International Atomic Energy Agency

United Nations Educational, Scientific and Cultural Organization

International Centre for Theoretical Physics

News from ICTP

No. 54/55 January/February 1992

The Diploma Course participants of High Energy Physics and Condensed Matter Physics with Course Co-ordinators.

Contents

The ICTP Diploma Programme

From October 1991, the International Centre for Theoretical Physics, Trieste, started a one-year Diploma Programme in Condensed Matter Physics and in High-Energy Physics. The objective of the Diploma Programme is to provide young promising graduates in physics or in mathematics (mainly from developing countries) with an advanced level of training suitable for pursuing further teaching and research work in these fields. Professor Abdus Salam, Nobel Laureate and Director of the ICTP, had felt the need for such a programme at the ICTP for quite a long time, as many of the developing countries do not have good graduate study and research programmes.

The structure of the Diploma Programme, modelled after that of Imperial College, is different from other schools/colleges and training cum research activities that take place at the ICTP in these disciplines. The Diploma Programme consists of several basic and advanced courses given by experts in the component fields. The number of participants in each Diploma Course is limited to about 10, allowing for close interaction between the students and the lecturers. Basic courses are given from 1 October and continue up to Christmas in each academic year. In Condensed Matter Physics, the three basic courses are Many-Body Physics, Solid State Physics, and Statistical Mechanics. In High-Energy Physics, they are Quantum Field Theory, General Relativity, Lie Groups, and Particle Physics. Efforts are made to involve the students in applying the techniques and the physical concepts learned to solve problems in the various topics.

In January, the students are expected to take an examination in each subject. After these examinations, there are a series of lectures on some selected advanced topics in each component. These are expected to cover important developments in each discipline and are meant to prepare the student for carrying out research. In Condensed Matter Physics, the advanced topics for the 1991-92 programme include Density Functional Theory, Disordered Systems, Electron Gas, Fractals, Liquids, Magnetism, Molecular Dynamics, Monte Carlo Methods, Non-linear Dynamical Systems, Quasi 1-dimensional Systems, Renormalization

Group Theory, Superconductivity, Surfaces and Interfaces, and Transport in Semiconductors. In High-Energy Physics, advanced topics include Cosmology and Particle Physics, Quantum Field Theory, Standard Model (both Electroweak Theory and Quantum Chromodynamics), Supersymmetries and Grand Unified Theories. At the end of the term, students are again expected to pass examinations.

During this second term, the students are also expected to select a topic on which they should write a dissertation. Since in the Summer period there are, at the ICTP, advanced Schools/ Conferences and Workshops in each discipline, the students are expected to participate in these activities and benefit from interacting with a large number of visitors from all over the world. During this third term of the Programme, each student should work on a particular topic under the guidance of a member of the ICTP Diploma Programme faculty, and should write a report on that topic; in some cases, this may even involve working on a research problem. Finally, the students are also expected to defend their thesis in an oral examination. The ICTP Diploma will be awarded only to those students who will have passed the examinations and completed other formalities as may be decided upon by the Scientific Committee of the Diploma Programme.

The Diploma Programme is open to young (generally below 28 years of age) qualified students from all countries that are members of the United Nations, the IAEA or UNESCO. The minimum qualification for applicants is a good British B.Sc. (Hons.) degree or [illegible] British B.Sc. (Hons.) degree or equivalent in Physics or Mathematics. The selection of the candidates is based on the quality of their university performance and, if necessary, on a written test.

The applicant is expected to have adequate knowledge of solid state physics, quantum mechanics, statistical mechanics, classical mechanics, electrodynamics and mathematical physics for the Condensed Matter component, and in classical mechanics, electrodynamics, special theory of relativity, relativistic quantum mechanics and statistical mechanics for the High-Energy Physics component. For the academic year 1992-93, a

The 1991-92 ICTP Diploma Programme in Brief

1 October 1991 through 30 September 1992

Condensed Matter Physics

Co-ordinator:
V. Kumar (India/ICTP)

Topics:

First term: 1 October - 20 December 1991
Many-Body Physics
Solid State Physics I: Electronic Structure
Solid State Physics II: Lattice Dynamics
Phase Transitions
Statistical Mechanics

Second term: 6 January - 24 April 1992
Density Functional Theory
Disordered Systems
Electron Gas
Fractals
Liquids
Magnetism
Molecular Dynamics
Monte Carlo Methods
Non-linear Dynamical Systems
Quasi 1-dimensional Systems
Renormalization Group Theory
Superconductivity
Surfaces and Interfaces
Transport in Semiconductors

Faculty:

First term: G. Benedek, L. Colombo, V. Kumar, A. Levi, G. Santoro, A. Tagliacozzo.

Second term: R. Bertoncini, C. Calandra, H. Cerdeira, E. Courtens, P. Fazekas, G. Jug, N. Kumar, V. Kumar, G. Pastore, L. Pietronero, M. Rovere, M. Tosi, Yu Lu.

