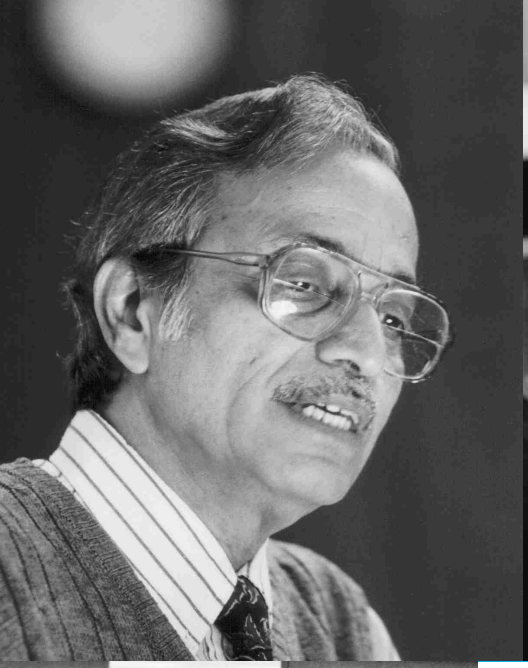
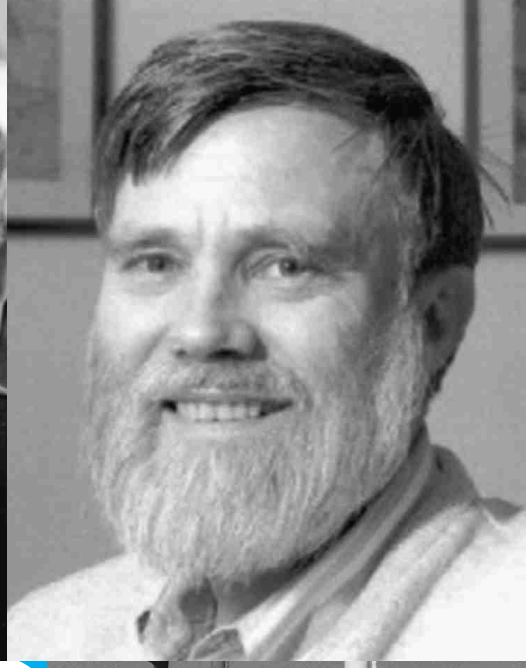
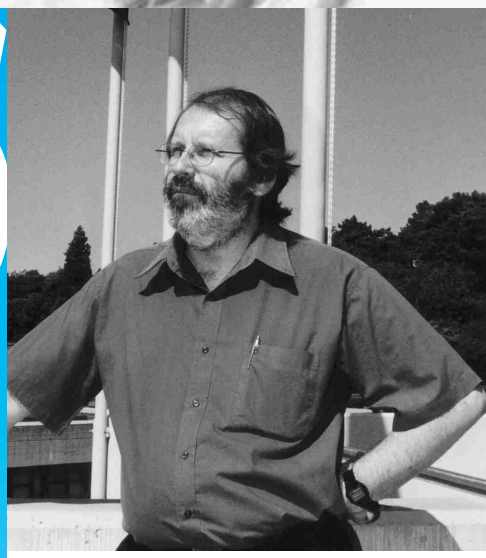




NEWS from ICTP



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international centre for theoretical physics

AUTUMN
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Riccardo Zecchina
ICTP Condensed Matter Physics Group

Matteo Marsili
Italian National Institute for the Physics of Matter (INFM) and International School for Advanced Studies (SISSA)

A new course will make its debut this fall at ICTP and SISSA. The focus will be on modelling and simulations. The goal will be to use these tools to cast light on real-world problems.

Math Matters

An enclosed walkway links the main building of one institution to the main building of the other. But ICTP and SISSA (the International School for Advanced Studies) are more than neighbours. They are, in fact, kindred souls. For more than 30 years, the two institutions have co-sponsored activities, shared facilities and agreed to joint research appointments—all as part of a mutual effort to advance the study of theoretical physics and mathematics.

In the early years of the relationship and indeed through the 1990s, the division of basic science into distinct disciplines often was straightforward. While mathematics served as a common language, high energy physics, condensed matter physics, cosmology, seismology and most other basic research areas travelled along clearly defined avenues of inquiry that rarely intersected. More recently, however, scientists have discovered that once-thought-to-be-separate research areas may share common ground.

ICTP and SISSA have participated in this journey of discovery through research and training activities devoted, for example, to string theory and algebraic geometry, field theory and statistical mechanics, disordered materials and chaotic systems. These activities, some of which appeared on the scientific calendars of ICTP and SISSA as early as the 1980s, often have blurred the formerly distinct boundaries between mathematics, physics and statistics.

The two institutions take another step in this direction this fall with the launching of a one-year graduate course, "Modeling and Simulation of Complex Realities. " The course will be expanded into a two-year master's degree programme in 2002. The goal is to provide students who have enjoyed solid backgrounds in mathematics and theoretical physics with the advanced training that they need to apply tools in basic science to real-world problems. An essential aspect of the second year of the master's programme will be the fostering of collaboration with industries and other institutions.

Methodologies from probability theory, stochastic processes, control and game theory, optimisation and fluid dynamics will serve as the backdrop for modelling issues ranging from population dynamics to climate change to the behaviour of consumers in emerging market economies to airline scheduling problems (see "Fiscal Physics," p. 8.).

What are the underlying principles in science and mathematics that provide common ground for these explorations? They are the non-linear, complex and unstable world in which we live, a world whose (dis)order can become clearer and more predictable through sophisticated use of mathematical models.

In tackling many of the world's most critical economic, environmental and even social issues, a key difficulty lies in reformulating the analyses into terms that are amenable to rigorous and quantitative scientific assessment. It's the difference between feeling that summer temperatures have been getting hotter and devising a database that proves your point and then building mathematical models that project what will happen to temperatures, cloud patterns and precipitation in the future under a variety of environmental assaults and atmospheric conditions. Use of mathematics and models, in effect, helps researchers verify what has happened in the past and propose reasonable predictions of what may happen in the months and years ahead. In short, models help scientists approximate the real world.

Where all of this leads remains difficult to predict, which may be a fitting description for an approach to science and problem-solving that seeks to better understand the complexity of the world in which we live. Yet this much is true: the frontiers of science have always resided where the greatest insights in understanding nature take place. That's just another reason why both ICTP and SISSA are seeking to expand their involvement in the emerging field of applicable mathematics. ®

Several theoretical physicists have proposed a new theory for understanding why the force of gravity is so weak. The answer to this perplexing question may lie in dimensions beyond our own.

Gravity in the Fifth Dimension

The force exerted by a small magnet, say one that can be held between your index finger and thumb, should be no match for the collective gravitational force operating within our universe. But place a nail near a magnet and we all know what happens—the magnet prevails. This 'David and Goliath' physics phenomenon has baffled theoreticians ever since the advent of modern physics a century ago. It's a puzzle that not even Einstein could solve.

Now a number of physicists have proposed a new theory for understanding the weakness of gravity in our universe. The notion is elegant in its simplicity: They suggest that most gravitons—'messenger' particles programmed by nature to carry the gravitational force (much like photons carry light impulses)—don't live in the same dimension in which we live. In fact, such particles may reside in a vast fifth dimension that remains largely separate from our own. Gravity, they contend, may be a powerful force, but its agents just don't live in our neighbourhood.

Lisa Randall

Lisa Randall, who is one of the chief architects of this theory, spoke at ICTP's Conference on Physics Beyond Four Dimensions, held between 3-6 July.

Randall, professor of physics at Princeton University, notes that "the theories that I and my colleague, Raman Sundrum, a physicist at Stanford University, have presented draw on ideas which have been central to the study of string theory over the past two decades. Like string theory, the intellectual construct on which we base our space-time concept depends on the existence of extra-dimensions. And like string theory, our theory suggests that the physical world is configured by strings or bands that anchor the particles and forces that fill our universe."

