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INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS

Scientific Activities in 1980

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INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS:
SCIENTIFIC ACTIVITIES IN 1980
IAEA, VIENNA, 1981

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FOREWORD

The poverty from which the developing countries suffer is not just material, it is intellectual also. And the first of these evils can never be eradicated until the second is effectively relieved.

In a unique attempt to fight intellectual deprivation in the Third World, and to foster contact between physicists of all countries, the International Centre for Theoretical Physics (ICTP) was established in 1964 under the aegis of the International Atomic Energy Agency. The Centre organizes research sessions, workshops, and extended courses on advanced topics in the physical and mathematical sciences and encourages scientists, especially from the developing countries, to visit the ICTP for extended periods. It forms an international meeting point for scientists from all countries and provides its visitors, principally those from developing countries, with facilities to conduct original research at the highest international standards of excellence. To extend the reach of its influence beyond the necessarily limited number of visitors the Centre can entertain in a year, it has organized an Associateship programme and a network of Federated Institutes which maintain extensive and fruitful links between the ICTP and the world's scientific community.

Situated mainly in developing countries, there are over 60 Federated Institutes whose main problem is scientific isolation and who can, by arrangement, send scientists to the Centre for between 40 and 120 man-days each year. The ICTP has 87 Associates, distinguished scientists living and working in developing countries, who can, three times in six years, spend between six weeks and three months at the Centre, researching and discussing research in a creative environment that may not obtain in their own scientifically isolated institutes. The Centre is also fostering young scientists from developing countries by appointing Junior Associates who gain access to books, journals, and scientific articles through the ICTP.

Thanks to the generosity of the Italian Government, and of the regional community, the Centre was established with its own premises in Miramare, just outside Trieste, Italy. The Italian Government also makes a substantial annual grant to the Centre. In 1970 UNESCO joined the IAEA in financing the Centre. Since 1964 the Centre has welcomed over 10 000 scientists from 119 Member States of the IAEA and UNESCO.

CONTENTS

PART I:
THE CENTRE'S ACHIEVEMENTS IN 1980 - A REVIEW BY THE DIRECTOR

Introduction

In 1980, the Centre was visited by 1431 scientists, 792 of whom came from developing countries. Although they represented nearly 55% of the total number of visitors, the contribution of scientists from developing countries to the work of the Centre was larger than this percentage indicates: they accounted for over 76% of the annual total of man-months spent at the Centre. As in previous years, the work of the Centre included active research work in advanced physics, symposia, and training-for-research courses. During the year, over 190 preprints or internal reports were published by researchers working at the Centre.

Compared with 1979 the total number of visitors to the Centre has remained roughly constant - we welcomed 1470 scientists last year. But scientists from developing countries made a larger contribution to the Centre's work this year: the 619 scientists from developing countries who visited the Centre in 1979 accounted for 63% of the annual total of man-months. The calendar of scientific activities for 1980 is given in Table I.

Co-operation with outside bodies

One fruitful development this year was the co-operation of outside bodies in organizing several of the Centre's activities. With the clear success of these programmes in 1980, I hope that this co-operation will continue in the future.

Among the bodies who assisted in this manner were: The International Union for Pure and Applied Physics, who were one of the joint organizers of a topical meeting on Amorphous Silicon Physics and Applications which will be followed up by a second conference in 1981; The International School for Advanced Scientific Studies (SISSA), who co-sponsored the Centre's geophysics and mathematics workshops in 1980, and with whom we hope to organize two or three joint projects each year from now on; The French Ministries of Co-operation and Foreign Affairs, who sponsored the second course on solar energy to be held entirely in French - similar events will, we hope, be held every alternate year with the support of these Ministries.

Scientific activities

The Centre's scientific programme for 1980 fell broadly under five main headings, each of which is briefly discussed below. Our activities comprehended both research work and also training-for-research; the participation in these activities is shown in Table II.