Participants:
1. M. Cardenas (Chile)
2. P.S. Gupta (India)
3. M.K. Hassan (Bangladesh)
4. A.E.I. Hassanien (Egypt)
5. H.-Y. Kee (Korea)
6. F. Matthews (Nigeria)
7. O. Nyamsuren (Mongolia)
8. A. Rastegar (Iran)
9. T. Shaheen (Pakistan)
10. H. Tatlipinar (Turkey)

High-Energy Physics

Co-ordinator:
F. Hussain (Pakistan/ICTP)

Topics:

First term: 1 October - 20 December 1991
General Relativity
Lie Groups and Lie Algebras
Quantum Electrodynamics
Quarks & Leptons
Relativistic Quantum Mechanics

Second term: 6 January - 24 April 1992
Cosmology and Particle Physics
Quantum Field Theory
Standard Model I: Electroweak Theory
Standard Model II: Quantum Chromodynamics
Supersymmetry and Grand Unified Theories

Faculty:

First term: G. Ellis, G. Furlan, F. Hussain, K.S. Narain, J.A. Strathdee.

Second term: S. Bilenky, G. Calucci, A. Masiero, S. Matarrese, S. Randjbar-Daemi, D. Treleani.

Participants:
1. A.H. Fariborz (Iran)
2. M. Haghighat (Iran)
3. A. Ibrahim Arbab (Libya/Sudan)
4. B.R. Karki (Nepal)
5. H.R. Khalesifard (Iran)
6. S.S. Khalil (Egypt)
7. M.A. Momen (Bangladesh)
8. S. Seunarine (Trinidad)
9. M.A. Yusuf (Pakistan)
10. S. Zakaullah (Pakistan)

Diploma Course in Mathematics will also begin. Applicants for this component should already have taken courses in abstract algebra, linear algebra, elements of real and complex analysis, differential equations, topology, and elements of applied mathematics.

A limited number of scholarships (around 10 per field) are awarded to successful candidates from developing countries for living expenses during their stay at the ICTP. Depending on the availability of funds, the ICTP may also offer candidates a full or partial travel grant. However, all applicants are advised to seek living and/or travel grants from other national or international sources.

The main purpose of the ICTP is to help scientists from developing countries. However, a limited number of qualified graduate students from industrialized countries will be welcome to attend the Courses, at their own cost. There are no course fees for the Diploma Programme.

Applicants should submit the relevant application form, a transcript of academic records and a copy of the highest university degree, with ***authorized*** English translations of the same, any certificates or documents, if available, which give proof of the student's ability to follow advanced level courses, study and write scientific literature in the English language; two letters of recommendation, from senior scientists familiar with the applicant's studies and work are also required. ◆

Wuppertal Institute for Climate, Environment and Energy

The Wuppertal Institute is the first major institute in Germany systematically addressing not only the global ecological challenges but also the complex tasks involved in the fundamental structural change necessary to meet these challenges. The Institute has therefore been conceived as a research body that links science, economy and public policy.

The Institute was founded as a member of the North Rhine Westphalian Science Centre family of interdisciplinary scientific institutes.

interdisciplinary scientific institutes.

Ernst Ulrich von Weizsäcker, hitherto Director of the Bonn based Institute for European Environmental Policy and former President of the University of Kassel, was appointed President of the Institute. The Institute became operational in June 1991 in the historical "Dürerhaus" in walking distance from the Intercity railway station of Wuppertal-Elberfeld.

The tasks of the Institute are initially seen as follows:

- Analysis of climatic changes, their effects and the ensuent necessity of structural change;
- Initiatives and co-operation in developing a climate-friendly and ecologically sustainable energy policy;
- Initiatives and co-operation in developing a climatically and ecologically compatible transport policy;
- Analysis of world-wide and local material flows ("from cradle to grave") and development of strategies to reduce their environmental impacts at all stages;
- Co-operation in structural changes towards resource efficiency;
- Co-operation in the development of a new and ecologically sustainable model of welfare notably in industrialised

of welfare notably in industrialised

countries.

The four divisions on climate, energy, material flows and transport will co-operate closely. Inter-divisional task forces will be set up for this purpose, e.g. a working group on aluminium which would link the material flows, energy and transport divisions. Another group could work on solar options in transport. A stable working group on a "new model of wealth" is also meant to work across all divisions. It will address also the cultural and psychological dimensions involved in the necessary structural changes away from our energy and material intensive economy.

To support the research divisions and working groups, a system analysis unit, a library and documentation and technical services are being established. A picture laboratory will facilitate conceptualisation of research results and understanding of complex problems. Training courses will be offered by the Institute for continued education of teachers, researchers, businesspeople, journalists or other people.

The Institute is practice-oriented. It wants to support the unavoidable changes towards sustainable structures scientifically, politically and practically. Geographically, the priority target of this structural change is Western Europe, but this implies indeed an invitation to guests from overseas and Eastern Europe, and it requires to look systematically at the world-wide interconnections of economic processes.

Within the family of institutes of the North Rhine Westphalian Science Centre, the Wuppertal Institute is establishing close research links with the "Institute of Work and Technology" in Gelsenkirchen and the "Institute of Cultural Studies" in Essen. Close academic relations to universities in North Rhine Westphalia, particularly to the Bergische Universität in Wuppertal, are planned and being arranged. Also, the Institute co-operates with the newly established North Rhine Westphalian Energy Agency which is also located at Wuppertal, addressing energy efficiency at small and medium size enterprises.