But Randall expands upon string theory in this way: Whereas string theorists suggest that gravitons and the force that they carry may be wrapped within tightly bound strings residing in as many 11 dimensions, Randall suggests that gravity—or at least most of it—is found on strings or bands that reside largely in a vast fifth dimension. As a result, gravity exerts a weak force on us not because it is tightly bound in strings but because it is largely insulated from our known reality. In Randall's words, "geography, not compaction, accounts for gravity's weak force."

"Think of ourselves as living in a bubble consisting of three dimensions plus time that floats within a vast multidimensional universe," explains Randall. "Within this physical landscape, three of nature's four elementary forces—electromagnetism and the weak and the strong force—are attached to strings inside the bubble, exerting a force that can be detected and analysed. Nature's fourth elemental force—gravity—is largely attached to strings in another dimension. We can only detect it when gravitons leak into our dimension through the surface or 'branes' of our universe's strings. In short, our multidimensional world consists of bubbles floating within bubbles that are comprised of constituent elements that rarely violate the constituent elements found in other space-time dimensions."

The theory, which was first presented in *Physical Review Letters* in 1999, has generated a great deal of excitement in both scientific publications and the popular press. In fact it has been examined extensively in *Nature* and *Science* and discussed at length in *The New York Times* and *The Economist*.

This unusual convergence of professional and public interest is based on several factors.

First, the theory offers a possible answer to one of physics' greatest mysteries: how gravity relates to nature's other elementary forces. Solving this mystery would mark a critical step forward in the unification of all the forces of nature.

Second, if gravitons exist in a much larger dimension than theorists have previously thought, and if these particles are not bound in tightly wound strings that require absurdly high energies to untangle, then it may be possible to test the theory in the near future.

At this point, the theory is just that—intelligent, well-formed speculation based on years of study and insight, as well as mathematical calculations that seem to point in this direction. The good news is that the theory is likely to be put to the test within the next few years. That, in turn, could bring theories and experiments in high energy physics closer together than they have been in more than two decades. ®

An increasing number of scientists are discovering that order has always been embedded within chaotic systems. We just haven't been able to uncover the underlying patterns—until now.

Chaos Rules

Chaos again took centre stage at ICTP this summer. But in typical ICTP fashion the event was meticulously organised.

The occasion for chaos's arrival was the Symposium on Synchronization of Chaotic Systems, which was held between 3-5 July 2000.

Hirokazu Fujisaka, Tomoji Yamada and Valentin Afraimovich launched the topic of synchronization of chaotic oscillators in the 1980s, but it only gained worldwide attention after Louis Pecora and Tom Carroll's hypothesis of its use for secure communications.

Later Kevin Cuomo and Alan Oppenheim showed that it was possible to encode messages within a noise-like chaotic signal. While this work raised hopes for a new system of secure communications, Gabriel A. Perez and Hilda Cerdeira at ICTP showed that the underlying structure of low-dimensional chaotic systems could be used by an eavesdropper to decode an encrypted message.

At the conference, more than 80 scientists from 27 countries listened to a broad range of presentations—25 in all—exploring the importance that the dimensionality of chaotic systems has in encrypting messages successfully.

What's so special about chaos and why does it deserve such extensive and careful examination? The short answer is this: Chaotic systems are unpredictable, unreliable and seemingly uncontrollable, but closer scientific and mathematical analyses often reveal that intricate, repetitive patterns lie behind the randomness. In other words, scientific studies can uncover the 'unseen' order in chaos and perhaps put that order to good use in areas ranging from communication technologies to genetic engineering to neural networks.

"One of the unique aspects of chaotic studies," explains Louis Pecora, conference organiser and staff scientist at the Naval Research Laboratory, in Washington, D.C., USA, "is that the field is truly multidisciplinary. At the conference, for example, Kunihiko Kaneko from the University of Tokyo, Japan, examined chaotic systems to better understand developmental cell biology and, more specifically, the intricately related physical and biochemical systems that enable lobsters to capture, chew and digest food. At the same time, José R. Rios Leite, from the Federal University of Pernambuco in Recife, Brazil, examined chaotic systems found in various light spectra to better understand the physics of lasers." As far apart as their research may seem, Kaneko and Rios Leite share the same methodologies in ways that allow them to learn from each other.

Thus, in a scientific world increasingly defined by narrower and narrower subfields, Pecora adds, the study of chaos stretches across many scientific disciplines.

What accounts for the cross-disciplinary nature of the study of chaos? Tito Arecchi, an Italian physicist at the University of Florence who was a speaker at the conference, observes: "This broad field is driven by a desire to find order in chaos by deciphering underlying patterns through, for example, mathematics or computer modelling."

"What scientists are trying to detect," he asserts, "are the repetitive signals that may be taking place within electric currents, light impulses or the microchemistry of organic molecules. These signals, if reduced to manageable levels of observation and analysis, can indeed turn chaos into order. The truth is that nature is brimming with regularity, most of which remains outside our purview."

"Another way of understanding the study of chaos," says Pecora, "is to view our analytical framework not as an abstract intellectual concept but as a universal tool that may prove useful in a variety of scientific disciplines. The problem is that the skills required to handle and apply the tool successfully remain difficult to master."

"A chaotic system contains one or more varying elements," Pecora notes. "These elements," he continues, "are in constant flux with patterns of motion that are not easy to pin down or replicate." As a result, scientists conducting research on chaotic systems must be prepared for constant surprises. In chaotic systems, unlike periodic systems, small changes grow exponentially—quickly leading to unpredictable changes and a loss of coherence. "All of this means that understanding how to synchronise chaotic systems may provide important insights in a variety of different fields, but the ability to do so is no simple task."

What is simple about chaos is the fact that you don't need complicated systems to create complex signals. This insight has served as the basis of one of the first real-world applications of the study of chaos: encryption.

"The simple signals that sound like background noise to those who don't know the code actually represent

spoken words or written text to those who do," says Pecora. "By keeping a complex system simple, you make the decoding machinery both lighter and more resilient."

The roles that encryption could play in communications technologies are obvious, particularly in promoting the safe and secure transmission of information. Part of the aim of this meeting was to understand how simple the system can be to successfully encrypt undecodable messages.

Despite its seemingly exotic nature and its high-tech applications, the study of chaotic systems has not been confined to scientists in the developed world. The large number of Third World scientists who participated in the ICTP symposium (more than half of the total number) indicates that the study of chaos is not only multidisciplinary but multinational in nature.

"One reason for the involvement of scientists from the South in the study of chaos," notes Argentinean statistical physicist Damian H. Zanette, of *Centro Atómico Bariloche*, Bariloche, Argentina, "is that the amount of computing power a researcher needs to do good work is relatively small. As a result, overhead costs are cheap. This is one area of science where you don't need expensive equipment to keep pace with your colleagues."

Another reason Zanette cites is that several developing countries, among them Brazil, China and India, now have a critical mass of scientists who are well-educated and well-trained in disciplines that are driving 'chaos' research—notably mathematics and theoretical physics.

Finally, Zanette maintains that "the study of chaos is a relatively new field that has yet to create well-entrenched centres of excellence compared to those, for example, in high energy physics, which have been around for 30 years or more. Those with the talent and drive have an opportunity to leave their mark on the emerging field of chaos regardless of where they choose to pursue their research." At the conference, Zanette himself confirmed his assessment of the involvement of Third World scientists in the study of chaos by examining methodologies for its synchronisation.

The study of chaos, in short, is a truly global scientific enterprise that draws its strength and vitality largely from the universal language of mathematics. Whether encrypting or decoding communication systems, learning more about cell differentiation among living organisms, or probing the motion of electrons in advanced materials, the search for order within the 'veiled' chaos of our physical, chemical and biological worlds has captured the attention of scientists from many different disciplines and many different parts of the world. And like the chaotic systems they study, the knowledge that they uncover in the future promises to be both exciting and surprising.®

FIREFLIES AND BRAIN WAVES

As children, many of us would spend quiet evenings in late summer watching fireflies perform their flash dance in seemingly carefully choreographed harmony. Damian H. Zanette, a statistical physicist at Centro Atómico Bariloche, Bariloche, Argentina, has carried this childlike fascination into his professional life by applying his study of abstract mathematical models to, among other things, the mechanisms at work when certain fireflies synchronise their light signals.

