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INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS

NEWS FROM ICTP

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PRESENTATION OF ICTP DIRAC MEDALS

On Saturday 15 November 1986, one of the 1985 and one of the 1986 Dirac Medals of the International Centre for Theoretical Physics (ICTP) in Trieste were officially given to Professor Yakov Zeldovich (Space Research Institute, Moscow, USSR) and Professor Alexander Polyakov (Landau Institute of Theoretical Physics, Moscow, USSR) respectively, by Professor Abdus Salam, Director of the ICTP, and Professor Stig Lundqvist, Chairman of the ICTP Scientific Council. The other 1985 Medal was given to Professor Edward Witten (Princeton University, USA) on 7 February 1986, while Professor Yoichiro Nambu (Enrico Fermi Institute for Nuclear Studies, Chicago University, USA) will receive the other 1986 Award in Spring 1987. More than three hundred scientists and officials attended the award ceremony which took place in the Main Lecture Hall of the ICTP.

After the Medals were handed over, Professor Zeldovich and Professor Polyakov lectured on recent developments in cosmology and directions in string theory respectively.

EKLUND PRIZE

At a special ceremony which took place in the afternoon of 19 November 1986 in the Main Lecture Hall of the International Centre for Theoretical Physics (ICTP) in Trieste (Italy), Professor Emeritus Chike Obi, Professor Emeritus from the University of Lagos (Nigeria) received the 1985 ICTP Prize awarded this time for outstanding contributions in the field of mathematics. The Prize is named after Dr. Sigvard Eklund, Director General of the International Atomic Energy Agency (IAEA) in Vienna (Austria) from 1961 to 1981 and a staunch friend of ICTP.

Dr. Eklund himself handed over the prize, a 1,000 US $ cheque and a certificate, while Professor Abdus Salam, Nobel Laureate for Physics 1979 and Director of the ICTP, read the citation in front of an audience of some 300 scientists from all over the world. One of the sons of Professor Obi, a lecturer in theoretical physics at the University of Ilorin, was among them.

Professor Obi has made significant contributions in the study of nonlinear ordinary differential equations with several parameters for which he established numerous results on the existence, number and some analytical expressions of harmonic, subharmonic or uniformly almost periodic solutions.

Professor Obi was born in 1921 and was the first Nigerian ever to get each of the B.Sc., M.Sc. and Ph.D in Mathematics. The first two he taught himself, since there was no one else in Nigeria to teach him, and took London externals. For his Ph.D., he went to Cambridge.

Professor Obi has also been engaged in the development of mathematics in Africa. His main contribution has been to inspire the whole of the existing mathematical community in Nigeria, which is the best in Africa. He is a man of vision and sees clearly how mathematics and science will develop in Africa in the future. He has just retired and is pioneering the position of Professor Emeritus. He is a fellow of the Nigerian Academy of Science, of the Science Association of Nigeria and of the Cambridge Philosophical Society and a Member of the Mathematical Association of Nigeria.

A former student of Professor Obi, Professor James Ezeilo (Department of Mathematics, University of Nigeria in Nsukka), himself a fervent promoter of science in Africa, paid a tribute to the works of the recipient. The ceremony was concluded by a speech by professor Obi on his memories as an African mathematician and a lecture by Dr. Sigvard Eklund on energy issues.

The ICTP 1983 and 1984 Prizes were awarded to two scientists from Asia and Latin America in the fields of solid state and plasma physics respectively. The 1986 Prize will be awarded in March 1987 to Professor Li Jiaming from China for his contributions in the field of atomic and molecular physics.

The International Centre for Theoretical Physics of Trieste (Italy) was founded in 1964 and is a research institution of the International Atomic Energy Agency (Vienna, Austria) and UNESCO (Paris, France). From 1970 to 1985, 307 Nigerian scientists took part in the research and training-for-research activities of the ICTP.

CEREMONY OF PRESENTATION OF TWAS AWARDS

On Sunday 26 October 1986, the Third World Academy of Sciences gave its first Awards to four scientists from developing countries who made singular contributions to basic sciences.

The Awards went to Prof. E.C.G. Sudarshan (India) for his fundamental contributions to the understanding of the weak nuclear force, in particular for his part in the formulation of the Universal V-A Theory of Sudarshan and Marshak; to Prof. S. Siddiqui (Pakistan) for his fundamental contributions in the chemistry of Rauwolfia alkaloids; to Prof. L. De Meis (Brazil) for his fundamental studies on the function of the Ca^{2+}-ATPase of the sarcoplasmic reticulum with particular regard to the mechanisms of energy transfer in biological membranes; and to Prof. Liao Shan Tao (China) for his fundamental contributions in two different areas of Mathematics: periodic transformation of spheres, and the qualitative theory of dynamics. The first Award was for Physics, the second and third for Chemistry and the fourth for Mathematics.

The Awards ceremony took place in the Main Lecture Hall of the International Centre for Theoretical Physics in Trieste in the presence of the President Professor Abdus Salam, the Vice-Presidents Professors T.R. Odhiambo (Kenya) and M.G.K. Menon (India) and the Members of the Council Professors Lu Jiaxi (China), A.R. Ratsimamanga (Madagascar) and E. Rosenblueth (Mexico).

The citations were read by the Executive Secretary Professor M.H.A. Hassan (Sudan) while the prizes consisting in a medal and a 10,000 US$ cheque were handed over by Dr. F. Salleo, Director of the Italian Department for Cooperation to Development of the Ministry for Foreign Affairs, the major financial contributor to the Third World Academy of Sciences.

All recipients gave a short lecture on their work. The day before, the financial contributor to the Third World Academy of Sciences.

All recipients gave a short lecture on their work. The day before, the Council and other members of the TWAS had a day-long discussion on South-South cooperation.

SUMMER AT ICTP

Traditionally, the summer is the densest period of activity at the ICTP due to the fact that academies from many countries are free of their teaching duties. This year has been no exception and turned out to be a record in terms of number of activities and attending scientists. In addition to the workshops in Condensed Matter and in High-Energy Physics, the summer programme included a Working Party on Physics of Condensed Matter at High Pressures, the Fourth IUPAP-ICTP Semiconductor Symposium, the College on Biophysics (Membranes) and the Adriatico Research Conferences.

WORKSHOP IN CONDENSED MATTER, ATOMIC AND MOLECULAR PHYSICS

Undoubted highlights of the 1986 Research Workshop in Condensed Matter, Atomic and Molecular Physics (16 June - 5 September) which was attended by a large number of fine theorists from the Third World, were the set of invited lectures by W. Kohn (Santa Barbara) on "The interaction of atoms with surfaces" and the Working Party of "Physics of Condensed Matter at High Pressures", directed by M. Ross (Livermore). Additionally, the IUPAP meeting on shallow impurity states, at which W. Kohn also gave a plenary lecture as the "father" of the subject, coupled strongly to the Workshop and was very successful. W. Kohn also reviewed, in a Workshop seminar, current progress in the use of density functional theory for excited states and this raised a good deal of interest.