An international Advisory Council will be established to support the Institute and to contribute to its independence an research quality.

The Institute receives its basic funding from the Ministry of Economics

funding from the Ministry of Economics

and Technology of North Rhine Westphalia. In addition, the Wuppertal Institute will accept research contracts.

Environmental organizations, businesses, associations or individuals are principally welcome to become members (shareholders) of the "GmbH" (limited liability company) or to support the institute and its aims in other ways within the framework of its independence. For further information please contact the president of the Wuppertal Institute, Döppersberg 19, Postfach 100480, D-5600 Wuppertal 1, Germany. ◆

Disaster Warning Using Space Technology in Bangladesh

Dr. A.M. Choudhury
Associate, ICTP

Introduction

A disaster can be defined as any change in the environment of man that affects his work or his life in an unwanted fashion. In general, a disaster implies breaking down of a stable system. Bangladesh is a frequent victim of natural disasters like tropical cyclones, floods, norwesters, tornadoes and droughts. Bangladesh Space Research and Remote Sensing Organization (SPARRSO) has established receiving system capable of receiving imagery from US NOAA and Japanese GMS satellites at six and one hourly intervals every day in both visible and infrared frequencies. They are used routinely for weather forecasts. The NOAA data can also be processed with the help of special software acquired for this purpose for mapping flooded areas if the sky is cloud free. The imagery cover the entire catchment area of Bangladesh rivers and from the distribution of cloud cover, an estimate of the rainfall in the catchment area can be made, which can be used as input in flood forecasting model.

Tropical cyclones

The tropics can be regarded as the region of the earth lying between 30°N latitude and 30°S latitude. All the tropical seas of earth with the exception tropical seas of earth with the exception of the south Atlantic and east south Pacific give birth to deadly atmospheric phenomena known as tropical cyclones. On the average, 80 tropical cyclones are formed every year all over the globe.

The cyclones are originally formed in the deep seas and hence their study has been very difficult. It is only with the advent of Space Age that weather satellites provide valuable information about them. Direct studies of cyclones with the help of aircraft reconnaissance are also being carried out by advanced countries. Only a beginning has been made towards the understanding of cyclones. A lot remains to be known still.

Though solar energy ultimately controls the terrestrial weather, the following environmental conditions have been found to be prerequisites for the development of cyclones: (i) absence of strong vertical wind shear of the horizontal wind near the cyclone centre and presence of strong vertical shear of opposite sign on either side of this system; (ii) Presence of low pressure region with cyclonic vorticity; (iii) Warm ocean temperature. A tropical storm does not form if the sea temperature is less than 27°C. Such a high surface temperature is necessary to produce a steep lapse rate for maintaining the vertical circulation in a cyclone.

The Bay of Bengal cyclones are formed mostly near the Andamans. They usually occur at latitudes greater than 5°N. It is thought that Inter-Tropical Convergence Zone (ITCZ) has got to do something with their formation. The ITCZ is the region where winds from the two hemispheres meet and is situated near the equator, but its position varies with season. Conditional Instability of the Second Kind (CISK) was suggested as a mechanism for the formation of tropical cyclones. However, other mechanisms have also been suggested. A cyclone derives its spinning motion from the rotational motion of the earth called the Coriolis Force. This force is virtually zero at the equator. Hence, cyclones do not usually form at the equator. They are formed slightly north or south of the equator to get the necessary spin. It is probable that the easterly waves also play some part in the formation of cyclones.

It has been observed from satellite pictures that a mature cyclone has got a well organized cloud pattern. It is

well organized cloud pattern. It is possible to deduce the wind speeds in cyclones from the size and degree of organization of the cloud pattern. Refined classification from categories T1 to T8 called T numbers in a continuous scale has been made.

The most individual feature of a cyclone is its 'eye' usually found in severe cyclones. The eye can be seen in the satellite pictures clearly in the case of strong cyclones. The cyclones in their initial stages move at a rate of 5-10 miles/hr. In their final stages they may move at a rate of 15-20 miles/hr or even up to 30 miles/hr.

The precise forces responsible for the motion of tropical cyclones are not understood clearly and hence determination of the path of the cyclone in advance is one of the most difficult tasks in meteorology.

The classical methods for forecasting cyclone tracks are judicious consideration of climatology of cyclones, persistence of motion and some steering current of the upper atmosphere. Tropical cyclones often show different preferred paths in different times of the year. Hence, climatology of cyclones provides some good guess for considerations to base the initial forecast. However, as there are large number of exceptions, forecast based on climatology alone cannot be entirely relied upon.

Persistence of motion assumes that integrated effect of all forces which have caused the tropical cyclone to move during some past period will continue in the future period. However, the technique fails when recurvature takes place and some cyclones may depict recurvature more than once.

