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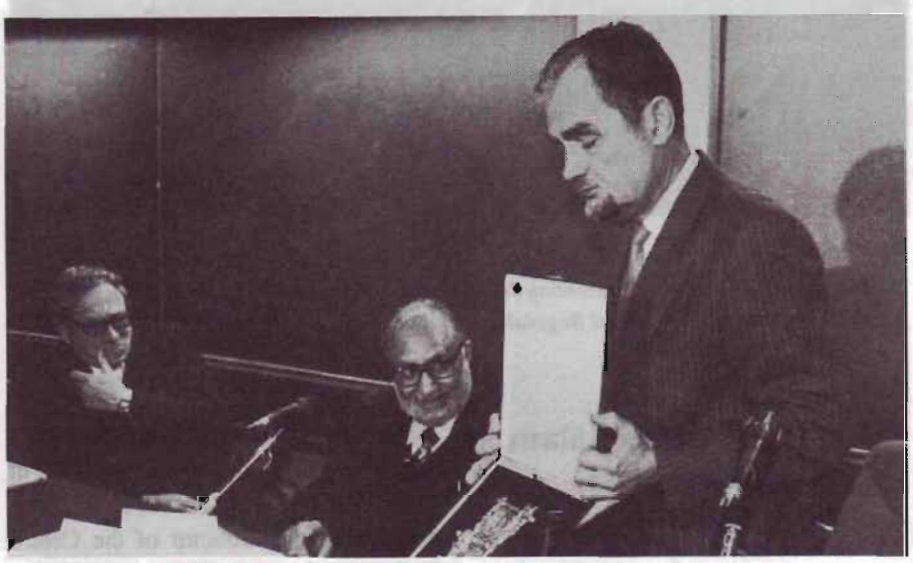

Professor Pavel Bogolubov receiving the Dirac Medal of 1992 from Professor Abdus Salam, Director of the International Centre for Theoretical Physics and President of Third World Academy of Sciences, on 2 December 1992, in the Main Lecture Hall of the ICTP. On the left, Prof. J.J. Giambiagi, Member of the ICTP Scientific Council.

Inside:

Dirac Medal Award Ceremony

On 2 December 1992, one of the 1992 Dirac Medals which had been assigned (posthumously) to Professor Nikolai

(posthumously) to Professor Nikolai Nikolaevich Bogolubov (Dubna, Russia), was presented to his son. The other 1992 Dirac Medal will be awarded to Professor Yakov G. Sinai (Landau Institute of Theoretical Physics, Moscow, Russia) during the 1993 High Energy Summer School. Two such medals are awarded every year on the birthday of P.A.M. Dirac — 8th August.

The ceremony took place in the Main Lecture Hall of the ICTP, Trieste, Italy. Professor Abdus Salam, Director of the International Centre for Theoretical Physics (ICTP) and President of the Third World Academy of Sciences (TWAS) presented the medal and a cheque of US$ 5,000 to Professor Pavel Bogolubov, the son of Professor N.N. Bogolubov.

Bogolubov.

Professor N.N. Bogolubov is honoured posthumously *"in recognition of his many fundamental contributions in physics and mathematics. In statistical physics, his treatment of Bose-Einstein condensation in a non-ideal gas was a seminal work which laid the basis for a microscopic theory of superfluidity in Helium II. It stimulated many of the later developments using quasi-particle methods. He later generalised this method to fermions and applied it to the phenomenon of superconductivity providing a systematic microscopic theory. The famous Bogolubov transformation is now a cornerstone of modern physics. In elementary particle physics, Bogolubov was the first to give a rigourous proof, based on local quantum*

rigourous proof, based on local quantum *field theory, of fixed angle dispersion relations for pion-nucleon scattering. This emerged from his study of the axiomatic basis of relativistic quantum field theory and the structure of the S-matrix. Another important result was a systematic formulation of the renormalisation programme for perturbative computations of the S-matrix. In mathematics, among his many important contributions we cite his work on non-linear mechanics and the general theory of dynamical systems"*.

Professor N.N. Bogolubov was born on 21 August 1909 in Gorky. At the age of 14 he wrote his first scientific paper

and in 1930 he received the degree of Doctor of Mathematics. In 1948 Prof. Bogolubov was elected Member of the Ukrainian Academy of Sciences and, in 1953, Member of the Academy of Sciences of the USSR. Subsequently, Prof. Bogolubov became a Member of the Presidium of the Academy and Head of the Section of Mathematics and, in 1964, Director of the Joint Institute for Nuclear Research in Dubna.

Over a very long period of scientific research in mathematics and theoretical physics, he published more than 300 papers. Prof. Bogolubov was awarded the Lenin Prize (1958), the Lomonosov Prize of the Academy of Sciences of the USSR and received the highest awards conferred by the Soviet Union. He became an honorary member of many scientific academies and was awarded several degrees *honoris causa*. He received the Helmholz Golden Medal of the Academy of Science of the German Democratic Republic (1969), the Max Planck Gold Medal of the Physical Society of the Federal Republic of Germany (1973), the Benjamin Franklin Medal (1974) and many other important awards. ♦

Professor J.J. Giambiagi presenting the plaquette to Professor Abdus Salam. On Professor Abdus Salam's right, Prof. Pavel Bogolubov (Dubna, Russia).

Professor Abdus Salam Appointed as Emeritus Professor

During the Dirac Medal Ceremony which was held on 2 December 1992 at the Main Lecture Hall of the ICTP, Prof. J.J. Giambiagi, Director of the Centro Latinoamericano de Física and Member of the ICTP Scientific Council, announced that Professor Abdus Salam, Director of the International Centre for Theoretical Physics and President of the Third World Academy of Sciences, had been appointed as Emeritus Professor of the Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro, Brazil.

As he presented a special plaquette for this occasion, Prof. J.J. Giambiagi said, "I have the honour to confer you the title of Emeritus Professor of CBPF to express in a concrete form our recognition for your scientific achievements as well as your tireless support for the development of science in the developing countries".

This award had the unanimous support of the Brazilian community of physicists in recognition of all the efforts Professor Abdus Salam has made for the development of physics in Brazil. ♦

Gold Medal Award Ceremony

On 3 December 1992, a gold medal was awarded to Professor Abdus Salam, Director, International Centre for Theoretical Physics (ICTP) and President, Third World Academy of Sciences (TWAS), in the Main Lecture Hall of the ICTP, Trieste, by the Slovak Academy of Sciences in Bratislava. For this purpose a Slovak delegation visited the ICTP. It was composed of Professor B. Frankovic, Vice-President of the Slovak Academy of Sciences, and Professor S. Luby, Head of the Department of Physics of the same Academy.

The Slovak Academy of Sciences decided to award a gold medal to Professor Abdus Salam for his engagement in science promotion and co-operation also in that country. In fact, the ICTP, the Slovak Academy of Sciences, and the Comenius University in Bratislava signed a co-operation agreement providing for a mutual exchange of scientists and researchers, according to which the ICTP bears the living expenses of scientists from Bratislava while attending courses or carrying out research at the ICTP. Similarly, the Slovak institution offers grants towards the living expenses of ICTP Associates while in Bratislava. ♦

Top Scorer in the ICTP Diploma Course Programme, 1991-92

Mr. Arshad Momen (Bangladesh), who was a participant of the 1991-92 Diploma Programme held at the ICTP, scored the top position among 20 participants. He was a participant in the High Energy Physics course. Following his brilliant success in this course, he got a research fellowship for his Ph.D. at Syracuse University, New York.

