International Atomic Energy Agency

United Nations Educational, Scientific and Cultural Organization

International Centre for Theoretical Physics

News from ICTP

No. 50/51 September/October 1991

Dr. Hong Van Le, Viet Nam, receiving Ettore Majorana Prize from Professor Abdus Salam, Director, International Centre for Theoretical Physics (ICTP) and President, Third World Academy of Sciences (TWAS).

Contents

Ettore Majorana Prize Ceremony 1
DDG's Visit at the Centre 3
ICTP Prize 1992 4
Conferences and Lectures 4
Nobel Prize in Physics and Chemistry 4
Visits to ICTP 4
Scientific Exhibition 1991 5
International Prize "Primo Rovis" 1991 5
Higher Education and University-Science-Industry Cooperation in USSR: Time for Change 5
Activities at ICTP in September-October 1991 11
Calendar of Activities at ICTP in 1991-92 15

Ettore Majorana Prize Ceremony

Professor Abdus Salam, Director, International Centre for Theoretical Physics (ICTP) and President, Third Physics (ICTP) and President, Third World Academy of Sciences (TWAS), presented the Ettore Majorana Prize 1991 to Dr. Hong Van Le of the Institute of Mathematics, Hanoi, Viet Nam. The ceremony took place in the Main Building Lecture Hall of the ICTP, Trieste, on 12th September, 1991.

The 1991 ICTP Prize in honour of Ettore Majorana, in the fields of Mathematics, has been awarded to Dr. Hong Van Le of the Institute of Mathematics, Hanoi, Viet Nam, in recognition of her profound work on calibrations applied to the theory of minimal surfaces and Lagrangian submanifolds.

Dr. Hong Van Le graduated from the Department of Geometry and Topology, Moscow State University, in 1983 and received her Ph.D. at the same University received her Ph.D. at the same University in 1987.

The 1991 ICTP Prize honours Ettore Majorana. Born in Sicily in 1906, at the age of four he revealed the first signs of a gift for arithmetic. He studied physics at the School of Engineering of the University of Rome. He was nicknamed "the Grand Inquisitor" for his exceptionally penetrating capacity for scientific criticism. He received his doctorate in 1929 with a thesis on the mechanics of radioactive nuclei sponsored by Enrico Fermi.

His work consists of nine papers; six on problems of atomic and molecular physics; and three on nuclear physics or the properties of elementary particles. His major scientific contribution is found in his last three papers. *Sulla teoria dei nuclei* (1932) concerns the theory of light *nuclei* (1932) concerns the theory of light nuclei under the assumption that they consist solely of protons and neutrons that interact through exchange forces acting only on the space coordinates so that the alpha particle — rather than the deuteron — is shown to be, as it is, the system with greatest binding energy per nucleon. The essential work on this paper was completed in the spring of 1932, only two months after the appearance of J. Chadwick's letter to the editor of *Nature* announcing the discovery of the neutron. Fermi and his friends tried in vain to persuade Majorana to publish, but he did not consider his work good enough and even forbade Fermi to mention his results at an

international conference that was to take place in July 1932 in Paris. At the beginning of 1933, Fermi convinced Majorana to travel abroad, he first went to Leipzig, where Heisenberg persuaded him to publish his paper on nuclear forces. Majorana's last paper was written in 1937 on Fermi's urging, after years of not publishing because of poor health. It contains a symmetrical theory of the electron and the positron based on the Dirac equation but in which the states of negative energy are avoided and a neutral particle is identical to its antiparticle.

In November 1937, he was appointed Professor of theoretical physics at Naples, but soon discovered that his course was too advanced for most of his students.

In the evening of 25 March 1938, he boarded a steamer for Naples. Although he was seen at daybreak as the ship entered the Bay of Naples, no trace was ever found of him, despite an inquiry continued for several months and repeated appeals of his family published in the Italian press.

Majorana had an extraordinary gift for mathematics and exceptionally keen analytic mind. His way of attacking problems and especially his mathematical methods, showed that he was naturally in advance of his times and, in some cases, almost prophetic.

Dr. Hong Van Le read out her article about the development of mathematics in Viet Nam. The article is given as it is:

Dear Professor Abdus Salam, Dear Professor Sinai, Ladies and Gentlemen,

I am very happy to be here in the International Centre for Theoretical Physics. I would like to express my deep thank to Professor Abdus Salam, the founder and the Director of the Centre, and the Mathematics Section for hospitality, financial support and providing excellent working conditions. It is a great honour for me to receive the ICTP Prize named after Professor E. Majorana for 1991. Today on this occasion I would like to tell you about the development of mathematics in Viet Nam and how I became a mathematician.

The development of mathematics in Viet Nam really starts after Viet Nam became independent in 1945. Before this time, only elementary mathematics had been taught in a few Vietnamese secondary schools since the beginning of this century. Hanoi University which was founded just before the second world war with mostly French professors, had only undergraduate mathematics after 1940. Forty years ago, there was only one Vietnamese mathematician having a Ph.D. degree. His name was Le Van Thiem. He graduated from the famous French school Ecole Normale Supérieure and defended his thesis for the degree Docteur d'Etat with Professor Nevanlinna, one of the founder of modern analysis. After, he got a position at the university of Zurich. In 1948 he left a promising career in Europe to join the resistance movement in Viet Nam. He was one of the founders of an university in the jungle. In 1954 when peace came back to Viet Nam for few years, the door of Hanoi University opened again, but there was a lack of qualified scientists because all the French teachers left and there were not enough Vietnamese scholars. Professor Le Van Thiem alone gave lectures on all fields of modern mathematics. Remarkably he gave these lectures in Vietnamese, which was not used before in the university and high schools. Almost all the teachers who taught mathematics to my generation are his former students. In 1970, during the war against the American intervention, Prof. Le Van Thiem was the first director of the Hanoi Institute of Mathematics of the National Center for Scientific Research of Viet Nam. Under his guidance this institute became the centre of mathematics in the whole country. One can consider him as the founder of modern mathematics in Viet Nam.

In their efforts to raise the scientific modern mathematics in Viet Nam.

In their efforts to raise the scientific education level in Viet Nam, Prof. Le Van Thiem and scientists like him got a strong support from some politicians. One of them was the former Minister for Education Prof. Ta Quang Buu. He went to France in 1924. Like some Vietnamese students of that time, he believed that only science and modern technology could turn Viet Nam into a prosperous country. He studied many subjects such as mathematics, biology, mining engineering in various French and English universities. He came back to Viet Nam and became a secretary of president Ho Chi Minh. He was Deputy Minister of Defense during the war against the French colonizers and served as a general. In 1966 he was appointed Minister for Education. He was a great enthusiast of mathematics. Beside his duties he also gave mathematical lectures in Hanoi University and led some seminars on mathematical physics, logics and singularity theory. He founded the journal "Mathematics and Youth" *for popularizing mathematics in Viet Nam. Due to his idea, national mathematical olympiads have been organized and special schools for children gifted in mathematics have been opened throughout the country. Almost all mathematicians and physicists of my generation studied in these special schools, and some of them were encouraged and supported by his personal consideration and administrative means.*

Despite 30 years of wars and economic difficulties, mathematics in Viet Nam has developed fairly fast. Now in Viet Nam there are about two hundred mathematicians with Ph.D. or Dr.Sc. degrees. If you look at the present issue of "Mathematical Review" you would certainly find names of Vietnamese mathematicians and their contribution. The mathematical education under the university level is internationally recognized. Vietnamese children always get high prizes in International Mathematical Olympiads.

The achievement of Vietnamese mathematics is also due to the generous international solidarity. The Soviet Union and other former Eastern socialist countries have helped educating mathematicians for Viet Nam for many years. A few mathematicians who remained in the South after the end of the war got their high education in France, America and Germany. I know almost no Vietnamese mathematician who has not studied abroad. Many mathematicians from the Western countries such as A. Grothendieck, L. Schwartz, P. Cartier, P. Hilton have visited Viet Nam during the war. They have given lectures and donated mathematical journals and books. The only library in mathematics of Viet Nam has been mainly built on these materials. Some Vietnamese mathematicians living in developed countries such as F. Pham and Le Dung

Trang also directed Ph.D. theses in Hanoi. In the last years the International Centre for Theoretical Physics contributes to the development of mathematics in Viet Nam by supporting a large number of Vietnamese mathematicians in its activities.