"Those who study chaotic systems," he explains, "speak to each other through the common language of mathematics. Math enables physicists to speak to chemists, and chemists, in turn, to speak to biologists—despite the fact they are trained in different disciplines and often work in very different, seemingly unrelated, fields."

"Where studies of chaotic systems, and I might add nearly all other scientific studies based on mathematical models, have fallen short," Zanette says, "are in their inability to create a common language when it comes to describing natural phenomena. For example, when a biologist comes to me with a set of equations explaining his or her work, I can understand the math, but that knowledge does not necessarily help me, as a statistical physicist, to understand the actual phenomenon he or she is analysing—whether it's population dynamics or neurological disfunctions or biomolecular reactions."

That's the bridge that Zanette hopes to build in his research. "The models that I study describe synchronisation at an abstract level, but can be applied to biological populations such as fireflies to explain the mechanisms that allow them to blink in harmony. The models tell us that synchronisation is possible when communication within the population is long-range and when its effect on individual behaviour exceeds a certain threshold."

Such knowledge may not only help us understand the intriguing but perhaps trivial world of fireflies but may also shed light on such neurological disorders as epilepsy. During epileptic seizures, scientists have discovered that the brain's neural activities are completely synchronised (unlike the complex uncorrelated patterns displayed during normal brain functions).

By studying synchronisation models, scientists could conceivably help uncover mechanisms that would avoid the trauma of epilepsy. It's the peculiar link that synchronisation potentially provides between such diverse phenomena as the blinking of fireflies in a farm field and overcharged in-synch brain waves during epileptic seizures that make the study of the synchronisation of chaotic systems so fascinating to explore and so difficult to explain.

Throughout his career, Abdus Salam called for the development of strong scientific communities in Pakistan. The progress he sought may finally be taking place after years of neglect.

Physics in Pakistan

Abdus Salam's place in the annals of the history of physics—and, more generally, the history of science—is secure. As the first scientist from the Islamic world to win the Nobel Prize and as the founder of the International Centre for Theoretical Physics (ICTP), there's little doubt that the scientific world will still be paying homage to Salam for decades to come.

Yet, one of Salam's lifelong goals—perhaps the one closest to his heart—ultimately proved to be the most elusive. Throughout his long and distinguished career, Salam devoted a great deal of time and energy to the promotion of science in Pakistan, the country of his birth. But, unlike his work in Trieste, Italy, on behalf of the developing world, his efforts in Pakistan fell far short of the long-term impact he had envisioned.

Despite serving as chief scientific advisor to the president of Pakistan for 13 years, despite launching in 1976 the International Nathiagali Summer College on Physics and Contemporary Needs (which is still going strong), despite writing extensively and passionately on the subject, and despite continually cajoling Pakistani officials to invest more funds in science, near the end of his life Salam lamented: "Countries like Turkey, Egypt and my own country have no science communities geared to development because we do not want such communities. We suffer from a lack of ambition towards acquiring science, a feeling of inferiority towards it, bordering sometimes even on hostility."

Today, some 35 years after the creation of ICTP that now bears his name and some four years after his death, Salam's call for the creation of a vibrant science community in Pakistan—spearheaded by research excellence in physics—may finally be emerging from the shadows of neglect.

But that doesn't mean serious problems don't persist. As Pakistani-born ICTP Senior Associate Ghulam Murtaza notes, "there are just 20 active physicists in all of Pakistan, a country of 130 million people. And, historically, there have been only a handful of institutions where 'serious' research in physics has taken place: the Department of Physics at Quaid-i-Azam University, the Pakistani Atomic Energy Commission's Institute of Science and Technology, and, more recently, the National Centre for Physics, also at Quaid-i-Azam University, and the Department of Physics at Government College. In fact, the majority of physics research is conducted by the nation's atomic energy commission. That's often made it difficult for the concerns of professors in university departments of physics to be heard."

As if small numbers of researchers and the absence of reputable institutions were not daunting enough, physics in Pakistan also faces an 'age' problem. As former ICTP Associate Riazuddin, who also hails from Pakistan, observes: "Although Salam may not have succeeded in establishing an internationally recognised physics community in Pakistan, he helped convince the Pakistani government to make a series of modest investments in scientific research. As a result, there was a flurry of activity in physics during the 1960s and 1970s that prompted the training of a small group of physicists who were born in Pakistan."

National Centre for Physics

He then goes on to add that "these researchers, and I include myself among them, have either retired or are approaching retirement. The problem is that there are fewer and fewer young Pakistani physicists now being trained to replace them." Indeed, several observers fear that if current trends are not reversed, the number of researchers working in Pakistan with active research agendas could dip below 10 within the next decade.

Despite these problems, there are some promising signs of a brighter future. Atta-ur-Rahman, a Cambridge-trained chemist, who has often praised ICTP (most recently at the World Conference on Science in Budapest in 1999, where he received the UNESCO Science Prize), was appointed Minister of Science and Technology this past spring. During his brief tenure, Atta-ur-Rahman has convinced his government that generous funding for science and technology could produce valuable long-term dividends for economic development. As a result, the government's proposed budget for science and technology has been raised from US$2.2 million in 2000 to US$300 million in 2001—an astonishing increase that brings Pakistan's expenditures for science and technology to 0.5% of its gross domestic product (GDP).

Atta-ur-Rahman

To date, the development of information technologies and strategies to promote such engineering-oriented sciences as biotechnology and materials science—both of which promise near-term commercial applications—have been the target points for next year's science and technology budget. But as Murtaza notes, "university-based researchers in fundamental science, including physicists, remain optimistic that the ministry will be responsive to their needs."

"Atta-ur-Rahman," he says, "is an accomplished research scientist who understands the importance of basic science. We are confident that his overall policy will include strong support for basic science as an integral part of the government's overall funding strategy."

Meanwhile, two recent university events raise hope that the decline in fortunes for physics in Pakistan will soon be turned around.

In January 1999, Riazuddin was named the founding director of the National Centre for Physics, headquartered at Quaid-i-Azam University in Islamabad. The centre, which traces its 25-year incubation period back to Pakistan's International Nathiagali Summer College on Physics and Contemporary Needs, has been modelled after ICTP. In fact, Riazuddin hopes that his centre "can evolve into a mini-, Pakistani-based, ICTP."

During its 18 months of existence, Riazuddin notes, "the National Centre for Physics has hosted a series of workshops, schools, courses and conferences devoted, for example, to the study of high energy physics, semiconductor physics, computational condensed matter physics, plasma physics and astrophysics." All activities are designed to assist physicists living and working in Pakistan. In addition, the centre has signed a collaborative agreement with CERN (the European Organization for Nuclear Research) in Geneva, Switzerland, to assemble and test the resistant plate chambers of the compact muon silicon detectors associated with the Large Hadron Collider (LHC), which will be the world's leading particle accelerator. CERN hopes to have the LHC in operation by 2005.

To build on its recent success, Riazuddin has submitted a funding proposal to the government that would allow the centre both to expand its research and training activities and to build a 50-room guesthouse, library and computer facilities so that "visiting scientists can pursue their studies free from the daily distractions that often take place in their home institutions." In the words of Riazuddin, the proposal, which calls for an additional US$2 million over a 3-year period, would transform the institution from a 'nucleating' to a 'permanent' centre.

Ghulam Murtaza

Another step in efforts to revive physics in Pakistan took place this March, when Murtaza, who was a student of Salam at Imperial College in London, was named the first Salam Professor of Physics at Government College in Lahore, where Salam taught in the early 1950s. Murtaza hopes to use the chair to build co-operative centres of excellence in such fields as plasma physics and condensed matter physics. "The focus," Murtaza observes, "will be on young scientists. In fact, we hope to launch master's and doctorate programmes that will serve as important training grounds for the next generation of Pakistani physicists."

