International Atomic Energy Agency

United Nations Educational, Scientific and Cultural Organization

International Centre for Theoretical Physics

News from ICTP

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Contents

Short Report on ICTP Activities in 1989

GENERAL

The main fields of research and training-for-research at the Centre in 1989 were:

(a) Fundamental physics (high energy and particle physics, cosmology and astrophysics);
(b) Condensed matter, atomic and molecular physics (condensed matter and related, atomic and molecular physics, materials science);
(c) Mathematics (applicable mathematics, analysis, differential geometry, ergodic theory, theoretical fluid mechanics);
(d) Physics and energy (nuclear physics, plasma physics, non-conventional energy);
(e) Physics and environment (soil physics, environmental radioactivity, physics of the atmosphere);
(f) Physics of the space (microgravity);
(g) Applied physics and high technology (microprocessors, communications, lasers, computational physics, telematics, remote sensing, instrumentation) and
(h) Science, high technology and development.

The ICTP celebrated its 25th anniversary on 31 October 1989 with an academic ceremony with the Prime Minister of Italy, Mr. Giulio Andreotti, as the guest of honour, followed by a Symposium on "Frontiers in physics, high technology and mathematics", attended by 138 participants.

Some 4100 scientists took part in the activities of the Centre and in the Programme for training at Italian laboratories, staying for a total of almost 4800 person/months. Sixty-two percent of them were from developing countries, accounting for 84% of the total person/months. Associate Members from developing countries numbered 190, and 652 of them were researchers from federated institutes in developing countries.

FUNDAMENTAL PHYSICS

Research in high-energy physics was carried out throughout the year with the participation of 103 physicists from developing countries out of a total of 181. A two-week school and workshop on superstrings held in April was attended by 61 physicists from developing countries, out of a total of 198. One hundred and fifty-five physicists from developing countries, out of a total of 246, took part in the Summer School in High-Energy Physics and Cosmology (June-August). Two one-week conferences — one on recent developments in conformal field theories and one on supermembranes and physics in 2+1 dimensions — were held in July and October respectively with, in all, 100 participants (26 from developing countries).

CONDENSED MATTER, ATOMIC AND MOLECULAR PHYSICS

Research was conducted throughout the year with 62 physicists from

developing countries out of a total of 85. The year started with the four-day Fourth International Workshop on Computational Condensed Matter Physics on "Total Energy and Force Methods" with the participation of 20 scientists from developing countries out of a total of 118. A college on atomic and molecular physics (Photon Assisted Collisions in Atoms and Molecules) followed in February, lasted three weeks and was attended by 62 physicists from developing countries out of a total of 86. A two-week experimental workshop on high temperature superconductors took place in April with the participation of 77 scientists from developing countries out of a total of 96. This workshop was followed by a conference on oxygen disorder effects in high T_c superconductors attended by 47 scientists from developing countries out of a total of 75. In May, there were two two-week working parties — one on modelling thermomechanical behaviour of materials and one on fracture physics — in which 52 scientists from developing countries out of 69 took part. The theme of the six-week Spring College on Materials Science, held in April-May, was "Ceramics and Composite Materials". It was attended by 110 physicists from developing countries out of a total of 138. The Research Workshop in Condensed Matter, Atomic and Molecular Physics (mid June-September) also included a workshop on strongly correlated electron systems, a symposium on highlights on condensed matter physics and a working party on condensed matter properties of neutron stars. In total, 438 scientists took part in this programme out of which 303 were from developing countries.

MATHEMATICS

Research in mathematics was carried out throughout the year with the participation of 73 scientists from developing countries out of a total of 85. A three-week workshop on theoretical fluid mechanics was held in January with the participation of 62 scientists from developing countries out of a total of 85. Two topical meetings — one on hyperbolic geometry and ergodic theory and one on variational problems in analysis which took place in April and September respectively— were attended by 100 mathematicians from developing countries out of a total of 177. A college on differential geometry held in November and attended by 110 scientists from developing countries out of a total of 180 was the last high-level course on mathematics in 1989.

PHYSICS AND ENERGY

A five-day workshop, the fourth in this series, on perspectives in nuclear physics at intermediate energies, was held in May and was attended by 33 participants from developing countries out of a total of 124. A four-week college on plasma physics followed, with the participation of 106 physicists from developing countries out of a total of 172. In September, two workshops — one on materials science and physics of non-conventional energy sources and one on the interaction between physics and architecture in environment conscious design — of a total duration of three weeks, attracted 192 participants from developing countries out of a total of 251. Some research was also carried out in plasma physics by 11 physicists from developing countries.

PHYSICS AND ENVIRONMENT

A two-week workshop on radon monitoring in radioprotection, environmental radioactivity and earth sciences was held in April. Sixty-three scientists from developing countries out of a total of 97 took part in it.

In October and December respectively, the Centre held a three-week college on soil physics and a three-week workshop on atmospheric radiation and cloud physics which altogether welcomed 126 scientists from developing countries out of a total of 179.

APPLIED PHYSICS AND HIGH TECHNOLOGY

The High-Temperature Superconductivity Laboratory started its activity in Spring with 12 scientists from developing countries out of a total of 16. Fifteen physicists from developing countries out of a total of 16 have worked in the Microprocessors Laboratory. A three-week college on microprocessors — the fifth of its kind — was held in October and was attended by 100 participants from developing countries out of a total of 114. It was followed by a four-week course on telematics in November with 85 scientists from developing countries out of a total of 92 and the four-week ICTP-INFN course in basic VLSI design techniques which took place in December with an audience of 36 participants from developing countries out of a total of 47.

Two closely-related courses — one on basic telecommunications science and one on theoretical and experimental radiopropagation physics — of a total duration of six weeks — were held in January-February with a total participation of 143 physicists from developing countries out of a total of 173. They were followed by a course on remote sensing techniques with applications to agriculture, water and weather resources. Out of a total of 101, 76 scientists from developing countries took part in it. The two-week ICFA School on Instrumentation in Elementary Particle Physics held in June was attended by 40 experimentalists from developing countries out of a total of 102.

PHYSICS OF THE SPACE

One activity was held in this field — the Workshop on "Materials in Microgravity", which was attended by 73 scientists (32 from developing countries).

ANNIVERSARY ADRIATICO RESEARCH CONFERENCES

In 1989, the series of the Anniversary Adriatico Research

Conferences included short meetings on: interface between quantum field theory and condensed matter physics; quasicrystals; strongly correlated electron systems; and computations in physics and physics in computation. One hundred and thirty-eight scientists from developing countries, out of a total of 305, took part.

SCIENCE, HIGH TECHNOLOGY AND DEVELOPMENT

As in the past, a number of the experts and leading scientists taking part in the activities at the Centre lectured on physics and its relevance to development. In all, 43 lectures were given in 1989.

TRAINING AT ITALIAN LABORATORIES

One hundred and seventy scientists from developing countries carried out research at Italian academic and industrial laboratories under a programme which started in 1982 with the financial support of the Italian Direzione Generale per la Cooperazione allo Sviluppo (Ministry for Foreign Affairs, Rome, Italy).

EXTERNAL ACTIVITIES

In the field of training for physics and mathematics teachers, the Centre sponsored 133 courses, workshops and symposia in 38 countries. Ten fellowships for visiting scholars to 8 countries were granted. These programmes were financed by the Italian Direzione Generale per la Cooperazione allo Sviluppo (Ministry for Foreign Affairs, Rome, Italy).

MEETINGS HOSTED BY THE CENTRE

The Centre hosted 19 meetings. Nine of them were organized by the Third World Academy of Sciences. Other organizing institutions were the Italian National Institute of Nuclear Physics, the International Centre for Genetic Engineering and Biotechnology, the International School for Advanced Studies and the Trieste Research Area.

BOOKS AND EQUIPMENT DONATION PROGRAMME

During 1989, the Centre was able to distribute 13184 journals, 4062 proceedings, 6119 books and 8289 publications to more than 700 institutions in 100 developing countries. Besides the donations directly distributed by the Centre, about 100 donations of complete sets of back-issues of journals have been shipped directly by the donors to about 60 institutions in 40 developing countries.

Hundreds of pieces of equipment from CERN were sent to institutions in the following countries: Colombia, P.R. China, Iran, Jordan and Pakistan. The Centre received a generous offer of approximately 43 items of surplus equipment from Dr. Iftikhar Ahmad in London. They were sent to 13 universities in the following countries: Bangladesh, Colombia, Egypt, Iraq, Jamaica, Nigeria, Pakistan, Peru, Tanzania and Uganda.

AWARDS

Michael B. Green from Queen Mary College, London, UK, and John H. Schwarz from the California Institute of Technology, Pasadena, USA, were the recipients of the 1989 Dirac Medals of the International Centre for Theoretical Physics, *"for their basic contributions to the development of superstring theory. Most significant was their discovery that chiral gauge anomalies are absent for a class of ten dimensional superstring theories"*.

The 1989 ICTP Prize in honour of Hideki Yukawa was awarded to Dr. Ashoke Sen from the Tata Institute of Fundamental Research, Bombay, India, *"for his contributions to string theory, and in particular for the application of the sigma model approach to the heterotic string theory"*.

PREPRINTS AND INTERNAL REPORTS

In 1989, 432 preprints and internal reports were issued.

Workshop on Environment

Courtesy of
TWAS Newsletter,
October-December 1989,
Vol 2, No. 1.

A high-level fruitful Workshop "For Policy Makers on Environment and Development" was held in Trieste at the ICTP complex on 21 October 1989, TWAS playing the host. It was organized and convened by the eminent Indian scientist, Prof. M.S. Swaminathan. The Workshop had under focus "The Science and Technology Implications of the Brundtland Commission's Report" and was attended by some of the leading scientists from Canada, China, France, India, Italy, Jordan, Kenya, Sweden, Switzerland, Tanzania, UK and USA. An expert from the United Nations also presented a paper.

His Royal Highness, Crown Prince Hassan of Jordan was scheduled to deliver the keynote address personally. He could however not attend due to unavoidable reasons, and his address was read at the opening session of the Workshop.

Prof. Abdus Salam, President of TWAS, in his opening remark said that it is a great day for us to have such a distinguished gathering to discuss such an important subject. He referred to some of the points made in his book "Notes on Science, Technology and Science Education in the Development of the South", a document he had prepared for the South Commission meetings in respect of environment and present levels of carbon dioxide. Prof. Salam regretted about the Antarctica case, particularly the meeting that was being held in Paris almost simultaneously and where North had not agreed to South's perceptions in leaving Antarctica as a natural laboratory, free of pollution.

Dr. Swaminathan, who chaired the meeting, in his "overview" of the Workshop ably articulated what the whole business of the day was about. He said that the 90s were going to be critical for environment and if nothing much is done about it, things may go beyond control. Through slides, he highlighted the issues of emissions of sulphur dioxide and carbon dioxide and talked of sustainable management and equitable use of the environment systems.

Dr. Swaminathan said that the Workshop would focus on a segment, while the Brundtland Commission had given a broad view of things.

Dr. Munro, Project Director of the Future World Conservation Centre in Switzerland, in his presentation stressed the following points:

"It is important to scientists to try to determine what we should do professionally to achieve sustainable development. It is important to everyone to try to determine how we should act personally for the same purpose. The report of the Brundtland Commission provided a most useful guidance for many different sectors. Scientists, technologists and others, must decide how they can translate the recommendations and themes of the Brundtland Commission into specific action in support of sustainable development.

"The challenge to scientists and technologists of the Third World is perhaps even greater than that to those in other parts of the world. Third World countries quite rightly place great importance on indigenous solutions. They recognize that action proposed to be undertaken in their countries must be designed by their own people; it must be in tune with their cultures and orientated towards their own capability.

"Having said that, it is well to remember the images that are brought to mind when we think of 'one world' and 'our common future'. It is one world and the future of all people in the world is linked. So, while we must recognize the importance of self-reliance and indigenous solutions, we must not forget our ecological interdependence and we must build up our ability and our will to collaborate for a better 'common future'.