Mr. Arshad Momen completed his B.Sc. (Hons.) in the Department of Physics, University of Dhaka, Bangladesh, and also scored top position for his outstanding performance in that university.

He has completed several research papers with Professor A.M. Harun-ar-Rashid, Department of Physics, University of Dhaka (also Senior Associate, ICTP). For his Diploma dissertation he worked with Professor S. Randjbar-Daemi, ICTP. ♦

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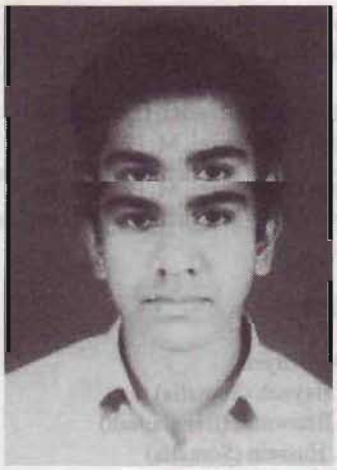
Interview with M. Arshad Momen



Mr. Arshad Momen

Q.: Let me first of all congratulate you for the fine work you have done towards the Diploma Course of ICTP. The Certificate was awarded to you on 25th September '92. Could you describe your reaction?

A.: Thank you. I am really glad to be able to complete all the trainings that we are supposed to do. It gives me a sense of achievement.

Q.: What are your impressions about the Course?

A.: The Course has been particularly useful for me to clarify certain topics which had remained quite 'fuzzy' to me for a long time, while I was trying to learn at home by myself. It also gives an opportunity to learn lots of things from eminent physicists at ICTP.

Q.: In what way will the Course influence your future career?

A.: Well, surely it has helped to enter a graduate school. Apart from that, I will be able to comprehend many things faster than my fellow students, I guess. One thing that I must mention is that here I worked on a subject for my dissertation which is on the interface of condensed matter and high energy physics, for which I had to interact with people from the condensed matter group as well. Thus, I now have a wide outlook towards physics.

Q.: Could you please briefly describe your research work or dissertation?

A.: Well, as I told earlier — it has to do with the interface of high energy physics and condensed matter. It was shown quite recently that the two-dimensional string theory admits an infinite symmetry called W^{-} infinity. We tried to look for this symmetry in the quantum Hall effect and what would be its consequences.

Q.: Did you give any lecture or seminar at ICTP? If so, kindly illustrate it briefly.

A.: Unfortunately, I should say no. However, as a part of our program, each of the high energy physics student had to give a talk on something for the cosmology examination. I gave a presentation on the "Cosmological Constant Problem".

Q.: Would you have any academic suggestion for future participants in the Diploma Course?

A.: The only thing I would suggest them is to take the course seriously and try to learn things from the people around as much as possible.

Q.: You have spent one year in Trieste. What are your impressions about ICTP?

A.: What amazes me is the size of the institution especially when I think that a person like Prof. Salam has done this almost single-handedly. I think this is really a remarkable achievement by itself. However, speaking frankly, the only problem that it faced is the financial crisis and that is because, I think, it had expanded too fast. I hope despite the financial problems the ICTP will still flourish and contribute to scientific development throughout the world.

Thanks. ♦

1991-92 ICTP Diploma Programme Ends and New Academic Year Begins

The 1991-92 ICTP Diploma Programme terminated as scheduled at the end of September. The Centre's Director, Prof. Abdus Salam, met with departing participants to wish them well in their continuing studies. He told the young scientists that they should consider the Programme not as an end, but as the beginning of a life in physics: they will have to work very hard, but should keep in mind that their efforts will eventually find reward, that they should do well in their chosen field and afterwards help others who, like themselves, often work in difficult and isolated conditions. It is important that in the future they remember their home countries and return there to assist other students. He also suggested that they stay in contact with the numerous scientists — many of whom are highly-qualified and of renown — that they met during their 12-month stay at the ICTP.

The one-year Diploma Courses programme is geared to providing young promising graduates in physics and

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The 1992-93 ICTP Diploma Programme in Brief

1 October 1992 through 30 September 1993

Condensed Matter Physics

Co-ordinator
V. Kumar (India/ICTP)

Topics:

Lattice Vibrations
Many-Body Physics
Statistical Mechanics & Phase Transitions
Symmetry & Bands

Density Functional Theory
Electron Gas
Magnetism
Nonlinear Dynamical Systems
Semiconductors & Superlattices
Superconductivity & Quasi-1-dimensional Systems
Theory of Complex Systems

Faculty:

First term: P. Fazekas, V. Kumar
G. Morandi, G. Santoro

Second term: H. Cerdeira, P. Fazekas, N. Kumar, V. Kumar, A. Levi, M. Parisi, M. Tosi, Yu Lu

N. Kumar, V. Kumar, A. Levi, M. Parisi, M. Tosi, Yu Lu

Participants:

1. E.R. Camacho (Peru)
2. Chan Minh Tien (Vietnam)
3. A.J. Ekpunobi (Nigeria)
4. H.F. El-Nashar (Egypt)
5. H.T.K. Hang (Viet Nam)
6. S.W. Hla (Thailand)
7. S.I. Khondaker (Bangladesh)
8. J.W. Kutor (Ghana)
9. S.I.H. Shah (Pakistan)
10. K. Uprety (Nepal)
11. D. Yurdabak (Turkey)

High-Energy Physics

Co-ordinator
F. Hussain (Pakistan/ICTP)

Topics:

First term: (1 October - 22 December 1992):

General Relativity
Lie Groups & Lie Algebras I
Quantum Electrodynamics
Quarks & Leptons
Relativistic Quantum Mechanics

Second term: (4 January - May/June 1992):

Lie Groups & Lie Algebras II
Quantum Field Theory
The Standard Model
Supersymmetry & Grand Unified Theories

Faculty:

First term: G. Ellis, G. Furlan, E. Gava, F. Hussain, J. Strathdee

Second term: G. Barbiellini, K. Narain, S. Randjbar-Daemi, G. Senjanovic, C. Verzegnassi

K. Narain, S. Randjbar-Daemi, G. Senjanovic, C. Verzegnassi

Participants:

1. M. Ahmed (Pakistan)
2. T. Alemu (Ethiopia)
3. H. Blas (Peru)
4. A. Husain (Pakistan)
5. E.I. Lashin (Egypt)
6. J.H. Léon (Peru)
7. A. Melfo (Venezuela)
8. C.I. Ogu (Nigeria)
9. B.M. Oktay (Turkey)
10. O.Y. Osman (Sudan)
11. K.D. Pance (Albania)
12. S. Peñaranda (Cuba)

Mathematics

Co-ordinator
C. Chidume (Nigeria/ICTP)

Topics:

Differential Geometry
Measures & Integration
Point-set Topology

Algebra (Groups, Rings & Modules, Fields & Galois Theory)
Complex Analysis
Functional Analysis
Introduction to Algebraic Geometry
Introduction to Algebraic Topology
Theory of Ordinary Differential Equations

Faculty:

First term: E. Ciriza, D. Repovs, G. Vidossich, B. Zimmermann

Second term: M. Brundu, C. Chidume, A. Logar, E. Mezzetti, M. Pontecorvo, D. Repovs, G. Vidossich, B. Zimmermann.