Returning to the Working Party, diamond anvil cell measurements were brought into contact with shock wave experiments in a number of materials and interpreted in terms of electronic structure theory, including electronic excitations by thermal energy in the shock experiments. It was of special significance that the Director of the Working Party linked these advances with corresponding progress in understanding the constitution and properties of the giant planets, white dwarfs and neutron stars, the interest in the transformation of molecular solid hydrogen into the metallic phase remaining of considerable importance. In addition to the compression of molecular solids and liquids, some activity centred around atomic and molecular physics, in addition to Kohn's lectures, and the experiment of broadening the base of the Workshop somewhat, excluding however computational quantum chemistry, will be continued, certainly until the 1988 Workshop following the College on the interaction of atoms and moleculs with solid surfaces.

As was recorded in the 1985 Research Workshop report, strong group activities continued to be a major feature: these groups hinging largely on the initiatives taken by Third World participants. In addition, specialistic reviews of several active areas of research were held in the new format of one-day Symposia by Workshop participants.

It is satisfactory that many of the problems of the 1985 Workshop, the first in the Adriatico Guest House, have now been resolved, a major factor being the new Library in the Adriatico which was functioning well by late July 1986.

SUMMER WORKSHOP IN HIGH ENERGY PHYSICS AND COSMOLOGY

The main topics of the Summer Workshop in high energy physics and cosmology which took place from 30 June to 15 August, included superstring theory, unification schemes and the physics of the early universe. For seven weeks, there were approximately four lectures, including tutorial sessions, every day. Professors G. Furlan (ICTP), R. Iengo (ICTP), J.C. Pati (University of Maryland, USA), D. Sciama (SISSA) and Q. Shafi (University of Delaware, USA) organized the programme. The continuity of the programme was guaranteed by the collaboration of 20 discussion leaders from Italy, UK, USA, Switzerland, India, Greece and ICTP. Altogether, 146 physicists took part in the Workshop and 28 preprints were issued by them.

As an illustration of the programme, we quote only a few of the lectures: sigma models and string theories (A. Sen), field and light cone theory of fields, covariant field theory (K. Kikkawa), superstrings and preons (J. Pati), Riemann surfaces and string theories (E. Gava), string theories in ten dimensions (J. Harvey), construction of Calabi-Yau manifolds (T. Hubsch), heterotic string (K.S. Narain), superstrings from the bosonic string theory (F. Englert), finite temperature field theory and inflationary universe (R. Brandenberger), cosmology (J.G. Taylor), cosmological constraints on supergravity (S. Sauhar) and embedding of galactic systems in dark matter (R. Cowsik).

THE 1986 ADRIATICO CONFERENCES

Six conferences were held on frontier topics more or less related to the fields covered by the Workshop. The core of the symposia consisted of a group of 12 hours of overview lectures presented in the mornings. In the afternoons, a more specialized programme was presented. Scientifically, these meetings were very interesting and presented the topics at the frontier level. For the ICTP and the Workshop the major positive feature was that these Conferences brought in a sizeable number of first class physicists who were previously not familiar with the ICTP/SISSA activities.

The topics of the Conferences were quantum chaos, dynamical screening and spectroscopy of surfaces, relativistic many-body problems, heavy fermion systems, environmental physics - atmospheric aerosols, and physics of structure of complexity.

A series of five conferences for 1987 is now under planning. Professor Stig Lundqvist is the head organizer.

PROFESSOR SHELDON LEE GLASHOW

Professor Sheldon Lee Glashow was the distinguished guest of the International Centre for Theoretical Physics on 29 July 1986 during the Workshop in High Energy Physics and Cosmology.

Together with Abdus Salam and Steven Weinberg he received the Nobel Prize for Physics in 1979 for his contribution to the electroweak theory, i.e. the theory which unifies electromagnetic and weak forces, a theory which found its experimental confirmation at CERN and for which Carlo Rubbia and Simon van der Meer received the Nobel Prize for Physics in 1984.

Professor Glashow gave a lecture on the Salam-Weinberg voids in a charged universe and dedicated much of his time to discuss with the physicists of the Centre.

FOURTH IUPAP-ICTP SEMICONDUCTOR SYMPOSIUM

This meeting continued the series of biennial conferences started in 1980 by the Committee for Joint IUPAP-UNESCO Semiconductor Activities in Trieste. It was also the Second International Conference on Shallow Impurity Centres and, in that capacity, continued the theme of the First such meeting held in Berkeley in 1984.

The Chairman of the organizing committee, Prof. A. Baldereschi, was able to take advantage of speakers coming to Europe for the Stockholm meeting on Semiconductors. The result was a lively meeting of 60 specialists discussing topical issues of considerable interest to the members of the Workshop working on semiconductors.

The corresponding meeting in 1988 is already planned. It will be on Quantum Wells and Superlattices.

The programme of the Symposium was coordinated by Profs. A. Baldereschi, P.N. Butcher, A. Frova, R. Resta, E. Tosatti and M. Tosi.

SCHOOL ON ADVANCED TECHNIQUES IN COMPUTING IN PHYSICS

SUPERCOMPUTERS AND SUPERPHYSICS*

The use of sophisticated computers to simulate and solve problems which once were considered 'beyond our grasp' has meant that theoretical and experimental physics -- and not only these fields -- can progress greatly.

"Computer physics is now at the same level as physics was in Galileo's times. That is, we still have 400 years to go before we can match today's knowledge."

A moment's pause makes this remark even more effective. Then a smile. And then Ken Wilson goes on: "But the application of the computer to theoretical scientific problems can also spread to other fields. Let us take chemistry, for example. Molecular structure can be determined by starting from Schrödinger's equations of quantum mechanics. How do electrons position themselves around the nucleus? What is the orientation of chemical bonds and valences? These are ambitious and very complex calculations".

Another pause. Then he goes on: "I mean, there is enormous potential. For example, there is no advanced industrial field which is not limited by the still scanty knowledge on materials chemistry - from the aeronautical to oil industry. Interests of the order of thousands of million dollars are involved."

These are the words of Kenneth Wilson, Nobel Prize winner in 1982, full professor at Cornell University, fifty years old, slightly plump but still showing his sporting past (minor scientific reviews report that he holds a personal 4 minutes-17 seconds record for the mile - not at all bad). He is wearing a sky-blue sweater which gives him a young casual look. It was he who "starred" at the Conference on Perspectives in Computational Physics" from 27 to 31 October 1986 at the International Centre for Theoretical Physics in Trieste.

"Computational Physics" is a term which is now translated literally into all languages and has been adopted by experts all over the world. It indicates the application to theoretical and experimental physics of the fastest and most highly sophisticated computers to simulate and solve problems which once could either have been solved by means of a practical experiment or not solved at all.

Wilson seems willing to become the "guru" or charismatic leader of this new discipline. One must admit he has all cards, since his intelligence has piloted him through the roughest waters of modern theoretical physics. He won the Nobel Prize for transforming "phase transitions" into mathematical formulas - that is to say, the transformation of matter from one state to another such as the ebullition of liquids or the formation of ice.

He has also greatly contributed to particle theory, from the analysis of the behaviour of protons and neutrons in violent collisions created in the behaviour of protons and neutrons in violent collisions created in accelerators, to the mathematical expedient called "normalization groups" which was introduced into physics to eliminate infinity in quantum-electrodynamic equations.

But let us go back to computational physics. The Conference in Miramare was organized by Claudio Rebbi, a theoretical physicist from Trieste who has been working in the USA, at the Brookhaven National Laboratory and Boston University, for over ten years, and also by Alvise Nobile of the International School for Advanced Studies (SISSA) and Fred James, an American scientist working at CERN, Geneva.