"The 1980 Conservation Strategy clarified the interdependence of conservation and development and clearly stated the requirements for achieving them both. These requirements, which are still valid, are: (1) the maintenance of ecological processes and life support systems; (2) the maintenance of genetic diversity; and (3) utilization of renewable natural resources at rates that can be maintained. The WCS proved influential. It stimulated the preparation of national or sub-national conservation strategies in more than 45 countries. Many of these have been useful. They have helped countries to decide on the orientation of their development programmes and on their priorities. They have helped those countries on the road to sustainable development. Others have been less perfect, but the experience of all countries, even those that seem not to have made much progress, is useful.

"Of course, much else has happened in the environment since 1980. There has been a virtual explosion in public awareness of environmental change. It is difficult to find a newspaper or news magazine these days that does not contain a reference to some impending or actual environmental disaster. (...) We are now thinking about a whole range of changes in agriculture, industry, transportation and forestry, that must be implemented if development is to become sustainable. (...) In my view, the need for a new strategy — should we call it a World Conservation Strategy, or a World Strategy for Sustainable Development, or should we call it something more cute and catchy? In any event, the need for it is great. It's no longer acceptable to plan development in different sectors independently.

"What is acceptable and what must become widespread is a form of development that is based on science, so that it will endure, so that its benefits will continue to flow in the long term; that is based on public participation so that its benefits are equitably extended, both with respect to their distribution now and their effects on following generations."

Dr. Tatsuro Kunugi, Deputy Executive Director of UNFPA (United Nations Population Fund) in his paper "The Population and Development Puzzle and Sustainability Equation" said:

"Here, then, lies the crux of the population and development puzzle — the golden promise of technology for continued human progress, on the one hand, and the ugly threat of unsustainable development as a consequence of worsening nexus between population, resources and technology, on the other. How to bring these elements into harmony to achieve a long-lasting, sustainable development is an issue which should deserve the most serious attention of the international community during the last crucial decade of this century.

"The world population, which has doubled since 1950, is currently estimated to be around 5.2 billion people. It is increasing at a rate of 1.73% a year — i.e. about 90 million people every year or nearly a quarter million persons daily. The United Nations estimates that the world population is likely to be 9.5 billion by the middle of the next century if human reproduction will continue to decline in the coming decades as expected; should it not decline, however, it is projected that the earth's inhabitants may be as high as 12 billion people by the year 2050. The fact that well over 90% of the population increase is taking place in developing countries adds a special dimension to the problem of achieving sustainable development.

"The international community is focussing its attention more than before on the problems and solutions to environmental degradation and mass poverty. Indicative of this trend is the concern voiced by the group of seven

industrial nations at their July summit in Paris. The Group recognized an urgent need to safeguard the environment as one of the three main global economic challenges, together with sustained growth and the integration of developing countries into the world economy.

"The concept of balance between population and sustainability should become part of the agenda in all global, national and local endeavours aimed at improving the quality of life of people.

"If we wish to leave behind for future generations a world which our great-grandchildren can enjoy, and in turn they can leave it for their great-grandchildren to enjoy, it is essential that we, the temporary trustees of this world, now make a solemn pledge to protect our precious earth from our misguided, impulsive and exploitative actions."

Dr. Anwar Nasim, a Pakistani/ Canadian scientist, and Prof. Arturo Falaschi, Director of the International Centre for Genetic Engineering and Biotechnology in Trieste, discussed genetic engineering and biodiversity, and how they dove-tailed into environmental issues, also the implications of the new developments in these fields.

Dr. S.Z. Qasim, Vice-Chancellor of Jamia Millia University in Delhi, who had acted as the leader of the Antarctica Mission of India a few years back, focussed on "Developing Antarctica into a Global Nature Preserve". He said that Antarctica is a natural laboratory and the science you can do there, can be done nowhere else. There is almost no pollution there. Biodegradation is almost nil. He pointed out that life on the sea bottom in Antarctica is very rich. Also very primitive life is available on the bottom of the sea. He pleaded for the "natural laboratory" of Antarctica to be preserved.

Two Chinese experts gave details of progress of sustainable agriculture in China. Prof. Wang Liangheng, the President of the Chinese Academy of Agricultural Sciences, spoke on the subject of "Techniques for Sustainable Agriculture in China", while Prof. Li Zhensheng of the Chinese Academy of Sciences discussed the "Sustained Progress of Agriculture in Huang-Huai-Hai."

Dr. M. Lees of France gave a very illuminating discourse on "Sustainable Development", detailing an example of Hainan Island, an island almost equal in area to Taiwan. The island has now been made a province of China. It has a small population on a large land area and so is a treasure house of plant and animal genes and that is what China wants the island to remain. To preserve the environment of Hainan, China wants international support, which is forthcoming. If the experiment succeeds, said Dr. Lees, it is going to be a unique model of development where development is to be done without destruction. In Hainan, the irreconcilable have been reconciled — development and environment.

Another Frenchman also gave a tantalizing discourse. He was Dr. I. Sachs who discussed the important subject: "Reorienting Research Strategies". Dr. Sachs said that our research should be for high productivity with sustainability. He talked of sustainable modernization. He was of the view that bio-industrialization and bio-energy through new knowledge of biotechnology should be our aim. He pleaded for little capital and more brain in the developing countries for this sector.

Dr. Sachs visualized a new type of life-supporting system, a qualified labour-intensive system. For building such a system, he recommended upstream generation of jobs with, say, plastic produced from biomass rather than oil. Similarly, alcohol for energy should be produced from sugarcane rather than from crude oil. But it must be competitive, he stressed. That should be a component of development strategy (rather than the whole strategy).

Dr. Sachs said all this should be a good agenda for discussion in UN for the next half century!

The Slow March of Technology

Courtesy of
The Economist,
January 13 1990.

The money paid for "technology transfer" to the Third World buys bad ideas as well as good. The World Bank thinks that half of its projects in Africa failed. What might be better bets in the 1990s?

Start in the farmyard, with milk, and the example of Pakistan. It has about 3½ times as much pasture as Wisconsin, America's most productive dairy state, and has 1½ times as many dairy cows. But it produces only a quarter as much milk. Pakistan's cows are only 15% as efficient as Wisconsin's, so Pakistan has to spend some $30m importing (mostly dried) milk each year. A report by Pakistan's ministry of industries admits that urban demand for milk will have to be met by extra imports.

To make more milk a farmer can get more cows and — better — increase the productivity of each one. Israel shows how this can be done. Its Friesians and Holsteins yield 35% more milk than even their American relatives. Such success comes from the clever use of artificial insemination and embryo transfer (ET).

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Artificial insemination has been around for 40 years. Because it uses superior males, it has proved to be a successful tool for the genetic improvement of livestock. The use of ET is more recent, especially in poor countries. Its attraction is that it can exploit the genetic potential of the female as well as the male.

Normally a cow produces one egg at each period of oestrus. With ET, hormones induce a genetically superior female to produce about 20 eggs at once. Each is then fertilised inside her with the semen of an elite bull. After six days

the fertilised eggs are removed and implanted in surrogate cows whose reproductive cycle has been synchronised with the elite female. ET thus quickly increases a herd's population as well as its genetic strength.

Since it is possible to freeze cattle embryos in liquid nitrogen for long periods, many developing countries can benefit from the exchange of genetic material. Dr. Ishrat Usmani of the International Foundation for the Promotion of New and Emerging Sciences and Technologies (NEST) in London has been trying to introduce ET into Pakistan for a few years. Success was slow at first, because few established dairy organisations had managers with the understanding to apply it. Now a private dairy in Kotri and a dairy on a military farm in Rawalpindi use the technique. NEST hopes to apply it to buffalo too; Pakistan already gets three times as much milk from these beasts as from cows. Western dairy science has mostly ignored the buffalo, since westerners do not drink its milk, so the scope for improving buffalo stocks is good.

Pumps and polymers

No development scheme can work without water. In many arid lands the nearest drink is not — as it appears to be — several kilometres away, but only a few dozen metres underground. Yet it is inaccessible. The way around that is to pump it out. The Norwegian Agency for International Development (NORAD) has spent millions of dollars to introduce fishing, road construction and irrigated agriculture to Turkana, a backward region of Kenya. Irrigation schemes use canals and sluice-gates to store and distribute the seasonal flow from nearby rivers. Where once there was only subsistence farming along riverbanks there are now valleys full of settled, productive holdings.

Deep wells provide water all year round. When possible, electric motors pump it up; otherwise people do the work. Solar-powered pumps are also being developed, to take advantage of abundant sunlight. They can draw two-three litres more water per second than en efficient manual pump. NORAD hopes to supply all of Turkana with clean water by 2008. Ironically, plentiful supplies of water will make that hard. As more people use water, there is more water to throw away. Dumping it on the ground is no good — it may seep away, but it can then contaminate the sources of clean water that people so badly need.

Irrigation does not always have to divert water from thirsty people. Better that the soil should retain water from what little rain there is than to let it seep away or evaporate. This can be done by applying synthetic polymers to the soil. These polymers are chains of molecules in a honeycomb structure; they expand 200-fold to absorb and hold water, like little sponges. Super-absorbent polymers have been around since the 1960s, but only became workable in the past five years. Several studies attest to their success. Greenhouse soil with 0.5% polymers doubled the time lettuce survived before wilting (to ten days) and increased the number of fresh shoots by 660%. Field trials in Egypt showed that growing sunflowers in soil with only 0.2% polymers needed only half the normal amount of watering: 3.7m litres of water less per hectare. It also yielded superplants that were twice the normal height and had twice as many leaves. Each leaf was three times the normal size. The polymers also help the soil to breathe and take up nutrients.

Many rich countries use polymers in agriculture, for cereal and root crops, trees and landscape gardening. Most of the polymers are made in Britain, France and America. Dr. Johnson thinks that poor countries would do better to make them themselves than to rely on imports. Much of the chemistry for making soil polymers is widely known, and not patented.

According to Dr. Michael Johnson at the University of Liverpool, the polymers are best seen as safeguards against drought. They are no panacea and should not be considered for a poor country until improved crops, greater use of fertilisers and mechanisation have been tried first.

Another home-grown resource is rubbish. Half of the world's people rely on wood for cooking, light and heat. Instead of increasingly scarce wood, crop residues — biofuel — could be used to keep the fires burning under the pots and pans of rural families. Some is used already, but not efficiently. Cooking a meal takes time and most rubbish burns too quickly. The remedy is simple: compress it into briquets. Denser stuff burns slowly and evenly, and leaves little ash.

There is no shortage of harvest residues. A third of the rice harvest consists of inedible husks; about a third of sugar-cane harvests is bagasse — what remains after you squeeze out the juice; for every tonne of cotton lint harvested there are between two and six tonnes of stalks left over. Not just any old agricultural rubbish will do. Wheat and rice straw and maize stalks are better saved for feeding animals. Other things, such as banana stems and stalks, are too moist and quickly rot. Nevertheless, the rubbish that is left adds up to plenty of potential fuel. Pakistan's discarded biofuel is equivalent to 54m barrels of oil a year, worth $970m, or nearly two-thirds of its 1988 external current-account deficit. NEST is trying — unsuccessfully so far — to find companies in Pakistan to invest in the mobile compacters to make briquets of biofuel.

A small oil crisis

The production and consumption of oil-seeds and their products are rising in most places. This should be good news for poor countries, since many of them cultivate oil-seeds and edible nuts. But the good news has not yet arrived. Exports are confined to the big producers — palm oil from Malaysia, coconut oil from the Philippines, soyabean oil from Brazil and Argentina. Other poor

countries depend on imports.

Most of the oilseed-processing plants in poor countries are large ones in urban areas. Remoter places often cannot get vegetable oil and animal feed, even though they planted the oilseeds in the first place. So the British government's Overseas Development Natural Resources Institute has for some years been developing small projects to help farmers process their own harvests. Oilseeds present other challenges too. Rape-seed and mustard seed are two of the main sources of edible oil in the Indian subcontinent. Unfortunately they contain two harmful compounds — erucic acid, which is responsible for the oil's bitter taste, and some enzymes called glucosinolates. With the help of Dr. Martin Dietz, a food scientist at the University of Reading, the institute is investigating three ways of removing the bad substances. Field trials in Nepal will be carried out soon.

Lightbulbs and ideas

Popular wisdom has it that rural electrification increases agricultural production, raises rural incomes and stops people moving away to the cities. One study found that 98% of small businessmen in Bangladesh believed that having a few light bulbs and fans around their stores had increased profits. Others dispute this — roads and proximity to markets and cities may be responsible. Studies in Bolivia, Costa Rica, Ecuador and the Philippines concluded that providing electricity was neither a catalyst nor a precondition for economic improvement. And in one part of India, only 16% of electrified villages had any plugged-in customers.