A. Logar, E. Mezzetti, M. Pontecorvo, D. Repovs, G. Vidossich, B. Zimmermann.

Participants:

1. M. Akil (Syria)
2. M.I. Beynah (Somalia)
3. S.C. Bhowmik (Bangladesh)
4. A.A. Hussein (Somalia)
5. M. Kabanda (Zaire)
6. D. Le Dung (Viet Nam)
7. M.O. Osilike (Nigeria)
8. M.S. Rahman (Bangladesh)
9. P. Tahmasebi (Iran)
10. C.J. Verjovsky (Mexico)

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mathematics an advanced level of training suitable for pursuing further teaching and research work. Of the 20 students who took part in the Condensed Matter Physics and High-Energy Physics components in this first academic year, 17 were awarded the ICTP Diploma. Some of these have been accepted in Graduate Studies programmes in such well-known institutions as Syracuse University in New York, the Indian Institute of Science in Bangalore, and the International School of Advanced Studies in Trieste. Others returned to their home countries to continue their higher education there and/or to study for GRE and TOEFL examinations required for enrolment in other prestigious institutions.

The second ICTP Diploma Course programme regularly began on 1 October 1992 and will continue through 30 September 1993. This year, the Mathematics component is also in full swing, bringing the total number of participants to 33 (11 in Condensed Matter Physics, 12 in High-Energy Physics, and 10 in Mathematics). Due to the already recognized usefulness of the programme, a number of these students have come to Trieste under scholarships offered by other institutions.

This year, the basic (first-term) courses in Condensed Matter Physics include Lattice Vibrations, Many-Body Physics, Statistical Mechanics and Phase Transitions, and Symmetry and Bands. Those in High-Energy Physics deal with General Relativity, Introduction to Lie Groups and Lie Algebras, Quantum Electrodynamics, Quarks and Leptons, and Relativistic Quantum Mechanics. First-term courses in Mathematics are dedicated to Differential Geometry, Measures and Integration, and Point-set Topology.

More advanced lecture series, planned for the period January to May/June 1993, will be as follows:

in Condensed Matter Physics: Density Functional Theory, Electron Gas, Nonlinear Dynamical Systems, Semiconductors and Superlattices, Superconductivity and Quasi-1-dimensional Systems, Surfaces and Interfaces, and Theory of Complex Systems.

in High-Energy Physics: Lie Groups and Lie Algebras II, Quantum Field Theory, Standard Model, and Supersymmetry and Grand Unified Theories.

in Mathematics: Algebra (Groups, Rings and Modules, Fields and Galois Theory), Complex Analysis, Functional Analysis, Introduction to Algebraic Geometry, Introduction to Algebraic Topology, and Theory of Ordinary Differential Equations.

Special topics lectures will also be delivered, and students are expected to participate in other scheduled activities of the Centre in the three fields.

As usual, after completion of the courses and relevant examinations, from May/June until the end of September 1993, Diploma Course participants will prepare a written dissertation and will be expected to orally defend their work. ♦

The Diploma Course participants of High Energy Physics, Condensed Matter Physics and Mathematics with Professor Abdus Salam, Director ICTP and President TWAS.

ICTP Visiting Mathematician wins Max-Planck Research Award

Dr. Ma Zhi-Ming, Visiting Mathematician at ICTP from the Chinese Academy of Sciences, Beijing, P.R. China, has been elected recipient of the Max Planck Research Award together with Prof. Sergio Albeverio, from University of Bochum, Germany, and Prof. Michael Röckner, from University of Bonn, Germany.

The award has been granted to Prof. Ma Zhi-Ming and Prof. Albeverio in recognition of their past accomplishments in research. The Award amounts to DM 100,000 and is provided for research work in collaboration with Prof. Albeverio over a period of three years.

The awarding ceremony was held in Bonn at the Alexander von Humboldt Foundation on 8 December. ♦

Collaboration in Mathematics

The Mathematics Research Group of ICTP has started a programme of joint seminars and discussions of open problems, in collaboration with the Scuola Normale Superiore (Pisa, Italy), the International School for Advanced Studies (SISSA) and the University of Trieste. ♦

Atoms in Intense Laser Fields

Concepts of multiphotons processes involving radiative-electron scattering, above-threshold ionisation and multi-harmonic radiation in intense laser fields are briefly discussed.

F.H.M. Faisal
Guest Scientist, ICTP

Courtesy of Asia-Pacific Physics News, Vol. 4, December 1989.

Introduction

Interest in both experimental and theoretical studies of photon-atom interactions in intense laser fields has increased rapidly in recent years. In Table 1, some properties of laser light are compared with those of an ordinary lamp. It is at once clear from a glance at this table that the field of a laser is very unlike that of ordinary light in many respects. The recent upsurge of interest in laser-atom interaction is motivated both by the desire to understand the physics of atoms subjected to such extraordinary perturbations as well as by the prospect of potential applications, e.g. in generating new kinds of radiation, laser-plasma fusion, control of chemical reactions, generation, transmission and guidance of information at optical speed and other problems in photonics. Here I shall restrict myself to the consideration of some processes of current interest in the physics of laser-atom interaction at high intensities. They include processes such as multiphoton and above threshold ionisations, radiative electron scattering and multi-harmonic generation of radiation.

Property		Lamp	Laser
Intensity	$I.$	10^2 W/cm^2	10^{17} W/cm^2
Spectral purity	$\frac{\Delta\omega}{\omega}.$	10^{-6}	10^{-15}
Coherence length	$\Delta L.$	10^2 cm	10^{10} cm
Pulse duration	$\Delta\tau.$	10^{-6} sec	10^{-14} sec.

Table 1

Multiphoton ionisation

Our understanding of the elementary process of photo-ionisation of atoms has gone through a significant change in recent years. It is known for some time now that photo-ionisation of electrons bound in isolated atom or in solids can take place in the presence of light waves with photons of energy *smaller* than that of the ionisation energy (or the work function). This is in apparent defiance of the traditional text book interpretation of photoelectric effect, originally explained by Einstein near the beginning of the century[1]. Fig. 1 shows typical measurement[2] of ion-signals obtained by shining light from a Nd-laser of various modes (with $\hbar\omega = 1.17$ eV) on Xe-atoms.

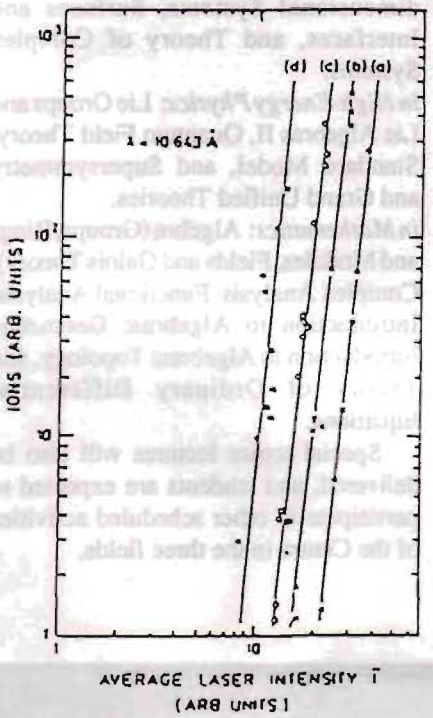

Figure 1.