The emphasis of our research work tends to be in the first three areas of the programme. This arises partly for historical reasons: these were our areas of strength when the Centre was first set up; and also for geographical reasons: there are strong research groups in these areas in the Physics Department of Trieste University. Finally, however strong the incentive, the availability of only limited resources places inevitable restrictions on what can be achieved.

The length of time visiting scientists have stayed at the Centre has declined from an average of over two months per visit in 1970 to less than a month in 1979. It is clearly difficult for anyone to do effective research in

TABLE I. Calendar of scientific activities, 1980

January	February	March	April	May	June	July	August	September	October	November	December
Nuclear physics workshop						Workshop on nonlinear boundary value problems					
	Heavy-ion physics mtg.										
							Summer seminar on complex analysis		Solar energy course (in French)		
Winter college on nuclear physics and reactors: Pt.I : Nuclear theory for applications Pt.II: Operational physics of power reactors											
Condensed matter physics and material science research (throughout the year)											
				Spring college on the physics of polymers, liquid crystals and low-dimensional solids		Research workshop in condensed matter physics					
						IUPAP Symposium on amorphous silicon physics & applications					
High-energy physics and fundamental theory research (throughout the year)											
				Seventh Trieste conference on particle physics				Session on developments in grand unified theories			
					Workshop on earthquake processes & premonitory phenomena						
									Autumn course on physics of flow in oceans, atmosphere & deserts		

such a short time, and so there has been a shift in emphasis in the Centre's activities: more training-for-research rather than research proper is being done now as compared to earlier years. This is evident in the proportion of publications arising from each of the Centre's areas of activity. In 1980 the trend towards visits of shorter duration was reversed slightly, but only because we received unexpected special contributions from outside sources.

The second part of this report gives a detailed "post-spectus" of the seminars, meetings, and courses which the Centre organized in 1980. A list of titles of the preprints and internal reports which our researchers produced during the year is also given for each area of activity. I will only give a brief synopsis of our work here.

Physics and Energy: The year began with a series of activities in the field of nuclear physics, including a workshop which ran from January through March; a topical meeting dedicated to heavy-ion physics (22-25 January); and two extended courses, one dealing with nuclear theory for applications, and the other with operational physics of power reactors. In continuation of the Centre's programmes geared to French-speaking scientists, the second Course on Solar Energy, held entirely in the French language, took place from 6 to 20 September.

Physics and Technology: This component of the Centre's activities was very strong during 1980: the permanent research group in condensed matter physics and material science was active throughout the year and was substantially strengthened during the period 23 June-12 September when the annual research workshop took place. In addition, a spring college on the physics of polymers, liquid crystals, and low-dimensional solids was held from 9 April to 20 June. In collaboration with the International Union of Pure and Applied Physics, a topical meeting dedicated to Amorphous Silicon Physics and Applications was organized from 21 to 25 July.

Physics and Frontiers of Knowledge: Research in elementary particles and fundamental theory was active throughout the year with the participation of some 180 scientists. This year, two topical meetings were organized in the field. The first, dedicated to particle physics, was a continuation of the series of meetings with the same title held over the past seven years. The second, held from 25 to 29 August, dealt with developments in grand unified theories.

Applicable Mathematics and Planning Models: From 9 to 20 June, the Centre organized, in collaboration with the newly-instituted International School for Advanced Scientific Studies (SISSA), a workshop on nonlinear boundary value problems. A second activity in this field, which brought together 195 mathematicians, was the summer seminar on complex analysis which took place from 7 to 31 July.

Physics of the Environment and of Natural Resources: In this area also, the Centre and SISSA were co-organizers of a workshop. Held from 5 to 10 May, this was devoted to earthquake processes and premonitory phenomena. From 30 September to 28 November, an autumn course on the physics of flow in oceans, atmosphere, and deserts was held. This course was divided into a basic course on geophysical flow dynamics; a one-week meeting on the physics of waterlogging and salinity, and another on circulation and transport in the Mediterranean; and a three-week workshop dedicated to the physics of desertification.