Neither the government's recent commitment to increase its funding for science and technology, nor the creation of a Salam chair in physics or a new physics research centre guarantees a resurgence in science—and, more specifically, physics—in Pakistan. But it does suggest that the study of physics, after a long period of dormancy, may soon experience a turn around.

Such a development would certainly have pleased Salam. As Riazuddin notes, "If he were alive today, I am sure he would be delighted to see that aspects of his vision are at last being transformed into reality." Riazuddin might well have added that Salam would be the first to say that much more needs to be done and that there is no better time to start than right now. ®

Riazuddin (right)

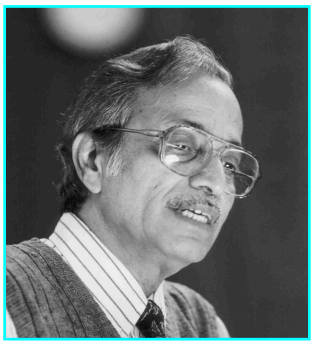
For additional information about the National Centre for Physics at Quaid-i-Azam University in Islamabad, contact ncp@comstats.net.pk or phone 92 51 273545. For additional information about activities associated with the Salam Chair of Physics at Government College in Lahore, contact schair@lhr.comsats.net.pk or phone 92 42 9212245.

DATELINE

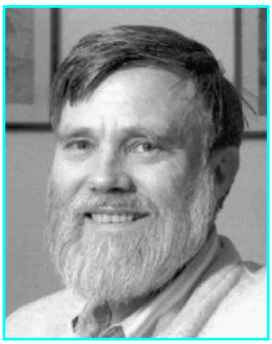
Three Share Dirac Medal

Helen Quinn

For the first time in the 15-year history of ICTP's Dirac Medal, the selection committee has chosen a woman as one of the medallists. Helen Quinn, staff scientist in theoretical physics at the Stanford Linear Accelerator Center, Stanford, California, will share the medal with Howard Georgi, professor of physics at Harvard University, Cambridge, Massachusetts, and Jogesh Pati, professor of physics at the University of Maryland, College Park, Maryland, USA. The announcement was made on 8 August, the birthday of the famed physicist and Nobel Prize winner Paul A.M. Dirac, who died in 1984. Dirac was one of the Centre's most forceful advocates during ICTP's first two decades of existence. The three scientists are being honoured for their "pioneering contributions to the quest for a unified theory of quarks and leptons and the strong, weak and electromagnetic interactions." Their research tracks the same line of investigation that earned ICTP's founding director, Abdus Salam, the Nobel Prize in 1979. Salam shared the prize with Steven Weinberg and Sheldon Glashow for proposing a theory of unification of nature's electromagnetic and weak forces. For additional information about the Dirac Medal and other ICTP awards, see the ICTP homepage at www.ictp.trieste.it.



Jogesh Pati



Howard Georgi

Fiscal Physics

ICTP's Second School on the Mathematics of Economics, held between 21 August and 1 September, included a host of intriguing theories concerning potential links between studies in theoretical physics and real-world economic and social patterns of behaviour. A series of lectures and discussions explored, for example, how game theory could shed revealing light on financial market volatility, strategic military planning and decision-making, and efficient airline scheduling. The most provocative lecture at the school, however, was given by Jean-Philippe Bouchaud, a condensed matter physicist from the French Atomic Energy Commission. Bouchaud contended that he had uncovered a theory explaining why every society, since the dawn of civilization, has been characterised by a minority of wealthy people who maintain power in their own hands. He claimed that the 'wealth and power' profile, revealed time and again in history books, was replicated in an equation used by physicists in their studies of disordered systems. Bouchaud's observations have received extensive coverage in the international press, including a front-page story in the French daily *Le Monde* and a feature article in the weekly magazine *New Scientist*. One conclusion drawn in the *Le Monde* is this: If the rich are always with us, why not tax them more?

ICTP in the News

Several ICTP scientists have recently received notice in *Science* and *Nature*. Filippo Giorgi, head, and Raquel Francisco, staff scientist, ICTP's Weather and Climate Group, were recently quoted in a *Science* news article ("Dueling Models: Future U.S. Climate Uncertain," 23 June 2000, p. 2113) that discusses the findings of the U.S. government report, "Climate Change Impacts on the United States." The report assessed the potential impact of global warming on various regions of the USA based on the output of the best available climate models. Giorgi and Francisco spoke about the reliability and uncertainty of climate models, especially at the regional level. Erio Tosatti, International School for Advanced Studies (SISSA), and consultant in the ICTP Condensed Matter Physics Group, co-authored a research article with Santi Prestipino, SISSA and Italian National Institute for the Physics of Matter (INFM), "Weird Gold Nanowires," *Science* (28 July 2000), p. 561-563. Amos Maritan, Christian Micheletti and Antonio Trovato, who hold joint appointments with SISSA and ICTP, co-authored a research article, "Optimal Shapes of Compact Strings," *Nature* (20 July 2000), p. 287-290.

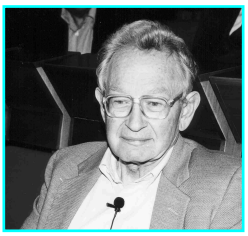
Nobel Musings

Martinus J.G. Veltman

"Theoretical physics requires experimental confirmation. For this reason, in my opinion, string theory is a sort of intellectual speculation more than real science. And cosmology is becoming a sort of religion: It has non-predictive power; it's totally speculative."

Dutch-born physicist Martinus J.G. Veltman, 69, professor emeritus at the University of Michigan, Ann Arbor, USA, reaffirmed his strong convictions at the ICTP on 4 July. He came to the Centre to receive the Dirac Medal that he was awarded in 1996. Last year, Veltman was honoured with the Nobel Prize together with his former student Gerardus 't Hooft.

Veltman is well-known for his pioneering work in the use of a 'theoretical machinery' that permits researchers to predict the properties of new elementary particles. It's a discovery that has revolutionised the field. His calculations, for example, provided the theoretical framework instrumental in the search for the top quark mass, which was discovered at Fermilab in 1995 within the exact range of energies forecast by Veltman. The same parallel track will hopefully be followed in the search for the Higgs particle.



Philip W. Anderson

Philip W. Anderson was another Nobel Laureate hosted by the Centre this past summer. Anderson, now 77, professor emeritus at Princeton University, is a frequent visitor to ICTP and a member of the Centre's Scientific Council.

Anderson received the Nobel Prize in 1977 for his studies on the magnetic properties of non-crystalline solids, permitting the development of a number of electronic devices. He has been one of the great innovators in the field of condensed matter physics.

His name, however, has been strictly linked to the history of complex systems since 1977, when Anderson postulated what has become a classic article in *Science*: "More Is Different". In that article, he formulated his ideas against a reductionist view that puts the physics of particles at the top in the hierarchy of sciences. "A vision that has no real meaning", he explains. "The truth is that we can't derive the properties of superconductivity or the laws of biology from the behaviour of elementary particles."

Since 1984, Anderson has been a fellow of the Santa Fe Institute, New Mexico, USA, a think tank of 'complexologists' that is a meeting place for physicists, biologists, economists, and anthropologists. "We are not seeing the end of science, as some critics contend," Anderson observes. "Instead, we are living in a strongly science-based world whose inhabitants ignore basic science. It's a troubling contradiction."

Tau Neutrino Uncovered...Higgs to Follow?

The tau neutrino, the most elusive particle of the ghostly family of neutrinos, has been detected at the Fermi National Accelerator Laboratory near Chicago, USA. An international team of 54 physicists working at Fermilab's Tevatron, the world's most powerful particle accelerator, announced the finding in late July. The tau neutrino had been one of the two remaining major undetected particles in the so-called Standard Model of elementary particle physics, which describes the properties of all the known building blocks of matter: quarks, protons, neutrons, electrons, and neutrinos. The other yet unseen particle is the Higgs boson, which physicists believe is the source of the masses of all particles.