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* Translation of an article by Fabio Pagan published in Italian in the local newspaper "Il Piccolo".

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Claudio Rebbi says: "Nowadays the computer is no longer simply subordinate to experimentation and theoretical analysis. It is no longer a tool for scientific calculation or storing data. The extraordinary progress in the power and versatility of computers over the last few years has made it possible to carry out research through the simulation of physical, chemical and biological phenomena, while controlling millions of elements. Thus, a discipline on its own, parallel to theoretical analysis and experimental research, is emerging, namely computational physics."

The reason for this quality jump lays in the supercomputers which have been built over the last decade. At the moment, there are about 150 of them, all made in USA and Japan (not in the Soviet Union which is still lagging behing as regards electronics and informatics). In Italy, there is only one such computer which was installed in Bologna two years ago. Universities and data processing centres in many Italian cities, including Trieste, are linked to it. The computer is a Cray XMP whith a capacity of 100/200 million operations per second (that is to say 100/200 megaflops).

But the utmost in this sector is the Cray-2 type which can carry out over one thousand million operations per second (1,000 megaflops or one gigaflop). And efforts are being made to build the Cray-3 type which is to reach two thousand million operations per second, thanks to the replacement of silicon chips with gallium-arsenide chips, a substance which enables electric charges to move much faster.

Monsters of this kind mean that programmes can be elaborated which could not have even been imagined until few years ago. A computer can simulate the behaviour of a theoretical model aeroplane or car. It can also "construct" the performance of extremely complex natural phenomena for which dozens or hundreds of thousands or even millions of atoms must be accounted for and all their coordinates followed.

"Anyway, let us be clear on one point — Rebbi remarks. "The computer cannot in any way replace experimental analysis. It accompanies theoretical analysis in the simulation of an experiment under controlled and obviously simpler than real-life conditions. It is a tool with a vast range of functions and it is an extremely powerful means which can even enable us to correct the mechanism of some phenomena whose behaviour up to now was wrongly taken for granted."

Let us make a practical example. A phenomenon of phase transition (and the Nobel Laureate Wilson is an expert in the matter) can be extremely complex. For instance, the demagnetization of a crystal due to thermal agitation. This is a phenomenon which involves an enormous amount of single atoms interacting among themselves. By means of an adequately programmed supercomputer, all the effects can be rebuilt, thus creating a simulated experiment by reproducing in the theoretical model the alterations of the parameters involved (temperature, effects can be rebuilt, thus creating a simulated experiment by reproducing in the theoretical model the alterations of the parameters involved (temperature, magnetization, external interference) and following the behaviour of the crystal to its extremes.

The applications of this research cover a wide spectrum of activities — from nuclear physics to plasma physics, from hydrodynamics to solid state physics, from quantum chemistry to particle physics.

Is it unwise to state that with this three-day conference including the contribution of some of the top American and Italian experts the ICTP has started to follow the path also of advanced informatics? Maybe it is not, since the Director of ICTP, Professor Abdus Salam has shown fresh interest in this tool — the computer — which he had previously regarded somewhat warily.

The reason is two-fold. Firstly, the kind of research which led Professor Salam to winning the Nobel Prize requires a kind of mathematics for which pencil and paper is enough, as in Einstein's times. Secondly, Professor Salam has always considered the computer a luxury which can be afforded by industrialized countries but not by Third World countries — the countries with which the major part of the Centre's activities are concerned.

Now, though, things are evolving rapidly. The sharp decrease in their cost has made computers available even to countries with limited financial resources. Let us just think of what it would mean for an African, Asian or Latin-American country to be able to avail itself of a network of personal computers and terminals linked via-satellite with the main data-banks in the world - it would mean to be in a position to tap directly the information it needs in order to develop its own science, technology and economy.

The attention which many Third World countries are giving computers is also proved by the participation of over a hundred young scientists from developing countries in the School on Advanced Techiques in Computational Physics which was held at ICTP for three weeks.

Hence, the decision that the School and the Conference must have a second edition and, why not, that they should become one of the constant activities of the ICTP to be held every other year. Wilson himself, in his closing speech at the Conference, underlined the strategic function of the ICTP in supporting the development and diffusion of computational physics. The appointment, therefore, is fixed from now for 1988.

WORKSHOP ON CURRICULUM DEVELOPMENT IN PHYSICS, MATHEMATICS AND COMPUTER SCIENCE IN KENYA
(1 — 13 September 1986)

The Workshop was opened on 1 September by the Minister of Education, Science and Technology of Kenya. It brought together 121 scientists from English as well as French-speaking African countries. The final product of the Workshop is a document presenting model curricula in physics, mathematics and computer science with the following objectives: (a) to produce graduates well grounded in the fundamentals, and the acquisition of the necessary skills in order to use their physics in a wide range of practical applications; (b) to develop creative thinking and the power of imagination to carry work further into research to solve society's problems; (c) to embrace as many fields in allied disciplines as possible so as to allow the graduate of physics fit into the interdisciplinary environment; (d) to relate the physics graduate's training to the employment opportunities within his own country. The document will be circulated in African universities.
graduate's training to the employment opportunities within his own country. The document will be circulated in African universities.

During the meeting, participants from Central African francophone countries agreed to form the Central Africa Mathematical Sciences Association (CAMSA). The Workshop also provided an opportunity for representatives of the Southern Africa Mathematical Sciences Association (SAMSA), the African Mathematical Union (AMU) and the ICTP Society of African Physicists and Mathematicians (ISAPAM). It had been organized by the ICTP in collaboration with ISAPAM under the auspices of the University of Nairobi. The local organizing Committee was composed of Prof. J. Otieno Malo (chairman), Dr. W. Ogana (Vce Chairman), Dr. A.J. Rodrigues, Dr. E. Maina-Ayiera, Dr. J.W. Odhiambo, Mrs. E. Kayondo, Dr. P.S. Bhogal, Dr. M.G. Charalambous, Dr. W.H. Drake, Mr. J.C. Opiyo and Mr. J.T. Gathogo.

Prof. L.K. Shayo from Tanzania, and presently a visiting mathematician at the ICTP, attended the whole Workshop as a coordinator. Ms. Louisa Sossi, Personal Assistant to the Director at the ICTP, gave her assistance for a smooth running of the meeting.

MICROPROCESSORS TECHNOLOGY AND APPLICATIONS IN CHINA

Since 1981, the ICTP has organized colleges on microprocessors technology and applications in Trieste every second year and outside, i.e. in Colombo, Sri Lanka (1984), and in Bogota, Colombia (1985). Hefei (People's Republic of China) was the host from 22 September to 17 October for the third extra mural College, organized by the ICTP and the Academia Sinica with Mr. C. Verkerk (CERN, Geneva, Switzerland), Professor Fang Li Zhi (Vice-president, University of Science and Technology, Hefei), Professor Zhang Lin Yu (Deputy Director, Bureau of International Cooperation, Academia Sinica) and Mr. Wu Weimin (Institute of High Energy Physics, Beijing). Mr. W. Von Rüden (CERN, Geneva, Switzerland) acted as Head of the Laboratory.

As in the other colleges and following a well-established practice, the emphasis was on an integrated hardware-software approach with formal lectures and an large amount of practical exercises. The necessary equipment, working stations and other came from the ICTP Microprocessors Laboratory.

The topics dealt with were microcomputer hardware (architecture and interfacing), assembly language programming, techniques for microprocessor project development and various applications.