Figure 1.
Log-log plot of the variation of the number of Xe-ions produced as a function of the average laser intensity (Nd-laser). The laser operates in (a) a single-mode, (b) two-modes (c) seven modes and (d) phase-locked seven modes. (From G. Mainfray, ref. 2).

The ion-signal is shown here as a function of the light intensity, in a log-log scale. Recalling that the ionisation energy gap of Xe-atoms is about 12.1 eV it is at once clear that photons from a Nd-laser have energy which lie *below* that of the ionisation threshold and in fact constitute only a small fraction of the latter. How does the laser light of sub-threshold photon energy cause ionisation of atoms? The physical picture that has emerged from extensive experimental and theoretical studies of these processes can be made intuitively clear with the help of the concept of "virtual absorption". A virtual absorption is a process in which an electron in an initial bound state of energy, E_i, absorbs a photon of (sub-threshold) energy, $\hbar\omega$, and reaches a "virtual state" at an energy $E_i + \hbar\omega$ (which, in general, does not coincide with any of the eigenenergies of the stationary states of the system) where it lives for a very short time. The "life-time" of a virtual state may be estimated by the uncertainty relation and is of the order of $\tau \approx \hbar/\Delta E$, where ΔE is the energy difference between that of the virtual state and the nearest stationary ("real") state of the atom. Fig. 2 depicts this in a schematic way. The more general photoelectric effect by subthreshold photons, is understood to occur by successive *virtual-absorptions* of as many photons as necessary to overcome the ionisation energy gap.

Naturally, such processes will have only a negligible probability in the fields of ordinary light; due to their weak intensity, they cannot provide sufficient photon-density for the successive absorptions to take place within the short ($\sim 10^{-16}$ sec.) "life-time" of the virtual states. The actual probabilities of such processes can be calculated using appropriately higher order perturbation theory (see e.g. ref. 3, chapter 2). The basic result of perturbation analyses can be summarised by the now well-known power law: $W^{(N)} \sim I^{(N)}$ where $W^{(N)}$ is the rate of the multi-photon ionisation requiring absorption of N-photons. It is directly proportional to the N^{th} power of the intensity I. ($I = E_0^2 c/8\pi = n_0 \hbar\omega c/L^3$, where E_0 is the classical peak amplitude of the laser-field, (n_0/L^3) is the quantal number density of photons and c is the

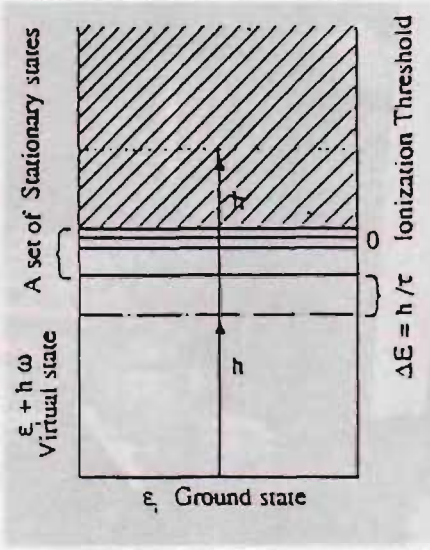

Figure 2.

A schematic illustrating the position of a "virtual state" (denoted by the dash-dot line) in a level-diagramme and its "life-time" $\sim\tau = \hbar/\Delta E$. ΔE is the distance to the nearest stationary (or "real") state. The wave function of a virtual state is a linear superposition of all the stationary states of the system, which appear with decreasing relative strength with increasing distance from the virtual state.

velocity of light).

Fig. 1 is typical of multi-photon ionisation signal at lower intensities. The initial linear dependence of the experimental result with either single mode or many mode lasers confirms this law. The power law is essentially independent of the kind of atoms used in experiments. A characteristic intensity, I_o, of the atomic system is the intensity of the Coulomb field of the nucleus of atomic hydrogen experienced by an electron in its ground state and is $I_o \approx 3.51$ electron in its ground state and is $I_o \approx 3.51 \times 10^{16}$ W/cm^2. Thus, for $I << I_o$ the power law may be expected to yield a rapid decrease of the multi-photon ionisation signal with increasing N (decreasing approximately by a factor of the order of (I/I_o) for every increase of N by one).

Multi-harmonic radiation

One of the more interesting effects currently under investigation, is the phenomenon of the multi-harmonic radiation[4,5,6]. This process is characterised by emission of a whole spectrum of harmonic photons when a strong laser-field of a fixed photon energy is allowed to interact with atoms at high density. For example, the multi-harmonic radiation (MHR) spectrum containing all the odd harmonics as far as the 33rd harmonic has been observed, when noble gas atoms were made to interact with strong Nd-laser fields. Fig. 3 shows such a MHR-spectrum obtained by shining Nd-laser of intensity ~10^{13} W/cm^2 on Ar-atoms[5].

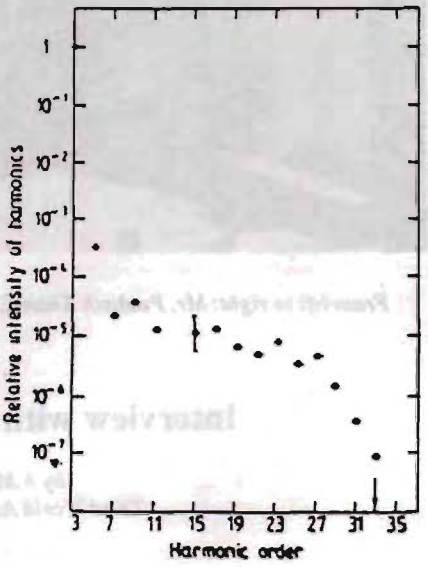

Figure 3.

A multi-harmonic radiation spectrum. Relative intensity of multi-harmonics generated by Ar-atoms in Nd-laser field ($\hbar\omega$ = 1.17 eV, I ≈ 3 × 10^{13} W/cm^2). The 13th harmonic is absent apparently due to strong absorption of 91.9 nm radiation by photo-excitation of a 5d-state. (From M. Ferray *et al.*, ref. 5).

From quantum mechanical point of view this implies creation of new photons by fusion of several (or many) laser photons from the incident field. Such "fusions of photons" in multi-harmonic radiation can be viewed to occur as follows. The incident photons of energy $\hbar\omega$ force the active electron to be excited temporarily to a state of energy $n\hbar\omega$ above the ground state (by stimulated n-photon absorption). This state of the electron can be in general a virtual one if $n\hbar\omega$ is below the ionisation threshold or it can be a real state in the continuum. The excitation energy $n\hbar\omega$ is then transfered to a vacuum mode of energy $\hbar\Omega = n\hbar\omega$, with a probability which becomes generally appreciable only at high incident photon-density. A new photon of energy $\hbar\Omega = n\hbar\omega$ is then created as the active electron returns to the initial (ground) state. Furthermore, in the direction of propagation of the incident photons the amplitudes of emission of the new photon from different atoms add up coherently, giving a N^2 dependence of the emitted intensity, where N is the number density of atoms within the coherence length (of the order of the wave-length of the emitted radiation). This also explains the fact why multi-harmonic radiation could be seen copiously in the laboratory for the first time when the density of atoms is raised to ~10^{18}/cm^3, far above the density usually employed (~10^{12}/cm^3) in ATI experiments with comparable field intensities. Due to parity conservation in electromagnetic interaction and centro-symmetric nature of the atomic system, multiple fusions of photons occur only in odd-harmonics of the incident photons, so that $\hbar\Omega = n\hbar\omega$ with n = 3,5,7,9... Due to the magnetic quantum number selection rule in multiphoton transitions (see e.g. ref. 3, sec. 5.2), for circularly polarised incident photons of specific handedness no such harmonic radiation is allowed. The origins of the multi-harmonic radiation under condition of uniform gas density over extended volume and with narrow gas jets are so far incompletely understood. However, these and the major spectral characteristics of the MHR-radiation such as the existence of a broad plateau in the spectral region extending from the 9th harmonic to a very high harmonic and a subsequent relatively abrupt cut-off, the unusual laser intensity dependence, its connection with the corresponding spectra of ATI and related problems are currently being studied vigorously[6,7,8]. This phenomenon opens up the possibility of efficient generation of possibility of efficient generation of coherent soft X-ray photons by direct interaction of low-frequency laser photons in atomic gases.