Now I would like to add some words about myself. In my family my parents like mathematics very much and I inherited the love for mathematics from them. They encouraged me to take part in a competition for the special school for children gifted in mathematics. At the special school I discovered a wonderful world of mathematics. For this I decided to devote one half of the prize to my parents and the other half to the special school where I learnt to love mathematics. At the national Mathematical Olympiad of 1977 I received the third prize. What followed was typical for many Vietnamese mathematicians of my generation. I was sent to the Moscow State University to study mathematics. There in 1980 I met Professor Fomenko and he agreed to supervise my study on differential geometry. His personality and experiences have a great influence on my formation as a mathematician. Today I think of him with deep gratitude.

Once again, I would like to express my sincere thanks to Prof. Abdus Salam and the Mathematics Section of ICTP. Thank you very much for your attention.

♦

DDG's Visit at the Centre

Dr. Sueo Machi, Deputy Director General for Research and Isotopes of the IAEA, visited the Centre on 21 October 1991. Professor Abdus Salam, Director, International Centre for Theoretical Physics, Trieste, Italy, warmly received him and discussed with him the scientific activities of the ICTP and TWAS. After which, the Deputy Director Prof. L. Bertocchi described to him the various sectors of the activity of the ICTP. This was followed by a description of the scientific programmes by the Course Directors and Senior Scientists of the Centre and TWAS. At 11 a.m., he met with the Professional Staff of the ICTP and discussed the present administrative and financial position of the Centre.

In the 2nd half of the day, the DDG met the Staff in the Main Lecture Hall of the Centre and assured the Staff that he would look into the financial question and the general well-being of the Centre.

Next day the Deputy Director General visited the Superconductivity, Microprocessor and Laser laboratories and talked to the working scientists. Finally he visited the Library of the Centre and highly appreciated the collection of latest books and journals in various scientific fields.

Dr. Machi was born in Japan on January 15, 1934. He graduated from Shizuoka University, Japan, in 1957. He did his Master degree in chemical engineering from Kyoto University, Japan, in the year 1959.

He received his degree of Doctor of Engineering in 1967 at Kyoto University, Japan. Dr. Machi had been permanently working at Atomic Energy Research Institute (JAERI) in the Department of Radiation Chemistry as a Director General. He started as a Research Scientist (1963), Senior Scientist (1971), Head of the Section for Industrial Application and Chemistry and RCA Co-ordinator IAEA (1980), then he became Deputy Director, Office of Planning JAERI (1983). He was appointed as Director, Department of Research and RD in the Atomic Energy Research Establishment in 1986-1988.

Honors bestowed include: Award of Chemical Society of Japan (1968), the Award of Iwatsani Memorial 1989, and Award of Minister of Science and Technology, 1989, for invention and development of "Preparation of New Battery Separator Using Radiation Processing". This technology is used for commercial production of battery separators. Committee Member of Science and Technology Council of Japan in 1989, Dr. Machi is a Vice-Chairman, Japan Society of Radiation Chemistry, and Member of many professional societies in Japan.

He has published more than 100 scientific articles and 70 registered patents and many oral presentation of scientific conferences in Japan and overseas. ♦

Dr. Machi addressing the ICTP Staff.

ICTP Prize 1992

The International Centre for Theoretical Physics announces the institution of the following prize for the year 1992:

the 1992 Prize (in honour of Professor V.F. Weisskopf) in the field of High Energy Physics.

The prize will be awarded for outstanding and original contributions within the above field. Candidates for the prize must be nationals of developing countries, working and living in developing countries. Leaves of absences due to sabbaticals or studies abroad would not disqualify candidates. The prize will consist of the sum of US$ 1000, payable in US dollars or in local currency.

The winner of the prize will be selected by an International Committee, from among the most outstanding scientists in the above-mentioned field.

In order to be considered for the prize, a candidate must submit a review of his work and attach a brief curriculum, a list of publications and any relevant published work.

The age of the candidate must not exceed 40 years at the time the submission is made. Submissions for the prize must reach the ICTP before 30 May of the relevant year.

Submissions should be sent to: The ICTP Prize Committee, ICTP, P.O. Box 586, 34100 Trieste, Italy. ♦

Nobel Prize in Physics and Chemistry

The Nobel Prizes for Physics and Chemistry went to pioneers in the fields of liquid crystals and nuclear magnetic resonance spectroscopy. Professor Pierre-Gilles de Gennes of France and Professor Ernst of Switzerland won the Prizes for Physics and Chemistry for the year 1991.

Prof. de Gennes won the Physics Prize for his work in bringing order to disordered systems, including polymers and liquid crystals, and Prof. Richard Ernst won the Chemistry Prize for the development of Nuclear Magnetic Resonance (NMR) spectroscopy, a technique now used around the whole world.

Professor de Gennes, of the Superior School of Physics and Chemistry, Paris, made an analysis of disordered systems which has contributed to the development of liquid crystals displays in calculators, thermometers and television screens.

"Physicists often take pride in dealing with systems that are as simple and 'pure' as possible, but de Gennes' work has shown that even 'untidy' systems can be described in general terms", the Royal Swedish Academy of Sciences said in the citation. By doing so, he had found parallels between polymer molecules in solution which tend to form long spaghetti-like tangles, and the behaviour of superconductors. Similar mathematics could be used to explain both, laying the theoretical foundation for the practical application of liquid crystals.

Professor Gennes who is now 58, said that all his work was motivated by practicality. He would use the money to defend the School of Physics and Chemistry, which faced financial problems because of what was seen as its emphasis on fundamental work.

The 1991 Nobel Prize for Chemistry was awarded to Swiss Professor Richard Ernst for his work on Nuclear Magnetic Resonance (NMR) Spectroscopy, an instrumental technique now used around the whole world.

In its citation, the Swedish Royal Academy of Sciences said NMR Spectroscopy in the past 20 years has developed into *"perhaps the most important instrumental measuring technique within chemistry because of a dramatic increase in both the sensitivity and the resolution of the instruments, two areas in which Ernst has contributed more than anybody else"*.

Ernst, 58, born in the Northern Swiss town of Winterthur, has been a Professor, Polytechnic University, Eidgenossische Technische Hochschule, Zurich, since 1976. Before that, he worked as a research scientist at Varian Associates, in Palo Alto, California, between 1963 and 1968. ♦

Conferences and Lectures

Dr. Bonaventure Loo, post-doctoral student at the ICTP Mathematics Section, participated in the Workshop on Minimal Surfaces (Granada, Spain, 5-10 September 1991) and gave a talk entitled "On the compactification of the moduli of branched superminimal immersions of S^2 into S^4". ♦

Visits to ICTP

Chinese Delegation

A Chinese scientific delegation led by Professor Song Jian, a Member of the State Council of the People's Republic of China and Chairman of the State Science and Technology Commission of China, visited the Centre on 30 September 1991. The members of the delegation included professor Sun Honglie, Vice-President of the Chinese Academy of Sciences and Professor Zhang Cunhao, Chairman of the Chinese National Natural Science Foundation.

The delegation was warmly received by Professor Abdus Salam, Director of the International Centre for Theoretical Physics and President of the Third World Academy of Sciences. Professor Song Jian highly appreciated the outstanding contributions of Professor Salam to the development of Science and Technology in the Third World. Professor Salam, in turn, heartfully thanked the Chinese delegation for the support provided by China. Further collaboration between China and the ICTP and TWAS was discussed.

Ambassador of Viet Nam

Mr. Nguyên Viêt, Ambassador Extraordinary and Plenipotentiary of the S.R. of Viet Nam, visited the Centre on 2 October. ♦

Scientific Exhibition 1991

In recent years, Trieste as the City of Science has become even more active, with the launching of new initiatives at a very high scientific level, to add to its already rich array of achievements. The scientific academic and industrial world, both national and international, has its eye on Trieste, aware of the leading role it is playing in the development of both basic and applied research.

In October this year, the exhibition "ERA" took place in Trieste. Its aim was to promote a full and up-to-date picture of just exactly what is happening at the scientific institutions in Trieste.

Many scientific institutions including the International Centre for Theoretical Physics (ICTP) participated in this exhibition which was organized by Associazione Globo Trieste, for a period of one week.

The Unione Giornalisti Scientifici Italiani (UGIS, the union of Italian scientific journalists) is now 25 years old and the European Union of Science Journalists' Association (EUSJA) is 20 years old. Four days 24-27 October were dedicated to these unions to celebrate this. One activity was a visit of the EUSJA to the International Centre for Theoretical Physics (ICTP) and various scientific institutions in the city.