This year for the first time, scientists from the Member State of Malawi and from the Nairobi and Tunis offices of the United Nations Environment Programme participated in the centre's programmes.

TABLE II(A). Participation in the research and training-for-research activities of the ICTP during 1980

Geographic area	Number of visitors		Number of man-months		Total for area	
	from developing countries	from advanced countries	for developing countries	for advanced countries	No. of visitors	No. of man-months
Africa	186	-	210.44	-	186	210.44
Asia	271	28	450.21	26.06	299	476.27
Europe	246	518	199.22	222.69	764	421.91
Indonesia & Oceania	7	1	13.49	0.46	8	13.95
North and Central America	21	90	28.74	50.79	111	79.53
South America	64	-	87.18	-	64	87.18
International Organizations	4	25	1.54	4.78	29	6.32
	799	662	990.82	304.78	1461	1295.60
	1461		1295.60			

Note: This table shows the actual number of visitors; i.e. visitors who participated in more than one activity are counted only once, since the table deals with all activities combined.

TABLE II(B).

	Long term activities		Short term activities		Total	
	No. visitors	No. man-months	No. visitors	No. man-months	No. visitors	No. man-months
Developing countries						
Africa	180	204.22	6	6.22	186	210.44
Asia	244	431.97	27	18.24	271	450.21
Europe	192	188.63	54	10.59	246	199.22
Indonesia & Oceania	7	13.49	-	-	7	13.49
North & Central America	19	28.45	2	0.29	21	28.74
South America	61	86.50	3	0.68	64	87.18
International Organizations	3	1.38	1	0.16	4	1.54
	706	954.64	93	36.18	799	990.82
Advanced countries						
Asia	17	24.08	11	1.98	28	26.06
Europe	305	188.60	213	34.09	518	222.69
Indonesia & Oceania	1	0.46	-	-	1	0.46
North & Central America	61	45.51	29	5.28	90	50.79
International Organizations	12	2.42	13	2.36	25	4.78
	396	261.07	266	43.71	662	304.78
Grand totals	1102	1215.71	359	79.89	1461	1295.60

Percentage representation from developing countries: Number of visitors = 54.7%
Number of man-months = 76.5%

TABLE III. Stable resources for the period 1970 to 1981 (in thousand US $)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Italian Government	250	250	250	250	300	350	350	350	544	725	736	700
UNESCO	150	150	150	155	190	225	225	310	310	310	320	385
IAEA	155	155	150	160	200	386	305	569	507	578	923	876
Total	555	555	550	565	690	961	880	1229	1361	1613	1979	1961
Italian inflation rate:	5%	6%	10.5%	20%	17%	16.5%	19%	12%	15%	20%	20.1%	
Utilization:												
No. of visitors from developing countries:	186	300	328	379	329	399	387	644	655	619	792	
No. of man/months for developing countries:	452	492	703	787	595	664	563	777	791	608	975	
Average length of stay (mths.):	2.43	1.64	2.14	2.08	1.81	1.66	1.46	1.21	1.21	0.98	1.23	

Many scientists came to the Centre to carry out individual research during periods when no specific activity in their particular field of interest was scheduled. The unique character of the Centre, its facilities, and the presence here of other experts in their own or related fields present an invaluable opportunity to these scientists to bring their knowledge up to date and to exchange ideas on research.

Financing the Centre

On behalf of the Centre I would like to express my thanks for the generous contributions made in cash and in kind by the Swedish International Development Authority (Swedish Agency for Research Cooperation), the United Nations Environment Programme, the United Nations University, the United Nations Sudano-Sahelian Office, the Organization of American States, the World Meteorological Organization, CERN, and the International Union of Geodesy and Geophysics, as well as by the Governments of Denmark, France, Italy, and the United States, and by the local Trieste Consorzio per l'Incremento degli Studi e delle Ricerche. I would extend special thanks to the Governments of the Federal Republic of Germany and of Japan who contributed, among other things, towards the Centre's Associate Membership Scheme.