A few days after the announcement of the discovery of the tau neutrino, reports surfaced of possible detection of the Higgs boson in the LEP accelerator at CERN (the European Organization for Nuclear Research) in Geneva, Switzerland. High energy physicists are thrilled by the possibility to 'see' at last the long-sought particle. For the moment, however, additional tests will be necessary to confirm or deny the rumoured findings. As a result, the race between Fermilab and CERN for the Higgs boson continues.

APEX Award

News from ICTP has received an APEX 2000 Award for publication excellence in the category of newsletters. The institution, headquartered in Springfield, Virginia, USA, honours print, broadcast and electronic communications. Some 5000 institutions participated in this year's competition. Those recognized by APEX 2000 included the Children's Hospital in Boston, Massachusetts; the Center for Science in the Public Interest in Washington, D.C.; and the Sea Grant Institute in Madison, Wisconsin, USA.

NEWS FROM ASSOCIATES

On the occasion of Pakistan's independence day, 14 August, President Mohammad Rafiq Tarar conferred the nation's highest civil awards on some of Pakistan's most accomplished scientists and artists. Among those honoured this year are two physicists well-known to ICTP: long-time ICTP Associate and 1987 ICTP Prize winner Abdullah Sadiq, Center for Nuclear Physics, Islamabad; and Fayyazuddin, former pupil of Abdus Salam's at Imperial College and one of ICTP's first Associates, who is professor emeritus at Quaid-i-Azam University in Islamabad.

REPORT ON REPORTS

SYMPOSIUM ON SYNCHRONIZATION OF CHAOTIC SYSTEMS (In Memory of Professor Stig Lundqvist)

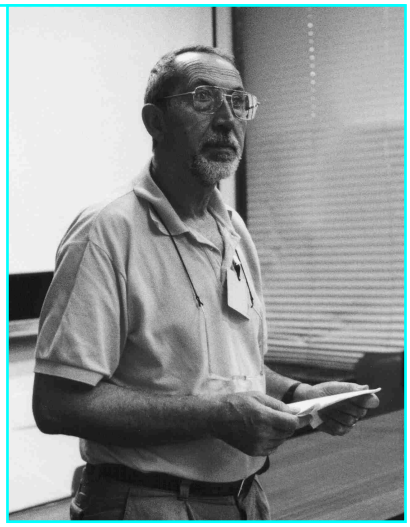
3 - 5 July

Co-sponsors: US Office of Naval Research and Office of Naval Research International Field Office - Europe (ONRIFO in London, UK).

Directors: T. Carroll (Naval Research Laboratory, Washington, USA), L. Pecora (Naval Research Laboratory, Washington, USA) and J.L. Hudson (University of Virginia, Charlottesville, USA).

Local Organiser: H. Cerdeira (ICTP).

The synchronisation of coupled non-linear systems, a ubiquitous phenomenon in nature, has been observed in such diverse systems as neuronal networks and chemical reactors. The meeting provided a cross-disciplinary review of the most recent advances in the field. Subjects included basic research in synchronised chaos, generalised and phase synchronisation, synchronising delay systems, applications of synchronised chaos in engineering, chemistry and biology, and synchronisation of chaotic systems and patterns in spatial/temporal systems. *(See "Chaos Rules," p. 4.)*



Tito Arecchi

CONFERENCE ON PHYSICS BEYOND FOUR DIMENSIONS

3 - 6 July

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

Organising Committee: I. Antoniadis (*Ecole Polytechnique*, Palaiseau, France), N. Arkani-Hamed (Stanford Linear Accelerator Center, Stanford, USA), G. Dvali (New York University, New York, USA), G. Senjanovic (ICTP), M. Shifman (University of Minnesota, Minneapolis, USA) and A.Yu. Smirnov (ICTP).

The conference discussed aspects of higher dimensional theories, emphasising phenomenological consequences and experimental testing. Topics included gravity in extra dimensions, gravitational tests, physics of branes, large extra dimensions and strings, mass hierarchy, unification of gauge couplings, gauge symmetry breaking, precision electroweak tests and extra dimensions, origins of approximate symmetries, flavour generation and violation, neutrino mass and mixing, dark matter and extra dimensions, baryogenesis and leptogenesis, and new scenarios of inflation. *(See "Gravity in the Fifth Dimension," p. 3.)*

Antonio Riotto

INTERNATIONAL TOPICAL CONFERENCE ON PLASMA PHYSICS: COLLOIDAL PLASMA SCIENCE

3 - 7 July

Directors: P.K. Shukla (*Ruhr-Universität Bochum*, Bochum, Germany), R. Bingham (Rutherford Appleton Laboratory, Didcot, UK) and L. Stenflo (University of Umeå, Sweden).

The conference—one in a series of biennial conferences held at ICTP—covered collective processes in colloidal and dusty plasma sciences, as well as strongly coupled systems with high-Z impurities. A key goal was to assist researchers from developing, and former Soviet Union and Eastern European, countries to build contacts and collaborations with scientists from Western countries and Japan. Topics included waves and instabilities in colloidal/dusty plasmas, wave-wave/particle interactions and coherent nonlinear structures, formation of dusty plasma crystals, technological impacts of dusty plasmas in processing, Coulomb explosions of molecules/large clusters by lasers, polar mesospheric charged dusts, acceleration of dust grains, dust-plasma interactions in astrophysics, and transport processes in colloidal/dusty plasmas.

XII WORKSHOP ON STRONGLY CORRELATED ELECTRON SYSTEMS

17 - 28 July

Co-sponsors: Asia Pacific Centre for Theoretical Physics (APCTP, Seoul, Korea) and International School for Advanced Studies (SISSA, Trieste, Italy).

Directors: G. Baskaran (Institute of Mathematical Sciences, Chennai, India), P. Coleman (Rutgers State University, Piscataway, USA), M. Fabrizio (SISSA and ICTP), A. Georges (*Ecole Normale Supérieure*, Paris, France), G. Kotliar (Rutgers State University, Piscataway, USA), E. Tosatti (SISSA and ICTP), A. Tsvelik (University of Oxford, UK) and Yu Lu (Academia Sinica, Beijing, P.R. China, and ICTP).

Local Organisers: M. Fabrizio and Yu Lu.

The 12th edition of this series of workshops, "Strong Correlation in the High T_c Era," focussed on the physics of high-temperature superconductivity. Experimentalists and theorists were brought together to discuss key issues in the field. Topics of special interest included recent progress on high-temperature superconductivity, novel phenomena in perovskite materials, physics of low-dimensional materials, including ladder compounds, heavy fermion physics, and realisations of correlated electron physics in mesoscopic devices.

SCHOOL ON AUTOMORPHIC FORMS ON GL(n)

31 July - 18 August

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

Directors: G. Harder (*Universität Bonn*, Germany) and M.S. Raghunathan (Tata Institute of Fundamental Research, Mumbai, India).

Local Organiser: L. Göttsche (ICTP).

The study of automorphic forms, which has been a central field in mathematics over the past century, has recently experienced many important developments. The school introduced this deep and difficult area both to research scholars and students with relatively modest backgrounds. Lectures covered the following topics: Abelian class field theory, Artin's L-functions and their meromorphy, the Langlands programme, structure theory of representations of groups over local fields, Taniyama-Weil conjecture, and analytic properties of L-functions of automorphic forms. The final week consisted of a research-level conference with participation from many leading experts.

MINISYMPOSIUM ON CORRELATION IN MESOSCOPIC SYSTEMS

1 - 4 August

Directors: B. Altshuler (NEC Research Institute, Princeton, USA) and V. Kravtsov (ICTP).

The minisymposium brought together leading researchers working in the field of normal-metal mesoscopic systems and 2D metal-insulator transition to discuss the most recent developments and potential future research directions in the field. Topics included interaction in mesoscopic systems, 2D delocalisation transition, and non-equilibrium mesoscopics.