A refresher seminar of EUSJA journalists was held on Saturday, 26 October, at the Stazione Marittima for updating them in physics, biotechnology and environmental sciences, this was followed by a visit to ERA. ♦

International Prize "Primo Rovis" 1991

On the occasion of the Workshop of the European Union of Science Journalists' Association, the Trieste International Foundation for Scientific Progress and Freedom awarded the Primo Rovis Prize to a candidate who has notably contributed to the dissemination of scientific information and world of journalism.

The Prize instituted out of the generosity of businessman Primo Rovis and with US$ 20,000 per year is a token of the role which Trieste is playing in Italy and the world in the field of scientific culture.

The Prize Committee, presided over by Prof. Abdus Salam, Director, International Centre for Theoretical Physics (ICTP), and composed of representatives of international repute from local universities and research institutes, has awarded the Prize to Sergio Moraes Castanheira Brandão of Rio de Janeiro, Brazil, for his outstanding contribution towards journalism and dissemination of scientific information. ♦

Higher Education and University-Science-Industry Cooperation in USSR: Time for Change

by Yuri V. Novozhilov,
USSR Physical Society.

Introduction

Changes in the economy of the USSR have shown that the old soviet system of higher education (HE) and its relations with Science and Industry designed for a State-run economy is incompatible with the conditions demanded by a market economy. Moreover, *perestroika* and *glasnost* have made clearer the extent by which USSR is behind Western countries and Japan in developing high technologies and protecting the environment. Consequently, in 1987 the first attempts (1) were made to reform HE and to involve universities more actively in restructuring the country's economy. However, the reforms were not sufficiently far-reaching to assist the country's transition to a market economy.

Socio-economic changes have brought to life a decentralisation movement. The republics constituting the USSR proclaimed sovereign rights and demanded a redefinition of their status. The Russian Federal Republic has emerged as a separate entity with an independent Parliament and a decision-making Government, as a real force of the national Renaissance. It is thus natural that the first far-reaching draft Programme of a new system of HE was prepared by the State Committee for Science and Higher Education of the RFR (2). The scope of the proposed system is wider than that of the old one: it also includes Sciences and University-Industry cooperation with Continuing Education and Environmental issues playing a prominent role.

Certainly, there is not much scientific research in the RFR compared with the USSR (about 10%) because the Academy of Sciences and the many institutes for Applied Sciences and Engineering still belong to the central authorities of the USSR. However, many would agree that the main principles and features of this draft Programme deserve to be accepted by the central authorities as well as by all the republics.

In the implementation of any Policy for HE, Science and Technology, there should be a flexible mechanism responding to changing needs. The specificity of the situation is that the old mechanism of the State-run economy has already become obsolete while a market economy mechanism is not yet functioning. The long-term transition to a market economy will certainly not be rapid; there will be a lot of uncertainty and change. A

general recipe is known — as formulated by Alexander King (3):

"In situations of uncertainty, complexity and very rapid change, all contemporary characteristics, there would seem to be an urgent need to devise complementary mechanisms".

One could add an obvious condition that such mechanisms should be highly adaptable and stable against the fluctuations encountered during the transition. Of course, this mechanism cannot be established without the active participation of the West.

We believe that the mechanism in question is a special kind of the University-Science-Industry cooperation between East and West. Universities, research institutions and professional societies should have associated private enterprises in the field of Higher Education in Science and Technology. The objectives of cooperation should include not only R&D with technological innovations but also Education and Training in the broadest sense. The cooperation should develop and strengthen private enterprise in the field; it should be easily adaptable to the changing needs as long as the transition to the market economy is in process. It should teach engineers, scientists and managers how to work within the private sector at a given point of the transition path.

These considerations are those determining the content of the present paper. We shall review some changes in the Higher Education system related to Science and Technology and then discuss University-Science-Industry cooperation as an international venture.

Old system of higher education

Old system of higher education in the USSR

This is the system which was functioning before the *perestroika*. Socio-economic changes in the country showed that the old system should also be transformed. Let us summarise some deficiences of the old system.

(i) Over-centralisation

All universities and other institutions of higher education were run to a large extent by republican ministries or state committees for higher education. It was up to ministries to appoint rectors and to approve the budget and programmes. Ministerial instructions formalized almost every point of the university life. In particular, it was up to ministries and the State Planning Commission to determine the country's needs in higher education.

In fact, it meant:

(ii) Running universities in a formal manner without real recourse to societal needs.

Admission plans as well as the number of graduates with university diplomas were defined by ministries. It was assumed that these figures correspond to the country's needs, known in great detail, because the output plan distinguished rather narrow specializations. It was up to ministries to send to universities plans of "distribution" or lists of places where young specialists were supposed to work for a minimum of three years after graduation at the university.

Ministries used to approve the total number of teachers according to students/teachers ratio established for a given university. Ministries elaborated a standard curriculum for any given specialisation at the university. The list of specialisations for higher education was to be approved by central authorities also. Only some exceptional universities like the Moscow or Leningrad ones were exempt from obligation to teach according to the standard curriculum of Ministries.

One of the most strictly supervised topics in the curriculum was the teaching of social sciences. An exact set of social disciplines for physicists and engineers, economists and historians was always defined by ministries.

Ministries were supposed to choose [illegible]

Ministries were supposed to choose foreign universities as partners in scientific and educational cooperation. Officially, it was they who sent professors abroad under exchange programmes and to conferences.

(iii) Developing mass scale "free of charge" education and producing narrow educated professionals instead of educated citizens.

"Free of charge" education means no tuition fees. Stipends were rather low and depending on academic successes. However, because the number of teachers was tightly bound to the number of students, the expulsion of non-capable students led inevitably to the cut in teaching staff. Therefore, the students' mentality gradually developed a sense of invulnerability and, consequently, their average level of knowledge was steadily declining.

An old education tendency was more to fill students' brains with sets of various knowledge rather than to teach them how to develop their creative capacities and promote initiative. Little time had been left for thinking and self-education. Students' time had been completely taken by lectures, seminars and laboratories: 36 hours per week was an official workload of students in universities, which was usually surpassed. A considerable part of this time was taken by obligatory disciplines unrelated to their future speciality, such as military service, social disciplines, ateismus, as well as agricultural assistance to *kholkoses*. There were examination session twice a year with well-defined examinations for all the country.

The curriculum was designed in such a manner as to give narrow specialisation. Problems of culture, philosophy, history of modern civilisation were not discussed, and quite often, students graduated from their universities without any noticeable cultural gain. In general, teachers were overloaded with teaching duties. A yearly workload for professors was established up from 660 hours, while for a young teacher it could be more than 1000 hours. Universities produced specialists with the Masters' degree after 5,5 years of education, including the preparation of the diploma paper and state examinations.

(iv) Separation of higher education and examinations.

(iv) Separation of higher education and research

It is stipulated in teachers' duties that they should spend half of their time on research. In practice, it is a difficult task if a teacher had his/her official teaching workload. Formally, all teachers used to present to authorities satisfactory scientific reports. Formally, all teachers were accustomed to plan research many years in advance, although the usual practice was to put into the next year plan what had already been done.

Separation of education from research is also related to the fact that most research in fundamental sciences

is carried out at the institutions of the Academy of Sciences which gets special financing. Only a few universities were able to organise their own research institutes or adequate research groups. Funds for research at universities were always at a low level.

(v) Retraining and open forms of education were thought to be of the second priority.

The traditional system of higher education placed its main accent on full-time training and left-aside evening courses, retraining and open universities. Continuous education was proclaimed but the funds available for this purpose amounted to a small percentage of that for university education. Special faculties for retraining of engineers were established at some universities representing a link between universities and industry.

(vi) University-Industry co-operation was very weak.

Officially, universities could have contracts with industry, but teachers and researchers had no real economic motivation. With industry in a bad shape, even the bright ideas of university professors had no hope for successful application. In the framework of a State-directed economy, there was no room for personal initiative.

Changes in public perception of higher education

The public at large was taught by the press to be proud of the higher education system in the USSR. However, during the last four years of changes in economic and political structures, even the public at large became aware of its many deficiencies, especially as far as it concerned the quality of education and planification of university graduates according to disciplines.