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2. G. Mainfray in *Multiphoton Processes*, eds. J.H. Eberly and P. Lambropoulos, p. 253 (John Wiley, NY 1978).
3. F.H.M. Faisal, *Theory of Multiphoton Processes* (Plenum Press, New York, 1987).

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Primo Rovis Prize 1992

The Committee of the International Prize "Primo Rovis" selected the Nepalese journalist Peakash Khanal as winner of the Prize this year, for his activities aimed at disseminating scientific culture. He was handed the Prize by Mr. Primo Rovis himself in the presence of the Director of ICTP Professor Abdus Salam on 18 December. The Prize, instituted out of the generosity of businessman Primo Rovis, and with US$ 20,000, 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 of ICTP, is composed of representatives of international repute from local universities and research institutes. Mr. Peakash Khanal is the in-charge of public relations at the Royal Academy of Sciences and Technology of Nepal, directs a scientific journal, and is correspondent from Europe for South-East Asian countries. ◆

From left to right: Mr. Peakash Khanal, Mr. Primo Rovis and Professor Abdus Salam.

Interview with Peakash Khanal

by A.M. Hamende
Third World Academy of Sciences

Mr. Peakash Khanal, a journalist from Nepal, received the medal of the Trieste International Foundation for the Scientific Progress and Freedom on 14 December 1992, in recognition of his outstanding work in the popularization of science. Professor Abdus Salam is the President of the Foundation.

Q.: Mr. Khanal, let me first of all congratulate you on the medal presented to you by the Trieste International Foundation for the Scientific Progress and Freedom. Can you tell us how you came to know about the Foundation and came to know about the Foundation and the international institutions in Trieste?

A.: It is indeed a great honour for me to receive the "Primo Rovis" Medal from the Trieste International Foundation for the Scientific Progress and Freedom. I must say that I never anticipated medals and awards when I started to popularize science as a journalist. But I must confess that this recognition of my services to this field has greatly motivated me and has given me a cause and enhanced my responsibility for continuing to serve this neglected domain from which a larger segment of our society stands to benefit.

I have known of TWAS and ICTP for many years because of my association with the Royal Nepal Academy of Science and Technology (RONAST). I had the first opportunity to work closely with TWAS and ICTP in 1989 when the First Summer School of Physics was organized in Kathmandu. Through TWAS and ICTP information channels I learnt about the Foundation for Scientific Progress and Freedom and the Primo Rovis Award.

Q.: The Third World Academy of Sciences considers that the popularization of science through media popularization of science through media is very important for raising the level of scientific culture in the developing countries, particularly at the grassroot. You have written many articles for the press of your country. Do you think that they can influence the public opinion and the viewpoint of decision makers in Nepal?

A.: Like TWAS, RONAST which was established in 1982, recognized the need to raise the level of scientific culture in Nepal. Great priority was given to the establishment of an information network and to starting scientific awareness activities. As a result, a pilot science

continued from Page 7

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popularization project with financial support from the International Development Research Centre (IDRC), Canada, was launched in 1985 under the aegis of RONAST. Therefore, 1985 was the first year of the science communication and science journalism era in Nepal.

I have written numerous articles for the Nepalese people as well as for the foreign press outside Nepal. I have edited the first science feature produced in my country for the exclusive use of mass media in Nepal. But it is extremely difficult to say whether those articles had any influence on the readers and listeners. However, one thing is sure: these articles were read by many and some of the information contained in them was useful. This was conveyed to me through various channels. For example, after the publication of a piece on the possibility of corneal transplant and its relationship with eye donation, I received many letters requesting more information about the subject and expressing willingness or the readers to donate their eyes after their death. This was also confirmed by the Eye Bank authorities.

Q.: You work for the Royal Nepal Academy of Science and Technology. Can you think of any help from the Third World Academy of Sciences to assist you and your colleagues, in the dissemination of scientific information?

A.: Scientific information is a serious issue and there should be much more than single pilot projects. For example, there should be training institutions or at least science journalism training programmes as well as continuing centres for informal education and learning for the promotion of scientific awareness and for stimulating science and environment popularization activities. TWAS could provide support with funds and with scholarships to train more science journalists or science communicators who will take up this challenging task. Perhaps, more awards need to be created to motivate more people to go into this

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Second UN/ESA Workshop on Basic Space Science

Hans J. Haubold
United Nations, New York.

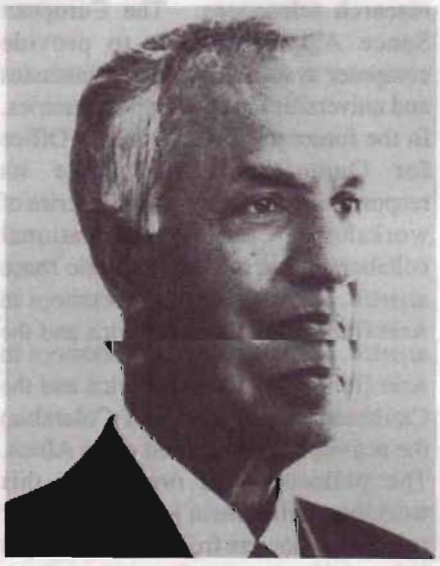
Second United Nations (UN)/European Space Agency (ESA)/The Planetary Society (TPS) Workshop on Basic Space Science, held at the University of Costa Rica, San José (Costa Rica), 2 to 7 November 1992, and at the University of the Andes, Santa Fe de Bogotá (Colombia), 9 to 13 November 1992.

