L'Oréal-UNESCO 2005 winners are Belita Koiller, *Pontifícia Universidade Católica do Rio de Janeiro*, Brazil, and Dominique Langevin, *Université Paris-Sud*, Orsay, France.

The L'Oréal-UNESCO for Women in Science Award, which was established in 1998, has become the world's most prestigious prize for women scientists. Each award carries a US$100,000 cash prize. The official awards ceremony took place at UNESCO headquarters in Paris on 3 March.

The Laureates of the 2005 L'Oréal-UNESCO Award for Women in Science: (left to right) Zohra Ben Lakhdar, Fumiko Yonezawa, Myriam P. Sarachik, Belita Koiller, and Dominique Langevin (Photo: Jean-François de ROUBAIX/GAMMA)

Appointments and Honours

Giorgio Parisi, professor of theoretical physics at University *"La Sapienza"* in Rome, Italy, and winner of the ICTP Dirac Medal in 1999, has been awarded the 2005 Nonino Prize. The prize ceremony took place on 29 January at the estate of the Nonino family in Percoto near Udine, Italy. The Nonino family has been one of northern Italy's most successful wine growers for more than a century and the family has used its wealth and prestige to establish a series of prizes that recognise contributions of eminent authors, film makers, musicians, scientists and scholars to culture. Past winners of Nonino prizes include Nobel Laureates Rigoberta Menchu and V.S. Naipaul. For additional information, see www.nonino.it.

A trio of physicists with close ties to ICTP have been awarded the King Faisal International Prize for Science: **Federico Capasso**, Harvard University, lectured at ICTP condensed matter physics courses from 1984 to 1989; **Frank Wilczek**, Massachusetts Institute of Technology (MIT), Cambridge, MA, USA, won the ICTP Dirac Medal in 1994; and **Anton Zeilinger**, University of Vienna, Austria, was a course director for the Conference on Quantum Interferometry in 1993 and a speaker at the School and Workshop on Quantum Entanglement in 2004. The prize, sponsored by the King Faisal Foundation, carries a US$200,000 cash award, which the recipients will share.

John Hopfield, winner of the ICTP Dirac Medal in 2001, is the new vice president of the American Physical Society (APS). He assumed office on 1 January. Hopfield will become president-elect in 2006 and president in 2007.

Giuliano F. Panza, head of the Structure and Non-linear Dynamics of the Earth (SAND) group, has been appointed honorary professor of the Institute of Geophysics, China Earthquake Administration, Beijing. Panza has been chosen for his "outstanding contribution to seismology, especially in the fields of earthquake hazard and strong ground motion as well as intermediate-term earthquake forecasting." The award ceremony will take place in Beijing on 23 July.

Karl-Göran Mäler, professor of economics at the Stockholm School of Economics and director of The Beijer International Institute of Ecological Economics in Sweden, and co-organiser of the ecological and environmental economics research and training activity at ICTP, will receive a lifetime achievement award from the European Association of Environmental and Resource Economists (EAERE). Mäler will share the award with David Pearce, professor of economics at University College London, UK. The award is given to individuals who have made outstanding contributions to scholarship, institutional development and the communication and dissemination of ideas.

Charles Townes, who shared the Nobel Prize for Physics in 1964 for his work in quantum electronics that led to the construction of the first lasers, has been named the winner of the $1.5 million Templeton Prize. The announcement took place at a press conference at the United Nations headquarters on 9 March. The Templeton Prize, which was established in 1972 by the inventor and philanthropist Sir John Templeton, is awarded annually to those pursuing and writing about spiritual matters. Previous winners include Mother Teresa (who was awarded the first Templeton Prize in 1973), Russian writer Aleksandr Solzhenitsyn and scientists Carl Friedrich von Weizsäcker, Paul Davies, Freeman Dyson, and George F.R. Ellis (last year. See "Going Home," *News from ICTP*, Winter 2003-2004, p. 14). Townes, a professor of physics at the University of California, Berkeley, visited ICTP in 1968 and 1972. As *The New York Times* recently noted, Townes, 89, "has long argued that those old antagonists science and religion are more alike than different and are destined to merge."