For instance, the reshuffling of State enterprises and several ministries with subsequent reduction of personnel has shown that the majority of ministerial staff either got a too narrow special education or, with the development of private or semi-private enterprises, often had an education quite irrelevant for their professional activities. Almost half of the total engineering corps was not used according to their training. An old problem that an engineering diploma does not necessarily imply the possession of skills, appeared. When the first cooperative enterprises had been established, it became clear that skills were appreciated more than a formal diploma. Skillful technicians were in demand in preference to engineers with diplomas but with no practical experience. There were too many engineers in the country with too low qualifications and experience.

Developing new types of economical activities, people discovered an amazing need of lawyers, economists and modern managers as well as qualified technical services. The profession of lawyer was not very popular in the country, when laws had been followed sporadically and often in the interest of ruling groups of politicians. Formally, there were many economists but they were trained in traditions of centralised economy without real knowledge of the market mechanisms. The profession of manager in the Western sense was absent.

The quality of traditional system of HE was once more questioned when the necessity to know foreign languages was recognized. The inability of the old HE system to give the students a good knowledge of languages is only partly due to the insufficient number of qualified teachers, the main reason being an absence of motivation or a lack of possibilities to practical application. Learning foreign languages was imposed on students without the opportunity to use them. When contacts with foreign countries were permitted for the public at large, private language schools immediately appeared.

The brain drain phenomenon has also contributed to changing people's attitude towards HE. People learned before that it is not rewarding to work hard in the pursuit of excellence. They were happy with just obtaining their diploma and the Master's degree paying less attention to the quality of acquired knowledge and skills. A career in administration or simply surviving quietly seemed to many people more promising than an obstinate pursuit of excellence. Some people were even astonished to see how quality is appreciated in the Western countries, how the most qualified people were welcomed there.

The public insistence helped to reveal some real figures characterising the traditional system of HE. It appeared that almost 50% of people with higher education hold positions not related to their speciality. Moreover, 20% of people occupied positions where higher education was not required at all. There was an overproduction of engineers of rather low level of qualification, while there was a lack of engineers in high technology, like microelectronics. Together, education and retraining were able to meet only 25% of the real needs in qualified personnel with higher education. This figure reduces to 1% when it concerns retraining in high technology or training of lawyers and well-qualified economists and managers. Only within the Russian Federal Republic, it was necessary to build 20 million square meters of space for students' laboratories and spend around 20 billion rubles for their equipment.

The mismatch of traditional Higher Education to the real needs of the country was very serious. It was obvious that it could lead to disastrous consequences to the country. It became clear that such a system of HE could not support the transition to a competitive economy of the present world. Should market economy be installed, such a system of HE would lead to large-scale unemployment and a social explosion of instability. Moreover, even democratic transformations of the society would become uncertain in the atmosphere of legal and economic ignorance of the population aggravated by the hard historical heritage and the loss of working habits.

Towards a new system of higher education

The State Committee of the Russian Federal Republic was the first in the USSR to propose a project for a new system of higher education which would hopefully avoid the deficiencies mentioned in the previous section. It is based on the following six principles:

– Self-development understood as decentralisation and democratisation of management and university autonomy

– Quality
understood as ensuring high quality of educational programmes important for society and people
– Diversity
understood as multitude of educational forms and degrees
– Unity
expressing integration of different educational levels within the framework of continuing lifelong education
– Effectiveness
understood as satisfying regional and republican needs in highly qualified personnel with minimal expenses
– Equality
as equal opportunities for everyone to obtain education and the realisation of constitutional rights and freedom in the field of HE.

Some changes previewed by the project have already been made or are under preparation. Universities got some autonomy. They can now establish themselves admission plans and elaborate their own curricula and programmes. The students/teachers ratio has been abolished as a criterion for fixing the number of teaching staff. Some universities are experimenting the two-degree system, instead of the traditional one-degree system.

Speaking about the quality of HE it is assumed usually that the notion of quality describes the level of satisfaction the country's needs by HE. Now that the needs and priorities are no more given from above by an order, the notion of quality can be given a detailed meaning only after needs are quantified and priorities are transcribed into educational goals. Of course, there exists a certain international standard of quality or "academic excellence", in Science and Teaching independent of particular country and invariant under the redefinition of societal needs that is usually applied to describe the academic level of a given university. In order to start the movement to excellence, it has been suggested in the Russian Federation that the best universities like the Leningrad State University, together with the scientific community will make an "attestation" of all institutions of higher education, classifying them according to their academic level.

It is proposed to increase drastically, beginning from 1991, the admission to faculties of Law, Economics, Psychology, Business Administration and new technologies, such as Biotechnology, Microelectronics, Informatics, Environmental Engineering, with the aim to increasing — by the year 2000 — the number of graduates in these disciplines up to 60-70% of the total number.

Universities as main centres for Education, Science and Culture

This idea is gaining support of not only educators but also politicians. The project for a new system of HE in the Russian Federation proposes to give a new place to universities and other institutions of HE in the life of the Republic by associating together university research institutes for R&D and cultural institutions as well as centres for continuing education and some high schools. It is also proposed to give universities, in addition to the academic autonomy, a type of the commercial freedom and promote commercial activities by exempting them from tax duties. University buildings and land, equipment and scientific appliances are now the property of the universities.

A specific feature of the Russian Federal Republic is that the USSR Academy of Sciences — as the main research organisation — is outside the jurisdiction of the Republic. Therefore, the emphasis given to universities is not only the most reasonable but also the only possible way for developing Education, Science and Culture in the Republic. Another new feature is the attention paid to the improvement of high school teaching and talent search as well as to the establishment of closer links of schools with HE. For instance, the Leningrad State University has its own boarding high school 'Academic Gymnasium' for talented children and supervises teaching in more than 10 high schools in Leningrad.

When estimating the expenses necessary for transition to the new system of HE, it is easy to conclude that governmental resources are far vastly insufficient to raise expenditure on HE from 5.5% of the GNP in 1987 to 10-12% of GNP as in Europe and the USA. The decrease of GNP and the instability of economy in the USSR, together with the unreasonably high commercial rate of US dollar ($1 = 27 rubles) make the comparison of education expenses quite shocking: $200 per capita in USA and 30 rubles in USSR.

A proposal is being considered that limited State resources of the Russian Federation are concentrated on several most important directions in a group of 100 more advanced universities and institutes of HE, out of a total number of 495. It appears now that the only realistic solution for universities to ascertain their development is to earn additional money themselves.

Moving to a new Education, Science and Technology Policy

The new system of HE requires a new Education, Science and Technology Policy (ESTP) devised for a transitional period of about 10 years from State-run to market economy. The success of ESTP depends crucially on whether a mechanism of automatic conciliation "needs-priorities-actions" could be formulated on the basis of juridically strictly respected equal opportunities and real possibilities for every citizen to launch initiative projects and to obtain high quality university education.

In the new situation, society and economy needs would not be defined by decree of authorities without thorough study, but only after a professional quantification of the needs is done. Therefore, the structures responsible for quantification, like centres for demographic analysis, statistical data and technological assessment should learn how to work objectively. Universities should be able to transform priorities into goals.

It is possible that such a mechanism of automatic conciliation specific for market economy would not work before many years. However, at present, needs are immense and money is rare. One could start with satisfying the most urgent needs, in particular, by designing policy for developing high technologies, with the University-Industry Cooperation as a major element.

The importance of high technologies is well recognised everywhere. It is fundamental sciences and universities which are usually the starting point for the innovation process. Certainly, conventional

technologies are also in high demand; here, applied sciences and technical universities are usually at the origin of innovation. The connection between sciences and innovation was rather well investigated theoretically in the case of state-directed economy. Practically, this connection was ineffective due to ministerial bureaucracy and the lack of economic incentives. Now, the task is to build up such a connection — or rather process — leading to innovation in the case of premarket economy with smooth limiting transition towards a fully competitive economy.

In order to promote the University-Industry Cooperation, the Commercial Bank for Science, Technology and Development will be established by the end of 1991. Technoparks and technopolies, as centres integrating Science and Technology, are already arising in some regions.

Importance of U(E) – I(W) cooperation

In view of the imminent integration of USSR into the world system of competitive economy, one can ask what kind of University-Industry cooperation for innovation may be chosen now as the most promising one for the years to come. We want to present arguments in favour of an answer that it is a cooperation of university type research and training in the East, as represented by universities, professional societies and associated private enterprises, with industry in the West, or, briefly, the U(E)–I(W) cooperation. We underline the word private because it is the key to the idea.