NORDIC-TRIESTE WORKSHOP: BLACK HOLES AND OPTICAL GEOMETRY

15 August - 15 September

Directors: M. Abramowicz (Chalmers University of Technology, Gothenburg, Sweden) and A. Lanza (International School for Advanced Studies, SISSA, Trieste, Italy).

Optical geometry conforms to Einstein's theory of general relativity, but simplifies the description of classical physics in strong, conformally static, gravitational fields. Conformal transformations are very useful in the Kalutza-Klein and string theories, and in the Hamiltonian approach to Einstein's field equations, particularly in York's formulation. Similar ideas are at the center of several approaches to quantum gravity. Discussions focussed on applications of optical geometry to the problem of black hole entropy, Hawking radiation and other quantum effects in strong gravitational fields.

SECOND SCHOOL ON THE MATHEMATICS OF ECONOMICS

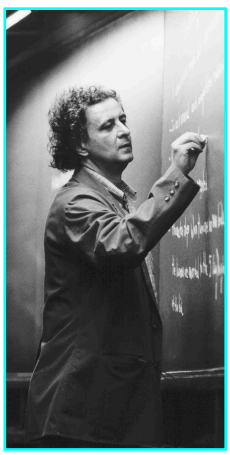
21 August - 1 September

Co-sponsor: Kuwait Foundation for the Advancement of Sciences (KFAS).

Directors: M. Boldrin (University of Minnesota, Minneapolis, USA), A. Rustichini (Boston University, USA) and J.A. Scheinkman (Princeton University, USA).

Local Organiser: M. Marsili (Italian National Institute for the Physics of Matter, INFM, and International School for Advanced Studies, SISSA, Trieste, Italy).

The purposes of the school were to (1) present a brief but advanced introduction to critical ideas and techniques in evolutionary game theory and adaptive learning, (2) provide an introduction to the theory of financial markets, and (3) examine the most recent research in these fields. The first nine days were devoted to lectures on evolutionary game theory, adaptive learning, and theory of financial markets. The final three days consisted of a conference on the three major lecture topics. (See "Math Matters," p. 2, and "Fiscal Physics," p. 8.)



Aldo Rustichini

Matteo Marsili, José Alexandre Scheinkman, Michele Boldrin

EU ADVANCED COURSE IN COMPUTATIONAL NEUROSCIENCE - An IBRO Neuroscience School

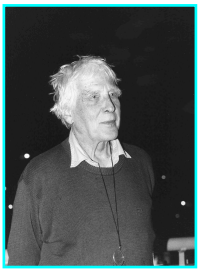
21 August - 15 September

Co-sponsors: European Commission (Brussels, Belgium), Boehringer Ingelheim Foundation (Stuttgart, Germany), International Brain Research Organization (IBRO, Paris, France), and Brain Science Foundation (Tokyo, Japan).

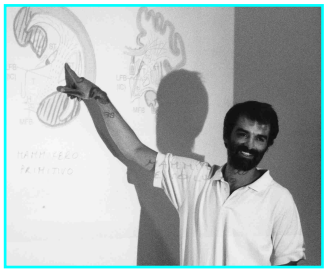
Directors: E. de Schutter (University of Antwerp, Belgium), K. Obermayer (*Technische Universität Berlin*, Germany), A. Treves (International School for Advanced Studies, SISSA, Trieste, Italy) and E. Vaadia (Hebrew University, Jerusalem, Israel).

The four-week course, which combined lectures with laboratory exercises, introduced students to the problems and methods of computational neuroscience, addressing neural organisation from subcellular processes to operations of the entire brain. Morning lectures explored topics in experimental and computational neuroscience; while the rest of the day was devoted to practicums, including how to use simulation software and how to implement a system model for study on individual Unix workstations. The first week introduced students to key neuroscience concepts and techniques in modelling single cells, networks, and neural systems. Lectures during the following three weeks covered issues related to specific brain functions dealing with sensory systems (especially vision), memory, and attention (particularly motor planning and control). Topics included modelling single cells and subcellular processes, simulation of simple circuits, large neuronal networks and system level models of the brain.

Terry Sejnowski



Valentino Braitenberg



Alessandro Treves

SCHOOL ON MATHEMATICAL PROBLEMS IN IMAGE PROCESSING

4 - 22 September

Co-sponsors: International School for Advanced Studies (SISSA, Trieste, Italy) and *Scuola Normale Superiore* (Pisa, Italy).

Directors: L. Ambrosio (*Scuola Normale Superiore*, Pisa, Italy), G. Dal Maso (SISSA), and J.-M. Morel (*Ecole Normale Supérieure*, Cachan, France).

Local Organiser: C. Chidume (ICTP).

Recent developments in image and signal processing involve many areas of mathematics and prompt many deep mathematical problems. The school's aim was to give an up-to-date account of the different mathematical techniques used in the field. Course work was complemented by computer-assisted demonstrations. The first two weeks were devoted to instructional lectures on the following topics: variational methods in image analysis, applications of geometric measure theory and nonlinear partial differential equations, wavelets in image analysis, and statistical methods in image analysis. The third week was devoted to discussions of the most recent mathematical findings in this field.

ADRIATICO RESEARCH CONFERENCE ON LASERS IN SURFACE SCIENCE

11 - 15 September

Directors: H.-J. Freund (*Fritz-Haber-Institut der Max-Planck-Gesellschaft*, Berlin, Germany), T.F. Heinz (Columbia University, New York, USA) and H. Zacharias (*Westfälische Wilhelms-Universität*, Münster, Germany).

The conference focussed on fundamental electronic and vibrational processes at clean surfaces and interactions of adsorbates with metallic semiconductor and insulator surfaces. The objective was to bring together experimental and theoretical scientists from different areas of surface science.

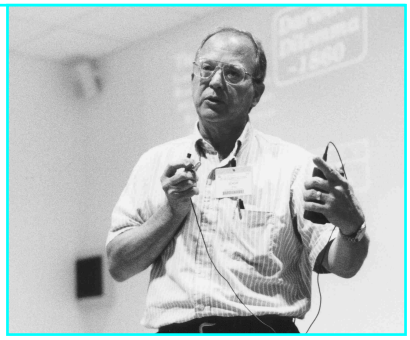
FIRST STEPS IN THE ORIGIN OF LIFE IN THE UNIVERSE - A Euroconference (Trieste Conference on Chemical Evolution - VI)

18 - 22 September

Co-sponsors: European Commission (Brussels, Belgium), International Centre for Genetic Engineering and Biotechnology (ICGEB, Trieste, Italy), SETI Institute (Mountain View, USA).

Directors: J. Chela-Flores (*Instituto de Estudios Avanzados*, IDEA, Caracas, Venezuela, and ICTP), T. Owen (Institute for Astronomy, Honolulu, USA) and F. Raulin (*Universités Paris 7 et 12*, Creteil, France).

The conference focussed on the transition from inert matter to cellular life, as we know it on Earth, and examined the possibility of life occurring elsewhere, particularly in environments other than our own. Recent advances in knowledge led largely by the European Space Agency (ESA) and the U.S. National Aeronautics and Space Administration (NASA) were highlighted.



J. William Schopf

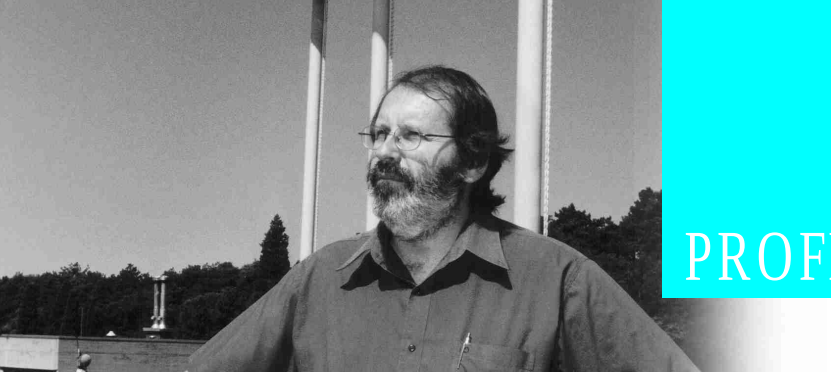
CONFERENCE ON NONLINEAR PHENOMENA IN GLOBAL CLIMATE DYNAMICS

26 - 29 September

Directors: F. Molteni (ICTP), T. Palmer (European Centre for Medium-Range Weather Forecasts, ECMWF, Reading, UK), and J. Tribbia (National Center for Atmospheric Research, NCAR, Boulder, USA).