ACTIVITIES

RESEARCH WORKSHOP ON ECOSYSTEMS AND TOURISM IN SOUTHERN AFRICA: ECONOMIC AND ECOLOGICAL RESILIENCE, Chobe, Botswana

6 - 8 January

Directors: P. Dasgupta (Beijer International Institute of Ecological Economics, Stockholm, Sweden, and Cambridge University, UK) and K.-G. Mäler (Beijer Institute).
Local Organiser: R. Hassan (University of Pretoria, South Africa).

RESEARCH SEMINAR FOLLOW-UP OF THE TEACHING WORKSHOP ON ACCOUNTING FOR URBAN ENVIRONMENT, Arusha, Tanzania

11 - 13 January

Directors: P. Dasgupta (Beijer International Institute of Ecological Economics, Stockholm, Sweden, and Cambridge University, UK) and K.-G. Mäler (Beijer Institute).
Local Organiser: R. Hassan (University of Pretoria, South Africa).

12TH INTERNATIONAL WORKSHOP ON COMPUTATIONAL PHYSICS AND MATERIAL SCIENCE: TOTAL ENERGY AND FORCE METHODS

13 - 15 January

Cosponsors: International School for Advanced Studies (SISSA, Trieste, Italy), DEMOCRITOS National Simulation Center (Trieste, Italy) of the Italian National Institute for the Physics of Matter (INFM), European Science Foundation's Psi-k Programme, Materials Computation Center of the University of Illinois at Urbana-Champaign (USA), Travel Program for Young Scientists, and Lawrence Livermore National Laboratory (USA).
Directors: E. Artacho (University of Cambridge, UK), A. Dal Corso (SISSA and DEMOCRITOS) and G. Galli (Lawrence Livermore National Laboratory, USA).

IAG-IASPEI JOINT CAPACITY BUILDING WORKSHOP ON DEFORMATION MEASUREMENTS AND UNDERSTANDING NATURAL HAZARDS IN DEVELOPING COUNTRIES

17 - 23 January

Cosponsors: International Association of Geodesy (IAG), International Association of Seismology and Physics of the Earth's Interior (IASPEI) and International Union for Geodesy and Geophysics (IUGG).
Directors: E.R. Engdahl (IASPEI), D. Jackson (US National Committee for IUGG), P. Suhadolc (University of Trieste, Italy, and IASPEI) and C. Tscherning (IAG).
Local Organiser: G.F. Panza (University of Trieste and ICTP).

ICTP SCHOOL ON LINUX CLUSTERS FOR HIGH PERFORMANCE COMPUTING, Kumasi, Ghana

17 - 28 January

In cooperation with Kwame Nkrumah University of Science and Technology (KNUST, Kumasi, Ghana).
Directors: S. Cozzini (DEMOCRITOS National Simulation Center, Trieste, Italy, of the Italian National Institute for the Physics of Matter, INFM), F.K.A. Allotey (Institute of Mathematical Sciences, IMS, Accra, Ghana) and K. Andam (KNUST).
Local Organisers: F.K.A. Allotey (IMS), E.A Jackson (KNUST), P. Okyere (KNUST), S. Osae (Ghana Atomic Energy Commission, GAEC, Accra, Ghana) and P.F. Okyere (Siemens AG, Munich, Germany).

WINTER COLLEGE ON OPTICS AND PHOTONICS IN NANOSCIENCE AND TECHNOLOGY

7 - 18 February

Cosponsors: International Commission for Optics (ICO), Optical Society of America (OSA), International Society for Optical Engineering (SPIE) and International Society on Optics Within Life Sciences (OWLS).
Directors: V. Degiorgio (University of Pavia, Italy), R. De La Rue (University of Glasgow, UK) and K.C. Rustagi (Indian Institute of Technology, Mumbai, India).
Local Organiser: G. Denardo (ICTP and University of Trieste).