University type research in many universities and research institutions is on a quite high level, comparable with that in Western universities. There are many well equipped laboratories and many bright scientists despite the brain drain phenomenon. They are able to develop new technologies and progress up to a stage of a prototype. However, industry is rather old-fashioned and services are not satisfactory if to compare them with Western industry and services. It is difficult for the industry to follow the scientific development; for universities, there is no necessary technological support from the industry. Therefore, even a prototype technology may lack modern electronics, etc.

In addition, there are many bureaucratic constraints for State-run enterprises and also there existed parasitic tendencies in industrial ministries. As a consequence, scientists were not so much interested in implementing their research results when supervising ministries or other bureaucratic structures are involved. What is needed is the reorganisation of industry with the privatisation of many branches — that could be a long process.

The peculiarity of the situation is that the country has spent a lot of efforts to create a community of highly qualified scientists and engineers — as many as some ten thousands of Doctors of Physics, Chemistry, Engineering, Biology — and all this only in order not to use properly their knowledge and experience due to poorly designed economic relations.

Socio-economic changes in the country gave a great momentum to those people who wished to contribute to the transformation of society. A variety of public organisations appeared in all fields of human activity.

To public organisations in the USSR relevant to technological innovation belong first of all the professional societies (e.g. the Physical Society — which was reinstated after more than 50 years of suspension —, the Chemical Society). Such societies would play an increasingly important role providing independent expertise and direct line of cooperation with foreign societies and scientists thereby avoiding bureaucratic structures. The societies themselves are non-profit organisations but they can establish private or semi-private commercial firms to promote science, technology and related services. Activities of some societies in this direction are exempt from taxation. Flexibility, absence of official bureaucratic intervention into business affairs are specific features of these new structures attracting active scientists and engineers. Possibilities to work directly on the innovation scheme within the framework established by themselves as well as to apply research results without adding co-authors from bureaucracy will bring to such new structures the most creative layer of the scientific and engineering community. It is these private enterprises already created, or to be created, around universities and professional societies that could become a nucleus of the private sector in S&T and R&D. Needless to say that this way would correspond to the aspirations of the S&T community and allow individual scientists and engineers to start their own enterprises. This way has its own stability in the sense that once started with some degree of success, it will bring in more and more people.

Up to now, we assumed implicitly that the West would be willing to collaborate. However, it is not so evident if one remembers that industrial enterprises in the West are supposed, first of all, to make profit but not to indulge into philantropic activities. In fact, the collaboration with the newly emerging S&T private sector in the USSR would mean not only joint work on technological innovation, but also joint research and a lot of training and retraining in high technology and management. In order to be in the right way, such collaboration should develop and strengthen the private S&T sector.

The question is: who would pay additional expenses? Who will realise that in the long-run the profit is assured and will organise the collaboration in such a way that the private S&T sector in the USSR could develop rapidly while the industrial enterprises in the West do not feel that they are losing?

One can understand from declarations of authorities of the Russian Federal Republic that the problem of the private sector development is of the first priority. The State Committee for Science and Higher Education of RFR is ready to support all necessary organisational matters. However, the know-how for business development and the mechanisms of technological innovation within the market economy exist in the West.

Looking for U(E) – I(W) model of cooperation

Now that there are some prerequisites for the East-West University-Industry cooperation, one should understand how it can attain the objective:

to develop collaboration between private S&T enterprises associated with

universities and professional societies in the the East and the R&D sector and industries in the West, in view of the technology transfer and innovation in such a way as to facilitate the creation and strengthening of the private sector in the East.

The task is to devise a U(E)-I(W) model of cooperation with the usual basic elements, including fundamental sciences and engineering, applied sciences, technology and marketing as well as links quite specific for the model. In addition, one should take into account a complex socio-cultural atmosphere of the transitional pre-market period in the East where legal basis for business is still under consideration by authorities and business relations are largely unknown.

For example, when estimating prospects for developing commercial activities, one should keep in mind that the sense of responsibility is rather low, obligations are not kept, people were not trained to express themselves briefly and logically. One could trace sources of such attitude to times when officials were giving orders, while factory directors were responsible for results. With little personal motivation, people got accustomed not to show their best. Of course, with personal ambitions in Science and Teaching, so characteristic of the academic world, universities have avoided such an atmosphere to a large extent. This consideration once more distinguish U(E)-I(W) cooperation as a promising venture.

Models of technological innovation had been formulated as a result of analytical studies of many cases. No experience in the U(E)-I(W) cooperation for innovation is known at present as far as non-governmental organisations in the East are concerned. Therefore, the only possibility to move forward not in the dark is to promote such experiments in this field which would help devise a realistic U(E)-I(W) model. Perhaps, these experiments would show that there is a variety of models or, that the model strongly depends on local conditions. In fact, it is conceivable that a way to technological innovation starting from science in Leningrad as a special economic zone is quite different from a way which starts from science in the Ural.

The delicacy of the problem can easily be understood when one remembers that industrial firms are rather reluctant to disclose their investigations and hide commercial and technological secrets. Here, a real flexibility is needed.

Thus, every particular collaboration has its own constraints related to commercial secrets, or, in a wider sense, to competitiveness. Hopefully, these constraints can be subdivided in a few classes so that one can have a limited number of models. In fact, the presence of constraints is usual for the European Community (6).

To summarise, the U(E) – I(W) collaboration should be conceived as a composition of three components. The first one is the collaboration between enterprises. The second component involves governmental or intergovernmental authorities, which provide training and different ways of supporting the private S&T sector in the USSR. In particular, they might decide that, instead of expanding such a private sector with the creation of jobs, it would be better to have people go to the West. The third component deals with the constraints of the collaboration.

Conclusion

Higher Education and University Science-Industry cooperation in the USSR are under transformations induced by socio-economic changes leading to market economy. The necessity of such transformations are well recognised by authorities and S&T community. In the present situation, the University-Science-Industry collaboration seems to be the most promising factor which could help to establish and develop the private S&T sector in the country. An active participation of Western universities and industrial firms is essential in order to bring in their best experience and know-how. The mechanism of collaboration between private S&T sector in the USSR and Western partners should be thoroughly studied.

References

(1) See for example E.Mc. Sweegan, "Soviets seek university-industry link", *The Scientist*, November 30, 1987, page 4.

(2) Draft Programme *Development of Higher Education in the Russian Federation Republic*, 1991.

(3) A. King, "The great transition revisited", *Science and Public Policy*, 18, N1, February 1991, pages 15-22.

(4) Yu.V. Novozhilov, "University-industry cooperation in Eastern Europe", *Industry & Higher Education*, September 1990, pages 163-169.

(5) J.P. Klus, "Continuing education: the only way to survive", *Int. Continuing Engineering Education*, 1, N1, pages 3-9.

(6) G. Ford and G. Lake, "Evolution of European science and technology policy", *Science and Public Policy*, 18, N1, February 1991, pages 38-50.

♦

Life of Prof. Yuri V. Novozhilov

Prof. Yuri V. Novozhilov was born in 1924 in Leningrad and graduated there at the Polytechnical Institute in 1947. In 1949 he started working with V.A. Fock at the Department of Theoretical Physics of the same University. From assistant he became associate professor and then professor in 1960. During these years, he taught electrodynamics and quantum mechanics through lectures and seminars. Since 1960 he has been professor of particle and nuclear theory and has taught quantum field theory and particle physics.

In 1966-67 he was UNESCO consultant to centres for advanced studies in Indian universities. From 1973 to 1981 he was Director of the Department of Scientific and Technological Development at UNESCO, Paris, and subsequently Deputy-Assistant Director General in the framework of the programme which included contributions to ICTP, the International Council of Scientific Unions and projects in 52 developing countries.

After his return in 1981 to the University of Leningrad, he was appointed Head of the Department of Theoretical Physics and Professor in high energy and particle theory, and then also Chairman of the Committee for University Education. Since 1989 he has been Vice-President and Chairman of the Executive Board of the USSR Physical Society.

His works in English include the following titles: Method of Functionals in Quantum Field Theory (1961), written with A.V. Tulub; Elementary Particles (1961); Introduction into Elementary Particles Theory (1975); and Electrodynamics (University lecture course, 1981, in collaboration with Yu.A. Yappa).

His research interests include composite electroweak bosons and induced gravity. ♦

Activities at ICTP September-October 1991

Title: RESEARCH WORKSHOP IN CONDENSED MATTER, ATOMIC AND MOLECULAR PHYSICS, 17 June – 27 September.