In cyclone forecasting, it is often assumed that cyclone follows the direction of upper atmosphere current at 200 or 300 mb. SPARRSO in collaboration with Dhaka University has undertaken an investigation into the problem and it has been found that there seems to be a steering current for every cyclone, but the level differs from cyclone to cyclone and there does not seem to be any relation with intensity of the cyclone. Moreover, the upper atmospheric current is as variable as the track of the cyclone and hence it is difficult to find out the exact steering current.

Recently various statistical and

Recently various statistical and numerical dynamical methods have also been introduced for the forecast of cyclone paths. SPARRSO has installed a model named TYAN for predicting the track of a cyclone based on climatology of Bay of Bengal Cyclones for the last one hundred years. This model has proved to provide quite reliable forecast at least twenty four hours in advance.

Bangladesh does not have either rocket or satellite facilities of its own, but with the help of ground stations, we can receive weather pictures from weather satellites launched by advanced countries. An APT (Automatic Picture Transmission) Ground Station for the reception of imagery from weather

satellites was established in 1968 in Bangladesh. Initially it was installed by former SUPARCO in the Atomic Energy Centre Building, Dhaka. Recently SPARRSO has established advanced receiving and analysing equipment including VAX computers, printers and International Imaging System monitors for the reception and analysis of satellite data under its Agroclimatic/ Environmental Monitoring Project with assistance from US-AID.

The data received by SPARRSO are supplied on an emergency basis to the relevant organisations for taking necessary actions. In the case of the Cyclone of 29 April, 1991, the cyclone was detected a week in advance and the information of the approaching cyclone was provided to the office of the Prime Minister. In spite of all the precautions taken there was loss of some one hundred thousand lives which was considerably less than the casualty in the case of a previously less deadly cyclone of 1970. The present Government is strengthening the Cyclone Warning and preparedness measures.

Floods

The primary cause of flood in Bangladesh is rainfall in the catchment areas of the rivers of Bangladesh. Situated in the monsoon belt with the Himalayas in the north, Bangladesh falls in the region of very heavy rainfall. About 80 percent of the rainfall occurs during the 5 months period from May to September. The annual rainfall varies from about 60 inches in the western part of the country to about 200 inches in the north eastern part. At Cherapunjee in Assam very near our Sylhet Border the average annual rainfall is about 500 inches which is highest in the world. But the average rainfall in Bangladesh generates annually only 100 million acre feet of water whereas 1100 million acre feet of water comes from outside Bangladesh. Thus about 90 percent of the water carried by Bangladesh river system, the Brahmaputra, the Ganges, the Meghna and other smaller rivers is brought from outside the country. These rivers carry water from an area of about 600,000 sq miles of which only 7.5 percent lies in Bangladesh. Water enters in Bangladesh through three major channels but the discharge takes pace through one major channel. The river system has evolved to carry the normal flow of water generated in the catchment area. Whenever the inflow of water is greater that the carrying capacity of the rivers (and this happens very often) flood results. The magnitude of the flood depends on the magnitude of excess water that is generated.

If the sky is cloud free, NOAA satellite imagery can be processed with computer to delineate the flooded areas. This has been done for August 31, September 01, September 10, September 15, September 18 and September 24 for the year 1988. It has been estimated that about 30,000 sq miles of Bangladesh was inundated in 1988.

A complete control of floods in Bangladesh seems to be a long way off. Until that is done it looks that we have to live with it. For that, reliable prediction of flood is necessary. Currently SPARRSO monitors the clouds in the catchment area several times a day regularly. The clouds could be translated into rainfall in different areas of the catchment. Mathematical models could be built for the catchment rainfall to be included as input in the model. The output of the model will give flood heights in the major rivers in subsequent times. This will increase the lead time for flood forecasting and preparedness. Emergency measures like evacuation and relief could be carried out more effectively. The model could incorporate the height contours of different areas of the country so that if we know the river level at a particular point, the areas that go under inundation could be determined. Flood images of NOAA satellite also shows which areas have been inundated so that the areas which need relief measures could be determined from satellite imagery.

Flood is mainly a climatic phenomenon and it is not possible to predict accurately excessive rainfall even a month not to speak of a year in advance. However, with the incorporation of satellite data in the flood prediction model, it would be possible to increase the prediction lead time by several days and this should enable the concerned agencies to carry out necessary preparedness measures. __ ♦

Satellite picture of April 29, 1991 cyclone taken at SPARRSO.

MEDIAS: A New Regional Climate Research Centre and Network

MEDIAS is the future Regional Climate Research Centre of Toulouse (France). It will be one element in a network of similar centres located mainly in Africa and Southern Europe. Five organizations are backing the creation of the MEDIAS Centre and Network: the European Centre for Research and Advanced Training in Scientific Computing, the French National Centre of Space Studies, the French National Centre for Scientific Research, METEO-France and the University of Toulouse III.

A workshop, held on 17-22 February 1992 at the Conference Centre of METEO-France in Toulouse, was to define MEDIAS' orientation and future lines of development with a very strong input from potential participants in the network from Africa. About one hundred scientists took part in the meeting.