The United Nations Office for Outer Space promotes collaboration in space science and technology among industrialized and developing countries. This workshop has been organized as part of the United Nations Programme on Space Applications, observing also the International Space Year (ISY) 1992 as a world-wide initiative of space agencies and the scientific community to enhance international collaboration in the field of basic space science. The workshop (i) brought together astronomers from 13 countries of Latin America and the Caribbean, Canada, Germany, Sweden, United Kingdom, United States of America, ESA, NASA and the UN, (ii) addressed scientific issues in planetary and solar system science in Costa Rica, cosmology and astronomy space missions in Colombia, and (iii) made observations and recommendations for promoting basic space science, particularly in Latin America and the Caribbean. The objectives of the workshop were achieved through intensive mutual discussion and detailed presentations made by selected astronomers from countries referred above. The workshop was held in the spirit of the continuing quest for fundamental knowledge, turning the achieved knowledge into education curricula, and the search for international collaboration at the highest scientific level. The ESA lecture (W. Wamsteker) "Archives and their relation to the development of fundamental scientific ideas", the TPS lecture (C.R. Chapman) "Catastrophic impacts on Earth", the ISY lecture (R. v. Ammon) "Detection of astrophysical neutrinos", and the presentations made by W. Fernandez (Costa Rica) "Changes in solar irradiance and atmosphere torbidity in Costa Rica during the total solar eclipse of July 1991" and S. Torres (Colombia) "COBE results and their cosmological implications" were setting the frame of the scientific programme of the workshop. Among the distinguished speakers whose support for the workshop was exemplary were W.J. Anderson (Canada), J. Bennett (NASA), C.G. Faelthammar (Sweden), M.H. Ibanez (Venezuela), A.M. Mathai (Canada), J. Sahade (Argentina) and H.U. Zimmermann (Germany). Through the initiative of Prof. M. Kitamura (Japan) the government of Japan will continue to support the establishment of national astronomical observatories in developing countries through the provision of equipment for astronomical research telescopes. The European Space Agency intends to provide computer systems to research institutes and universities in developing countries. In the future the United Nations Office for Outer Space will take its responsibility in promoting this series of workshops and international collaboration in the field of basic space science. After organizing workshops in Asia (India) and Latin America and the Caribbean (Costa Rica and Colombia) the activity will be carried on to Africa. The philosophy of organizing this workshop will remain to bring together active astronomers from developing and industrialized countries and to seek strong support from space agencies and the international scientific community to strengthen the growth of basic space science in countries where this science in all its aspects has not yet been fully developed. ♦

***Brian David Josephson** (U.K.), 1973*
"for his theoretical prediction of the properties of a super-current through a tunnel barrier, and in particular those phenomena which are generally known as Josephson effects".
Dates of visits:
1972, September 18 – 25
1973, August.

Thirty-five Nobel Laureates have visited the ICTP since 1964. The citations for the Prize and dates of their visits are given for five of them in this issue. More will be published in future ICTP newsletters.

***Samuel Chao Chung Ting** (U.S.A.), 1976*
"for the discovery of a new type of elementary particle known as psi".
Dates of visits:
1970, September 15 – 18
1974, June 19 – 23
1989, October 31 – November 3.



***Subrahmanyan Chandrasekhar** (India), 1983*
"for his studies of the physical processes of importance to the structure and evolution of stars".
Date of visit:
1975, July 9 – 13.

***Chen Ning Yang** (U.S.A.), 1957*
"for penetrating investigations of the parity laws which led to important discoveries regarding subatomic particles".
Date of visit:
1981, December 12 – 15.

***Burton Richter** (U.S.A.), 1976*
"for the discovery of a new type of elementary particle known as psi".
Dates of visits:
1974, June 19 – 22
1987, June 29 – August 7.

Role of Science in Indian Society

S.N. Tiwary
Associate, ICTP.

The first Prime Minister of India, Pandit Jawaharlal Nehru, formulated the science policy based on the fact that our problems of hunger, poverty and population can be solved only by science. Science cannot remain confined to the ivory towers of the universities and research institutes. Scientists have to educate the society in such way that at every level there should be a scientific attitude and an aptitude to understand the nature of scientific knowledge and the process of the investigation that generates knowledge.

Bertrand Russell rightly said, "A society can be called scientific in the degree to which scientific knowledge, and the techniques based upon that, affects its daily life, its economic and its political organizations". To what extent is the Indian society scientific in the above sense? No doubt the Constitution grants us freedom of speech, but the Indians do not enjoy the freedom from want of food and water, from fear of diseases, torture and terrorism.

In a fit of frustration one may say that the average happiness in the society today is much less than before the advent of scientific revolution. But science can not be blamed for this. It provides a means which can be used or misused. Science has brought to us enormous material advantages, but the scientists have failed to see that they are properly handled and uniformly distributed.

However, one can not fail to observe that science has improved the quality of life in the world and in India. Science is aiming at a smaller, contented population with abler and more productive hands and fewer mouths to be fed, so that the nation can progress to economic prosperity.

Science has contributed immensely to industrial and agricultural growth, so that there is restricted import and increasing export. The nation could survive the worldwide economic crisis and is progressing to recovery. Science has always come to the rescue of the nation and it has not failed our country.

Semiconductors, microchips and computers helped the industries immensely. The introduction of superconductors is on the anvil. Transportation, communication, labour and management have become efficient. Availability of energy has improved. In agriculture, the use of better quality of seeds, fertilizers, pesticides and better irrigation facilities has brought green revolution. Better breeding methods have brought boom in poultry, meat, fish and dairy products.

Our natural resources have been explored. Fields and ocean beds are being tapped for natural oil, leading to petrochemical industries. Alkali industries have developed based on marine chemicals. Numerous drugs and improved surgical methods have eradicated various diseases and made life happier. Family planning devices are showing results.

There are some arguments that the other worldly attitude in the Indian philosophy hinders the growth of scientific temper in the society. Scientific theories and moral truths are complementary to each other. Contradiction between Indian philosophy and science does not exist any more. Let the Indian society be imbued with the spirit of science. Planned use of science will certainly make the nation economically advanced to attain greater prosperity. Only science can save the nation. ♦

Interview with Peakash Khanal,
continued from Page 9

profession. The awards do not need to be of a huge amount: a medal and a visit to scientific institutions will be useful.

Q.: You have visited the scientific institutions in Trieste. What are your impressions? Will you write about them?

A.: Trieste is the first science city I have visited and it gave me an impression of how a real science city should look like, bursting with national and international centres of scientific excellence. Upon reaching here I realized that ICTP/TWAS and the untiring personality of Nobel Laureate Prof. Abdus Salam have not only become a source of inspiration to many talented scientists from the developing world who without these institutions would have ended in oblivion, but has also played an equally important role within Italy. This transpires from the international institutions and from the research and development centres that have come to be created within Italy. It is very impressive to see that Trieste has carved a very special place. Its fame is bound to multiply with the scientific achievements in the coming years.

Born in October 1958, Peakash Khanal obtained a B.Sc. at the Tribhuvan University in Nepal in 1981 and is presently completing a Master in Business Administration at the same university. He currently works at the Royal Academy of Sciences and Technology where he is in charge of the liaison with the media. He has written many articles on science and environment for newspapers and journals and contributes to radio and television programmes production. He is also the coordinator of a course for prospective journalists and a consultant for science and technology promotion and popularization. ♦

Obituaries

Prof. A. Borsellino

Prof. A. Borsellino, a distingushed biophysicist of Italy, died at the age of 77. Born in Reggio Calabria (Italy) in 1915, he obtained his degree in physics in 1938 at the Scuola Normale Superiore in Pisa and started immediately research activities at the Polytechnic of Milan where he taught until 1950 when he became Full Professor in theoretical physics.

In the '50s, when the description of elementary processes of electromagnetism was topical, Prof. Borsellino became notable for examining for the first time the process whereby a photon produces an electron-positron in an electron field. He was the author of an important research on the so-called electromagnetic showers produced by cosmic rays. Hans Bethe, Nobel Laureate 1967, remarked the fundamental role of Professor Borsellino's research. To be remembered are also his studies on nonclassical statistical laws to which elementary particles are subjected as well as those on photonuclear reactions.

At the University of Genoa he was an innovator who took the fame of the department to an international level. He insisted for introducing computers at that university which then could boast one of the first computer centres in Italy.