Organizers: Professors P.N. Butcher (University of Warwick, UK), H. Cerdeira (Universidade Estadual de Campinas, Brazil, and ICTP, Trieste, Italy), F. Garcia-Moliner (Instituto de Ciencias Materiales, Madrid, Spain), I.M. Khalatnikov (Landau Institute for Theoretical Physics, Moscow, USSR), S. Lundqvist (Chalmers University of Technology, Göteborg, Sweden), Chi Wei Lung (Institute of Metal Research, Academia Sinica, Shenyang, P.R. China), N.H. March (University of Oxford, UK), E. Tosatti (International School for Advanced Studies, SISSA, and ICTP, Trieste, Italy), M.P. Tosi (University of Trieste and ICTP, Trieste, Italy) and Yu Lu (Academia Sinica, Beijing, P.R. China, and ICTP, Trieste, Italy).

Plenary Seminars: Phase transition in graphite intercalation compounds: a CESR study. Multifractal analysis of the morphology of real systems (polymer alloys and thin films). Quantum electrodynamics in condensed matter. Order parameter kinetics in structural phase transitions. Chaos-like oscillatory behaviour in generalized shift map. Electronic structure of disordered alloys. The driven lattice gas: surprises far from equilibrium. Theory of the depinning transition in charge density waves. Pauli potential, Pauli energy and their consequences for density-functional theory. Computer simulation of protein structure and interactions. Disordered alloy model for copper oxide superconductors. Wigner electron crystals with and without magnetic fields. Thermal effects in the phase coherence of high-temperature superconductors. Exciton and soliton in solids — mechanism of the energy and electron transport in molecules by solitons. Bisoliton model high-temperature superconductivity. Qualitative cosmology. Electromagnetic fields in the vicinity of a molecule and intermolecular interactions. Nonlinear electromagnetic phenomena at surfaces. Nonlinear interaction of surface waves in superfluid liquid helium. Dressed atoms and quantum measurements. The confined electron gas in a quantum well. Scaling theory of localization in quantum chaos. The recent study of fluctuation phenomena in layered superconductors. Heavy and light hole mixing in quantum well systems. Anyons in the fractional quantum Hall effect. Impure spin systems: phase diagram and damage spreading. New forms of carbon. Structure and properties of nanocrystalline materials. Recent development of internal friction study on point defect-dislocation interaction. Quantum percolation. Uncertainty principle in symmetry broken systems. Two chain infinite U Hubbard problems. Some important inverse problems in condensed matter physics and Möbius transform.

Working Group Seminars: Fractography of embrittled copper bicrystal by means of reflection electron microscopy. Cyclic creep and creep-fatigue interaction in a nickel base alloy. Transition strengths in superlattices under in-plane magnetic field. Geometry and energetics of dislocations in grain boundaries in quasicrystals. Ab-initio molecular dynamics simulation of liquid NaSn alloy. Critical phenomena in co-operative Raman scattering. Integrability of classical isotropic biquadratic Heisenberg spin chain. Transmission of waves through random layered systems. Magnetoconductance of mesoscopic rings in the tight-binding approach. The influence of mechanical properties on the machinability of low alloy case hardening steel. Rigorous inequalities in density functional theory. Resonant magneto-optical spin transitions in zinc-blende and Wurtzite semiconductors. Quasi 2D systems. The role of dissipation in quantum Hall voltage profiles. Impurity band hopping Hall mobility in semiconductors at low temperatures. Occupancy correlation corrections to the d.c. conductivity of hopping systems. Envelope function investigation of magneto-optics in lead salt superlattices. Wetting transition and adhesion. First principles studies of surface reconstruction in metals and semiconductors. Reentrant behaviour and thermal hysteresis effects at the CDW transition in the presence of impurities. Localization and hopping conductivity in quasi-one-dimensional metals. Photoluminescence spectrum of a semiparabolic quantum well. Interplay between disorder and $2k_F$-quasi-regularity in quasi-1D CDW systems. Wetting transition and adhesion. Parameter-free exchange potential for ground and excited states in the density functional theory. Channeling and channeling radiation in semiconductor superlattices. Anisotropy of two-photon absorption in cubic direct-gap semiconductors. On the enhanced exchange energy of some axial gauge parent states of the 2D EG in a magnetic field. Landau level and cyclotron resonance broadening in 2D systems. Creep collapse of tubes made from $NiCr_{22}Co_{12}Mo$ at 950°C and external pressure. Mechanical properties of Pb-Sb metallic alloys. Thermodynamics, structure and resistivity in liquid metals — a brief overview. Improved spin wave theory. An application to 2D antiferromagnetic Heisenberg model. Shallow impurity states in GaAs-(Ga,Al)As quantum well wires and related optical phenomena. Optical phonons in 1D quantum well wires. Electron fluctuations and suppression of current noise under classical size effects. Möbius transform and its applications in solid state physics. Photoconductive response of semi-conductor epitaxial layers. Atomic defect formation at high-temperatures studied by positron life-time spectroscopy. Thermal lattice gas cellular automata fluids. Dielectric constant of dipolar liquids. Structure and stability of metallic glasses near glass transition. A study on surface plasmon-polariton method for the determination of ε_2 & H of thin metal films. Extended Hubbard model in two dimensions. Quasiperiodicity and magnetic phase transition of the one-dimensional aperiodic systems with any substitution rules. Resonant magnetic fields of a magnetopolaron bound to a Coulomb impurity in a GaAs-$Ga_{1-x}Al_xAs$ quantum well. Finite-size scaling and quantum fluctuations (an exactly solvable model).

Miniworkshop on "Quantum and classical many-body theory in condensed matter physics", 22 July – 2 August.

Lectures: Metals as a many-body problem. Weak coupling theory of the Hubbard model. Properties of one-dimensional interacting electrons. Dynamical electron correlations in the

dielectric response of the electron-gas. Thermal effects in the phase coherence of high-temperature superconductors. Strong electron correlations from the many-body theory point of view. Charged bosons in two dimensions. Liquids for the high T_c superconductors. Introduction to the Heisenberg model. Baym-Kadanoff techniques in condensed matter physics. Moment distribution anomaly in the Luttinger-Tomonaga model. Current density functional theory for electronic systems in strong magnetic fields. Exciton and soliton in solids — mechanism of the energy and electron transport in molecules by solitons. Bisoliton model high-temperature superconductivity. Electron-electron effects in simple metals. Quasiparticle properties in normal Fermi liquids. Density functional theory of freezing for superfluid He-4. Introduction to colloidal systems. Qualitative cosmology. Introduction to mode-coupling theory. Nuclear spin relaxation due to a two-dimensional electron-gas. Static response of superfluid He-4 and 2D electrons from QMC. Electromagnetic fields in the vicinity of a molecule and intermolecular interactions. Tracer diffusion in simple liquids. Diffusion in liquids. Perturbation theory of the Anderson model. Density functional approach to phonon dispersion relations and elastic constants of high temperature crystals. Phonons in the Tomonaga-Luttinger model: a fermion approach. Nonlinear electromagnetic phenomena at surfaces.

Topical Discussion Groups: Current understanding of plasma excitations in metals. Van der Waals interactions in electronic systems.

interactions in electronic systems.

The Workshop was attended by 278 lecturers and participants (202 from developing countries).

Title: WORKING PARTY ON SURFACE PHASE TRANSITIONS, 2 – 13 September.

Organizers: Professors A. Levi (International School for Advanced Studies, SISSA, and ICTP, Trieste, Italy) and J. Villain (Centre d'études nucleaires de Grenoble, France).

Lectures: Theory of equilibrium and growth shapes of crystals. Growth modes and models. Experimental methods of surface physics. Interfaces, walls and critical endpoints (introductory background). Microscopic bases of surface physics. Wetting. Deconstruction of Au(110). Rutherford back-scattering. Interfaces, walls and critical endpoints. Transitions in adsorbed submonolayers. Equilibrium and growth shapes. surface melting. Growth and ordering of Cu on Cu. Simple growth models. A tutorial renormalization group. Steps on the Si(100) surfaces. Critical properties of surfaces. Interfaces, walls and critical endpoints. Wetting dynamics. Interactions of lipid membranes. Step wandering. Walls, steps and frozen surface disorder. TEAS studies of Pb submonolayer on Cu(110). Surface electronic structure. Incommensurate magnetic ordering at surfaces. Spectroscopy of adsorbates. Terrace sizes in MBE. Structure and stability of clusters. Kinetic roughening by power-law noise. Growth of Hg and Pb on Cu. Quantum adsorbates. The surface of a hot crystal. Spectroscopy of adsorbates. Surface diffusion in quasi-one-dimensional adsorption systems. Ultrahigh vacuum microscopy (with video). Percolation in 2D superconductors. Surface electronic structure. New phenomena in quantum films. Deconstruction and roughening of Au(110): a Monte Carlo study. Kinetic roughness of vicinals. The (III) surface of Ge: a Car-Parrinello study of the 1x1 → 2x1 transformation. Elasticity-mediated interaction. Reactivity of clusters.