SCHOOL ON RADIO BASED COMPUTER NETWORKING FOR RESEARCH AND TRAINING IN DEVELOPING COUNTRIES

7 February - 4 March

Cosponsors: International Union of Radio Science (URSI) and Telecommunication Development Bureau of the International Telecommunication Union (ITU/BDT, Geneva, Switzerland).
Directors: S.M. Radicella (ICTP) and R.G. Struzak (ITU).

2ND WORKSHOP ON EARTHQUAKE ENGINEERING FOR NUCLEAR FACILITIES. UNCERTAINTIES IN SEISMIC HAZARD ASSESSMENT

14 - 25 February

Cosponsors: International Atomic Energy Agency (IAEA, Vienna, Austria).
Directors: A. Godoy (IAEA) and P. Contri (IAEA).
Local Organiser: G.F. Panza (University of Trieste and ICTP).

WORKSHOP ON ALGEBRA, GEOMETRY AND ALGORITHMS FOR YOUNG MATHEMATICIANS IN AFRICA, Niamey, Niger

20 - 27 February

Directors: F. Broglia (University of Pisa, Italy), W. Harouna (University of Niamey, Niger) and M.-F. Roy (University of Rennes, France).

1ST LATIN-AMERICAN SCHOOL AND CONFERENCE ON STATISTICAL PHYSICS AND INTERDISCIPLINARY APPLICATIONS, Havana, Cuba

28 February - 12 March

In cooperation with the University of Havana (Cuba).
Directors: E. Altshuler (University of Havana, Cuba), S. Franz (ICTP), M. Marsili (ICTP), R. Mulet Genicio (University of Havana), O.G. Sotolongo-Costa (University of Havana) and R. Zecchina (ICTP).

CONFERENCE ON HIGHER DIMENSIONAL QUANTUM HALL EFFECT, CHERN-SIMONS THEORY AND NON-COMMUTATIVE GEOMETRY IN CONDENSED MATTER PHYSICS AND FIELD THEORY

1 - 4 March

Directors: A.P. Balachandran (Syracuse University, New York, USA), K. Gupta (Saha Institute, Kolkata, India), V.P. Nair (City University of New York, USA) and Zhang Shoucheng (Stanford University, California, USA).

SECOND IAEA TECHNICAL MEETING ON THE THEORY OF PLASMA INSTABILITIES: TRANSPORT, STABILITY AND THEIR INTERACTION

2 - 4 March

Cosponsors: International Atomic Energy Agency (IAEA, Vienna, Austria).
Director: A. Malaquias (IAEA).
Local Organiser: B. Stewart (ICTP).

WORKSHOP ON PLASMA PHYSICS: CAPACITY BUILDING IN PLASMA APPLICATIONS AND DIAGNOSTIC TECHNIQUES

7 - 11 March

Cosponsor: Central European Initiative (CEI, Trieste, Italy).
Directors: B. Stewart (ICTP), G. Mank and A. Malaquias (International Atomic Energy Agency, IAEA, Vienna, Austria).

WORKSHOP ON NUCLEAR DATA FOR ACTIVATION ANALYSIS

7 - 18 March

Cosponsor: International Atomic Energy Agency (IAEA, Vienna, Austria).
Directors: M. Blaauw (Technical University of Delft, The Netherlands), A. Trkov (IAEA) and C. Tuniz (ICTP).
Local Organiser: B. Stewart (ICTP).

SPRING SCHOOL ON SUPERSTRING THEORY AND RELATED TOPICS

14 - 22 March

Directors: E. Gava (Italian National Institute for Nuclear Physics, INFN, Trieste, Italy), K.S. Narain (ICTP), H. Ooguri (California Institute of Technology, CALTECH, Pasadena, USA), S. Randjbar-Daemi (ICTP) and A. Sen (Harish-Chandra Research Institute, Allahabad, India).