In the mid '60s Prof. Borsellino became interested in biophysics and neurophysiology as he was convinced that mathematical and experimental methods could be applied to those fields. Thus, he became one the fathers of biophysics in Italy — he founded the Laboratory of Cybernetics and Biophysics of the National Research Council and developed a school in Genoa which has produced very good results and scholars.

In 1985 he moved to Trieste where the International School for Advanced Studies (SISSA) requested him to start and develop a research group in biophysics. ♦

Prof. R. Marshak

Professor Robert E. Marshak, an outstanding physicist and a scientist of world renown, died on 23 December 1992. Prof. Marshak, 76, led City College of New York, USA, during the 1970s and later was a Professor at Virginia Polytechnic Institute and State University in Blacksburgh. He drowned in the sea on December 23 while on vacation in Cancun, Mexico.

Prof. Marshak, a distinguished Professor Emeritus of physics at Virginia Tech. and State University, had recently been selected as the first recipient of an American Association for the Advancement of Science Prize for fostering international scientific cooperation. Most of his career was spent at the University of Rochester in New York where he was Chairman of the Department of Physics and Astrophysics.

He was a great friend of Professor Abdus Salam, Director of the International Centre for Theoretical Physics, Trieste, Italy. In 1960 he discussed with Prof. Abdus Salam the feasibility of an international centre for theoretical physics. He became a member of Three Wise Men Feasibility Study Committee of the International Centre for Theoretical Physics (ICTP), Trieste, Italy. In 1967-75 he was a Member of Scientific Council of the International Centre for Theoretical Physics (ICTP), Trieste, Italy.

He wrote a number of books alone and in collaboration including a book to be published as a textbook "The Conceptual Foundation of Modern Particle Physics". ♦

Activities at ICTP in November-December

Title: SECOND AUTUMN WORKSHOP ON MATHEMATICAL ECOLOGY, 2 – 20 November.

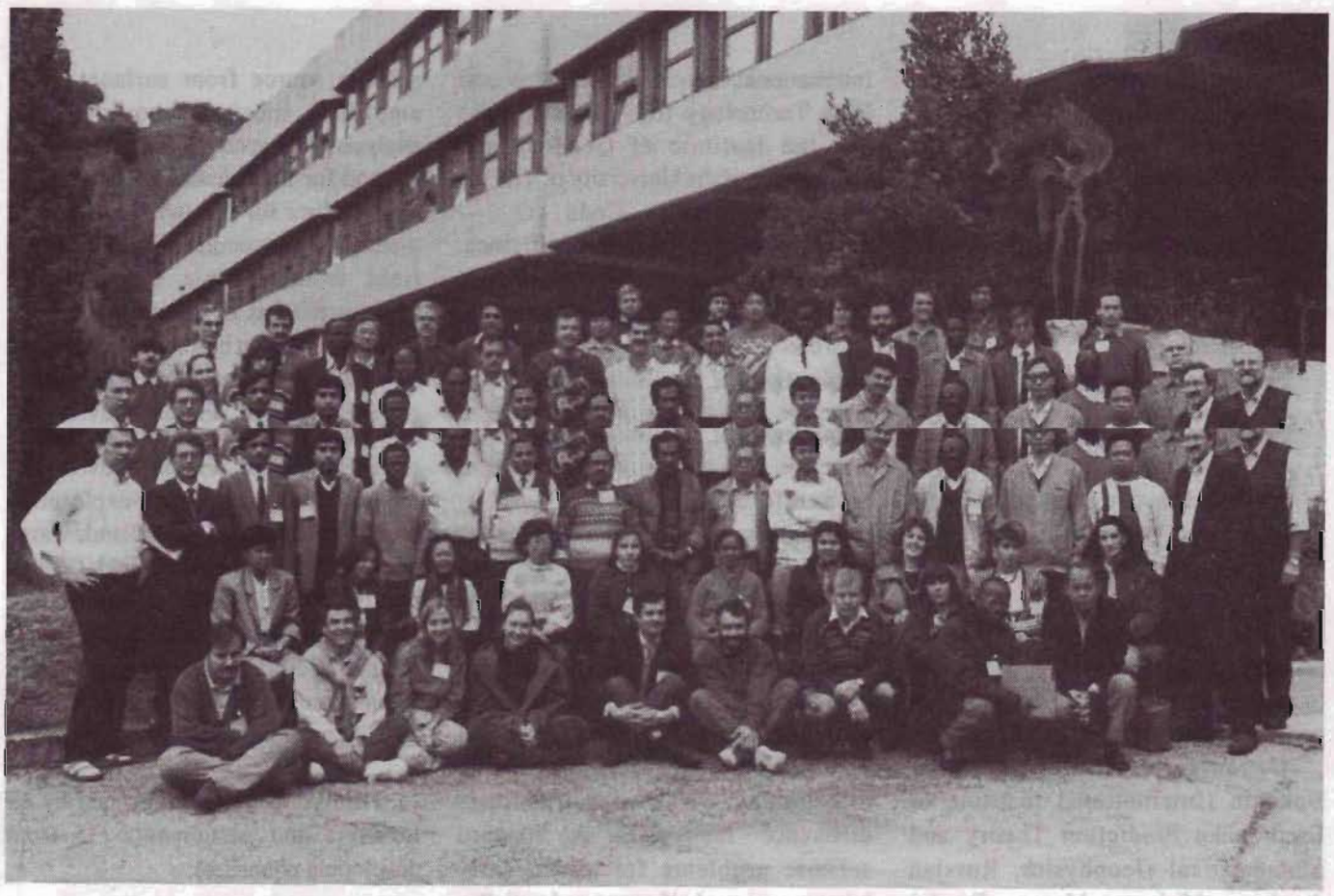
Organizers: Professors L.J. Gross (University of Tennessee, Knoxville, USA), T.G. Hallam (University of Tennessee, Knoxville, USA), S.A. Levin (Princeton University, USA) and G. Vidossich (International School for Advanced Studies, SISSA, Trieste, Italy).

Lectures: Water quality and governmental regulation issues. Risk assessment measures in conservation biology. Modelling water-sediment interactions. Individual-based approaches in ecological risk assessment. Conceptual issues in biological diversity. Computer-based risk assessment tools. Low and high frequency oscillations in three dimensional food chain systems. Decision theory and extinction risk. The role of the biosphere in climate change — questions and rationales. African elephants and the ivory trade: the importance of social structure in determining population viability. Using all the data: modern approaches to interpreting fisheries data. The problem of scale. Global climate modelling. Biospheric components of earth system models with emphasis on soils processes. Landscape-scale models. Competition and cooperation in a marine fishery: applying ecological principals in a bioeconomic analysis. Population modelling: the zebra mussel in North America. Tick population modelling at the ICIPE. Computer-informational system bank of ecophysiological plant models. A three age-groups model for HIV-AIDS epidemic (in Uganda). Rocket scientists have it easy. Infectious diseases and conservation biology: rinderspest in the Serengeti and brucellosis in Yellowstone. Modelling response functions and data analysis. Distributed lags in discrete dynamical