In spite of the generosity of these bodies, our financial prospects are very modest. In order to plan our activities, we have to know our likely income well in advance. The Centre has a guaranteed income from three sources: the Italian Government; UNESCO; and the IAEA. The development of the Centre's "stable resources" from these bodies over the last 11 years, and the projection for 1981, is shown in Table III. It can be clearly seen that the Centre's aggregate stable income has fallen far behind the pace of inflation in Italy. This makes forward planning difficult, and to maintain the range and quality of the Centre's activities we have had to rely on individual donations from other sources and will likely have to continue to do so in future.

Local Support

In concluding my review of the Centre's activities in 1980, I must express my thanks for, and great appreciation of, the continuous and precious collaboration in the Centre's programme of the Institute of Theoretical Physics and the Advanced School of Physics of the University of Trieste, and of the newly instituted International School for Advanced Scientific Studies, Trieste.

Abdus Salam
Director

PART II: THE SCIENTIFIC PROGRAMME

Physics and Energy

Title: Nuclear Physics Workshop

Dates: 22 January-28 March 1980

Organizers: Profs. G. Alaga (Zagreb, Yugoslavia), M.V. Mihalović (Ljubljana, Yugoslavia), J.J. Schmidt (IAEA) and L. Fonda (ICTP and University of Trieste).

Purpose: To stimulate research in the field at the highest level and to initiate collaboration between physicists present from the developing and the advanced countries. The workshop was also meant to host the research work of Associate Members and visitors from Federated Institutes who often work in isolated conditions in their home countries.

Programme: Self-consistent QRPA in the theory of nuclear structure (ground state correlations, Pauli principle corrections). Microscopic approach to nuclear friction. Giant back-bending, super-rigid rotation, Coriolis enhanced pairing. Transition rates at high spin: heavy-ion Doppler shift experiments; and phenomenological coupled band models. Antisymmetrical and non-antisymmetrical theories of reaction. Deformed double folding procedure. A calculable microscopic description of collision of "heavy" nuclei. On calculating the decay of a composite system. Possible interplay between non-axial and hexadecapole degrees of freedom - an explanation for "enormously" large Q_4. Rotational states in heavy nuclei: deformation energy surfaces and high-spin states; path integral formulation of nuclear rotation. Classification of quadrupole and octupole phonon states by group theoretical techniques. On the charge-exchange collective modes in Zr-90. Alpha decay as a Fermi-liquid process. Integral shell model theory of alpha decay. Gamma decay of coherent rotational states. Influence of the measuring apparatus on the gamma decay of coherent rotational states.

Participation:
Total visitors: 66
From developing countries: 52

Representation:

Africa		4
Asia	- developing:	16
Europe	- developing:	23
	- advanced:	12
Indonesia & Oceania	- developing:	1
South America		8
International Organizations	- from advanced:	2

Results and follow-up: 26 preprints and internal reports were issued in nuclear physics during 1980, written by participants in the scheduled activities or who came for individual research in other periods of the year. Another course, workshop and topical meeting are being organized for 1982.

Title: Topical Meeting on Heavy-Ion Physics

Dates: 22-25 January 1980

Organizers: Profs. R. Broglia (Niels Bohr Institute, Copenhagen), G. Ripka (CEN, Saclay) and A. Winther (Niels Bohr Institute, Copenhagen), together with Prof. L. Fonda (ICTP and University of Trieste).

Purpose: To bring scientists present at the Centre for the Nuclear Physics Workshop and the Course on Nuclear Theory for Applications up-to-date with recent developments in the subject.