The MEDIAS Network intends to help in the organization of the long-term research within the general framework of the International Geosphere-Biosphere Programme (IGBP) and other related programmes, and to promote cooperation between existing research institutions in the Mediterranean area. It will concentrate on priorities resulting from the existence of processes which are specific to the area and interact with global processes, and which are related to the evaluation and prediction of the consequences of the global change at the local or regional scale. Special features of MEDIAS regions include the existence of marginal zones, meridional gradients, desertification and drought.

Three topics for future work were selected by MEDIAS. The first regards fresh water and more specifically precipitations, water resources, droughts and extreme events. One of the first task of the network is to improve the present situation in terms of the characterization of the problem by collecting, organizing and distributing data on water availability in the atmosphere, the soil, the vegetation and the surface hydrology. These data should be interpreted and "synthesized" and made available to groups and laboratories involved in arid lands and desertification work. The MEDIAS network will also study specific processes like tropical land surface convection, Mediterranean cyclone-genesis and cyclone tracks, possible links between local evaporation and local precipitation as well as active anti-desertification action. It will also deal with the prediction of the modification and migration of rainfall patterns and droughts and will use the present data as well as results from high-resolution global and local modelling for early warning.

The second topic chosen by MEDIAS is the study of the **atmospheric composition**. This will involve investigation on processes which are highly sensitive, in the MEDIAS region, to the modification of surface characteristics like the savanna and the forest. The network will also dedicate its efforts to the study of tropospheric ozone in relation with emissions from biomass burning or from the savanna; to continental aerosols and their influence upon radiation, convection and the clouds; and to atmospheric and precipitation acidity and greenhouse gases.

Oceanography is the third topic. It will have two sectors: the Mediterranean area and the tropical Atlantic Ocean. In the Mediterranean area, the Network will study the changes in the biochemical cycles and, in particular, the fluvial and atmospheric inputs, the eutrophization atmospheric inputs, the eutrophization and the accumulation of heavy metals. Furthermore, climatic impacts will be studied like the response to global warming in terms of sea-level rise and temperature rise in deep waters as well as the response to the changes in precipitation. In the tropical Atlantic Ocean area, the Network will concentrate on the response of the tropical ocean to global change, i.e. the ocean circulation, the coastal upwelling and its consequence from the point of view of coastal production, and the regional modification of CO_2 ocean-atmosphere exchange. The Network will also investigate the climate impact of both areas, Mediterranean and Tropical Atlantic Ocean, on neighbouring climates.

These are the topics which MEDIAS should, in principle, deal with. But there are many other international and regional initiatives and MEDIAS should not and in fact will not duplicate the activities undertaken in other programmes. It has taken the existing situation into consideration. While the expertise in the North is well known, the same is not true for the countries of the South, and much work will have to be done to strengthen the existing structures in the African Mediterranean and subtropical area. These structures are mainly in the administrations for meteorology, for forests, for agriculture and hydrology. Specialized expertise is found in universities and special schools, in centres and in national programmes. In many cases, these structures do technical work rather than research. Here, MEDIAS will have a specific task. It will strengthen the cooperation between the technical and the research teams, coordinate the research, refine methodologies and make results available to all the networks. Therefore MEDIAS will stimulate scientific meetings with the Africans in order to discuss the results of the activities. The potential exists, but it must be coordinated.

Modelling will play an important role in the future activities of MEDIAS. So far, modelling is the only tool available for prediction. There are models for the atmosphere, the oceans, vegetation and soil as well as for the chemistry of the atmosphere. These models should be adapted to the MEDIAS area and should enable MEDIAS area and should enable prediction on the greenhouse effect, deforestation, desertification over 10 to 100 years periods. Regional aspects will have to be taken into account. They include as special features the Mediterranean Sea, the mountains, the Sahara, the Equatorial Forest and the boundaries between meteorological regimes. The adaptation of the models will require an improved input of soil and vegetation data, hydrical budgets, erosion, and coastal problems. The implementation of these programmes implies the availability of supercomputers for simulations and for data recording. These exist only in a few "heavy" centres. Part of the programmes

which require less intensive computation can be carried out in other "lighter" centres of the Network. The programmes will integrate the scientific teams within the IGBP and function on a partnership basis.

For modelling, data must be available. In the short-term (1992-1993), MEDIAS will identify national contact points and collect information on current and future research programmes in its area. It will also make a survey of existing data and on the methods for their processing. A working group will deal with the technical implementation of the Network (means of communication, access procedure to the catalogue of data, format and support for the exchange of data). In the medium term (1993-1995), MEDIAS will standardize the informatics systems related to data (format, support and software) and study the possibility for the members of the MEDIAS Network to accede to the "heavy" computing tools and, in particular, to climate models.

MEDIAS is also making plans for the training of the personnel from the Southern countries who will work in modelling, remote sensing, data acquisition and processing. This training has many facets. The first is the long-duration training at the graduate level which should be done locally i.e. in the South, with local scientific faculties collaborating with scientists from the North, in specialized disciplines. Short duration (few weeks) training either in specialized methodologies or on multidisciplinary problems should be combined with research periods in the various centres of the Network and this, in collaboration with existing initiatives.