Still, there is no harm in electrification. One popular source of power is an extension of the grid that light up cities. In principle, national grid supplies are reliable and cheap; in fact they are often overloaded and break down. Even if they run well, the power lines, pylons and poles to extend them can be expensive. Kenya's national utility found that costs in sparsely populated areas were seven times higher than in areas three times as dense.

The best supply for remote areas seems to be local generators that are not connected to a grid. Diesel motors are flexible and economic, if they are well maintained. Unfortunately they also pollute. Better to convert energy from otherwise wasted sources, like falling water. Intermediate Technology, a development agency based in Rugby, England, finds that "micro hydro" technology works well in hilly areas. Working with the Agricultural Development Bank of Nepal, it has installed some 600 small hydro units. By day they turn sugar-cane crushers, saw-mills, rice hullers and the like — doing in 15 minutes what it takes a person three days to do. At night they are connected to generators to light a few hundred homes.

NEST's hydroelectric scheme works on flat ground and involves a submersible "hydro-flow" turbine. It acts like an upside-down windmill put in a river. America's Department of Energy had it designed during the oil shock of the late 1970s. Used throughout America, these small turbines — costing about $40,000 each — might have turned a hefty profit on the electricity they generated. But the project was shelved when oil prices fell. Dr. Usmani had the idea of bringing the turbines to Pakistan and Bangladesh, two countries with little electrification and lots of flowing water. NEST tested the turbine's effectiveness last year at the Mangla Dam in Pakistan, where it discharges water into the Bong Canal. In a flow of two metres per second it yields as much power per day as 90kg of coal or 67 litres of oil. In the country's canal system an array of these could generate 100,000 times as much power — equivalent to 44,000 barrels of oil a day, or one-third of Pakistan's oil imports.

Catalysts and wrenches

The various agencies involved in technology transfer have different theories about what they are up to. NEST sees itself as a catalyst. Its job is to run feasibility studies of projects it believes in and then to convince governments or companies to pay for them. At the moment it concentrates on Pakistan and Zambia. Dr. Usmani believes that the key to success is adaptive research. Developed countries are a cornucopia of scientific knowledge. Developing countries should take what they need, both in technology and inspiration, rather than try to copy exactly. Developing countries cannot compete with a fully equipped and staffed western university or research institute. So its scientists should pick up ideas from western laboratories and adapt them at home (see "Fingering salmonella").

The British government's institute is one such laboratory. It runs a huge operation in five dozen countries, working mainly with governments. With a budget last year of £13.7m ($21.5m) and a team of 330 scientists in 22 disciplines, it says it promotes the sustainable development of renewable resources in poor countries. All the right buzz-words. Besides starting pilot projects, it conducts applied research in pest management, food science and crop science — and worries about environmental consequences.

Intermediate Technology treads softly and carries a small wrench. It forms partnerships with local entrepreneurs and non-governmental organisations. It believes that transferred technology should be efficient, but also much simpler and cheaper than the highly sophisticated stuff in the West. For example, animal power is often a more profitable alternative than full-scale mechanisation, which needs spare parts and continuous, knowledgeable attention.

Adapting new technologies can have its problems. Often it benefits the powerful, leaving the poor even more disadvantaged. One of Intermediate Technology's main aims is self-sufficiency for the small workman. So, since many newly trained carpenters

cannot afford tools, the group shows them how to make their own. This keeps skills in rural areas that might otherwise be lost to urban migration.

Dr. Usmani prefers to encourage mass production. NEST believes that poor countries should leap rather than creep into the next century. There are too many technologies to adapt and these countries cannot afford to miss out on their potential benefits. For instance, the World Bank says there is plenty of good research in agricultural biotechnology that fits Africa needs.

Having good ideas is not enough; the right people have to hear about them. The Panos Institute in London is a sort of clearing house for third-world information. It provides many of the services of a news agency, and publishes reports about the development, population and natural resources of poor countries. Its reports are written by indigenous non-governmental organisations and journalists. For the past six years Panos has worked with the media in East Africa and South Asia, and more recently in the Sahel and the Caribbean.

Many governments concede that they are bad at finding out what their people think about the development projects which are planned for their benefit. In Bangladesh in 1988 Panos helped a local organisation investigate the building of a dam and its effects on villages. It turned out that local people did not want the dam because they did not want their homes to be flooded. The prime minister said he was sorry he had not known of their feelings — and would support smaller irrigation schemes in future.

He is not the only one in the dark. Many scientists whose research might do a lot of good in poor countries complain that their results are seldom noticed by the people with the money to transfer technology. Their job is to publish in scientific journals, not to go knocking on the doors of development agencies. The agencies have little scientific acumen, and scientists have little time to be publicists.

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Fingering salmonella

In rich and healthy countries members of the salmonella family of micro-organisms cause a few upset stomachs, periodically scare people off eggs, but not — usually — much more than that. In poor countries some 3½m children die each year of diarrhoea that is linked to salmonella. Most tests for salmonella-infected foods take time to complete, and may miss new and dangerous strains. A better test would be one that could reliably spot the genetic fingerprint of salmonella — a DNA probe.

Dr. Joseph Gopo of the University of Zimbabwe has developed one. He and his colleague, Dr. Lilian Marovatsanga, say that it is faster and more sensitive than existing ones. In Harare's shops and restaurants, 57% of sandwiches and pies proved positive in tests. Conventional tests spotted salmonella in just 2% of them. The probe also found that two-thirds of chickens that died on farms were contaminated with salmonella.

Dr. Gopo developed his DNA probe while he was at the Institut Jacques Monod in Paris. First he dissected the genes of a salmonella bacterium. Out of its 400-500 pieces he found one that was specific to all of the hundreds of types of salmonella and to nothing else. This length of DNA is the key to Dr. Gopo's probe, since copies of it bind only to salmonella genes.

The idea of the test is simple. Food is dissolved together with the probe. If there is any salmonella in the solution, the probe will bind to it. Everything else is washed away, leaving behind a tagged sample. The problem is that the sample is too small to see. Back home in Harare, Dr. Gopo perfected the test by labelling the probe with biotin, an acid found in egg yolks and beef liver. So when the probe detects salmonella, biotin goes along for the ride. The sample is then exposed to avidin, a protein found in egg whites that likes to gobble up biotin. The avidin is itself labelled with an enzyme that imparts a colour to the solution as avidin eats up the biotin. The more salmonella in the food, the more biotin-labelled probes will be eaten by the avidin and will turn the solution (in this case) green.

It is a simple test that Dr. Gopo thinks he can package as a cheap and rugged kit. Dr. Gopo claims his DNA probe can handle 500 samples accurately in a few hours, as opposed to the normal few days. But success in the laboratory does not always imply success outside it. It has taken two years to find someone to think about manufacturing his kit commercially, despite efforts to patent and market it himself. Even a Zimbabwean company showed surprisingly little interest. Now a Scottish company, Stirling Diagnostics, is considering marketing Dr. Gopo's salmonella probe.

Some western scientists are sceptical of the claim that a colour-labelled test could be sufficiently finely tuned to give accurate readings. Others complain that Dr. Gopo's probe confusingly detects levels that are too low to pose a health risk. Dr. Gopo maintains that people, including Africans, find it hard to believe it is possible for Africans to do first-rate science.

Electron-Doped Superconductors Gain Attention; Cold Fusion Papers Prompt Much Talk, Few Results

Courtesy of
Science Watch,
Vol. 1, No. 1, January 1990.

One year ago this month, a paper by three Japanese scientists "shocked everybody", says Brian Maple, a superconductivity researcher at the University of California, San Diego. "This paper reported a surprising development, namely that electrons are the charge carriers responsible for superconductivity in a certain class of

materials." The report has entered *Science Watch*'s list of the 10 most cited papers in the physical sciences for the first time; with 40 citations during September-October 1989, it now holds third place.

Until this discovery — which the University of Tokyo trio encountered in a lanthanide-copper oxide compound at 24 K — it was the electron vacancies, or "holes", that were the charge carriers in all the then-known high-T_c materials. The existence of electron-doped superconductors, while not yet established with absolute certainty cautions Maple, has sent superconductivity theorists back to the drawing board. It also has experimentalists hoping for the discovery of new electron-doped superconducting compounds with transition temperatures in the range of 100 K-125 K, which is currently the high end for the original hole-doped superconductors.

Science Watch sought out Maple for his comments on this development and other recent trends in superconductivity research, which is represented by 8 of the 10 papers in the accompanying table.

Maple observes that four of the papers (# 1, 5, 8 and 10) deal with the bismuth-strontium family of superconductors. The first-ranking paper — also first last period — was the earliest to announce superconductivity above 77 K in a bismuth material, whereas the other three discuss specific structural determinations of compounds in this class, he says. There is only one paper in the list dealing with the thallium compounds (#4), and Maple thinks this is due to thallium's toxicity. "Not too many labs have worked with it because of that," he notes.

The seventh-ranking paper, Maple says, "indicated that the transition temperature appears once you dope the materials enough to make them pretty good metals, but then when you dope them further they become even better metals but the superconductivity disappears." He continues: "This suggests that there's an optimal hole concentration, and that finding has been borne out by more recent work."

Besides the topic of electron-doped superconductors, the subject of giant flux creep, represented by paper # 9, has received much attention lately. This is important, Maple says, "not only from the point of view of basic science but also because of the possible implications that it might have for technological applications." Giant flux creep is the tendency for vortices in the magnetic flux lattice to move too easily, a process that dissipates energy and causes a resistance to the flow of current.

"There have been some pessimistic views presented about the prospects for applications due to this kind of phenomenon, but that has been

WHAT'S HOT IN PHYSICS...