The College was attended by 38 Chinese scientists and 34 participants from the region (Pakistan, Thailand, Sri Lanka, Singapore, Indonesia, India, Philippines, Nepal, Bangladesh and Malaysia). It was sponsored by the Italian Department for Cooperation to Development and by the United Nations University (UNU).

Professor Abdus Salam and L. Bertocchi, Director and Deputy-Director of the ICTP respectively, and Dr. Ines Wesley-Tanaskovic from the UNU were invited to the College. Ms. D. Giombi from the ICTP provided administrative assistance.

COLLEGES IN PHYSICS OF THE LIVING STATE

One of the Colleges dealt with biological membranes and was held at the ICTP Adriatico Guest House from 8 September to 10 October 1986. Its scientific programme had been prepared by Prof. A. Borsellino from the International School for Advanced Studies (ISAS) of Trieste, Prof. K.R.K. Easwaran from the Indian Institute of Sciences in Bangalore (India) and Prof. F. Quadrifoglio from the Department of Biochemistry of the University of Trieste. Prof. G.C. Ghirardi from the Department of Teoretical Physics of the University of Trieste was the local coordinator.

The main topics which were discussed included membranes structure and dynamics, membrane proteins and lipid-protein interactions, membrane transport, physical methods in membrane research, and cell surface and cell-cell recognition - membrane fusion. Practical demonstrations as illustration of part of the lectures were organized in the small but modern Biophysics Laboratory of the ISAS which is presently housed in the ICTP-INFN Microprocessors Laboratory.

The second programme in physics of the living state was the College on Neurophysics which was held from 10 November to 11 December 1986 and organized by Prof. J.H. Kaas from the Department of Psychology of the Vanderbilt University in Nashville (USA) and by Professor O. Siddiqui from the Department of Molecular Biology of the Tata Institute in Bombay (India). Prof. A. Borsellino from the International School for Advanced Studies of Trieste and Prof. G.C. Ghirardi, Director of the Department of Thoretical Physics of the University of Trieste were local directors.

The first part of the lectures dealt with the fundamental structure of the nervous system, the function of neurons and the evolution of the brain. The purpose of the College was also to review and discuss the models for the functioning of the brain and the research on artificial intelligence. The participation of Prof. T. Poggio, an Italian national working at the MIT Laboratory for artificial intelligence, and of several other internationally-known experts was particularly appreciated.

Both Colleges were held at the ICTP Adriatico Guest House.

WORKSHOP ON "ASPECTS OF CONFINEMENT.
ACHIEVEMENTS IN PARTICLE AND PERSPECTIVES FOR NUCLEAR PHYSICS"
29 September - 3 October

This Workshop, organized by F. Cannata, M. Locher, A. Molinari and N. Paver, in addition to ICTP, had as sponsoring scientific institutions the Istituto Nazionale di Fisica Nucleare, the Schweizerisches Institut für Nuklearforschung, the Scuola Internazionale di Studi Avanzati (SISSA) and the Dipartimento di Fisica Teorica di Trieste.

It was attended by about fifty participants from several countries, either nuclear or particle theorists actively working in the field of nuclear structure and quark confinement. In addition, many of the physicists already present at ICTP also took part.

The central argument of the workshop was the relation between quarks as "constituents" of hadrons and as "partons" in deep-inelastic scattering. From the practical point of view, the construction of constituent quarks requires the solution of Qantum Chromodynamics (QCD) in the non-perturbative regime, Thus, after reviewing the hadronic structure as seen in deep-inelastic scattering and the quantization formalism for gauge theories, the discussion was focussed on non-perturbation physics, in particular on the QCD inspired quark confinement models (such as the "bag" model) and the requirements set by the chiral symmetry of the QCD Lagrangian, the lattice calculations of the hadronic spectrum by numerical methods, the transition from nuclear matter to quark-gluon plasma and the deep-inelastic scattering off nuclei.

Invited lectures on the above-mentioned topics were given by G. Altarelli, C. Becchi, R.E. Cutkosky, R.L. Jaffe, F. Lenz, H.B. Nielsen, R. Petronzio and H. Satz. Moreover, there were discussion sessions and contributed talks and papers by the participants. Finally, a round table was devoted to discussing future achievements in the understanding the physics of confinement.

MATHEMATICAL ECOLOGY

The Second Autumn Course on Mathematical Ecology organized by the ICTP was held from 10 November to 12 December 1986. It was directed by Professors T.C. Hallam from the University of Tennessee and S. Levin from Cornell University, both from the United States, with the objective of surveying the mathematics currently being applied to ecological and environmental sciences. Topicswise, the Course covered physiological ecology, ecology of population, ecology of communities, ecology of ecosystems and applications to resource management, epidemiology, agriculture, demography and biotechnology. While the first two-and-a-half weeks consisted in lectures covering the foundations of the subject, the accent during the last portion of the course was on seminars and workshops on recent developments and applications of mathematical ecology.

THE MICROPROCESSORS LABORATORY

The Laboratory was founded in Autumn 1985. The equipment used by the periodical "Colleges on Microprocessors – Technology and Applications in Physics" held at the ICTP or outside (in Sri Lanka in 1984, Colombia in 1985 and People's Republic of China in 1986), provided for a starting basis for a more permanent activity. The Laboratory is now jointly operated by the ICTP and the Trieste Section of the Istituto Nazionale di Fisica Nucleare (INFN). Prof. A. Colavita from the National University of San Luis (Argentina) has taken up his functions of Director of the Laboratory since August 1986. With the financial assistance of the United Nations University, more equipment is now available and several projects have already been implemented; for instance, the development of a Forth language for a 68020 32 bit microprocessor, a development system based on the 6809 microprocessor for the production of cheaper microcomputers, work with the software development tools for computer-aided electronic design. These projects were carried out by scientists from developing countries. In the future, the Laboratory will develop, among others, a parallel computer system as well as a special gate array chips for telephone switchboards for a faster and more intelligent selection.

The Laboratory particularly welcomes those scientists who have attended one of the ICTP Microprocessors Workshops for working on projects of their own which only require a reasonable outlay.

SYNCHROTRON RADIATION AT TRIESTE

This article is by Mr. Brian Southworth and appeared in CERN Courier, June 1986.

The fast developing field of synchrotron radiation has its origins in the mastery of storage rings in high energy physics and is a prime example of spinoff from pure science.

Intense electromagnetic radiation streams off when beams of high energy electrons are bent or shaken. This synchrotron radiation was once an annoying waste of energy in particle storage rings, but now the wheel has turned full circle, with dedicated machines supplying this radiation for a wide range of science.

The astonishing growth rate in this field was highlighted at an International Conference on Synchrotron Radiation, held at the International Centre for Theoretical Physics (ICTP), Trieste, Italy, from 7 to 11 April 1986.

The Conference was appropriately sited since the construction of a 1.5 to 2 GeV 'third generation' synchrotron radiation source has been approved for Trieste. In addition, the precise venue of ICTP illustrated the extension of the interests of the Centre into fields considered to be of more immediate practical use.