systems. Island biogeography revisited. The growth model of H. persicum population in Mosouwan Desert of Zhungeer Basin. Models for animal movement of a home range. Persistence and evolutionary dynamics in fluctuating, spatially structured populations. An introduction to AIDS modelling. Thermodynamic ideas in ecology. Epidemic modelling. Software for teaching and doing research in ecology. The threshold between persistence and extinction of populations invaded by toxicant and some open problems. Risk analysis in agriculture. Structured dynamical models of forest stand dynamics in different time scales. A unified approach to model social dynamics and pair formation with applications to epidemiology. Models for wildlife: individual-based to landscape approaches. Simulation modelling system for aquatic bodies. Global climatic changes and some consequences for Russia. Resource management based on risk analysis. Dynamical systems in biology: Lyapunov functions and information. Chance and chaos in measles dynamics. Natural selection in a diploid host and its viral pathogen. A new strategy for preventing measles epidemics. R0 for models of sexually transmitted diseases that take long lasting partner relations into account. Discrete effects in continuous ecological models. Methods for estimating mixing/pair formation matrices. Plant life history theory and population dynamics. The cumulative formulation of structured population dynamics. The saturating contact rate for marriage and epidemic models. Environmental variation and species richness: a model and an example. Stability problems in chemostat equations with delayed nutrient recycling. A qualitative analysis of chemostat equations with (or without) delay nutrient recycling. Models in plant biology: from physiology to landscape scale. Simulation models for risk management. Stability and persistence in models with dispersion. Natural selection and the dynamic coexistence of defective and complementing virus segments. Energy partitioning models and conservation practice. Seasonal components of transmission in a free-living host-parasite system. Fish populations in flooded regions. Life span of irradiated mammals — mathematical modelling. Bifurcative analysis of predator-prey population models. Do plants adopt optimal reproductive strategies? Models of Chagas' disease. Desertification, causes and possible solutions. Disturbance and the dynamics of tropical forests.

Working Groups:

Conservation biology assessment: RAMAS – model demonstration. Applications of RAMAS. Environmental data from aquatic systems in Italy. Decision theory and extinction risk.



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

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

Ecological risk assessment: Computer tools. Ecological models.

Resource management: The Serengeti ecosystem: developing simple models for analysis of resource management alternatives in an African Park.

Global change.

Epidemiology.

Forest/agriculture.

The Workshop was attended by 98 lecturers and participants (57 from developing countries).

Title: WORKSHOP ON THREE-DIMENSIONAL MODELLING OF SEISMIC WAVES GENERATION, PROPAGATION AND THEIR INVERSION, 30 November – 11 December.

Organizers: Professors B.G. Bukchin (International Institute of Earthquake Prediction Theory and Mathematical Geophysics, Russian Academy of Sciences, Moscow, Russia) and G.F. Panza (University of Trieste, Italy), in collaboration with the International Centre for Science and High Technology (ICS, Trieste, Italy) and the Institute of Geodesy and Geophysics of the University of Trieste.

Lectures: Lg Coda Q — measurement and physical significance. A back-projection technique for Lg Coda Q tomography. Introduction to computer exercises. Seismic source models. Implications of Lg Coda Q for crustal structure and evolution. The inverse structure and evolution. The inverse problem for the seismic source. Synthetic seismograms calculations in 1D and 2D media from multimodal summation. Seismic ray method for 3-D structures: possibilities and limitations. Finite integral transformations of different kinds and their use in the forward seismic problems. New frontiers for world safety. Some problems of seismic tomography. The spectral-finite difference method for the forward seismic problems for a vertically inhomogeneous half-space and radially-inhomogeneous sphere. Determination of spatio-temporal characteristics of a seismic source from surface waves amplitude spectra. Frequency-time analysis. The spectral finite difference method for the calculation of synthetic seismograms for 2D and 3D models of media. Reconstruction of tectonic stress field from seismic observations. Characterization of strong motion and wave propagation based on Smart-1 data — source and local effects. Numerical investigations of non-ray waves. The investigations of non-ray waves. The method for geophysical exploration based on the interaction of seismic waves with the Earth's magnetic field. Ground motion modelling for seismic hazard zoning. Synthetic seismograms with a hybrid method: coupling of mode summation and finite differences.

Computer exercises.

The Workshop was attended by 63 lecturers and participants (35 from developing countries). ♦

Calendar of Activities at ICTP
1993

Sixth International Workshop on computational condensed matter physics ..... 11 – 13 January

Experimental Workshop on high temperature superconductors and related materials
(advanced activities), San Carlos de Bariloche, Argentina ..... 11 – 29 January

Fourth Training College on physics and technology of lasers and optical fibres ..... 18 January – 5 February

Second Workshop on functional-analytic methods in complex analysis
and applications to partial differential equations ..... 25 – 29 January

Third ICTP-URSI College on theoretical and experimental radiopropagation physics ..... 1 – 26 February

Winter college on optics ..... 8 – 26 February

Workshop on scientific aspects of the rural communications in developing countries ..... 1 – 5 March

Adriatico Research Conference on quantum interferometry ..... 2 – 5 March

Conference on "Highlights of particle and condensed matter physics" ..... 8 – 12 March

Workshop on representation theory of Lie groups ..... 15 March – 2 April

Spring School and Workshop on string theory, gauge theory and quantum gravity ..... 19 – 29 April

Meeting on "Intracellular channels, organelles and cell function" ..... 21 – 23 April

Sixth Workshop on perspectives in nuclear physics at intermediate energies ..... 3 – 7 May

Workshop on qualitative aspects and applications of nonlinear evolution equations ..... 3 – 14 May

Course on ocean-atmosphere interactions in the Tropics ..... 10 – 29 May

College on computational physics ..... 17 May – 11 June

Spring College on plasma physics ..... 17 May – 11 June

Summer School in high energy physics and cosmology ..... 14 June – 30 July

including

Third School on non-accelerator particle astrophysics ..... 28 June – 9 July

Miniworkshop on strongly correlated electron systems ..... 21 June – 9 July

Research Workshop in condensed matter, atomic and molecular physics ..... 21 June – 3 September

Adriatico Research Conference on strong correlation phenomena at low carrier densities ..... 22 – 25 June

Adriatico Research Conference on scattering from surfaces ..... 6 – 9 July

Workshop on the liquid state of matter: opportunities from new radiation sources ..... **19 – 30 July**

Miniworkshop on non-linearity: chaos in mesoscopic systems ..... **26 July – 6 August**

Adriatico Research Conference on mesoscopic systems and chaos, a novel approach ..... **3 – 6 August**

Conference on variational problems in differential geometry and partial differential equations ..... **16 – 20 August**

Adriatico Research Conference on vortex fluctuations in high T_c superconductors ..... **17 – 20 August**

Working Party on mechanical properties of interfaces ..... **23 August – 3 September**

Workshop on materials science and physics of non-conventional energy sources ..... **30 August – 17 September**

Course on geometric phases ..... **6 – 17 September**

College on soil physics ..... **6 – 24 September**

Second Workshop on composite media and homogenization ..... **20 September – 1 October**

Workshop on telematics ..... **27 September – 22 October**

Workshop on radioecology: mechanisms of transfer of radionuclides to the environment ..... **11 – 29 October**

Conference on the origin of life ..... **25 – 29 October**

Second School on the use of synchrotron radiation in science and technology:

"John Fuggle Memorial" ..... **25 October – 19 November**

Trieste Conference in high energy physics ..... **8 – 12 November**

Second Workshop on non-linear dynamics and earthquake prediction ..... **22 November – 10 December**

ICTP-UNU-Microprocessor Laboratory: Third Course

on basic VLSI design techniques ..... **22 November – 17 December**

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

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