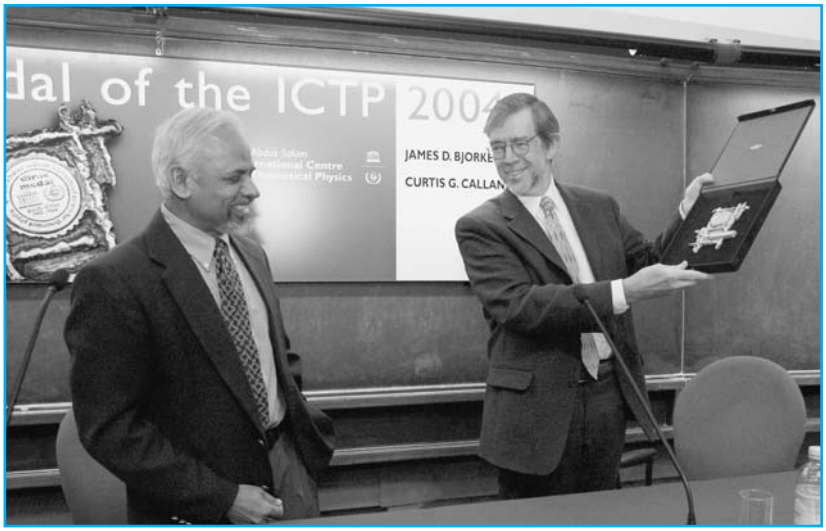
MONITOR

Science Dissemination Unit (SDU)

Part of the ICTP/TWAS Donation Programme has been turned into the Science Dissemination Unit (SDU) to reflect the expanded need for information via electronic communication. The new unit, which will be coordinated by ICTP staff scientist **Bobby Acharya** and include staff members **Enrique Canessa**, **Carlo Fonda** and **Marco Zennaro**, will seek to make the broad range of scientific information (for example, preprints, lectures and seminars) produced at the Centre available on-line; devise strategies for linking ICTP scientific information with electronic portals at other institutions, especially universities and research centres in the developing world; and strengthen ICTP's eJournal Delivery Service. SDU also plans to prepare a comprehensively indexed web archive of recorded lectures given by prominent scientists visiting ICTP. The remaining part of the ICTP/TWAS Donation Programme will now be operated by the Library.

Enrique Canessa (standing), Carlo Fonda (in foreground) and Marco Zennaro

Dirac Medallists 2004



K.R. Sreenivasan and Curtis G. Callan

James D. Bjorken, professor emeritus at the Stanford Linear Accelerator Center (SLAC), and **Curtis G. Callan**, professor of physics, Princeton University, presented their Dirac Medal Lectures at ICTP on 16 March 2005. Bjorken spoke on "Scaling the Heights" (see "Features", p. 6-7) and Callan presented a lecture on "From Scaling to Asymptotic Freedom and Beyond: Quantum Field Theory and the Struggle to Understand the Strong Interaction." The work of Bjorken and Callan was instrumental in the theoretical developments that led to the use of deep scattering in shedding light on the nature of strong interactions. For additional information, see www.ictp.it.

ICO/ICTP Award

The ICO (International Commission for Optics) /ICTP Award for 2005 has been awarded to **Sarun Sumriddetchkajorn**, National Science and Technology Development Agency (NSTDA), Pathumthani, Thailand, for his achievements in applying photonics and micromechanics to biomedical devices and telecommunications. He was also honoured for his efforts to promote optics and photonics in Thailand. The award ceremony took place on 9 February 2005.

Maria Calvo and Sarun Sumriddetchkajorn

IN MEMORIAM

Nobel Laureate **Hans Bethe**, one of the most prominent theoretical physicists of the past century, died at his home in Ithaca, New York. He was 98. Bethe, who won the Nobel Prize for physics in 1967 "for his contributions to the theory of nuclear reactions, especially his discoveries concerning the energy production in stars", was an ardent supporter of ICTP and close friend of the Centre's founding director Abdus Salam. He was a guest of honour at ICTP's Symposium on Contemporary Physics in 1968, celebrating the opening of the Main Building. Bethe's lecture was published in *From a Life of Physics* (Vienna: International Atomic Energy Agency, 1969).