Programme: Deep inelastic collisions. Angular momentum in deep inelastic collisions. Fusion reactions. Diffusion models. Coherent excitation of surface modes. Fusion of lighter ions. Multiplicities and deep inelastic reactions. Beyond TDHF. Evaporation processes. Zero point fluctuations. High spins. Coulomb excitation. Excitation of giant resonances. Inelastic scattering. Absorptive potentials. Widths of giant resonances.

Participation: Total visitors: 76
From developing countries: 48

Representation:

Africa		6
Asia	- developing:	26
	- advanced:	1
Europe	- developing:	10
	- advanced:	25
Indonesia & Oceania	- developing:	1
North & Central America	- advanced:	1
South America		5
International Organizations	- from advanced:	1

Title: Winter College on Nuclear Physics and Reactors - Part I: Nuclear Theory for Applications

Dates: 28 January-22 February 1980

Organization: This activity was organized jointly by the IAEA Nuclear Data Section and the Centre. It was directed by J.J. Schmidt (IAEA), M.K. Mehta (Bhabha Atomic Research Centre, Bombay) and L. Fonda (ICTP and University of Trieste).

Purpose: To review recent advances in contemporary neutron nuclear reaction theory; to train scientists from developing countries on an advanced level in the application of this theory to the computation of neutron nuclear data needed for nuclear reactor calculations and in the generation and processing of evaluated neutron data.

Programme: Experimental techniques and theoretical models: for the study of integral 14 MeV neutron cross sections; and for the study of secondary particle energy spectra and angular distributions emanating from 14 MeV neutrons-induced nuclear reactions. Nuclear data requirements for fusion reactor design. Advanced techniques for the determination of integral cross sections for the emission of complex particles in 14 MeV neutron-induced nuclear reactions; and the determination of energy spectra and angular distributions of charged particles emitted in 14 MeV neutron-induced nuclear reactions. Evaluation and processing of nuclear data. Critical review of the theory of fission. Theory and phenomenology of neutron-induced fission cross sections. The rise of nuclear theory for calculating the neutron cross sections of actinides. Progress in the theoretical understanding of fast neutron-nuclear interaction mechanisms and associated models. Advances in the application of nuclear reaction theory and models to the computation of neutron nuclear reaction data of the most important constituents of nuclear fission reactors (fissile and fertile isotopes, structural, coolant and shielding materials).

Participation: Total visitors: 91
From developing countries: 72

Representation:

Africa		13
Asia	- developing:	31
Europe	- developing:	18
	- advanced:	14
Indonesia & Oceania	- developing:	1
North & Central America	- developing:	2
	- advanced:	3
South America		7
International Organizations	- from advanced:	2

Title: Winter College on Nuclear Physics and Reactors - Part II: Operational Physics of Power Reactors

Dates: 3-28 March 1980

Organization: The course was organized in co-operation with the Division of Nuclear Power and Reactors of the IAEA and directed by Profs. J.B. Dee (IAEA), U. Farinelli (CNEN, Rome), I. Neamu (IAEA), T. Weber (University of Trieste) and L. Fonda (ICTP and University of Trieste)

Purpose: To offer to nuclear reactor physicists and engineers with appropriate background a broad review of typical reactor physics problems associated with the start-up and operation of currently available nuclear electric power generating stations, and to delineate various potential problems and suggest ways and means of overcoming them to ensure safe and economic operation.

Programme: Pressurized water rector and boiling water reactor fuel management. Three-Mile Island accident, pressurized water and boiling water reactor accident analysis, light water reactor safety research in the USA, engineered safety systems, licensing process. Candu-PHW fuel management, nominal power distribution for Candu equilibrium core, VIP-codes, sequences of Candu channels to be fuelled. Power operation, measurement and methods of calculation of power distribution for commercial pressurized water reactors and for commercial boiling water reactors. Fuel burnup effects and reload strategies, interpretation of neutron flux monitor, fuel reload strategies in BWR and PHWR. Fundamentals of pressurized water reactors, pressurized heavy water reactors, Soviet pressurized water reactors and boiling water reactors.