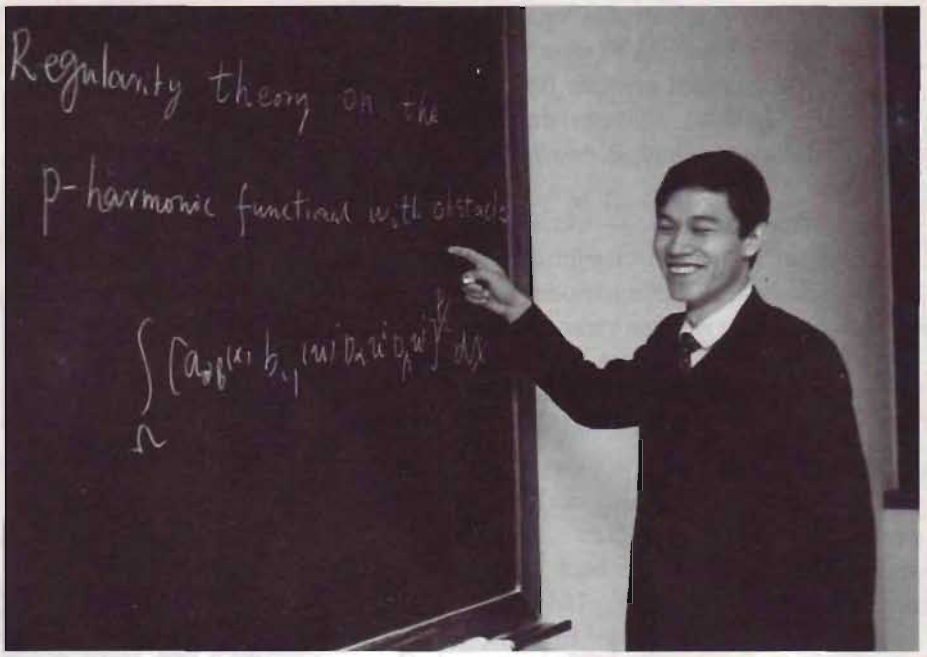
Rank	Paper	Citations This Period (Sept-Oct 89)	Rank Last Period (July-Aug 89)
1	H. Maeda, Y. Tanaka, M. Fukutomi, T. Asano, "A new high-T_c superconductor without a rare earth element," *Japanese J. Appl. Phys.*, 27(2):L209-10, February 1988. [Natl. Res. Inst. Metals, Tsukuba Labs, Ibaraki, Japan]	88	1
2	M. Fleischmann, S. Pons, "Electrochemically induced nuclear fusion of deuterium," *J. Electroanalyt. Chem. and Interfacial Electrochem.*, 261 (2A):301-8, 10 April 1989. [U. Southampton, U.K.; U. Utah, Salt Lake City]	43	5
3	Y. Tokura, H. Takagi, S. Uchida, "A superconducting copper oxide compound with electrons as the charge carriers," *Nature*, 337(6205):345-7, 26 January 1989. [U. Tokyo, Japan]	40	*
4	Z.Z. Sheng, A.M. Hermann, "Bulk superconductivity at 120 K in the Tl-Ca/Ba-Cu-O system," *Nature*, 332(6160), 138-9, 10 March 1988. [U. Arkansas, Fayetteville]	34	3
5	M.A. Subramanian, C.C. Torardi, J.C. Calabrese, J. Gopalakrishnan, K.J. Morrissey, T.R. Askew, R.B. Flippen, U. Chowdhry, A.W. Sleight, "A new high temperature superconductor $Bi_2Sr_{3-x}Ca_xCu_2O_{8+y}$," *Science*, 239(4843):1015-7, 26 February 1988. [DuPont Co., Experimental Station, Wilmington, Del.]	32	8
6	S.E. Jones, E.P. Palmer, J.B. Czirr, D.L. Decker, G.L. Jensen, J.M. Thorne, S.F. Taylor, J. Rafelski, "Observation of cold nuclear fusion in condensed matter," *Nature*, 338(6218):737- 40, 27 April 1989. [Brigham Young U., Provo, Utah; U. Arizona, Tucson]	32	*
7	J.B. Torrance, Y. Tokura, A.I. Nazzal, A. Bezinge, T.C. Huang, S.S.P. Parkin, "Anomalous disappearance of high-T_c superconductivity at high hole concentration in metallic $La_{2-x}Sr_xCuO_4$," *Phys. Rev. Lett.*, 61(9):1127-30, 29 August 1988. [IBM Corp., Almaden Res. Ctr., San Jose, Calif.]	30	10
8	R.M. Hazen, C.T. Prewitt, R.J. Angel, N.L. Ross, L.W. Finger, C.G.	29	*
8	R.M. Hazen, C.T. Prewitt, R.J. Angel, N.L. Ross, L.W. Finger, C.G. Hadidiacos, D.R. Veblen, P.J. Heaney, P.H. Hor, R.L. Meng, Y.Y. Sun, Y.Q. Wang, Y.Y. Xue, Z.J. Huang, L. Gao, J. Bechtold, C.W. Chu, "Superconductivity in the high-T_c Bi-Ca-Sr-Cu-O system: Phase identification," *Phys. Rev. Lett.*, 60(12):1174-7, 21 March 1988. [Carnegie Inst. Washington, Washington D.C.; Johns Hopkins U., Baltimore, Md.; U. Houston, Texas]	29	*
9	Y. Yeshurun, A.P. Malozemoff, "Giant flux creep and irreversibility in an Y-Ba-Cu-O crystal: an alternative to the superconducting glass model," *Phys. Rev. Lett.*, 60(21):2202-5, 23 May 1988. [IBM Corp., T.J. Watson Res. Ctr., Yorktown Heights, N.Y.]	29	9
10	J.M. Tarascon, Y. LePage, P. Barboux, B.G. Bagley, L.H. Greene, W.R. McKinnon, G.W. Hull, M. Giroud, D.M. Hwang, "Crystal substructure and physical properties of the superconducting phase $Bi_4(Sr,Ca)_6Cu_4O_{16+x}$," *Phys. Rev. B—Condensed Matter*, 37(16):9382-9, 1 June 1988. [Bellcore, Red Bank, N.J.; Natl. Res. Council Canada, Ottawa]	27	4

SOURCE: ISI's Hot Papers Database

NB. Only papers published since the beginning of 1988 are tracked. An asterisk indicates that the paper was not ranked in the top ten during the last two-month period. In the event that two or more papers have collected the same number of citations in the most recent bimonthly period, total citations to date determine the rankings.

countered recently by what I regard as more sensible views," says Maple. He points out that flux creep can be overcome by introducing flux pinning centers, in the form of defects, into the material. Researchers at AT&T Bell Labs, Murray Hill, New Jersey, have devised at least two ways to introduce flux pinning: neutron irradiation, and extreme heating that leaves extra copper and oxygen atoms in the material. "Bill Nellis of Lawrence Livermore and I have also done some work in this area," says Maple. "In papers submitted to *Applied Physics Letters*, we show how you can use shock compaction to introduce defects that increase the pinning potential. "In short, he says, "It's beginning to appear that there are a number of things to do to overcome these flux motion problems."

The last two papers (# 2 and 6) — both just nine months old — report the existence of a fusion reaction at room temperature by passing electrical current through palladium electrodes immersed in deuterated water. Lack of confirmation has convinced all but a few that the phenomenon reported was chimeric, perhaps an artifact of the experimental technique used. The latest in an ever lengthening line of papers publishing negative results on cold fusion is one from the Harwell Laboratory of the United Kingdom's Atomic Energy Authority (see *Nature*, 342[6248]:375-84, 23 November 1989). In the last issue, *Science Watch* predicted that this continuing lack of confirmation would cause the Pons and Fleischmann article to drop off the list. Instead, it has now risen from firth to second spot, and the paper by Jones et al. has entered the list for the first time (#6). Obviously, *Science Watch* was premature in its prediction but, one wonders, how much longer will the publication of negative results go on before scientists move on to something else?



Dr. Hong Min-chun, winner of the Mathematical Prize for Young Chinese Scientists 1989.

1989 Mathematical Prize for Young Chinese Scientists

Dr. Hong Min-chun of the Department of Mathematics, Zhejiang University, Hangshou, P.R. China, and currently visiting ICTP, has been awarded the top Mathematical Prize for Young Chinese Scientists 1989. This Prize is organized through the Chinese Education Committee, within the framework of the Huo Ying-dong Foundation.

My Experience with ICTP

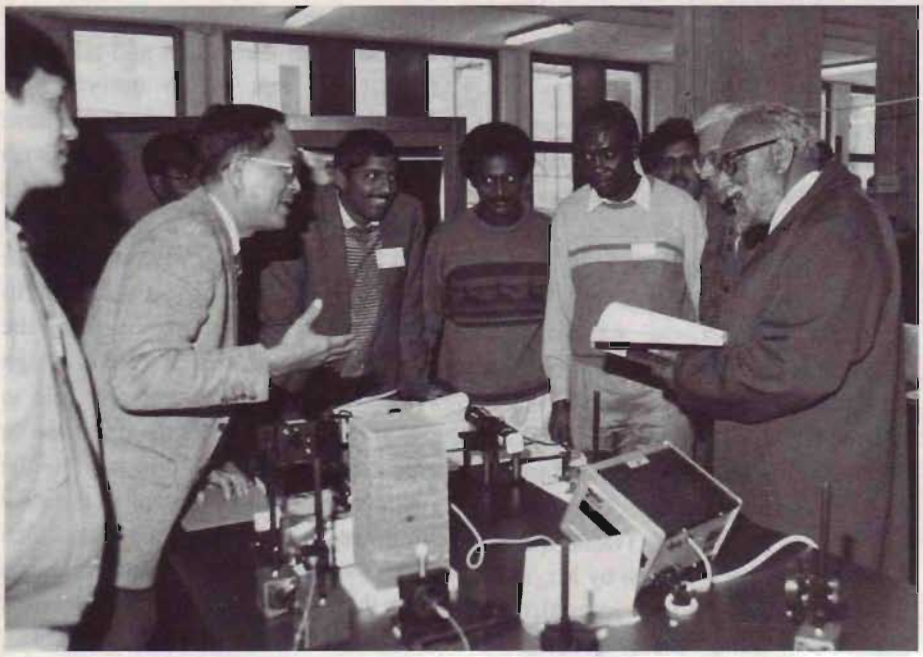
by

Dr. V. Bhanthumnavin,
King Mongkut Institute of Technology,
Bangkok, Thailand.

Dr. Bhanthumnavin has been an Associate Member of the ICTP since 1984. In his article, he recounts how his affiliation with the Centre has enabled him and his collaborators to start an excellent scientific activity in a sophisticated field of science-cum-technology not only through his visits to the ICTP but also through the contacts with other scientists developed while at the Centre.

"News from ICTP" would welcome reports from other Associate Members and others from developing countries who have been through similar experiences.

I am grateful for the kind assistance received from the ICTP and especially from Prof. Abdus Salam. This assistance has allowed me to make a tremendous progress in the laser-physics activities undertaken at the King Mongkut's Institute of Technology Thonburi (KMIT Thonburi), Bangkok, Thailand. After my first attendance in the 1981 ICTP Winter College in Atomic, Molecular and Laser Physics, I was appointed as a Junior Associate of the ICTP. Later, in 1984, with kind recommendations from Prof. J.C. Lehmann and Prof. B. Wilhelmi and from my advisor Prof. C.H. Lee, the Scientific Council of the ICTP promoted me as a Regular Associate.



Dr. Bhanthumnavin shows Professor Abdus Salam the equipment of the Laboratory of Lasers and Optical Fibres recently set up by Prof. G. Denardo.

The Associate Scheme, conceived and set up by Prof. Abdus Salam in the mid-1960's, has had a great significance for my academic advancement in the field of laser physics and technology. It has helped me to overcome the "academic isolation" prevailing in Thailand. Despite my graduation in USA, upon my return to Thailand, conditions were such that I was unable to start any laser activity at all. The reason was that I was assigned the task of establishing, from scratch, the Department of Physics at the Prince of Songkla University, in Southern Thailand in 1967. Later, in 1974, I was given the duty of establishing the Faculty of Science and Industrial Education at King Mongkut's Institute of Technology Thonburi, Bangkok. Therefore, instead of doing post-doctoral work right after my Ph.D. graduation, I had to do administrative work and academic planning in universities. At that time, there was no equipment and no laser activities in Thailand. As time passed by, I began to realize that I was working in isolation — as if I were walking in the darkest academic tunnel — and I struggled very hard to overcome it. Since I got the support of ICTP through its very effective Associate Membership Scheme, I have been able to visit the Centre quite often since 1983, I have been exposed to scientists from both developed and developing countries and then I had the feeling that I could see the light at the other end of the academic tunnel. This is how I gained confidence in starting laser activities in Thailand at KMIT Thonburi.

With the kind advice and technical know-how in laser construction received from Prof. J.C. Lehmann and Prof. W. Demtröder, in 1983 I was able to construct and develop, with the help of a colleague, a helium-neon laser system of 1.6mW (external mirror cavity) for the first time in Thailand — and this by using indigenous technology and local materials as much as possible. As a consequence, the helium-neon laser system won the Third National Award for useful developments in science and technology of Thailand. Furthermore, with generous help from Prof. F.P. Schäfer, who lectured at ICTP in 1981, 1983 and 1985 and from Mr. J. Jethwa, Max-Planck Institut für Biophysikalische Chemie, Göttingen, West Germany, we were able to construct and develop a Flashlamp Excited Dye Laser system (FEDL) with tunable laser wavelength (λ = 550-640nm) for the first time in Thailand in 1987. Prof. F.P. Schäfer not only provided technical information but also arranged for a financial support to enable me to go twice to Max Planck Institut at Göttingen for a period of two months so that I could acquire more experience in dye laser system and be exposed to equipment used in laser experiments. Furthermore, Prof. F.P. Schäfer always provided me with various components, e.g. silicon O rings, laser dye, laser mirrors, used power supplies, high voltage capacitors, home-made laser head etc. These items were extremely difficult to find in Thailand.

Under the Associate Scheme, I also had the opportunity of visiting the laboratory of Prof. O. Svelto at the Polytechnic in Milan, Italy, for one week. There, I had opportunities to discuss and acquire technical know-how for the construction of a Neodymium YAG Laser system (Nd:YAG Laser) from Dr. F. Docchio and Mr. L. Pallaro. With this information I was able to develop a Nd:YAG laser system (pulse operation) which is nearly complete at KMIT Thonburi.