The Working Party was attended by 45 lecturers and participants (5 from developing countries).

Title: ADRIATICO RESEARCH

Title: ADRIATICO RESEARCH CONFERENCE "PATH INTEGRATION AND ITS APPLICATIONS", 3 – 6 September.

Organizing Committee: Professors S. Lundqvist (Chairperson; Chalmers University of Technology, Göteborg, Sweden, and ICTP), H. Cerdeira (Co-chairperson; Universidad Estadual de Campinas, UNICAMP, Campinas, Brazil, and ICTP), A. Levi (International School for Advanced Studies, SISSA, and ICTP, Trieste, Italy), E. Tosatti (International School for Advanced Studies, ISAS-SISSA, Trieste, Italy, and ICTP), M. Tosi (University of Trieste and ICTP) and Yu Lu (Academia Sinica, Beijing, P.R. China, and ICTP).

Directors: Professors D. Mugnai (Istituto di ricerca sulle onde elettromagnetiche, IROE–CNR, Florence, Italy), A. Ranfagni (IROE–CNR, Florence, Italy), V. Sayakanit (Chulalongkorn University, Bangkok, Thailand) and L.S. Schulman (Clarkson University, Potsdam, USA).

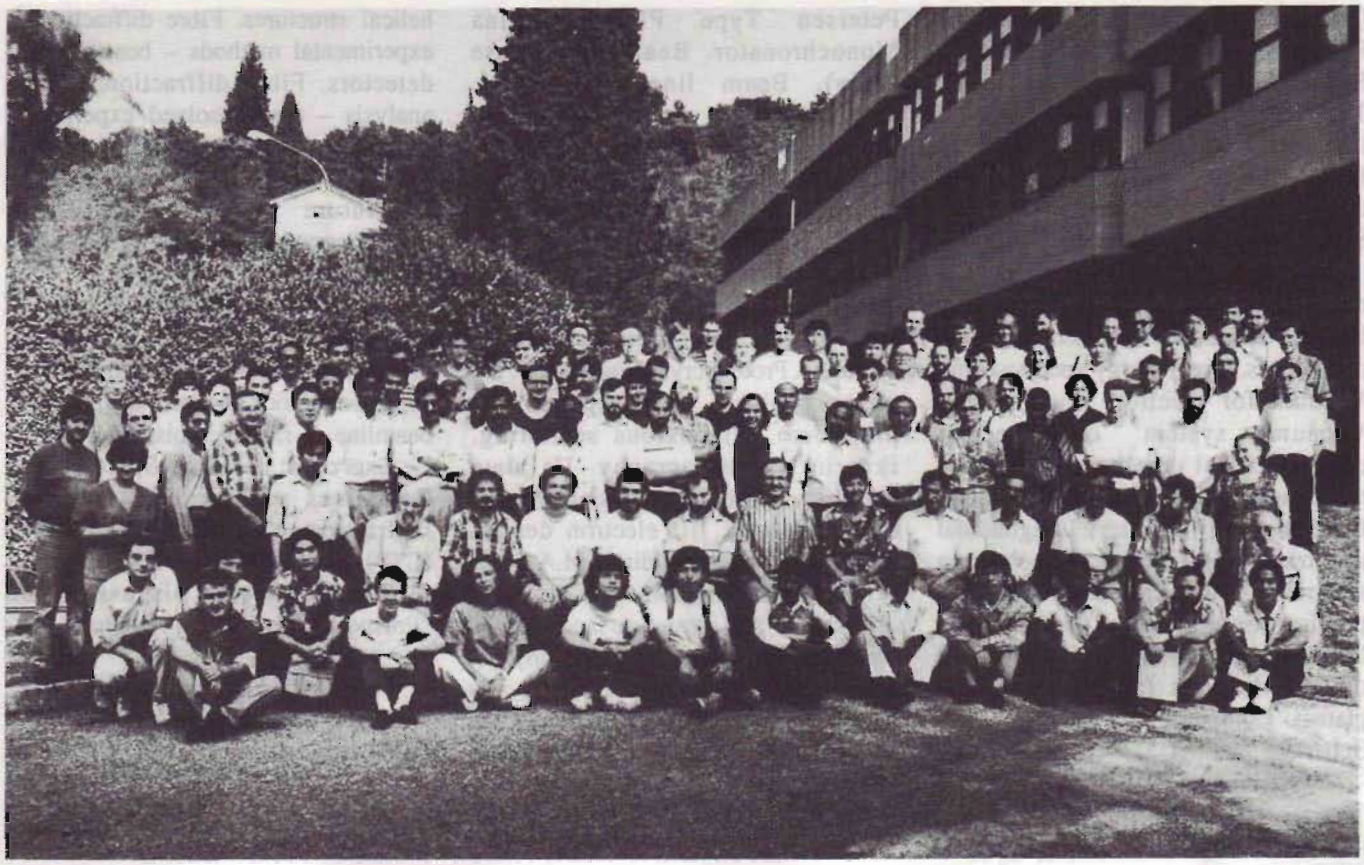
Co-sponsorship of the Commission of the European Communities, International School for Advanced Studies (SISSA, Trieste, Italy) and Fondazione IBM Italia.

Lectures: Two-time localization and relativistic path integrals. Stochastic processes on fibre bundles: their uses in path integration. Results of path integral simulations of superfluid ^{4}He and simple Coulombic systems. Gribov copies and the fundamental modular domain. Path integral approach to tunnelling times and complex-valued interaction times. Tunnelling time in the potential steps: an asymptotic analysis. Path integral approach to electrodynamic and gravitational anyons. Solution of the problem with the Feynman-Jenses variational principle with a magnetic field: application to polarons. Optical propagators in vector and spinor theories by path integral formalism. Reaction rate for certain noise induce transitions. The functional integral description of electron-phonon interaction in molecules. Quantum tunnelling fluctuations in anharmonic potentials. Path integral for the Wigner distribution. Quantum coherence of hydrogen tunnelling in metals. Tunnelling in waveguides. Path integral solution of the telegrapher equation. Irreversible quantum hydrodynamics from kinetic theory. Remarks on path integrals in quantum hydrodynamics from kinetic theory. Remarks on path integrals in supersymmetric quantum mechanics. Periodic orbit theory and quantum-classical correspondence. The question of the tunnelling time duration: some contributions to its determination. An improved ground state energy of the polaron. Random path formulation of quantum mechanics.

The Conference was attended by 90 lecturers and participants (47 from developing countries).

Title: SCHOOL ON DYNAMICAL SYSTEMS, 9 – 27 September.

Organizers: Professors J. Palis



School on dynamical systems, 9 – 27 September.

(Instituto de Matemática Pura e Aplicada, IMPA, Rio de Janeiro, Brazil), Ya. Sinai (Landau Institute for Theoretical Physics, Moscow, USSR) and E.C. Zeeman (Hertford College, Oxford, UK).

Lectures: Dynamics of Darwinian evolution. Dynamics of complex flows. Hyperbolic dynamics. Homoclinic bifurcations and sensitive-chaotic dynamics. Analytic differential equations. Introduction to Lagrangian variational methods. Universality and renormalization. Ergodic theory. Hyperbolic dynamics — examples. Dynamical systems: Hamiltonian systems. Iterates of polynomial maps: topology of the Julia set.

The School was attended by 182 lecturers and participants (113 from developing countries).

Title: TRIESTE CONFERENCE ON RECENT DEVELOPMENTS IN THE PHENOMENOLOGY OF PARTICLE PHYSICS, 23 – 27 September.

Organizers: Professors G. Altarelli (CERN, Geneva, Switzerland), J. Ellis California, Los Angeles, USA).