The emphasis was on the lower energy storage rings, up to 2 GeV, for research using radiation in the vacuum ultraviolet (VUV) rather than the higher energy rings, up to 6 GeV, for research using hard X-rays like the European Synchrotron Radiation Facility, ESRF, to be built at Grenoble and its proposed American equivalent which would probably be built at Argonne. Thus the stars of the Conference were the Trieste machine presented by Sergio Tazzari and the Lawrence Berkeley Laboratory equivalent presented by Max Cornacchia. The Berkeley proposal is in the US President's budget from Fiscal

Year 1987 but has yet to pass through Congress. There are similar machines in gestation elsewhere, such as BESSY II for the Laboratory in Berlin.

It is clear that the maximum amount of flexibility must be built into the designs of the new generation of machines because there is no single figure of merit for machine operation - the definition of ideal conditions varies throughout the use community and the users have to be involved in the machine design decisions. Also there is not enough experience with the operation of undulators (around which the third generation machines are constructed) to fix parameters too rigidly. A lot of work is going into developing machine magnet lattices with abilities beyond the best presently available (the lattice of the late Rena Casman and Ken Green which made the VUV ring at the Brookhaven National Synchrotron Light Source the brightest in the world).

Good beam monitoring and control become more important because the low emittance machines will be sensitive to operate. This means also that, though injection of the beam at the storage ring operating energy is still probably preferable, the control systems could handle injection at lower energies and acceleration to operating energies. It is clear, however, that the injection of positrons rather than electrons will give longer lifetimes and more stable beams by avoiding the problems due to ion trapping. When the positive ions, liberated by any mechanism, are pulled into the negative region of an orbiting electron beam they can cause havoc with beam stability. This phenomenon, which is still not well understood or predictable, has caused trouble at many machines and positron injection would circumvent it.

One of the machines which suffered from the disruptive effects of ion-trapping during its commissioning phase was the Aladdin ring at Wisconsin which has been under sentence of death for the past year. The latest news is that beam currents as high as 200 mA have been stored and, now that this level of performance has been reached, it is likely that the US National Science Foundation will resume funding.

Neither the Trieste nor the Berkeley teams have frozen their designs though Trieste intends to have ideas fixed firmly enough by the end of the summer to produce a detailed cost estimate.

These new machines are 'third generation': the light intensities they aim to achieve will reach beyond the second generation machines designed as 'dedicated' synchrotron radiation sources. They advance in the light fluxes they can deliver to experiments by using 'wigglers' and 'undulators' - new dense periodic magnet structures to extend or amplify the spectrum of radiation which can be delivered to experiments.

Herman Winick covered experience with these devices at the Stanford Synchrotron Radiation Laboratory, which has pioneered their use, and even managed the extraordinary feat of explaining the difference between wigglers and undulators in less than one hour. There are two 8-pole wigglers to serve three experimental stations each (which is possible because of the wide emerging beam), a 64-pole wiggler and a 'multi-undulator' on the SPEAR ring and an undulator on the PEP ring. SSRL has been helped in forefront work on wigglers and undulators by the comparatively relaxed operating conditions on the SPEAR and PEP rings - high energies and high emittances. Life will not be easy with these devices on the newly proposed rings.

Much of the Conference was devoted to the research at VUV rings in solid state physics. The intensity and quality of the synchrotron radiation makes it possible to extract astonishing detail about bulk structures and the intricacies of surfaces and interfaces. (A revealing remark is that 'God prepared the solids and the Devil prepared the surfaces'.) The Conference closed with the latest news on angiography - diagnostic heart scans with synchrotron radiation promoted particularly by E. Rubenstein. Human heart scans are imminent at the Stanford Synchrotron Radiation Laboratory.

These abilities have come with the increase in light flux from synchrotron radiation sources, compared to the X-ray tubes of twenty years ago. When the new facilities discussed at the Conference come into action, this increase in flux will be of fifteen orders of magnitude and ther is further increase on the horizon with the proposal of Claudio Pellegrini to add a free electron laser by-pass to synchrotron rings.

A NEW OPPORTUNITY FOR SCIENTIFIC COOPERATION
THROUGH FEDERATION AGREEMENTS

This year, the ICTP has signed Federation Agreements with 195 institutions mostly in developing countries whereby these institutions can send one or more scientists to the ICTP for a total number of days ranging from 40 to 120 depending essentially on their distance from the ICTP. A daily allowance is paid to the scientists while the travel is, as a rule, paid by the federated institute. A partial contribution from the ICTP to travel expenses may also be given.

In order to stimulate South-South cooperation, the Third World Academy of Sciences (TWAS) and the ICTP have agreed to support one-month visits of scientists from one federated institute to another one in other developing countries. The travel and subsistence costs are borne by TWAS and ICTP respectively.

Those wishing to avail themselves of this new opportunity should approach their Heads of Department.

PROMOTION OF JOINT ACTIVITIES INN PHYSICS
IN BANGLADESH, CHINA, SRI LANKA, INDIA AND PAKISTAN
(EXCERPTS FROM THE FOUNDING DOCUMENT OF THE BCSIP COMMITTEE)

At a meeting held on August 8, 1986, of the physicists visiting the International Centre for Theoretical Physics, Trieste, Italy, from the five countries Bangladesh, China, Sri Lanka, India and Pakistan (BCSIP), it was resolved to form an Ad-hoc Committee consisting of representatives from each of the five countries, for promoting joint activities in physics. Professor Abdus Salam participated in this meeting. There was a general consensus that such joint activities would not only help enrich the physics research in the area but also promote better understanding among the neighbouring countries. Organizations such as the International Centre for Theoretical Physics and the Third World Academy of Sciences may be approached to provide support, in cooperation with support from host countries, to promote such south-south collaboration.

The Committee formed in this meeting consists of the following members:

(1) Yu Lu (China)
(2) C.W. Lung (China)
(3) Farid A. Khwaja (Pakistan)
(4) Shaukat Ali (Pakistan)
(5) Siba Prasad Misra (India)
(6) S. Wadia (India)
(7) K.D. Jayasuriya (Sri Lanka)
(8) R.I.M.A. Rashid (Bangladesh)
(9) A.M. Choudhury (Bangladesh)
(10) Jogesh C. Pati (India, convenor).

On 12th and 14th August 1986, the first and second meetings of this Ad-hoc Committee were held to finalize the aims and the objectives as well as the plans for the future activities of the Committee. Prof. M. Hassan was present in one of these meetings to participate in the discussions and provide information about TWAS.

The aims and objectives of the Committee as approved by its members are the following:

(A) to promote cooperative research and physics discussions among the BCSIP countries by adopting the following steps:

(1) Organizers of conferences and workshops in physics, which are already being planned in one of the five countries, should be encouraged to extend invitations to a fair number of participants from the other four neighbouring countries. This number would undoubtedly depend upon the amount of financial support which would be available from organizations such as ICTP and TWAS.

(2) Starting from 1988, one conference in physics should be organized under the premises of the BCSIP committee in one of the five countries with full participation from the five countries. By virtue of its nature, this conference would need a major support from the TWAS and ICTP and perhaps other organizations in order that it may come to life. There was a suggestion that instead of or in addition to a conference, the Committee may organize a BCSIP Winter School in Physics in an attractive location once a year during the months of December and January following the pattern of the Les Houches Summer School. While the area of physics to be emphasized in the school may vary from year to year, the school should aim at excellence and invite only outstanding leaders in the respective fields as lecturers. The idea of the school was strongly endorsed by all the members of the Committee and it was decided that certain specific decisions regarding the BCSIP conference or school should be taken before the summer of 1987.