Hans Bethe at ICTP, June 1968

Sergio Fubini, Italy, an eminent theoretical physicist who taught at the universities of Padua and Turin, Italy, and who in his later years devoted his international standing in physics to promoting peace in the Middle East, died on 6 January 2005 after a prolonged illness. He was 77. Fubini contributed to several cutting-edge fields of theoretical physics, including S-matrix concepts that played an important role in dual resonance models. He also helped to devise the preliminary mathematical framework for the development of string theory. In

Sergio Fubini at Symposium on Elementary Particle Interactions in Trieste, June 1960

1995, Fubini organised the Sinai Physics Meeting in Dahab, Egypt, which brought together physicists from Arab countries, Israel, Europe and the United States to discuss strategies for promoting international cooperation in physics in the Middle East. The meeting led to the launch of the Synchrotron-light for Experimental Science and Applications in the Middle East (SESAME) project and the relocation of a synchrotron radiation light facility from Germany to Jordan. The facility will begin operation later this decade. Fubini taught at ICTP in the 1960s and returned in 1997 to attend the Abdus Salam Memorial Meting.

Former ICTP Associate Anita Mehta leads a life of a 'renaissance' scientist examining big issues with imagination and vigour.

Science in Sandpiles

She refers to herself as an 'expert dilettante.'

But the truth is that ICTP Associate (1999-2004) **Anita Mehta** is an 'expert expert.' Today, she is recognised as one of the world's foremost statistical physicists, having earned an international reputation for her pioneering work in the physics of granular media. Mehta's accomplishments were recently acknowledged in India when she was named the 2004 Stree Shakti Woman Scientist by a panel of eminent Indian scientists.

Mehta, who earned her bachelor of sciences degree from Presidency College in Kolkata and her master's and doctorate degrees from Oxford University, where she was a Rhodes Scholar, has applied her knowledge and skills as a postdoctoral consultant at IBM in New York, a research associate at Cambridge University and visiting fellow at Oxford University, UK, and a research associate at IRC for Advanced Materials in Birmingham, UK. She is currently an associate professor with the statistical and soft condensed matter physics group at the S.N. Bose National Centre for Basic Sciences in Kolkata. Her global travels have brought her to ICTP on more than 10 occasions and, in 2001, she served as director of the ICTP Research Workshop on Challenges in Granular Physics.

"I would say that my most noteworthy work has focused on the behaviour and structure of sandpiles," explains Mehta, "which is far more complicated than you might imagine."

"Think of a pyramid-like sandpile, which is capable of retaining its shape for long periods, yet can be misshapen—indeed flattened—by the lightest of touches."

Whether a sandpile remains stable, she maintains, has less to do with material than with the structure and what she calls 'the sandpile's dynamical history.' "Sandpiles," she insists, "have memory!"

Anita Mehta

Mehta, with her collaborators, has used statistical physics to learn more about the 'memory' of sandpiles and to build models that can explain, and sometimes predict, their behaviour.

"What I've been able to learn has applications far beyond the sandpiles themselves."

The knowledge and skills she has acquired, for example, have led her to work closely with cosmologists on issues related to the evolution of primordial black holes; with economists on game theory; and with polymer physicists on issues related to entanglement.

In fact, her diverse research agenda has ranged from the whimsical (investigating the way in which a ball bounces on a vibrating platform) to the deadly serious (how to assure the structural integrity of bridges and building arches). Her resume, while largely academic, shows her links with such large multinational corporations as IBM, Exxon-Mobil, Schlumberger and Unilever. And her academic activities, in addition to her research, include organising a conference on the Anatomy of Laughter at Oxford University.

"I find my research to be fascinating on two counts," says Mehta. "First, as a statistical physicist I bring a set of tools to problems spanning the full spectrum of scientific disciplines—biology, chemistry, physics and engineering. As a result, my work as a collaborative scientist bears little resemblance to the public perception of a solitary scientist labouring alone in a laboratory. And second, because the tools that I use are designed to help shed light on the behaviour of large and complex systems, I often have an opportunity to investigate large, challenging problems."