At present, I have just published the first laser physics textbook in Thai, entitled *Laser Physics*. I hope that this textbook will be useful to Thai students and scientists in laser. Presently our group at KMIT Thonburi is developing solid state laser systems, e.g. Ruby Laser, Md:Glass Laser and is looking forward to their operation in Q-switched pulse and pico-second pulse regimes with applications in spectroscopy, second harmonic generation, environment monitoring (Lidar) and in medicine.

I am grateful and in debt to the ICTP Associate Scheme, created by Prof. Abdus Salam. In my case, at least, the Associate Scheme has proved to be a

vital instrument for the enhancement of science and technology in my country. It has done much to eradicate the "academic isolation". I believe it to be a deterrent to the brain drain and also to make it possible for science and technology to flourish in the developing countries.

Gianfranco Guerriero, The New Senior Administrative Officer of the ICTP

The Centre has a new Senior Administrative Officer, Gianfranco Guerriero, since 2 January.

Dr. Guerriero has been a civil servant of the Italian Ministry of Treasury for more than twenty-five years during which he has acquired a solid experience as a negotiator and also as an auditor, both at the national and at the international level. He is 48 years old and graduated in law at the University of Rome.

His office and telephone numbers are 138 and 359 respectively, at the Main Building. We congratulate him on his appointment and wish him all the best in his new position.

Book Review

The Greats in Science from the Third World — Abdus Salam, by Azim Kidwai, published by the Third World Academy of Sciences, Trieste, 1989, 72 pages, paperback.

The Third World Academy of Sciences (TWAS) has recently published a short but complete biography of Abdus Salam, Nobel Laureate for physics in 1979, President of TWAS and Director of the International Centre for Theoretical Physics of Trieste (Italy). The book has been written by Mr. Azim Kidwai, a well-known journalist of *Dawn* — the most prestigious newspaper in Pakistan — and, for one year, Editor of the TWAS Newsletter. Though primarily intended for the youth, adults will find it a most stimulating reading as well.

The publication by TWAS of the biography of a great scientist from the Third World is by no means casual. This is just one of the instruments imagined by the Academy for strengthening science in the developing countries. It is well known that much of the backwardness of the Third World in its majority is due to the weakness of its scientific and technological basis. This point and many others are discussed in great depth and also with great passion in many writings of Abdus Salam himself*. One of these weaknesses lies in the small number of active scientists. Compared to some 2,000-2,500 scientists and engineers per million population in the rich countries, the Third World can only deploy one tenth of them. The gap between the rich and the poor is abysmal and to narrow it, much will have to be invested. This implies that scientific vocations should always be encouraged among the young who show an inclination and talent for them, and this at an early stage. Youngsters from all over the world have their heroes whom they admire and wish to emulate. Many a vocation has its origin in the meeting or reading about men of great learning, wisdom, virtue or of great artistic or political skill. Exposure to science provided by the media and the teaching of science in high schools also play an important role in pushing youngsters to embrace a scientific career. In this regard, the biography of Abdus Salam is a timely initiative — the first of a series which will cover the lives of great scientists from the Third World from all continents — and provided it is widely distributed, especially in high schools, it will definitely contribute to a better understanding of science as a profession and persuade hesitant but gifted teenagers to decide for it.

The book shows that a young person, provided he has talent and is determined to work very hard, can reach the highest reputation he can dream of, whatever the conditions at the start may be. Yet, among the great contemporary scientists, Abdus Salam is a singularity. Not only has he been honoured with the Nobel Prize in 1979 — the highest honour that can be bestowed upon a scientist — but he has also created two successful institutions: the International Centre for Theoretical Physics and the Third World Academy of Sciences in 1964 and in 1985 respectively. In twenty-five years, 44,000 physicists and mathematicians have come to the Centre in order to keep abreast with the latest in their discipline and remain competitive scientifically. The TWAS, his other brainchild, plays a parallel role in other disciplines.

Abdus Salam has advocated the cause of science in the developing countries in the most prestigious arenas of the world. He is received by Heads of State and Ministers as well as by leaders of international organizations. Eminent personalities from the academic,

* See, for instance, *Ideals and Realities*, World Scientific Publishing Co., Singapore, 1983 (reprint), and *Notes on Science, Technology and Science Education in the Development of the South*, the Third World Academy of Sciences, 3rd edition, December 1989.

diplomatic and scientific scene visit him in Trieste. Among many others, the Secretary General of the United Nations, Mr. J. Perez de Cuellar, came to Trieste to inaugurate the TWAS in July 1985.

In 72 pages, the booklet narrates the itinerary of Abdus Salam from his native town Jhang in Pakistan to Lahore first, then to Cambridge and Princeton and back to England — where he was appointed as a Full Professor at the Imperial College of Science an Technology in London — and later to Trieste, the city in the North-East of Italy where he founded the ICTP and TWAS and where he could give the full measure of his passion to the cause of science in the Third World. Salam had the great fortune of being raised in a family where moral and intellectual values were held in high regard. He admits that favourable circumstances have given him a hand in many occasions. This may be true but fortune only helps those who seize the importance of the opportunities and are prepared for them. Many photographs illustrate the biography with Salam as a child, as a young man and in his years of maturity, with the ICTP which has been his home for more than a quarter of a century.

The author, Azim Kidwai, has produced a text which encapsulates Salam's epopea in a style which will certainly please the teen-agers from the Third World and elsewhere, to whom it is addressed. If the book kindles only a thousand vocations, the purpose for which it was written will be more than fulfilled.

Activities at ICTP January-February 1990

Title: WINTER COLLEGE ON HIGH RESOLUTION SPECTROSCOPY, 8 January - 2 February 1990.

Organizers: Professors G.S. Agarwal (University of Hyderabad, India), E. Arimondo (University of Pisa, Italy) and G. Denardo (ICTP), in co-operation with the International Centre for Science (ICS, Trieste, Italy) and with the co-sponsorship of the Italian Direzione Generale per la Cooperazione allo Sviluppo (Ministry of Foreign Affairs, Rome, Italy).

Lectures: Theory of multiphoton transitions. Non-linearity of atomic and molecular resonances in optical transitions. Nonlinear spectroscopy. Multiphoton transitions and chaos. Multiphoton processes with strong and short pulses. Non-linearity of atomic and molecular resonances in optical transitions. Single atom/ion spectroscopy. Three-level spectroscopy and cooling. Far-infrared lasers. Cooling of atomic beams. Laser clocks. X-ray laser (theory and experimental). Tunable laser sources in the IR and visible. Physics at the National Institute of Standards. Physics and instrumentation for X-ray lasers. Chaos in lasers. Quantum in optics and squeezed states. Chaos in lasers and bistability. Multiphoton processes and chaos.

The College was attended by 73 lecturers and participants (28 from developing countries).

Title: WORKSHOP ON COMPOSITE MEDIA AND HOMOGENIZATION THEORY, 15 - 26 January 1990.

Organizers: Professors G. Dal Maso (International School for Advanced Studies, ISAS-SISSA, Trieste, Italy) and G.F. Dell'Antonio ("La Sapienza" University, Rome, Italy).

Lectures: Spectral properties of operators singularly depending on parameters and applications to mathematical physics. Composite media and Dirichlet forms. Relaxed formulation for a class of shape optimization problems. Variational models of coherent phase transitions. Plasticity, yield design, and homogenization. Homogenization and correctors for nonlinear elliptic equations. Bounds on elastic moduli for two phase anisotropic elastic composites. Semilinear elliptic equations with singular potential. Mixed boundary conditions on perforated domains and point interactions in quantum physics. Wave propagation in random media. Homogenization of flow and transport through porous media. The overall physical properties of a solid reinforced by parallel plates. The Lavrentieff phenomenon as a source of different homogenization processes. Homogenization of two-component miscible flows through porous media. Remarks on the G-closure problem. Homogenization of a class of stochastic partial differential equations. Properties of averaged models of periodic media mechanics. Homogenization of quasi-linear equations. Lusin type theorem for gradients. Homogenization with small shape-varying perforations. The field-equation recursion method. Correctors for the wave equation. A minimality condition for magnetisation domains. A Galerkin approximation method in multicellular beams. On the homogenization of folliated annuli. Convergence of solutions of variational inequalities in higher order Sobolev spaces. Homogenization and scaling for convection-diffusion equations. Geometry and asymptotics in homogenization. A remark on the structure of Stoke equation and application to homogenization. G-convergence of monotone operators. Homogenization of monotone operators. Non-equilibrium problems, hydrodynamic scaling, large deviations and homogenization. Topology and shape optimization of an elastic structure using the homogenization method. Compactness methods in homogenization. Electromagnetic wave propagation in periodic media. On some results of homogenization: piezoelectricity, fissured solids and plates, shells. An approach to the G_m closure problem for two-component composites. A solution scheme for many-particle interactions based on the method of reflections. The estimates of effective moduli of two-component

elastic composites. Effects of blood flow, curved boundary and environmental conditions on temperature distribution in a two dimensional structure of human skin and subcutaneous tissues. On homogenization and large deformations. Weakly and strongly nonlinear (power law) electrical properties of isotropic composite media. Limit analysis of the Maxwell system in case of a very thin scattering body. On a model of weak adhesion in composite plate vibrations. Critical phenomena in random resistance network. Perfectly plastic plates surrounded by soft material. Calculation of effective physical parameters in porous and composite media with periodic structure. Homogenized models of composite media. New problems on Gamma-convergence. Multi-scale analysis of composite media. Homogenization of random electric resistors. The G-closure for two-dimensional elasticity. G-convergence and the Eigenvalue problems. Homogenization for operators in non-divergence form. Homogenization of nonstationary Navier-Stokes equations.

The Workshop was attended by 97 lecturers and participants (14 from developing countries).

Title: SECOND COLLEGE ON VARIATIONAL PROBLEMS IN ANALYSIS, 29 January - 16 February 1990.

Organizers: Professors A. [illegible]

Organizers: Professors A. Ambrosetti (Scuola Normale Superiore, Pisa, Italy) and J. Mahwin (Université Catholique de Louvain, Louvain-La-Neuve, Belgium), with Prof. E. Zehnder (ETH-Zentrum, Zürich, Switzerland) as honorary director.

Lectures: Introduction to minimax methods in critical point theory and their applications. Convex and lower semicontinuous functions. Critical point theory. Critical point theory and Hamiltonian systems. Sobolev spaces. Rearrangements in variational problems and applications. Hamiltonian systems. Direct methods in calculus of variations. Applications of Liapunov's theorem on the range of vector measures. Variations on the forced pendulum equations. Jumping nonlinearity for the periodic case, via the Poincaré Birkhoff theorem. The length of isolated invariant sets of equivariant flows and applications to bifurcation theory. Subharmonics near an equilibrium for Hamiltonian systems. Semi-coercive variational methods at resonance. Infinite cup length and category of free loop spaces with applications. Multiple geodesics on space-time manifolds. Geodesical connectivity of Lorentz manifolds with boundary. Almost periodic solutions of forced Lagrangian systems. Variational approach to rough surface scattering; impedance boundary conditions. Periodic solutions with minimal period for superquadratic Hamiltonian systems. Morse theory and subharmonic oscillations of second order systems. The geometry of minimizing curves. On the Conley-Index for discrete dynamical systems. Approximate solutions to Hamilton-Jacobi equations. Nonexistence of nodal solutions for critical exponent problem in $\mathbb{R}^n$. Some elliptic problems in an annulus. Existence and nonexistence of positive radial solutions for Sobolev critical exponent problem with Neumann boundary condition. Regularity theorems for the p-harmonic functional with non-bounded obstacles. Weak harmonic maps into non-smooth manifolds: a variational approach. Singular Hamiltonian systems. Generalized Ljusternik-Schnirelmann theories for Lie group actions with an application to the Plateau problem.

The College was attended by 79 lecturers and participants (25 from developing countries).

Title: TRAINING COLLEGE ON PHYSICS AND CHARACTERIZATION OF LASERS AND OPTICAL FIBRES, 5 February - 2 March 1990.

Organizers: Professors G. Denardo (ICTP, Trieste, Italy), G. Guekos (Swiss Federal Institute of Technology, Zurich, Switzerland), M. Matera (Istituto di Elettronica Quantistica, Florence, Italy) and F. Tosco (Centro Studi e Laboratori Telecomunicazioni, Turin, Italy), in co-operation with the International Centre for Science and High Technology (ICS, Trieste, Italy) and with the co-sponsorship of the Direzione Generale per la Cooperazione allo Sviluppo (Italian Ministry of Foreign Affairs, Rome, Italy).