(3) The Committee should encourage exchanges of individual researchers between the institutions in the BCSIP countries involving few-weeks- to few-months-visits of these researchers. The Committee would recommend strongly that financial support be given for such exchanges by ICTP and TWAS as well as the relevant host institutions.

(B) The Committee should attempt to help develop undergraduate teaching of physics in the BCSIP countries, in close cooperation with local authorities, through joint efforts which may include some of the following activities:

(1) Organizations of training workshops/refresher courses.

(2) Preparations of appropriate audio visual materials.
Recognizing that teaching methods, curricula and languages vary within the five countries, such activities should be sponsored primarily when joint efforts could be helpful and benefits could be shared between the countries.
The aims and objectives outlined above should still be regarded as preliminary until the summer of 1987 so that the Committee would have time to think it over for a year and include inputs from individuals outside of the Committee.

Other Decisions of the Committee Pertaining to Its Activities during the 1986-1987 Year

(1) The committee decided that the founding document should be sent in its preliminary form to leading physics institutions in the BCSIP countries as well as all physics associations in these countries, so that the activity may be highlighted and suggestions may be received from all those who are interested. The mailing may be done through secretarial help from ICTP.

(2) The founding document or a summary should also be published in the Newsletter of TWAS.

(3) It was decided that the Committee could expand to an association or society by inviting all those from the BCSIP countries who have visited ICTP to become members, so that the association would consist of "Friends of ICTP". The benefits of the association should still be available to all physicists from the BCSIP countries. The purpose of the association would be to involve a large representative body.

It was, however, decided that the activities of the Committee should already be visible by the promotion of joint activities during 1987 before it should expand itself into an association. The Ad-hoc Committee should continue functioning till December 1988. It should work towards expanding itself into an association during the summer of 1987. Once the association is formed, a representative Committee should be formed thereafter by election sometime during 1988 and 1989, which should replace the Ad-hoc Committee.

(4) Professor Yu Lu, who will remain at ICTP during 1986-87, has kindly agreed to serve as the BCSIP representative for keeping contact with the ICTP and TWAS on behalf of the Committee during the year.

(5) It was agreed upon that, if some member of the Committee is unable to participate in a given year, he may nominate a substitute. Some attention should be given to represent different areas of physics within the Committee.

(6) Regarding the selection of participants from the neighbouring countries for BCSIP sponsored activities, it was decided that the Committee members of each country should name two or three leading physicists from their own countries, who should suggest the names of possible participants to the local organizers. Other individuals should also be encouraged to apply who should be considered on an equal footing. The final selection of participants should be the responsibility of the local organizers.

(7) For 1988 January BCSIP Conference/School, we invite suggestions of a few well-motivated, already planned activities from the Committee members who should consult physicists within their countries and should communicate their suggestions to all members of the Committee by December 31, 1986. It is important that any such suggestion be made only provided local institutions agree to cooperate with the BCSIP Committee for the organization of the Conference/School.

(8) Members of the Ad-hoc Committee are encouraged to participate in the BCSIP sponsored activities in their own research field. Funding for such participation may be sought through ICTP/TWAS and possibly local organizations.

(9) Promotion of Neighbouring Participation for 1987 Activities
The Committee members of each country were asked to submit two or three well-motivated activities* which are being planned in their respective countries for the year 1987 for consideration by the Committee. The idea was that the Committe should evaluate the scientific merit and the prospect for neighbouring participation of each submitted activity and accordingly recommend the selected activities for appropriate support by ICTP and TWAS. The support should include not only the cost of travel of the invited speakers but also of the neighbouring participants.

The Committee recommends that the organizers of any selected activity in a given country should invite 15 to 20 participants from the remaining four BCSIP countries. Taking into account the fact that the cost of travel to and from China is higher than that involving the other countres, this means that ICTP and TWAS should provide an additional $10,000/- just to cover the cost of travel of neighbouring participants, if the activity is held in Bangladesh, India, Pakistan or Sri Lanka, and $15,000/- of it is held in China. The cost of travel of invited speakers is extra.

I) The Committee suggests that the ICTP/ TWAS, in making the offer for a recommended activity, should spell out that the activity was selected for support with the expectation that neighbouring participation as recommended by the BCSIP Committee will materialize. The extra amount awarded for such a participation should be specified with a mention that if the desired participation did not take place, for any reason, the corresponding amount should be refunded to ICTP/TWAS.

II) The Committee also requests that ICTP and TWAS should make <u>early decisions</u> regarding awards so as to allow at least 9 months lead time to plan neighbouring participation efficiently. Such a lead time is also necessary to obtain outstanding speakers. This would be possible if decisions are made twice a year i.e., in March and September of every year.

III) The Committee requests that the BCSIP Committee be informed of ICTP/TWAS decisions regarding its recommendations as early as possible. This may be done by informing Professor Yu Lu at ICTP and Professor Pati at Maryland.

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* In view of the shortage of time, this procedure was adopted for the sake of efficiency and concrete decisions for the year 1987. It was recognized that in subsequent years, starting with the summer of 1987, a comprehensive list of activites would have to be considered. In any case, an activity should be selected, even for 1987, only if it qualifies on the basis of its scientific merit and the prospect of neighbouring participation.

APPENDIX

APPENDIX

LIST AND ADDRESSES OF COMMITTEE MEMBERS

BCSIP AD--HOC COMITTEE
PROMOTING JOINT ACTIVITIES IN PHYSICS
IN BANGLADESH, CHINA, INDIA, PAKISTAN AND SRI LANKA,
FORMED IN AUGUST, 1986

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   USA

Third International Workshop on Total Energy and Force Methods
26   28 January

Second Workshop on Mathematics in Industry
2 - 27 February

International Workshop on Remote Sensing and Resource Exploration
9 February - 6 March

Spring College on Geomagnetism and Aeronomy
2 - 27 March

Winter College on Atomic and Molecular Physics
9 March - 3 April

Spring School and Workshop on Superstrings
1 - 15 April

Espaces fibres: leur utilisation en physique
27 April - 1 May

School on Polymer Physics
27 April - 15 May

Workshop on Surface Science and Catalysis
4 - 9 May

Workshop on "Nonlinear Charge Density Wave Systems"
4 May - 17 July

Spring College in Materials Science on "Metallic Materials"
11 May - 19 June

Third Workshop on Perspectives in Nuclear Physics at Intermediate Energies
18 - 22 May

Spring College on Plasma Physics
25 May   19 June

25 May   19 June

ICFA School on Instrumentation in Elementary Particle Physics
8 - 19 June

New Scales Effects on Low-energy Precision Experiments
22 - 24 June

Research Workshop in Condensed Matter, Atomic and Molecular Physics
22 June - 4 September

Synchrotron Radiation and Free Electron Lasers
23 - 26 June

Summer Workshop on High Energy Physics and Cosmology
29 June - 7 August

One-dimensional Organic Conductors: Chemistry, Physics and Applications
(Adriatico Conference)
    30 June – 3 July

Vacuum in Non-relativistic Matter-Radiation Systems (Adriatico Conference)
    14 – 17 July

Scanning Tunnelling in Microscopy – Fundamental Experimental and
Theoretical Progress (Adriatico Conference)
    28 – 31 July

Interatomic Forces in Relation to Defects and Disorder in Condensed Matter
(Adriatico Conference)
    11 – 14 August

Working Party on "Physics of Porous Media"
    17 – 28 August

Workshop on Materials Science and the Physics of Nonconventional Energy
Sources
    26 August – 18 September