Local Organiser: F. Molteni.

Main conference topics included regimes and non-linearity in the extratropics, scale interactions and non-linearity in the tropical climate, and impact of non-linearity on systematic errors of general circulation models (GCMs). Specific issues included: What observational and modelling evidence is available on the existence of non-linear, regime-like behaviour in the atmospheric and oceanic circulation? What aspects of the atmospheric response to variations in natural and anthropogenic forcing are best described by non-linear dynamics? How is intraseasonal variability in the extratropics modulated by interannual and interdecadal fluctuations arising from ocean-atmosphere interactions? Are non-linear dynamical processes likely to be important sources of systematic errors in GCMs? To what extent is the reliability of climate predictions (both for seasonal forecasting and assessment of anthropogenic effects) negatively affected by systematic errors?



A new book, co-authored by ICTP Associate Joseph C. Várilly, to be published this fall, seeks to explain the principles of noncommutative geometry to both mathematicians and physicists.

Crossing Cultures, Spanning Disciplines

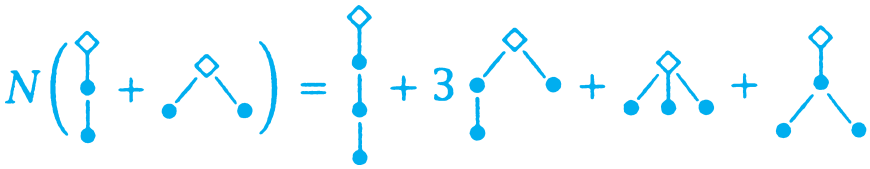
Newly appointed ICTP Associate Joseph C. Várilly has been a professor of mathematics at the University of Costa Rica for more than 20 years. But that hasn't thinned his Irish blood or softened his Irish character. Even when the lilt in his accent doesn't give him away, his easy-going story telling and self-deprecating humour does.

Várilly's journey from the isle of Ireland to the isthmus of Costa Rica began about 30 years ago in Dublin, where he earned his bachelor's degree in science from University College in 1973. Várilly was then accepted at the University of Rochester in the United States for graduate studies in mathematics. Gérard G. Emch was his major professor; quantum statistical mathematics his major research field.

While working towards his doctorate degree, which he earned in 1980, Várilly spent a year at the University of Campinas in Brazil. There he met a Costa Rican woman. "The rest," Várilly says, "is history." In 1979, he moved to his wife's native country, where he has been ever since.

Várilly's research has unfolded across a broad field of topics all related to quantum theory. In the late 1980s, he concentrated on phase-space methods in quantum mechanics; in the early 1990s, symmetries in quantum field theory; and for the past eight years, noncommutative geometry and its physical applications. Each of his specialised research areas has reached beyond mathematics to physics. As Várilly notes, "theoretical physicists have expressed as much interest in my work as my colleagues in mathematics."

In fact, the interest that theoretical physicists have shown towards noncommutative geometry has largely driven his latest project: a 'primer' on the subject written in part for theoretical physicists who would like to know more about the concept as a way to better understand quantum space-time.



As Várilly explains: "Less than a decade ago, the great French mathematician and Fields Medal winner Alain Connes almost single-handedly invented the subject of noncommutative geometry. The book he wrote, *Noncommutative Geometry*, remains the field's main reference. But it is a compilation of research papers, which make for difficult reading even for colleagues in related fields. The book I have co-authored, which is descriptively titled *Elements of Noncommutative Geometry*," Várilly says, "is one that mathematicians and theoretical physicists should read before they read Connes' book."

Elements of Noncommutative Geometry, scheduled to be published this fall by the well-respected science publisher Birkhäuser, will be distributed world-wide. Várilly and his co-authors, José M. Gracia-Bondía and Héctor Figueroa, who are his colleagues at the University of Costa Rica, hope to reach a wide range of scientists and mathematicians with their book. "Noncommutative geometry," the authors note in the book's preface, offers "a bouquet of applications related to analyses of the standard model, the quantum Hall effect, string theory and renormalisation."

Várilly says that it should be no surprise that many of his articles are written with other physicists, particularly his long-time colleague Gracia-Bondía. "Science has increasingly become a collaborative enterprise as the lines between disciplines, particularly mathematics and physics, continue to blur. Collaboration," he adds, "is particularly important to researchers from the developing world. Teamwork helps break our isolation and expands our range of contacts."

With his new book in press, Várilly, appointed an ICTP Associate in 1998, arrived in Trieste in June "to see what's next." He is particularly interested in exploring the interface of noncommutative geometry with quantum field theory, especially the role that Hopf algebras play in symmetries. "My new avenue of inquiry remains focussed on areas where mathematics can speak directly to physical phenomena. I hope that both mathematicians and physicists continue to find my research and writing useful."

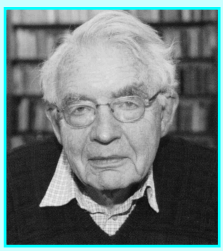
"I first visited the Centre in 1985 to participate in the College on Representation Theory of Lie Groups and that really got me going as a researcher. Now with my appointment as an Associate, the Centre should serve as my research retreat for the next several years. I plan to put this opportunity to good use."

His visits to Trieste, Várilly says, will help energise and direct his research, which will continue to take place largely in Costa Rica. To confirm his commitment to his adopted homeland, Várilly quoted a saying often heard in Spain. *"Uno nace donde quiere,"* he observes in his Irish-lilted Spanish, *"pero se muere en el pueblo de su mujer."* The English translation: "A man is born wherever he likes, but he always dies in his wife's village."®

TRIBUTES and CHANGES

IAEA DDG

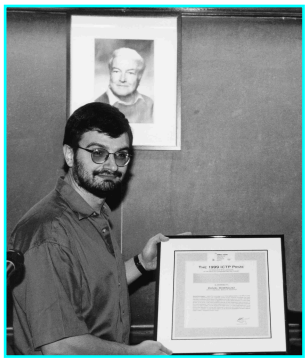
Werner Burkart has been appointed the new deputy director general, head of the Department of Nuclear Sciences and Applications, at the International Atomic Energy Agency (IAEA) in Vienna, Austria. Burkart replaces Sueo Machi, who had served in that capacity since 1991. Born in Olten, Switzerland, but now a German national, Burkart studied biochemistry and microbiology at the Swiss Federal Institute of Technology in Zurich, where he earned a Ph.D. in biochemistry. For the past decade, Burkart has worked in the German Federal Office for Radiation Protection in Munich and Freiburg. Earlier in his career, Burkart held posts with the Swiss National Science Foundation, the Swiss Institute for Reactor Research, the Marine Biological Laboratory at Woods Hole, USA, and the Paul Scherrer Institute in Switzerland.



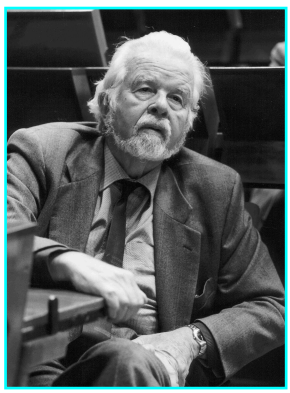
Hendrik B.G. Casimir 1909-2000

Hendrik Brugt Gerhard Casimir, a Dutch theoretical physicist equally at ease in academic classrooms as he was in corporate boardrooms, died on 4 May at the age of 91. Casimir, who served as president of the first ICTP 'ad hoc' committee in the early 1970s, was a strong supporter of the Centre since its inception. His wide-ranging career included important contributions to the theory of superconductivity. He predicted the so-called Casimir effect—a universal attractive force that occurs between two conducting metal plates when they are placed an extremely short distance apart. He also gave his name to the Casimir operator in quantum mechanics. Born in The Hague, The Netherlands, Casimir worked in Copenhagen, Denmark, with Niels Bohr, and in Zurich, Switzerland, with Wolfgang Pauli, both Nobel Prize winners. In 1942, during the German occupation of the Netherlands, he moved to the Philips Research Laboratories in Eindhoven, becoming one of the three research directors just after the war. He remained at Philips for the remainder of his career, retiring in 1972 to become professor emeritus at Leiden University. He was also the first president of the European Physical Society. His autobiography (Haphazard Reality) was published in 1983. Casimir was a frequent visitor to ICTP, attending several conferences on physics for development. His final visit took place in 1993.