Lectures: Basic laser physics. Laser resonators. Dye lasers. Applications of lasers. LIDAR. VUV generation. Optogalvanic spectroscopy. Solid state lasers. Gas lasers. Excimer lasers. Optical fibre theory. Optical fibre communications. Attenuation measurement — CSELT experiment. Bandwidth measurement — CSELT experiment. Fibre-optic systems. Digital transmission — ETH experiment. Fibre characterization. Splices and connectors. Fibre fabrication. Source for fibre communications. Detectors for fibre communications. Integrated opto-electronics. Semiconductor lasers. The generation of ultrashort pulses of light-compression in optical fibres. Future prospects. High power diode lasers.

The College was attended by 118 lecturers and participants (32 from developing countries).

Corrigendum

In Issue 28/29 of *News from ICTP*, on Page 15, it was written that Dr. A. Colavita (Argentina/ICTP) acted as Head of the Laboratory during the Fifth College on Microprocessors: Technology and Applications in Physics (2 - 27 October 1989). In fact, the Head of the laboratory exercises was Dr. Dai Jialin (P.R. China/ICTP).

Winter College on High Resolution Spectroscopy, 8 January - 2 February 1990.

Workshop on Composite Media and Homogenization Theory, 15 - 26 January 1990.

Second College on Variational Problems in Analysis, 29 January - 16 February 1990.

Training College on Physics and Characterization of Lasers and Optical Fibres, 5 February - 2 March 1990.

STATISTICAL DATA ON ACTIVITIES AT ICTP IN 1989

The following tables deal with all activities combined, therefore they show the *actual* number of visitors, i.e. those scientists who participated in more than one activity are counted only once.

Summary of participation 1989 vs. 1988

	Visitors		Man/Months		Total		Percentage (Dev. vs. total)	
	Dev.	Ind.	Dev.	Ind.	Visitors	M/M	Visitors	M/M
1989	2532	1568	4057.84	761.57	4100	4819.41	61.76%	84.20%
1988	2220	1894	3729.47	867.18	4114	4596.65	53.96%	81.13%
Increase/ Decrease	+14.05%	-20.79%	+8.80%	-13.87%	-0.34%	+4.85%		
The above figures for 1989 include:								
Training in Italian laboratories	170	-	1116.66	-	170	1116.66	100.00%	100.00%
The above figures for 1988 include:								
Training in Italian laboratories	170	-	1093.76	-	170	1093.76	100.00%	100.00%

Participation by geographical areas in the research and training-for-research activities

in the research and training-for-research activities
of the ICTP in 1989

Geographical Areas	Visitors		Man/months		Total for Area	
	Dev.	Ind.	Dev.	Ind.	Visitors	Man/Months
Africa	489	-	790.96	-	489	790.96
Asia	1137	45	2068.45	54.55	1182	2123.00
Europe	446	1166	436.84	544.42	1612	981.26
Indonesia and Oceania	11	9	9.85	4.24	20	14.09
North and Central America	102	282	201.26	135.36	384	336.62
South America	347	-	550.48	-	347	550.48
International Organizations	-	66	-	23.00	66	23.00
TOTAL	**2532**	**1568**	**4057.84**	**761.57**	**4100**	**4819.41**
% Developing vs. Total					**61.76%**	**84.20%**

Breakdown of the number of scientists who worked at the ICTP in 1989 and of man/months per scientific field

Other tables show that the total number of scientists who came to the ICTP is 4100 while the total number of man/months is 4819.41. In the tables which follow the number of scientists will be higher since several of them took part in more than one activity.

Table I shows a summary of the breakdown while Table III shows the details. Percentages refer to the total participation in the field vs. the grand total.

Table I
Summarized breakdown by field of activity

Activity	Number of Visitors				Number of Man/months			
	Dev.	Ind.	Total	%	Dev.	Ind.	Total	%
1. Fundamental Physics	385	478	863	17.61%	503.08	327.09	830.17	17.23%
2. Condensed Matter	733	372	1105	22.55%	809.64	127.42	937.06	19.44%
3. Mathematics	345	182	527	10.75%	459.00	94.98	553.98	11.49%
4. Physics & Energy	342	217	559	11.41%	216.34	53.10	269.44	5.59%
5. Physics & Envir.	189	87	276	5.63%	110.66	28.37	139.03	2.88%
7. Applied Physics	507	154	661	13.49%	538.73	77.09	615.82	12.78%
9. Physics of the Space	32	41	73	1.49%	21.47	10.39	31.86	0.66%
10. Adriatico Conferences	138	167	305	6.22%	31.31	28.69	60.00	1.24%
11. Other research	300	62	362	7.39%	250.95	14.44	265.39	5.51%
TOTAL	2971	1760	4731	96.54%	2941.18	761.57	3702.75	76.82%
Outside activities								
Italian laboratories	170	-	170	3.47%	1116.66	-	1116.66	23.17%
GRAND TOTAL	**3141**	**1760**	**4901**		**4057.84**	**761.57**	**4819.41**	

Hosted activities

1. Scientific Council E.U.G VI.
2. Meeting of ISCSS.
3. Third World Network of Scientific Organizations.
4. INFN School on advanced Studies in Nuclear and Subnuclear Physics.
5. Womens' Study Group.
6. Workshop/Symposium on "Molecular Genetics of Lower Eukaryotes".
7. Bouchet Council Meeting.
8. Trieste Encounters on Congnitive Science.
9. Meeting on Marketing Strategies.
10. SARF (Arab Friends Society) General Meeting.
11. Meeting on "Fundamentals of Quantum Mechanics".
12. International School of Philosophy of Science.
13. I Meeting of the International Commission on Food for Peace.

14. TWAS Council Meeting.
15. Meeting of TWOWS (Third World Organization for Women in Science) Committee.
16. TWNSO (Third World Network of Scientific Organizations) Executive Board Meeting.
17. Workshop for Policy Makers on Environment and Development.
18. International Conference on Desert Environment.
19. INFN School on VLSI Design.

In addition, the Centre supported 133 regional courses, workshops and conferences in all regions of the world.

Table II shows a statistical summary of the activities at the ICTP itself and outside its premises.

Table II
Statistical summary of all activities held at and outside the ICTP

Figures on research include long- and short-term scientists as well as Associate Members, some scientists from Federated Institutes and seminar lecturers.

Activity	Number of Visitors			Number of Man/months		
	Dev.	Ind.	Total	Dev.	Ind.	Total
1. At the ICTP:						
(a) Research:						
Fundamental Physics	103	78	181	276.02	177.18	453.20
Condensed Matter	62	23	85	163.10	5.50	168.60
Mathematics	73	12	85	242.15	8.61	250.76
Plasma Physics	11	1	12	15.26	0.26	15.52
Microprocessors Lab	15	1	16	100.76	0.10	100.86
High Tc Superc. Lab	12	4	16	31.37	14.14	45.51
Other	219	53	272	239.62	13.63	253.25
Total	495	172	667	1068.28	219.42	1287.70
% Total vs. Grand Total	10.01%	3.51%	13.61%	22.17%	4.55%	26.72%
(b) Training for research (courses, workshops and conferences)						
Total	2476	1588	4064	1872.90	542.15	2415.04
% Total vs. Grand Total	50.52%	32.40%	82.92%	38.86%	11.25%	50.11%
2. Outside activities:						
Italian laboratories	170	-	170	1116.66	-	1116.66
% Total vs. Grand Total			3.47%			23.17%
GRAND TOTAL	**3141**	**1760**	**4901**	**4057.84**	**761.57**	**4819.41**

Associate Members Expected at ICTP in 1990

KEY:

AP	Atomic Physics	MATH	Mathematics
ASTRO	Astrophysics	MED.PHYS.	Medical Physics
BIO	Biophysics	NP	Nuclear Physics
CLIMA	Climatology	PP	Plasma Physics
COMM	Communications Physics	SE	Solar Energy
COMP	Computational Physics	SOIL	Soil Physics
EP	Elementary Particles	SS	Solid State
GEO	Geophysics		

Name	*Field*	*Member State*	*Period of Stay*
ABDALLA, E.	EP	Brazil	17 June-5 Sept
ABOUELSAOOD, A.	EP	Egypt	mid Jun
ADEGBOYEGA, G.	SE	Nigeria	Sept (x 90 days)
AFUWAPE, A.U.	MATH	Nigeria	end Aug (x 90 days)
AGRAWAL, R.C.	GEO	India	26 Mar-14 Apr
AHMAD BITAR, R.N.	AP	Jordan	18Jan-1 Feb
AINA, P.O.	SOIL	Nigeria	30 Apr-28 July
AKHTER, P.	SS	Pakistan	early July-end Sept
ALEMU, Y.	MATH	Ethiopia	18 June-18 Sept
ALIAGA-GUERRA, D.	SS	Peru	Jan
AMUASI, J.H.	MED.PHYS.	Ghana	May
ANANTHAKRISHNA, G.	SS	India	1 June-15 July
ANDAM, A.A. (Ms.)	NP	Ghana	1 Sept-16 Nov
ARAGONE, C. (Senior)	EP	Venezuela/Uruguay	18 Feb-5 Mar
ASGHAR, S.	MATH	Pakistan	beg. June (x 10 weeks)
AYDIN, R.	AP	Turkey	20 June (x 6 weeks)
AZAD, H.	MATH	Pakistan	1 July-27 Sept
BAIG, A.M.	AP	Pakistan	June (x 2 months)
BAQUERO PARRA, R.	SS	Mexico/Colombia	15 June-15 Aug
BARRY, M.B.	SE	Guinea	15 July (x 45 days)
BELAL, I.K.	AP	Syria	8 Jan-9 Mar
BELAL, I.K.	AP	Syria	8 Jan-9 Mar
BESTMAN, A.R.	MATH	Nigeria	Aug or Sept (x 90 days)
BHANTHUMNAVIN, V.	AP	Thailand	6 Feb-15 Apr
BHASKAR RAO, D.V.	GEO	India	7 May-1 August
BORZI, C.	BIO	Argentina	5 Feb-21 Apr
BREZINI, A.	SS	Algeria	20 June (x 10 weeks)
CALDEIRA	SS	Brazil	1 June-20 July
CAMACHO DE GALAN, A. (Ms)	EP/SS/NP	Colombia	12 May-12 Aug
CHIDUME, C.	MATH	Nigeria	27 Aug
CHIDUME, C.E.	MATH	Nigeria	9 Sept-10 Dec
CHOUDHURY, A.M.	GEO	Bangladesh	beginning May-June
DA CUNHA LIMA, I.C.	SS	Brazil	1 May-30 July
DABBOUR, A.E.S.A.	MATH	Egypt	20 June (x 2 months)
DATTAGUPTA, S.K.	SS	India	30 June
DE DIOS LEYVA, M.	SS	Cuba	21 Apr-18 June
DIAZ ARENCIBIA, P.M.	AP/Laser/SE	Cuba	26 Feb-30 Apr

contd.