These are, in brief, the main points which were discussed in four days at the Toulouse meeting. MEDIAS will issue a report on the debates and recommendations shortly. The participants in the meeting were invited to join one or more of the eight different groups to discuss the working papers prepared by MEDIAS. Revised working papers were then presented and discussed in plenary sessions. The Network will most likely include centres with different capabilities. In this regard, it was strongly recommended, and approved by all participants, that there should be no hegemony of one or more centres over others and that one the "heavy" centres, i.e. a centre with supercomputing capabilities, should be located in Africa. Opportunities for collaboration offered by the Trieste institutions, i.e. the Third World Academy of Sciences, the International Centre for Theoretical Physics and the International Centre for Science and High Technology were presented in the meeting.

The workshop was directed by Prof. Jean-Louis Fellous assisted by a committee composed of eminent scientists including Prof. T. Rosswall, Director of IGBP. For more information contact: MEDIAS – 18, Avenue Edouard-Belin – 31055 Toulouse Cédex – France. ♦

André-Marie Hamende

Conferences and Lectures

Dr. Bonaventure Loo, Post-doctoral Fellow of the ICTP Mathematics Research Group, was invited to give talks at the universities of Rome, Florence (both in Italy), Durham and Warwick (both in UK). The title of his talk was "On the compactification of the moduli space of branched minimal immersions of S^2 into S^4". ♦

Governor Visit at ICTP

Mr. Sergio Vitiello, Governor of Trieste, visited the Centre on 6th February 1992. Professor Abdus Salam, Director, International Centre for Theoretical Physics and President, Third World Academy of Sciences, warmly received him and briefed him on the scientific activities of the Centre and TWAS and other programmes in Trieste. Mr. Vitiello highly appreciated the outstanding contribution of Professor Salam to the development of Science and Technology in the Third World and, particularly, in Italy. Prof. Salam in turn hartfully thanked the Italian Government for its generous long-standing support for the work of the ICTP.

Mr. Vitiello visited the Laser Laboratory and the Library of the Centre. After that, the Governor met the Deputy Director and the high officials and discussed the activities of the Centre. ♦

Prof. Abdus Salam had a meeting with Trieste Governor Mr. Sergio Vitiello in his office at ICTP. Prof. H.R. Dalafi was also present.

Research Cooperation Agreement Signed

A cooperation agreement was signed between ICTP-ICS and Jozef Stefan Institut and the Department of Physics of the of the University of Ljubljana, Slovenia, on 15th February 1992 in the office of the Director of the International Centre for Theoretical Physics (ICTP), Trieste, Italy. Professor Abdus Salam, Director of ICTP, and Professor P. Tancig, Minister of Science and Technology of the Republic of Slovenia, signed on behalf of the two sides.

The International Centre for Theoretical Physics (ICTP), the International Centre for Science and High Technology (ICS), the Jozef Stefan Institute and the Department of Physics of the University of Ljubljana, recognizing the importance of strengthening scientific cooperation among them, undertake an exchange programme as follows:

a) Junior researchers/students from ICTP-ICS are offered the opportunity to stay at one of the above-mentioned scientific Institutions in Slovenia. With this purpose, grants will be offered by the Government of the Republic of Slovenia. The hosted researchers/students are expected to benefit from cooperation with Slovenian colleagues and to be offered the possibility of:

- attendance of the Graduate Studies Course (GSC) for one year, renewable to a second year;
- participation in training programmes for six months, renewable to six additional months.

Living costs will be covered from

Living costs will be covered from grants offered by the Government of Slovenia and international organizations. The parties of this agreement will make efforts to raise funds towards this programme; to this end, they will invite national and international organizations to offer their contribution. Travel costs of the fellows from their home country to Trieste and to Ljubljana will be covered by the ICTP/ICS. Fellows will receive extra support from ICTP/ICS, in order to enable them to visit ICTP/ICS periodically during their stay in Slovenia.

b) Junior researchers from Slovenia will be invited to participate in ICTP/ICS programmes in Trieste with support from the ICTP and ICS.

c) Grants will be offered by the Slovenian Government to ICTP senior scientists for a three/four-months stay in Ljubljana, in order to collaborate in specific scientific projects at the Institutions in Slovenia and/or lecture at the GCS programmes.

d) Senior scientists from the Institutions in Slovenia will be invited to lecture and to participate in activities at the ICTP/ICS in the fields relevant to their expertise. The expenses of such visits will be covered by ICTP/ICS.

A joint scientific Committee will be appointed in order to discuss and finalize the detailed cooperation programme. The Committee will identify the fields of actions which will assure complementarity, in order to avoid overpositions of the scientific programmes at the ICTP/ICS and at Slovenian Institutions within this agreement.

Moreover, the joint scientific

Moreover, the joint scientific Committee will decide the number of grants to be allocated by both parties. ♦

Visits to ICTP

Chairman of Region Friuli-Venezia Giulia

Mr. Vinicio Turello, Chariman of Region Friuli-Venezia Giulia, met the Director and Officials of ICTP on 18 February.

Association "Giuliani nel mondo"

A visit of the Centre's facilities was organized on 16 January for joung students, mainly from Australia and South America. They were all children of members of the Association of emigrated natives from the region embracing Trieste, Gorizia and bordering Histria. ♦

Obituary

Prof. Afonya-A. Bestman

We regret to announce the untimely and sudden death of our beloved Professor Afonya A. Bestman, Professor of Mathematics, University of Port Harcourt, on Sunday 12th January 1992. He was 49 years old.