The Path Integral Method with Applications (Adriatico Conference)
    1 – 4 September

Workshop on Telematics
    7 September – 2 October

Workshop on Economics, Modelling, Planning and Management of Energy
    14 – 25 September

Workshop on Interaction between Physics and Architecture in
Environment-conscious Design
    21 – 25 September

Fourth College on Microprocessors: Technology and Applications in Physics
    5 – 30 October

College on Soil Physics
    2 – 20 November

College on Riemann Surfaces
    9 November – 18 December
College on Riemann Surfaces
    9 November – 18 December

Second College on Cloud Physics and Climate
    23 November – 18 December

College on Variational Analysis
    11 January - 5 February

Second School on Advanced Techniques of Computing in Physics
    18 January - 12 February

Workshop on Complex Analysis
    8 - 19 February

Workshop on Applied Nuclear Theory and Nuclear Technology Applications
    15 February   18 March

College on Laser Physics: Semiconductor Lasers and Integrated Optics
    22 February - 11 March

Workshop on Optical Fibres
    14 - 25 March

Conference in Biotechnology
    21 - 25 March

Workshop on Space Physics
    5 - 29 April

Supergravity and Supersymmetry
    11 - 22 April

College on Condensed Matter Physics: The Interaction of Atoms and
Molecules with Solid Surfaces
    25 April - 17 June

Workshop on Nondestructive Evaluation
    2 - 20 May

Second Workshop in Solar and Wind Climatology
    23 May - 17 June

Workshop in Condensed Matter Physics (including Adriatico Conferences and
Working Party)
    20 June - 9 September

Course in Solar Energy (in French)

Workshop in High Energy Physics
    20 June - Mid August

Summer School and Workshop on Dynamical Systems
    16 August - 23 September

College on Biophysics
    12 September - 7 October

20 June - 9 September

Course in Solar Energy (in French)

College on Oceanography
26 September - 28 October

Workshop and International Conference in Medical Physics
10 October - 4 November

Workshop in Mathematical Ecology
31 October - 18 November

College on Neurophysics
7 November - 2 December

Workshop on Earthquake Predictions
15 November - 16 December

College on Global Geometric and Topological Methods in Analysis
21 November - 16 December

Hosted Meeting:

Conference in Astronomy
6 - 9 April

Nuclear Physics preprints and internal reports issued
in July - December 1986.

(128)   S.S. MALIK, N. MALHOTRA, D.R. SAROHA and RAJ K. GUPTA - Coupled
          mass-asymmetry and relative-motion co-ordinates for the collective
          alpha-particle transfer resonances.

(148)   S. RAMADAN, S.S. MONTASSER and M.Y.M. HASSAN - On the thermal
          properties of neutron matter with spin up excess.

(158)   S.S. MALIK, R. SULTANA and RAJ K. GUPTA - A dynamical model for the
          new radioactive decay mode.

(200)   H.M.M. MANSOUR, M.Y.M. HASSAN and S. RAMADAN - Skyrme interaction
          and the properties of cold and hot neutron matter.

(209)   AHMED OSMAN - Contributions of the three-nucleon forces to the
          three nucleon systems.

(217)   A. SMIDA, L. DEKAR and F. MEKIDECHE - The nucleus-nucleus
          scattering at high energy.

(276)   AHMED OSMAN - Quark cluster model in three-nucleon system.

(300)   AHMED OSMAN - Total disintegration of three-nucleon systems from
          charged π - mesons reactions.

(350)   K. PREMA and S. RAGHAVAN - Solitary wave exchange potential and
         nuclear-nuclear interaction.

(370)   P.K. RAINA and S.K. SHARMA - Form factors and transition charge
         densities for the quadrupole and hexadecouple electroexcitation
         of some 2p-If shell nuclei.

(371)   ZHANG YU-SHUN - Inelastic two composite particle systems scattering
         at high energy.

(380)   I. MEHROTRA and B.K. AGARWAL - Composite model approach to the $_2He^4$
         nucleus ground state.

(381)   I. MEHROTRA, K. PREMA and B.K. AGARWAL - A study of strange-,
         charmed, and beauty-nuclei.

(384)   S.K. SHARMA, P.N. TRIPATHI and S.K. KHOSE - Onset of large
         deformations and the occurrence of anomalous high-spin yrast
         spectra in the Zr-Mo region.

(387)   M. APOSTOL, I. BULBOACA, F. CARSTOIU, O. DUMITRESCU and M. HOROI -
         Dynamical alpha-type correlations in deformed superfluid nuclei.

High Energy Physics preprints and internal reports issued

in July - December 1986

(127)   M.W. MORSY and M.EMBABY - Intrinsic self adjointness and the calculus
         of variations.

(131)   E. ABDALLA, M.C.B. ABDALLA and A. LIMA SANTOS - A non-linear σ-model
         related to the fine structure of strings.

(132)   DAO VONG DUC and NGUYEN THI HONG - An estimate of σ → axions decay rate.

(133)   DAO VONG DUC and NGUYEN THI HONG - Extension of SU(m) algebra to graded
         superalgebra.

(137)   ANNA OKOPINSKA - Non-standard perturbative methods for the effective
         potential in $\lambda\varphi^4$ QFT.
(137)   ANNA OKOPINSKA - Non-standard perturbative methods for the effective
         potential in $\lambda\varphi^4$ QFT.

(138)   QAISER SHAFI - Baryon and lepton number violation in superstring
         motivated models.

(153)   NGUYEN VAN HIEU and NGUYEN HUNG SON - On the exceptional Lie algebras
         E_6 and E_8.

(159)   C.P. SINGH, M. SHYAM and S.R. TULI - Model for nucleus-nucleus, hadron-
         nucleus and hadron-proton multiplicity distributions.

(160)   AMOUZON TEKOU - Eikonal multiple scattering model within the framework
         of Feynman's positron theory.

(162)   A.O. BARUT - On the covariance of two-fermion equation of quantum
         electrodynamics.

(163)   A.O. BARUT - Electron as a radiating and spinning dynamical system and discrete internal quantum systems.

(167)   NAUM I. KARCHEV - Covariant canonical formulation of gauge field theory of string.

(168)   M.A. AWADA - Non-commutative analytic geometry and a new model for the field theory of closed bosonic strings.

(170)   T.R. GOVINDARAJAN, ANJAN S. JOSHIPURA, S.D. RINDANI and U. SARKAR - Coset spaces as alternatives to Calabi-Yau spaces in the presence of gaugino condensation.

(171)   ERNST-MICHAEL ILGENFRITZ and JOCHEN KRIPFGANZ - Complex Langevin simulation of real-time quantum evolution.

(172)   ERNST-MICHAEL ILGENFRITZ - Complex Langevin simulation of chiral symmetry restoration at finite baryonic denstiy.

(174)   T. CHRISTODOULAKIS and J. ZANELLI - Canonical approach to quantum gravity.

(175)   MAREK OLECHOWSKI - Fermion masses in $SU(2)^L \times SU(2)^R \times U(1)^{B-L}$ model.

(180)   K. MAEDA - Attractor in a superstring - the Einstein theory, the Friedmann universe and inflation.

(181)   K. MAEDA - A history of the universe in a superstring model.

(182)   M.W. MORSY and M. EMBABY - Generalized quantal equation of motion.