That not only suits Mehta's education and training but her temperament as well. Beyond her expertise as a scientist, Mehta is an accomplished classical pianist who has performed at public concerts, and a skilled writer who has penned a novel and published articles and short stories in newspapers and magazines both in India and abroad.

"The 'big picture' science that I do," Mehta notes, "allows me to draw on my inspiration as well as the methodologies and skills that I have been taught. That, in turn, enables me to tap both the left (logical) and right (intuitive) sides of my brain. It is this duality that makes my work both exciting and personally rewarding."

Or, as Mehta also likes to say: "I enjoy doing science both at the frontier of knowledge and the edge of disciplines." And that ironically has often brought her back to the science in sandpiles.□

WHAT'S NEXT

4 - 15 April
Nuclear Structure and Decay Data: Theory and Evaluation

11 - 15 April
3rd Workshop on Spatial Dynamic Models of Economics and Ecosystems & Workshop on Infectious Disease: Theoretical, Ecological and Economic Approaches

11 - 22 April
Spring Colloquium on the Physics of Weather and Climate: Regional Weather Predictability and Modelling

13 - 15 April
2nd Workshop on Inclusive Wealth and Accounting Prices

18 - 22 April
Workshop on Methods and Mathematical Models for Estimating Environmental Damage from Electricity Generation

25 April - 6 May
ICTP-INFM-DEMOCRITOS-ISMO-IUT School on Electronic-Structure Calculations and Their Applications in Materials Science, Isfahan, Islamic Republic of Iran

25 April - 13 May
Workshop on Genes, Development and the Emergence of Behaviour

2 - 4 May
Meeting on Network on Environmental Economics in the Middle East

9 - 12 May
Nonlinear Cosmology: Turbulence and Fields

9 - 20 May
Workshop on Quantitative Ecology

15 - 26 May
First International Workshop on Climate Variability over Africa, Alexandria, Egypt

16 - 28 May
School and Workshop on Structure and Function of Complex Networks

23 - 28 May
Planck 05

30 May - 3 June
Workshop on Biopolymers: Thermodynamics, Kinetics and Mechanics of DNA, RNA and Proteins

31 May - 4 June
Conference on Computational Cosmology

6 - 10 June
Conference on Vortex Rings and Filaments in Classical and Quantum Systems (6-8 June), followed by: Workshop on New Experimental Techniques for the Study of Quantum Turbulence (9-10 June)

6 - 24 June
Summer School and Conference on Geometry and Topology of 3-Manifolds

6 June - 1 July
ICTP-ITU/BDT Advanced Training Activity on the Use of Wireless for Campus Networking

13 - 24 June
Summer School on Particle Physics

27 June - 1 July
Conference on Single Molecule Magnets and Hybrid Magnetic Nanostructures

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.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 Scientific Calendar of Activities
Create a new e-mail message and type
To: `smr@ictp.it`
Subject: `get calendar 2006`
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 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.it`
Under the e-mail's subject, type
Subject: `get index`
Leave the body of the message blank and send it.
You will receive automatic reply messages containing all documentation available on that particular activity.

(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.it`
Leave the subject line empty.
In the body of the message type
`subscribe`
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.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. Katepalli R. Sreenivasan 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.

Editor-in-Chief
Daniel Schaffer

Staff Writer*/Direttore responsabile*
Fabio Pagan

Managing Editor
Anna Triolo

Copy Editor
Katrina Danforth

Statistician
Giuliana Gamboz

Photos
ICTP Photo Archives,
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Layout
Associazione Progettisti Grafici

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Public Information Office

The Abdus Salam
International Centre for Theoretical Physics

Strada Costiera, 11
34014 Trieste
Italy
sci_info@ictp.it
fax: (+39) 0402240565
www.ictp.it

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