Professor Bestman was an internationally acclaimed mathematician, working all over the world, especially in Italy where he worked at the International Centre for Theoretical Physics (ICTP), Trieste. His research interests were physiological fluid dynamics, aero space and astrophysical sciences, mathematical and environmental physics and mathematical modelling.

Prof. Bestman was also an aeronautical engineer, having received his B.Sc. at Imperial College, London, with 1st Class Honours in 1967. He then obtained his Master of Science degree at the same University in Aerodynamics in 1968. From London he went to Sydney University in Australia, where he gained the Ph.D. degree in applied mathematics.

He is the winner of over a dozen international awards. ♦

UNESCO Prize

UNESCO Prize

South African President F.W. de Klerk and Nelson Mandela, President of the African National Congress, will share the 148,000 dollar UNESCO Peace Prize. It was announced in January 1992.

The UN Scientific, Educational and Cultural Organization said both men will attend the Feb. 3 Ceremony to receive the award. The Prize is named for Ivory Coast President Feliz Houphouët-Boigny. ♦

Activities at ICTP in January/February 1992

Title: ADRIATICO RESEARCH CONFERENCE ON POLARIZATION DYNAMICS IN NUCLEAR AND PARTICLE PHYSICS, 7 – 10 January.

Organizers: Professors A.O. Barut (University of Colorado, Boulder, USA), N. Paver (University of Trieste and Italian National Institute of Nuclear Physics, INFN, Italy), A. Penzo (INFN, Trieste, Italy) and R. Raczka (Institute of Nuclear Studies, Warsaw, Poland), with the co-sponsorship of the International Centre for Science and High Technology (ICS, Trieste, Italy), Italian National Institute of Nuclear Physics (INFN, Italy) and International School for Advanced Studies (Trieste, Italy).

Lectures: Theoretical aspects of polarization phenomena in high energy collisions. The experiment SMC: results and perspectives. The quark content of the proton spin. Polarized structure functions from pp colliders. Measurements of tau polarization at LEP. Polarization effects at LEAR. Polarization mechanisms for p/pbar beams. Polarization phenomena in $e^+e^- \rightarrow W^+W^-$. Extra neutral gauge bosons effects in $e^+e^- \rightarrow W^+W^-$. Helicity effects in e^+/e^- interactions. Spin dependence of N-Nbar forces: nuclear evidence. Spin effects in exclusive charmonium decays. Helicity and planar amplitudes in pion-nucleon scattering at 6 GeV. Spin effects and non-perturbative dynamics. Polarized RHIC. The Fermilab polarized Polarized RHIC. The Fermilab polarized beam: results and plans. Spin and symmetries: polarization experiments at KEK. Spin physics projects at UNK. Transverse spin effects. Hyperon radiative decays: the latest results from Fermilab Experiment E761. Vector di-quarks and the Gottfried sum rule. Origin of polarization for inclusive production in pp collisions. Spin dynamics of p/pbar storage rings. Diffractive model for hyperon polarization. Spin measurements in nuclear reactions. The parity violating spin effect in NN interaction. Polarized ion sources and gaseous jet targets. Polarized gaseous targets and the HERMES Project. The HELP Project. Experimental aspects of polarized DIS. Polarization in e^+/e^- machines. The proton spin and QCD. Polarimeters for high energy muon beams. JPT, the polarized jet target project at CERN. Sea polarized structure functions and Regge trajectories. EM-strong interference in pp elastic scattering. Scattering of polarized $e^+/e^- \rightarrow$ p/pbar. First results on polarization at LEP. Spin phenomena in binary processes. Coupling functions from polarized pp-scattering. The "strangeness" of the proton and neutral currents. Helicity and planar amplitudes in pion-nucleon scattering at 6 GeV. Recent results with polarized neutrons at Saturne II. Strong-EW sector and polarized colliders. Tests of T-invariance at COSY. Spin correlation measurements at IUCF. Polarization experiments as quantum measurements. Polarization measurements at Saturne II. High spin structure of large A nuclei. Long/short range components of P-odd NN forces. Overview of high energy spin effects.

The Conference was attended by 65 lecturers and participants (10 from developing countries).

Title: THIRD TRAINING COLLEGE ON PHYSICS AND TECHNOLOGY OF LASERS AND OPTICAL FIBRES, 27 January – 21 February.

Organizers: Professors G.S. Agarwal (University of Hyderabad, India), C. Dainty (Imperial College, London, UK), V. Degiorgio (University of Parma, Italy), Prof. G. Denardo (ICTP and International Centre for Science and High Technology, ICS, Trieste, Italy) High Technology, ICS, Trieste, Italy) and C. Someda (University of Padua, Italy), with the co-sponsorship of the International Centre for Science and High Technology (ICS, Trieste, Italy).