Lectures: The quark-gluon plasma. Theory of rare B-decays. Status of QCD on the lattice. Chiral effective Lagrangians: recent developments and perspectives. Testing CP and CPT violation in K and B decays. Weak decays beyond leading logarithms. Baryon and lepton number violation. Dark matter. Heavy quark physics at LEP. Precision tests of the electroweak theory at LEP. Higgs and other particle searches at LEP. Tests of QCD at LEP. Towards a model independent analysis of precision electroweak data. Recent issues in phenomenological supersymmetry. Polarised deep inelastic processes. Perturbative QCD. Present and future limits on extended gauge models. Recent results on weak t, c, and b decays. CP violation and rare kaon decays. The SLAC B-factory project. Physics programme at a Phi factory. Physics at HERA. Highlights in neutrino physics.

The Conference was attended by 89 lecturers and participants (22 from developing countries).

Title: WORKSHOP ON STOCHASTIC AND DETERMINISTIC MODELS, 7 – 11 October.

Organizers: Professors F. Chersi, S. Invernizzi and A. Wedlin (University of Trieste, Italy).

Lectures: Deterministic dynamical models. Stochastic dynamical models with continuous parameter. Econometrics of continuous models. Elements of stochastic processes. Econometrics of continuous models. Elements of stochastic processes. Econometric model analysis within system theory. Stochastic dynamical models with discrete parameter. Optimal stochastic control in economic models. Complex dynamics. Rational expectations economic models.

The Workshop was attended by 29 lecturers and participants (7 from developing countries).

Title: SCHOOL ON "USE OF SYNCHROTRON RADIATION IN SCIENCE AND TECHNOLOGY", 14 October – 8 November.

Organizers: Professors A. Craievich

(National Laboratory for Synchrotron Radiation, Campinas, Brazil) and R. Rosei (Sincrotrone Trieste S.p.A., Trieste, Italy), with the cooperation of the International Centre for Science and High Technology (ICS, Trieste, Italy), the Sincrotrone Trieste and the European Synchrotron Radiation Society (ESRS).

Lectures: Elettra: progress report. A report from Beijing facilities. Interaction between radiation and matter. Overview of SR uses. High energy spectroscopy. Vacuum for electron storage ring. Vacuum system optimization: computational methods. Electromagnetic radiation. Transverse focusing. Electron-energy analyzers. Longitudinal and transverse focusing. Synchrotron integrals. Facility case study. Machine physics (insertion devices 1 and 2). Beam lines (general and hard X-rays). Special optical elements (multilayers, zone plates). Comparison: Rowland Circle Spherical Gratina Monochronator and Petersen Type Plane Gratina Monochronator. Beam lines (case study). Beam lines (detectors). Introduction to image formation. Introduction to the structures of biological macromolecules. Diffraction theory I: 1, 2 and 3-D arrays. Miller indices. The reciprocal lattice. The Ewald Sphere construction. Diffraction theory II: the structure factor. Friedel's law. Systematic absences. Fourier synthesis. Protein crystallography 1: the phase problem. Isomorphous replacement. Anomalous scattering. Protein crystallography II: data collection and data processing. Protein crystallography III: electron density maps and model building. M.A.D. 1. Protein crystallography IV: structure refinement and structure analysis of proteins. Protein crystallography V: results and applications: enzymes and their activity. Design of drugs. M.A.D. 2. Fibre diffraction 1: diffraction from helical structures. Fibre diffraction 2: experimental methods – beam lines – detectors. Fibre diffraction 3: data analysis – time resolved experiment. XAS – introduction. XAS – what is EXAFS? Fibre diffraction: recent results – future prospects. Protein crystallography VI: new approaches. Laue diffraction. EXAFS: optics; theoretical basis; data analysis; review of applications; time dependence; high pressure; solid state detectors; surfaces; superconductors; design of an integrated beamline. X-rays dichroism (MXD).

Exercises: General. Spectroscopy. Beamlines and machines physics. Diffraction. Vacuum (at Elettra and ICTP). Fibre diffraction. EXAFS.

Round Table Discussion on "Prospects of biological research".

The School was attended by 71 lecturers and participants (48 from developing countries). ♦

School on "Use of synchrotron radiation in science and technology", 14 October – 8 November.

Calendar of Activities at ICTP

1991

Conference on major problems of the atmospheric system and the developing countries ..... 11 – 16 November

School on materials for electronics: Growth, properties, and applications ..... 18 November – 6 December

Second International Workshop on radon monitoring in radioprotection and earth science . 25 November – 6 December

Workshop on non-linear dynamics and earthquake prediction ..... 25 November – 13 December

1992

Adriatico Research Conference on polarization dynamics in nuclear and particle physics ..... 7 – 10 January

Third Training College on physics and technology of lasers and optical fibres ..... 27 January – 21 February

Workshop on computation and analysis of nuclear data relevant to nuclear energy and safety 10 February – 13 March

Topical Workshop on coherent atom-radiation interactions ..... 24 February – 6 March

College on neurophysics — Object recognition by man and machine ..... 2 – 27 March

Spring School on string theory and quantum gravity ..... 30 March – 7 April

Workshop on string theory ..... 8 – 10 April

Workshop and Conference on "Global change and environmental considerations
for energy systems development" ..... 21 April – 8 May

The essential role of science in technological progress and economic development ..... 22 – 24 April

Spring College on superconductivity ..... 27 April – 19 June

Experimental Workshop on high T_c superconductivity (advanced activities) ..... 27 April – 19 June

Conference on chemical evolution and the origin of life ..... 4 – 8 May

Workshop on Mediterranean cyclones ..... 18 – 22 May

School on dynamical systems ..... 25 May – 5 June

Workshop on dynamical systems ..... 8 – 19 June

Seventh Trieste Semiconductor Symposium on: "Wide-band gap semiconductors" ..... 8 – 12 June

Seventh Trieste Semiconductor Symposium on: "Wide-band gap semiconductors" ..... 8 – 12 June

Miniworkshop on strongly correlated electron systems ..... 15 June – 10 July

Summer School on high energy physics and cosmology ..... 15 June – 31 July

Research Workshop in condensed matter, atomic and molecular physics ..... 22 June – 11 September

Adriatico Research Conference on clusters and Fullerenes ..... 23 – 26 June

Miniworkshop on non-linearity: dynamics and surfaces in nonlinear physics ..... 13 – 24 July

Adriatico Research Conference on wrinkling of surfaces in nonlinear systems ..... 21 – 24 July

Adriatico Research Conference on synergetics in condensed matter ..... 4 – 7 August

Miniworkshop on methods of electronic structure calculations ..... 10 – 21 August

Workshop on climate variability and predictability ..... 17 – 21 August

continued on following page

Calendar of Activities at ICTP in 1992, contd.

Adriatico Research Conference on hydrogen atoms in intense electromagnetic fields ..... 18 – 21 August

Workshop on vegetation-climate interaction ..... 24 – 28 August

Course on two-dimensional quantum field theory for condensed matter physicists ..... 24 August – 4 September

Advanced Workshop on arithmetic algebraic geometry ..... 31 August – 11 September

College on medical physics: imaging and radiation protection ..... 31 August – 18 September

Workshop in commutative algebra ..... 14 – 25 September

Fourth International Conference on applications of physics in medicine and biology: advanced detectors for medical imaging ..... 21 – 25 September

WMO Workshop on limited area modelling ..... 28 September – 2 October

College on methods and experimental techniques in biophysics ..... 28 September – 23 October

Second College on microprocessor-based real-time control — Principles and applications in physics ..... 5 – 30 October

Second Trieste Conference on recent developments in the phenomenology of particle physics ..... 19 – 23 October

School on physical methods for the study of the upper and lower atmosphere system ..... 26 October – 6 November

Second Autumn Workshop on mathematical ecology ..... 2 – 20 November

Third Workshop on basic VLSI design techniques ..... 2 – 27 November

Second Workshop on the applications of synchrotron radiation ..... 2 – 27 November

Experimental Workshop on high T_c superconductivity: advanced activities ..... 16 November – 11 December

Workshop on three-dimensional modelling of seismic waves generation, propagation and their inversion ..... 30 November – 11 December

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

International Centre for Theoretical Physics
of IAEA and UNESCO
Strada Costiera, 11
P.O. Box 586
34014 Trieste
Italy

Telephone: (40) 22401
Cable: CENTRATOM
Telex: 460392 ICTP I
Telefax: (40) 224163
E-mail: POSTOFFICE@ICTP.TRIESTE.IT
Bitnet: POSTOFF@ITSICTP
Decnet: VXICP1::POSTOFFICE
or 40124::POSTOFFICE
PPSDN: 022224110125

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. M. Farooque, Scientific Information Officer.