(183)   K. MAEDA - The Einstein gravity as an attractor in higher-dimensional theories.

(185)   YOUSEF SOBOUTI - Radial and non-radial oscillations of spherically symmetric stellar systems.

(188)   M.W. MORSY and Z.A. EL-KOTABI - Implications of the generalized quantal equation of motion.

(189)   V.K. DOBREV - Multiplets of Verma modules over the osp $(2,2)^{(1)}$ super-Kac-Moody algebra.

(190)   M.W. MORSY, S.S. ALY and M.O. SHAKER - Generalized quantal equation of motion.

(193)   T. LHALLABI and E.H. SAIDI - Extended BRS and anti-BRS symmetries in N=2 harmonic superspace.

(198)   LI MIAO - Cosmological Kaluza-Klein monopoles.

(210)   B.F.L. WARD - How to tell a charged Higgs from top?

(211)   B.F.L. WARD - Renormalization group improved Yennie-Frautschi-Suura theory.

(224)   M. KOCA - Integral octonions and E_8.

(226)   X. SONG - A semi-empirical formula for the leptonic width of vector
          bosons.

(227)   TSUNEO UEMATSU - Structure of N=1/2 conformal and Poincare super-
          gravity in 2 dimensions.

(288)   A.O. BARUT and J. KRAUS - Non-perturbative quantum electrodynamics
          without infinites.

(232)   E. SOKATCHEV and D.T. STOYANOV - Non-relativistic supersymmetry and
          Lorentz invariance.

(233)   J.W.F. VALLE - Expectations for neutrino mass and baryon number
          violation in superstring models.

(241)   V.K. DOBREV - Characters of the unitarizable highest weight modules
          over the N=2 superconformal algebras.

(243)   J. GAMBOA and J. ZANELLI - Supersymmetric quantum mechanics of the
          relativistic particle.

(244)   E.H. SAIDI - SU(2) classification of N=2 complex supersymmetric
          representations.

(245)   E.H. SAIDI - Free hypermultiplet duality is an N=1 SU(2) supersymmetry.

(247)   SONG XIAOTONG and LIN HEFEN - A new potential model for heavy quarkonium.

(257)   YUE-LIANG WU - Superstring and effective action.

(258)   T. LHALLABI - The N=2 supersymmetric Ward identities on harmonic
          superspace.

(259)   A. EL HASSOUNI, T. LHALLABI and E. OUDRHIRI - Anomalies of BRS and
          anti-BRS Ward indentities in the N=1 supersymmetric theory.

(260)   A.O. BARUT - On the treatment of Moller and Breit potentials and the
          covariant two-body equation for positronium.

(261)   R.M. GODBOLE and S.D. RINDANI - Intermediate mass Higgs Boson production
          and the equivalent vector boson approximation.

(262)   T. ACIKTEPE, K.G. AKDENIZ, A.O. BARUT and J. KALAYCI - Conformally
          covariant coupled non-linear field theory on the hypercone: vacuum
          solutions and quantization of normal modes.

(264)   I.G. KOH and R.B. ZHANG - Stochastic quantization and random surface
          approach to string theories.

(265)   G. ALDAZABAL, F. HUSSAIN and R. ZHANG - Superconformal invariance and
          dilaton coupling in string theory.

(268)   B.F.L. WARD - Test of the magneticity of the $\xi(2,23)$.

(269)   XIE YAN-BO - The general solution of chiral model in 1 + 1
          dimensions.

(280)   LI YI-SHEN and ZHANG LI-NING -A note on the super-AKNS equations.

(284)   S.P. MISRA - Salam-Weinberg symmetry breaking with superheavy Higgs
          particles.

(285)   E. BERGSHOEFF, E. SEZGIN and H. NISHINO - (8,0) locally supersymmetric sigma models with conformal invariance in two dimensions.

(286)   M. KOTRLA and J. NIEDERLE - Supertwistors and superfields.

(291)   K.G. AKDENIZ, A. HACINLIYAN and J. KALAYCI - Possible inflationary solution to the short-distance gravity model.

(292)   J. LUKIERSKI - Holomorphic and real Euclidean supersymmetries in three and four dimensions.

(293)   S.P. MISRA - Bound states in quantum field theory and coherent states: a fresh look.

(301)   H. BOUTALEB-J and A.L. MARRAKCHI - A scalar-tensor theory for induced gravity.

(306)   A.H. COOK - A Hamiltonian with linear kinetic energy for systems of many bodies.

(312)   C.P. SINGH - Signal for quark-gluon plasma in fragmentation region.

(313)   C.A. DOMINGUEZ, N. PAVER and RIAZUDDIN - Dynamical enhancement of $D^0 \to \bar{K}^0\varphi$ from current algebra.

(315)   K. MAEDA - Our universe as an attractor in a superstring model.

(316)   K. MAEDA - Is the compactified vacuum semiclassically unstable?

(318)   J. LUKIERSKI and W.J. ZAKRZEWSKI - Euclidean supersymmetrization of instantons and self-dual monopoles.

(319)   J. LUKIERSKI - On supersymmetric extension of twistor formalism and some applications.

(320)   M. BLAGOJEVIC - Soft photon radiation effects in monopole processes.

(329)   E. SEZGIN - Perturbative and global anomalies in supergravity theories.

(330)   A.O. BARUT and J.P. DOWLING - Quantum electrodynamics on self-energy: spontaneous emission in cavities.

spontaneous emission in cavities.

(331)   F. BENATTI, G.C. GHIRARDI, A. RIMINI and T. WEBER - Quantum mechanics with spontaneous localization and the quantum theory of measurement.

(341)   A.O. BARUT and J.P. DOWLING - Quantum electrodynamics based on self-energy without second quantization: the Lamb shift and long range Casimir-Polder-Van der Waals forces near boundaries.

(342)   NAZIR S. BAAKLINI - The regular effective action of quantum field theory and quantum gravity.

(347)   Y.Z. ZHANG - On the theory of the Michelson-Morley experiment in earth's gravitational field.

(360)   A.O. BARUT - Large polarization asymmetries in nucleon-nucleon scattering.

(361) A.O. BARUT - On the connection between CP violation, muon-neutrino lifetime, muonium conversion and K^0 decays. An explicit model.

(366) J. LUKIERSKI, M. MOZRZYMAS and L. RYTEL - Geometrization of Planck length in composite gravity model.

(367) A.O. BARUT - Explicit calculations with a hidden variable spin model.

(369) E. BERGSHOEFF, M. RAKOWSKI and E. SEZGIN - Higher derivative super-Yang-Mills theories.

(375) GEORGE THOMPSON and RUIBIN ZHANG - Schwinger models in arbitrary gauges and at finite temperature.

(378) V.K. DOBREV - On the relevance of some constructions of highest weight modulus over (super) Kac-Moody algebras. (In connection with a paper by Wakimoto).

(379) T.S. SANTHANAM - Finite-dimensional matrix representation of the differential operator, determinental form and zeroes of special functions.

(386) B.K. PAL - Experimental tests of unification models.

(388) E. GAVA - Riemann surfaces and string theory.

(389) B.K. PAL - Role of symmetry principles in high energy physics.

(390) LI SHUJIE and J.Q. LIU - Non-trivial critical points for asymptotically quadratic function.

(393) V.K. DOBREV - Canonical construction of differential operators inter-twining representations of real semisimple Lie groups.

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