Lectures: Fundamentals of lasers. Laser beams and resonators. Applications of light scattering. CO_2 laser physics. Solid state lasers. UV lasers. Holography and Fourier optics. Principles of lasing. Dye lasers. Optical data storage and optical computing. Nonlinear optics. Applications of solid state lasers in science, technology and medicine. Propagation in optical waveguides. Materials for nonlinear optics. New tunable solid state lasers. Semiconductor lasers. Fundamentals of fibre characterization. Fibre characterizations. Detectors and receivers. Modulators and switches. Fibre amplifiers and lasers. Cables, connectors and passive components. Optical communication systems. Nonlinear propagation and solitons in optical fibres. Fibre technology and characterization.

Demonstrations on light scattering.

Laboratory sessions.

The College was attended by 94 lecturers and participants (70 from developing countries).

Title: WORKSHOP ON COMPUTATION AND ANALYSIS OF NUCLEAR DATA RELEVANT TO NUCLEAR ENERGY AND SAFETY, 10 February – 13 March.

Organizers: Dr. D.E. Cullen (Lawrence Livermore Laboratory, USA), Prof. M.K. Mehta (Vikram Sarabhai Community Science Centre, Ahmedabad, India), Dr. J.J. Schmidt (International Atomic Energy Agency, IAEA, Vienna, Austria) and with the assistance of Prof. H.R. Dalafi (ICTP) and Prof. L. Fonda (University of Trieste and ICTP, Italy), in co-operation with the Nuclear Data Section of the International Atomic Energy Agency (IAEA, Vienna, Austria).

Lectures: The role of nuclear reaction theory and data in nuclear energy and safety applications. Review of recent progress in nuclear reaction theory and nuclear models. Review of resolved and unresolved neutron resonances and their relationship to safety related reactivity coefficients. Optical Model calculations — Optical Model calculations — introduction to the theory and use of the SCAT2 code. Review of optical, statistical and pre-equilibrium models. Statistical Model calculations — introduction to the theory and use of the ABAREX code. Review of level densities. Pre-equilibrium Model calculations — introduction to the theory and use of the ALICE code. Review of nuclear fission. Multistep compound and multistep direct calculations — introduction to the theory and use of the EXIFON code. Multistep compound and multistep direct calculations. Review of uncertainties in the results of nuclear model calculations. Comprehensive nuclear model calculations —

introduction to the theory and use of the GNASH code. Review of code intercomparisons conducted by the OECD/NEA/Data Bank. The computer code services of the OECD/NEA/Data Bank. Review of the intent, scope and content of the workshop.

Computer exercises: Introduction to the ICTP computer facilities. SCAT2. ABAREX. ALICE. EXIFON. GNASH.

Visit to: National Laboratories in Legnaro (Italy).

The Workshop was attended by 60 lecturers and participants (41 from developing countries).

Title: TOPICAL WORKSHOP ON COHERENT ATOM-RADIATION INTERACTIONS, 24 February – 6 March.

Organizers: Professors B. Bederson (New York University, USA), G. Denardo (ICTP and International Centre for Science and High Technology, ICS, Trieste, Italy), N. Rahman (University of Trieste and International Institute for Pure and Applied Chemistry, IIC, Trieste, Italy) and H. Walther (Max Planck Institute for Quantum Optics, Garching, Germany), with the co-sponsorship of the International Centre for Science and High Technology (ICS, Trieste, Italy).

Lectures: Coherence: still a sticky subject after all these years. Photons from a fake star: another lesson in coherence. Atomic collisions — coherent and incoherent — in laser excited atoms. Quantum noise reduction in nonlinear optical systems. Field coherence, intermolecular forces, and cavity QED. New ideas and experiments in cavity QED. Optical atoms. Microsphere resonances and applications. Experiments on atoms in a micron sized cavity I and II. Quantum noise reduction in optical fields and applications. Quantum noise in optical systems: a semiclassical approach. Extreme vacuum effects in active microcavities. Rydberg wave packets. Quantum noise. Atoms in superstrong fields: an introduction. Ionization, stabilization and harmonic production in superstrong fields. Single atom experiments and tests of quantum physics. Coherent population trapping in spectroscopy and laser cooling. Semiclassical theory of radiative forces on neutral atoms. Laser cooling in the quantum regime. Laser cooling in atomic beams and optical molasses. Experiments with optical molasses. Atoms in intense laser fields I and II. Resonances in the interaction of strong lasers with atoms. Electron collisions in laser fields I. Description of nonlinear optical processes in strong laser fields. Multiphoton ionization of atomic hydrogen.

The Workshop was attended by 67 lecturers and participants (47 from developing countries). ♦

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

Calendar of Activities at ICTP

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 on computer networks ..... 30 March – 17 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

ICS/ICTP/WMO International Workshop on Mediterranean cyclones studies ..... 18 – 22 May

Trieste Workshop on the search for new elementary particles: status and prospects ..... 20 – 22 May

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

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

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

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

Summer School on high energy physics and cosmology ..... 15 June – 31 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 tropical climate variability and regional impacts ..... 17 – 21 August

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

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Calendar of Activities at ICTP in 1992, contd.

Course on low-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 on 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

Conference on chemical evolution and the origin of life ..... 26 – 30 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

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.

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