Lundqvist Prize, Lecture Hall



Daniel Domínguez, professor of physics at *Instituto Balseiro* in Bariloche, Argentina, officially received the 1999 ICTP Prize on 21 July. Domínguez was honoured for his studies of vortex dynamics in superconducting materials and Josephson junction arrays. The 1999 ICTP Prize in the field of condensed matter theory is named in honour of Stig Lundqvist. At a ceremony held on 21 July, ICTP officially opened the Lundqvist Lecture Hall. The ceremony included brief presentations by ICTP Director Miguel Virasoro and Stig Lundqvist's elder daughter (see photo below). Nine members of the Lundqvist family, including his sister, children and grandchildren, joined Stig's colleagues and friends to honour the memory of one of the Centre's most important figures. Lundqvist, who served as the head of ICTP's Scientific Council from 1983 to 1992, was the driving force behind the creation of the Centre's condensed matter group. He died on 6 April following a long illness. For personal commentaries on Stig Lundqvist's life and career, see *News from ICTP* #93 online edition through the ICTP homepage at www.ictp.trieste.it.



Budinich Remembers

Paolo Budinich, instrumental in the creation of ICTP and for many years its deputy director, tells his story in an autobiography titled *L'arcipelago delle meraviglie (The Archipelago of Wonders)*, published by Di Renzo Editore in Rome, Italy. Apart from his personal remembrances (Budinich was born in 1916 in Dalmatia, then part of the Austrian-Hungarian Empire), the book recounts the political battle leading to the creation of ICTP in Trieste as well as the early days of the Centre. In the concluding pages, Budinich writes about the reconciliation between science and philosophy and the capacity of mathematics to anticipate unknown physical realities—from antimatter to string theory.

Retirements and Refurbishments

The bar in the ICTP Main Building has been refurbished and a new 'bar man', Antonio Cefalù, has taken over responsibility for the facility from Erasmo Iannello, who retired in July. Other recent ICTP retirees include conference clerk Patricia Sessi and maintenance worker Roberto Leibelt. All were honoured at a party on 6 July. ICTP scientists and staff extend them all good wishes for an enjoyable retirement.

25 September - 6 October
5th Workshop on Three-Dimensional Modelling of Seismic Waves Generation, Propagation and Their Inversion

2 - 13 October
Earth Systems Sciences Course in Watersheds and Coastal Zone Simulation

6 - 10 October
QED 2000 - 2nd Workshop on Frontier Tests of Quantum Electrodynamics and Physics of the Vacuum

9 - 27 October
ICTP - Latin American School on Strings 2000 (ICTP-LASS 2000), to be held in Mexico City, Mexico

9 October - 3 November
6th College on Microprocessor-Based Real-Time Systems in Physics

12 - 13 October
Workshop on Plasma Diagnostics and Industrial Applications of Plasmas

16 - 27 October
Workshop on the Application and Development of Nuclear Reactor Simulators for Educational Purposes

4 - 5 November
15th Anniversary Meeting of Dirac Medallists

6 November - 8 December
School on Synchrotron Radiation

13 - 24 November
Workshop on Physics of Mesosphere-Stratosphere-Troposphere Interactions with Special Emphasis on MST Radar Techniques

13 November - 1 December
Microprocessor Laboratory Third Regional Course on Advanced VLSI Design Techniques, to be held in Lima, Peru

Throughout the year, the most up-to-date information on ICTP activities may be found on the World Wide Web and via e-mail. Here's how to find out what's going on.

ON THE WORLD WIDE WEB (WWW)
Our address is `http://www.ictp.trieste.it/`
The site includes detailed information on our research groups and activities, and a listing of our preprints, awards and job opportunities.

ON E-MAIL
(1) For Yearly Calendar of Scientific Activities
Create a new e-mail message and type
To: `smr@ictp.trieste.it`
Subject: `get calendar 2001`
Leave the body of the message blank. Send it.
Your e-mail will generate an automatic reply from the ICTP server containing the most updated version of the yearly Calendar.

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

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

NEWS from ICTP

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

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

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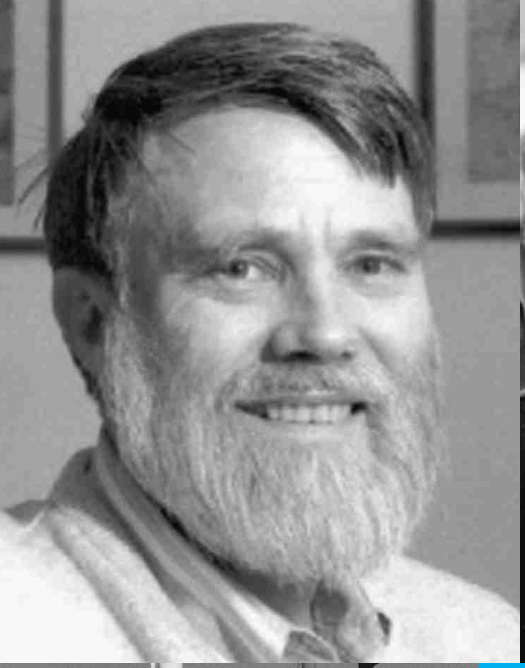

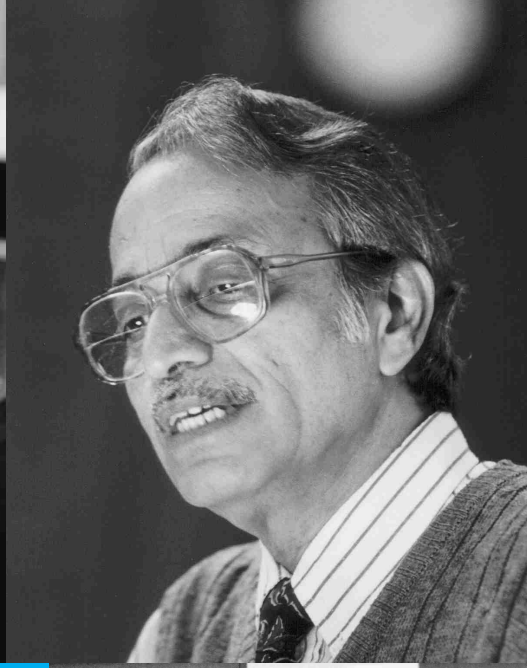
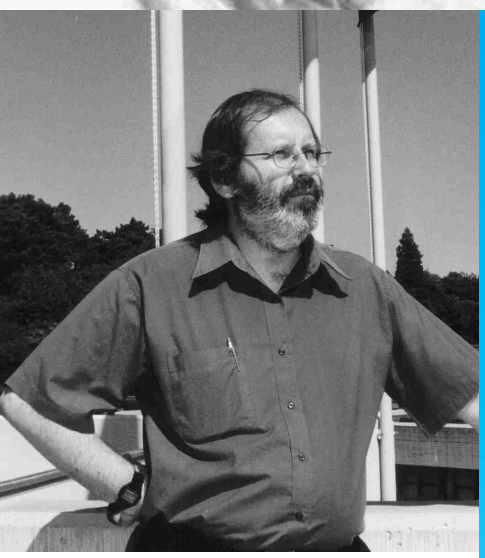


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