Name	*Field*	*Member State*	*Period of Stay*
DIAZ-PUENTES, E.	BIO	Colombia	3 Sept-3 Dec
DJAFARI-ROUHANI, B.	MATH	Iran	12 July-11 Oct
DONANGELO, R.	NP	Brazil/Uruguay	7 May-1 June
DONNAMARIA, M.C.	SS	Argentina	4 June
DZINOTYIWEYI, H.A.M.	MATH	Zimbabwe	1 Mar-25 Apr
EDEE, M.K.A.	BIO	Togo	18 Aug-28 Oct
EL MEKKI, O.M.	GEO	Sudan	8 Apr-15 June
EL MOUSLY, M.K.	SS	Egypt	Summer
EL TOM M.E.A.	MATH	Sudan	25 Mar-7 Jun
EL-SAYED, M.E.S.	BIO	Egypt	1 July-end Aug
ELION MBOUSSA, A.	BIO	Congo	Autumn
GAMAL, Y.E.	AP	U.A.E./Egypt	22 June (x 2 months)
GAMBINI, R. (Senior)	EP	Uruguay	20 Apr-30 May
GAMBOA SARAVI, R.E.	EP	Argentina	10 June-end July
GARCIA-CALDERON, G.	SS	Mexico	mid June-30 Aug
GARIBOTTI, C.R.	SE/AP	Argentina	30 Aug-14 Oct
GODBOLE, R.M.	EP	India	10 June-30 July
GONDAL, M.A.	AP	Libya/Pakistan	Summer
GONG C.	SS	China	1 June-1 Sept
GOVINDARAJAN, T.	EP	India	23 Apr-23 July
GUPTA. M.C. (Senior)	SE	India	mid May-mid Aug
GUPTA. R.K.	NP	India	May
HAOUBA, A.O.	MATH	Mauritania	20 June-5 Sept
HE, Shan-Yu	MATH	China	beg. Sept-end Nov
HOSSAIN, M.A.	MATH	Bangladesh	May (x 90 days)
HUSAIN, M.S.	SE	Bangladesh	28 Mar-27 June
HUSSEIN, A.M.	PP	UAE/Egypt	28 June-23 July
IMORU, C.O.	MATH	Nigeria	Aug
IQBAL, M.Z.	SS	Pakistan	June-Aug
ISMAIL, M.	MATH	Sudan	4 Apr-2 July
JHA, L.N.	PP	Nepal	5 Feb-23 May
KADRI, A.	SS	Algeria	15 July
KANHERE, D.G.	SS	India	15 June-31 July
KARAKURA, F.	MATH	Burundi	4 June-July
KARAKURA, F.	MATH	Burundi	4 June-July
KAREMERA, M.	AP	Zaire	18 Jan-12 Apr
KOCA, M.	EP	Turkey	1 July-14 Aug
KOREK, M.	AP	Lebanon	19 July (x 90 days)
KUMAR, D.	SS	India	14 May-23 June
KUNARATNAM, K.	GEO	Sri Lanka	16 July-15 Oct
LEELANANDA, S.A.	GEO	Sri Lanka	21 May-15 June
LI Zhongyuan	PP	China	Summer (x 90 days)
LIU, Fu-Sui	SS	China	18 Jan-18 Apr
LIU, Zhen-Yuan	LASERS	China	4 Feb-4 May
MAKADSI, M.A.R.	SS/SE	Iraq	20 Apr-15 June
MANSOURI, R.	EP	Iran	5-15 Apr
MBOW, C.M.	AP	Senegal	27 Jan-10 Mar
MEJIA-LIRA, F.	SS	Mexico	6 May-20 June
MEKHFI, M.	EP	Algeria	18 June
MELEK, M.	EP	Egypt	2 Jan-9 Feb

contd.

Name	*Field*	*Member State*	*Period of Stay*
MONTOYA, M.	NP	Peru	June
MOOKERJEE, A.	SS	India	7 May-17 June
MOULAY, M.	NP	Algeria	end July-mid Sept
MSHELIA, E.D.	NP	Nigeria	1 Sept-31 Oct
MSHIMBA, A.S.A.	MATH	Tanzania	5 Mar-21 May
NAYYAR, A.H.	SS	Pakistan	15 June-31 Aug
NAZAR, F.M.	SS	Pakistan	Mar
NKOMA, J.S.	SS	Botswana	1 June-31 Aug
OBADA, A.	AP	Egypt	5 July-end Aug
OH, S.J.	SS	Korea	1 July-20 Aug
OMOTOSHO, J.B.	CLIMA	Nigeria	1 Aug-30 Oct
ONG, C.K.	SS	Singapore	8 May-19 June
OYINLOYE, J.O.	GEO	Nigeria	5 Sept-31 Oct
PENG, Jin Sheng	AP	China	22 July-21 Oct
PONCE, T.C.	COMM/SS	Philippines	21 Apr-8 June
POVOLO, F.	SS	Argentina	14 May (x 90 days)
PRAMUDITA, A.	EP	Indonesia	3 May-1 Aug
PROETTO, C.R.	SS	Argentina	21 Apr-21 June
RAMASWAMY, R.	SS	India	1 June
RAMBOLAMANANA, G.	COMM/GEO	Madagascar	Oct-Nov
RAO, K.S.	SOIL	India	1 May (x 90 days)
RAYCHAUDHURI, A.	EP	India	30 Apr-1 July
RAZMI, M.S.K.	AP	Pakistan	15 June (x10 weeks)
RUDERMAN, G.	BIO	Argentina	Sept
SAMARANAYAKE, V.K. (Senior)	COMP/EP/NP	Sri Lanka	6-9 Feb
SCHAPOSNIK, F.	EP	Argentina	July
SEADE, J.	MATH	Mexico	1 Mar-1 May
SEBALLOS, S.	BIO	Chile	15 Aug-15 Nov
SEDDIK, M.	SE	Egypt	18 May-6 Aug
SHAHSHAHANI, S.	MATH	Iran	24 Mar-12 Apr
SHARAF-EL-DIN, A. (Senior)	EP	Sudan	18 June-28 July
SHARMA, A.	AP	India	28 Jan-10 Mar
SINGH, C.P.	EP	India	23 May-31 July
SINGH, C.P.	MATH	India	13 May-8 July
SISWADI	MATH	Indonesia	12 Oct-8 Jan '91
SITARAMAYYA, M.	MATH	India	1 May-1 Aug
SOBOUTI, Y.	ASTRO/EP	Iran	5 June-31 Aug
SU, Zhao-Bin	SS	China	11 June (x 90 days)
TAGLIAFERRI, A.A.	AP	Brazil	1 Feb-19 Mar
THAHEEM, A.B.	MATH	Pakistan	1 June
TIWARY, S.N.	AP	India	July-Sept
TORRES-HERNANDEZ, J.L.	BIO	Mexico	1 Sept-15 Oct
TOUZANI, M.	SS	Morocco	14 May (x 90 days)
TWESIGOMWE, E.M.	GEO	Uganda	5 Sept-3 Dec
WAGUE, A.	AP	Senegal	1 July-end Sept
WAHEED, A.	NP	Pakistan	1 June-31 Aug
WANG Shui	GEO	China	20 Apr-20 July
WANG, Yu-Zhu	AP	China	1 Aug-30 Oct
WEISSMANN, M. (Senior)	SS	Argentina	25 June (x 4 weeks)
XIONG, J.	MATH	China	1 Nov-end Jan '91

contd.

Name	*Field*	*Member State*	*Period of Stay*
YUNUS, A.	BIO	Bangladesh	11 Apr-4 July
ZEWDIE, H.B.	SS	Ethiopia	28 June-28 Sept
ZHANG, Yuan-Zhong	EP	China	16 Feb-18 May

Long-term Scientists Expected at ICTP in 1990

Name	*Institute*	*Period of stay*	*Research topic at ICTP*
Astrophysics			
CHEN Dao-Han	Purple Mt. Observatory, Nanjing, China	1 Jan - 13 Apr	Planetary physics.
DENG Licai	Purple Mt. Observatory, Nanjing, China	1 Jan - 23 Nov	Stellar evolution; stellar convection theory.
HUANG Songnian	Shanghai Observatory, China	1 Jan - 31 Dec	Dynamics of galaxies.
IYER Balasubramanian	India	31 Aug - 30 Nov	
LANZA Antonio	SISSA, Trieste, Italy	1 Jan - 31 Dec	
OH Kap-Soo	Univ. of California, Santa Cruz, USA	1 Jan - 25 Oct	Dynamical evolution of globular clusters.
POLLOCK Martin Donald	UK	25 Feb - 22 Apr	Quantum cosmology.
PRASANNA Aragam Ramarad	Phys. Res. Lab., Ahmedabad India	9 May - 8 Sep	
SINGH Tejinder Pal	Tata Inst., Bombay, India	1 Jan - 18 Oct	Quantum general relativity.
Condensed Matter			
CANESSA Enrique	Univ. Konstanz, Fed. Rep. of Germany	1 Sep - 31 Dec	
CERDEIRA Hilda A.	UNICAMP, Campinas, Brazil	1 Jan - 31 Dec	Condensed matter nonlinear physics.
CHOWDHURY Debashish	Nehru Univ., New Delhi, India	15 May - 15 Jul	
CERDEIRA Hilda A.	UNICAMP, Campinas, Brazil	1 Jan - 31 Dec	Condensed matter nonlinear physics.
CHOWDHURY Debashish	Nehru Univ., New Delhi, India	15 May - 15 Jul	
GEERTSMA Wiebe	Univ. Groningen, Netherlands	11 Jan - 1 May	
GONG Xin-Gao	Inst. Solid State Phys.,China	1 Jan - 31 Dec	First-principle molecular dynamics on gallium.
GRANADA Juan Carlos	State Univ., Kharkov, USSR	6 Feb - 15 Jun	Collective excitations in superlattices.
JAYANNAVAR Arun Mallojirao	Indian Inst. of Sc., Bangalore, India	26 Feb - 26 Jun	Theoretical condensed matter physics.
LAI San Kiong	Nat. Central Univ., Taiwan	1 Jan - 10 Jul	Electronic, thermodynamic and surface properties of simple liquid metals.
LI Yan-Min	Inst. of Theor. Phys., Beijing, China	1 Jan - 31 Dec	Theory of high T_c superconductivity.
LIU Fu-Sui	Beijing Univ., China	18 Jan - 18 Apr	High T_c superconductivity.
MOHAN Ram	Nat. Inst. of Health, Bethesda, USA	1 Jan - 31 May	

contd.

Name	*Institute*	*Period of stay*	*Research topic at ICTP*
NAFARI Nasser	At. En. Agency, Iran	1 Jan - 28 Sep	Pseudopotential theory and interfacial phenomena.
SHEHATA Louis Naim	At. En. Auth., Cairo, Egypt	1 Jan - 31 Dec	High T_c superconductivity.
SINHA Sudeshna	Tata Inst., Bombay, India	15 Mar - 31 Dec	Chaos and nonlinear dynamics.
VICENTE Luis Alberto	Univ. Nacional, Mexico D.F.	1 Apr - 31 Jul	Nonlinear systems; chemical dynamics.
WANG Li	Inst. of Metal Res., Shenyang, China	15 Feb - 31 Dec	Theoretical research of liquid metals and alloys.
XU Hong-Hua	Shanghai Jiao-Tong Univ., China	3 Jan - 2 Jul	Nonlocal Ginzberg-Landau equations in superconductivity.
YU Lu	Inst. of Theor. Phys., Beijing, China	1 Jan - 31 Dec	Low dimensional physics; strongly-correlated electron systems.
High Energy			
ANINI Yaqoub	Birzeit Univ., West Bank	1 Jan - 30 Apr	Quantum cosmology.
BAAKLINI Nazir S.	Lebanon	1 Jan - 8 Aug	
BARUT Asim O.	Univ. of Colorado, Boulder USA	10 May - 31 Aug	
BONINI Marisa	Univ. of Parma, Italy	1 Jan - 11 Sep	Superstrings; conformal field theory.
FLORES BAZAN Fabian	Univ. Nacional de Ingeniería, Lima, Peru	1 Jan - 23 Nov	
HELLER Krzysztof Jan	Jagellonian Univ., Cracow, Poland	1 Jan - 27 Oct	Lattice gauge theory; computational algorithms.
ISLAM Saiful	Chalmers Univ. of Technology, Göteborg, Sweden	1 Jan - 31 Dec	
LIZZI Fedele	Rutherford Appleton Lab, USA	1 Jan - 31 Dec	Elementary particles.
MARZBAN Caren	N Carolina Univ., USA	1 Jan - 30 Nov	High energy physics.
MAZZITTELLI Francisco Diego	Inst. de Astronomía, Buenos Aires, Argentina	1 Nov - 31 Dec	
MIYAZAKI Tadashi	Science Univ. of Tokyo, Japan	19 Sep - 31 Dec	
MOHAMMEDI Noureddine	Univ. of Liverpool, UK	1 Jan - 31 Dec	Strings and conformal field theories.
PANDA Sudhakar	Tata Inst., Bombay, India	1 Oct - 31 Dec	
PARK Seon-Hee	Univ. of Texas, Austin, USA	1 Oct - 31 Dec	
[illegible]	[illegible]	[illegible]	
PARK Seon-Hee	Univ. of Texas, Austin, USA	1 Oct - 31 Dec	
RAI Balram	Syracuse Univ., USA	1 Oct - 31 Dec	
SENDA Ikuo	Univ. of Tokyo, Japan	1 Jan - 31 Dec	
SHAMIR Yigal	Tel Aviv Univ., Israel	1 Oct - 31 Dec	
SIGALOTTI Leonardo	SISSA, Trieste, Italy	1 Jan - 31 Dec	Theoretical astrophysics.
VISWANATHAN R Raju	Univ. of Florida, Gainesville, USA	1 Jan - 31 Dec	
WANG Jin	Univ. of Illinois, Urbana, USA	1 Oct - 31 Dec	
YU Ming	Niels Bohr Inst., Copenhagen, Denmark	1 Jan - 31 Aug	2D conformal field theory.
ZHANG Xiao He	CALTECH, Pasadena, USA	1 Jan - 20 Jul	Astrophysics.
ZHAO Zhi-Yong	Beijing Univ., China	16 Apr - 13 Aug	
ZHU Chuan-Jie	Graduate Sch., Beijing, China	1 Jan - 30 Sep	String theory and field theory.

contd.

Name	*Institute*	*Period of stay*	*Research topic at ICTP*
High T_c Laboratory			
GANGULY Parthasarathy	Indian Inst. of Sc., Bangalore, India	1 Jan - 3 Jun	
INFANTE Carlos Ernesto	Univ. de Chile, Santiago, Chile	1 Jan - 7 Jun	
MA Beihai	Inst. of Phys., Beijing, China	1 Jan - 30 May	Experimental high T_c superconductivity.
MATACOTTA Francesco Cino	ITM, Milan, Italy	1 Jan - 31 Dec	High T_c superconductivity.
RAMOS ARHUIS Jaime H.	Chalmers Univ. of Technology, Göteborg, Sweden	1 Jan - 25 Sep	High T_c superconducting thin films.
SEGRE Carlo	Illinois Inst. of Tech., Chicago, USA	1 Jan - 31 Aug	
Mathematics			
ADHIKARI Sukumar Das	Tata Inst., Bombay, India	10 Feb - 31 Dec	Analysis (asymptotic) of error terms of averages of arithmetic functions.
AMINOU Rachidi	Nat. Univ., Cotonou, Benin	17 Jan - 17 Apr	Differential geometry (Poisson structure on a manifold and Yang-Baxter equation).
BAKASOV A.A.	Joint Inst. of Nuclear Research, Dubna, USSR	1 Sep - 30 Nov	
BOZHKOV Yuri Dimitrov	Univ. K. Ohridski, Sofia, Bulgaria	1 Feb - 31 Dec	Complex geometry; nonlinear differential equations.
BRAMBILA PAZ Fernando	UNAM, Mexico City, Mexico	1 Jan - 31 Dec	Analysis PDE.
CHEN Yu	Inst. System Sc.,Beijing,China	1 Jan - 23 Jun	
CIRIZA Eleonora	SUNY, Stony Brook, USA	1 Jan - 30 Nov	Geometry.
DANAEE Ali	Univ. of Isfahan, Iran	1 Jan - 31 May	
DATTA Basudeb	Indian Statistical Inst.,Bangalore, India	6 Mar - 5 Dec	Almost complex and complex structures on manifolds; applications of Clifford algebra in topology.
DENKOWSKI Zdzislaw	Jagellonian Univ., Cracow, Poland	Autumn	
DESQUITH Etienne	Inst. de Rech. Mathématiques, Abidjan, Côte d'Ivoire	1 Sep - 31 Dec	
DESQUITH Etienne	Inst. de Rech. Mathématiques, Abidjan, Côte d'Ivoire	1 Sep - 31 Dec	
DOGUWA Sani Ibrahim	Ahmadu Bello Univ., Zaria, Nigeria	1 Jul - 31 Dec	
FREITAS Raphael	Univ. of Caen, France	1 Jan - 31 Dec	Algebraic topology.
GRAMCHEV Todor Vassilev	Bulgarian Acad. of Sciences, Sofia, Bulgaria	16 Apr - Jul	
HOANG Le-Minh	Hochiminh City Un.,Vietnam	13 Jan - 1 Dec	Complex differential geometry of vector bundles and their moduli spaces.
JI Min	Grad.Sch., Acad of Sc., China	1 Jan - 31 Dec	Analysis in manifold.
JIANG Mei-Yue	Peking Univ., Beijing, China	21 Feb - 31 Dec	Hamiltonian systems, symplectic geometry.
KATOK Anatole	CALTECH, Pasadena, USA	July - Sep	
KATOK Svetlana R.	Univ. of California, Santa Cruz, USA	July - Sep	
LOO Bonaventure	SUNY, Stony Brook, USA	1 Jan - 17 Nov	Geometry; topology.

contd.

Name	*Institute*	*Period of stay*	*Research topic at ICTP*
LOPEZ MORALES Martin	Acad. of Sc., Habana, Cuba	25 Jan - 24 May	Partial differential equations; neurophys.
LUBUMA Mbaro-Saman	Univ. de Kinshasa, Zaire	1 Jan - 31 Dec	Numerical functional analysis.
MAHDAVI-HEZAVEHI M.	Sharif Univ. of Technology, Tehran, Iran	1 Jan - 31 Dec	Valuation theory.
MUSHTAQ Qaiser	Quaid-i-Azam Univ., Islamabad, Pakistan	1 Jan - 31 Dec	
MUSINA Roberta	SISSA, Trieste, Italy	1 Jan - 31 Dec	Harmonic mappings between Riemannian manifolds.
NGUYEN Anh Huu	Ho Chi Minh Univ., Ho Chi Minh City, Vietnam	1 May - 27 Nov	
NGUYEN Xuan-Loc	Nat. Sc. for Sc. Res., Hanoi, Vietnam	1 Jun - 31 Aug	
OLMOS Carlos Enrique	Univ. de Cordoba, Argentina	1 Jan - 29 Dec	
PALOMINO DE ROSALES S.E.	Univ. Nacional de Ingeniería, Lima, Peru	7 Mar - 6 Nov	
RAHMAN Mohammad Shamsur	Jahanjirnagar Univ., Dhaka, Bangladesh	28 Mar - 27 Jun	Riemannian geometry.
SIDDIQI Abul Hasan	Aligarh Muslim Univ., India	Apr-Jun	
SIMANCA Santiago R.	SUNY, Stony Brook, USA	May-Jul	
VILA FREYER Ricardo F.	CIMAT, Guanajuato, Mexico	1 Jan - 30 Aug	Complex geometry.
YANG Lu	Acad. Sinica, Chengdu, China	October	
YIN Weiping	Univ. of Sc.&Tech., China	1 Jan - 19 Apr	Comparison theorem of Kobayashi metric and Bergman metric on class of Reinhardt domains.
Microprocessors Laboratory			
BEZZAM Ignatius Samuel A.	Centre for Development of Advanced Computing, Pune, India	1 Jan - 1 Oct	Astromag Project.
CARCIONE Laura Maria	Universidad de Buenos Aires, Argentina	12 Feb - 31 Oct	Structured design of real-time systems.
COLAVITA Alberto Antonio	Univ. de San Luis, Argentina	1 Jan - 1 Sep	
DAI Jialin	Shanghai Univ. of Sc.&Tech.,	1 Jan - 31 Dec	
DAI Jialin	Shanghai Univ. of Sc.&Tech., China	1 Jan - 31 Dec	
EGGARTER Pablo	Univ. Nacional de San Luis, Argentina	30 Jan - 30 Sep	Structured design of real-time systems.
NAIM Nader Louis	Ain Shams Univ., Cairo,Egypt	15 Jan - 31 Dec	VLSI design of ASICS.
ROSALES Cordova Cesar A.	Univ. Nacional de Ingeniería, Lima, Peru	1 Jan - 6 Nov	
SHAMIM Anwar Ahmed	Univ. College, Cardiff, UK	1 Jan - 31 Dec	VLSI design.
TRUJILLO VARGAS Jose M.	Univ. de Antioquia, Colombia	1 Jan - 11 Jul	
VENKATARAMAN Srinivasan	Centre for Dev. of Telematics, New Delhi, India	1 Jan - 6 Nov	
Plasma Physics			
SKARKA Vladimir	Phys.Inst., Beograd, Yugoslavia	4 Jan - 11 Dec 90	Plasma physics; statistical mechanics.

contd.

Name	*Institute*	*Period of stay*	*Research topic at ICTP*
Other Fields			
BHANTHUMNAVIN Vutthi	King Mongkut Inst. of Tech., Bangkok, Thailand	7 Feb - 12 Apr	Laser physics.
BORZI Carlos Humberto	IFLYSIB, La Plata, Argentina	1 Jan - 5 May	Biophysics: pattern formation — learning processes; Condensed Matter: reaction diffusion systems — soliton theory — computational methods; phase transitions of critical phenomena.
HUSAIN Md Sakhawat	Dhaka Univ., Bangladesh	28 Mar - 27 Jun	Solar energy.
JHA Lok Narayan	Tribhuvan Univ., Kathmandu, Nepal	25 Feb - 22 May	Computation of transport properties in plasma.
LIU Zhen-Yuan	Univ. of Sch&Tech., Hefei, China	5 Feb - 4 May	
ZHANG Caicheng	Astronomical Observatory, Beijing, China	1 Jan - 25 May	Solar physics.

Activities at ICTP in 1990

Winter college on high resolution spectroscopy	8 January - 2 February
Workshop on composite media and homogeneization theory	15 - 26 January
Second college on variational problems in analysis	29 January - 16 February
Training college on physics and characterization of lasers and optical fibres	5 February - 2 March
Workshop on reactor physics calculations for applications in nuclear technology	2 February - 16 March
Fourier optics and holography	6 - 9 March
Experimental workshop on high temperature superconductors and related materials (basic activities)	12 - 30 March
Workshop on group theory from a geometrical viewpoint	26 March - 6 April
Spring school on string theory and quantum gravity and workshop on string theory	23 April - 4 May
Spring college in condensed matter on: Physics of low-dimensional semiconductor structures	23 April - 15 June
College on recent developments and applications in mathematics and computer science	7 May - 1 June
First ICFA school on beam dynamics and engineering of synchrotron light sources	7 - 18 May
College on atmospheric boundary layer physics: I – "Modelling of the atmospheric flow fields" II – "Air pollution modelling for environmental impact assessment"	21 May - 15 June 21 May - 1 June 4 - 15 June
Miniworkshop on quantum chaos	4 June - 6 July
Adriatico Research Conference on Quantum chaos	5 - 8 June
Conference on lasers in chemistry	11 - 15 June
Trieste conference on topological methods in quantum field theory	11 - 15 June
Miniworkshop on strongly correlated electron systems	18 June - 27 July
Research workshop in condensed matter, atomic and molecular physics	18 June - 28 September
Summer school in high energy physics and cosmology	18 June - 28 July
Adriatico Research Conference on Quantum fluctuations in mesoscopic and macroscopic systems	3 - 6 July
Adriatico Research Conference on "Physics of strongly correlated systems"	10 - 13 July
Adriatico Research Conference on Defects in HCP crystals	14 - 17 August
6th Trieste IUPAP Semiconductor Symposium on "Hydrogen and semiconductors: Bulk and surface properties"	27 - 31 August
Working party on electrochemistry – Condensed matter aspects	27 August - 7 September
International conference on medical physics	3 - 7 September
College on medical physics	10 - 28 September
School on qualitative aspects and applications of nonlinear evolution equations	10 September - 5 October
College on neurophysics: "Neural correlates of behaviour, development, plasticity and memory"	1 - 19 October
College on "The design of real time control systems"	1 - 26 October
Workshop on atmospheric limited area modelling	15 October - 3 November
Third autumn course on mathematical ecology	29 October - 16 November
Workshop on earthquake sources and regional litospheric structures Third autumn course on mathematical ecology	29 October - 16 November
Workshop on earthquake sources and regional litospheric structures from seismic wave data	19 - 30 November
Experimental workshop on high-temperature superconductors and related materials (advanced activities)	26 November - 7 December

For information and applications to courses, kindly write to the Scientific Programme Office.

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EDITORIAL NOTE - *News from ICTP* is not an official document of the International Centre for Theoretical Physics. Its purpose is to keep scientists informed on past and future activities at the Centre and initiatives in their home countries. Suggestions and criticisms should be addressed to Dr. A.M. Hamende, Scientific Information Officer.