Participation: Total visitors: 71
From developing countries: 56

Representation:

Africa		9
Asia	- developing:	25
Europe	- developing:	13
	- advanced:	9
Indonesia & Oceania	- developing:	1
North & Central America	- developing:	1
	- advanced:	5
South America		6
International Organizations	- from developing:	1
	- from advanced:	1

Title: IIème Séminaire sur l'Energie Solaire

Dates: 6-20 September 1980

Organization: The Seminar was organized at the International Centre for Theoretical Physics and co-sponsored by the French Ministry for Foreign Affairs, the French Ministry for Co-operation, the CNRS and the Solar Energy Commission. The organizing committee included Prof. M. Cadène (University of Montpellier), Prof. A. Kastler (Ecole Normale Supérieure, Paris), Dr. M. Rodot, Director of the Interdisciplinary research programme for Solar Energy Research, National Centre for scientific research, Paris, Prof. M. Averous, Prof. A. Donnadieu, both from the University of Montpellier, Prof. J. Flechon, University of Nancy and Prof. A. Moyse, University of Paris Sud.

Purpose: To review and discuss topics relating to measurements in solar energy and conversion into thermal energy, photovoltaic conversion, bioconversion and photosynthesis as well as technological and economical aspects of solar energy, for the benefit of French-speaking scientists and engineers mainly from Africa. This was the second Course held in the French language on Solar Energy physics.

Programme: Photothermal conversion of solar energy. Measurement in solar energy and thermal energy conversion. Concentration of solar radiation. Homojunctions and heterojunctions. "Solar quality" silicon. Characterization of a solar cell. Photovoltaics. Development of photovoltaic generators. Amorphous silicon. Applications of photopiles. Photovoltaic solar pumps. Radiation and vegetation. Biomass production and modelling. Biological fixation of nitrogen. Bioconversion. Desalination and solar energy. Elements of economics computation. Solar energy systems and rural development. Wind energy. Solar energy and photoelectrochemical alternative. Rural experiments in Egypt. Energy needs in isolated settlements.

Participation: Total visitors: 78
From developing countries: 54

Representation:

Africa		38
Asia	- developing:	9
Europe	- developing:	1
	- advanced:	24
North & Central America	- developing:	1
South America		5

Nuclear Physics Preprints and Internal Reports
(In order of publication in 1980)

ICTP Ref. No.

[8] G. STRATAN - On the alpha decay branching ratios of nuclei around A = 110.

[9] N.Y. AYOUB - Effect of high lying states on the ground and few low lying excited 0^+ energy levels of some closed-shell nuclei.

[10] L. FONDA, N. MANKOČ-BORŠTNIK and M. ROSINA - The decay of coherent rotational states subject to random quantum measurements.

[12] M.V. MIHAILOVIĆ and M.A. NAGARAJAN - A proposal for calculating the importance of exchange effects in rearrangement collisions.

[13] A. BULGAC, F. CARSTOTU and O. DUMITRESCU - Double folded Yukawa interaction potential between two heavy ions.

[16] AHMED OSMAN - Four-body problem for four bound alpha particles in O-16.

[20] W.I. FURMAN and G. STRATAN - On alpha decay of some isomeric states in Po-Bi region.

[23] P. ROZMEJ, J. DUDEK and W. NAZAREWICZ - Possible interplay between non-axial an hexadecapole degrees of freedom - An explanation for "enormously" large Q-4?

[30] R. NOJAROV, E. NADJAKOV and V. ANTONOVA - High spin structure in a coupled bands model.

[31] AHMED OSMAN - Rearrangement collision between four identical particles as a four-body problem.

[33] A. AMUSA - Point-triton analysis of exchange free direct two-nucleon transfer reaction cross-sections.

[34] I.Zh. PETKOV and M.V. STOITSOV - On a generalization of the Thomas-Fermi method to finite Fermi systems.

[35] A.M. KHAN and M. SHAMSHER ALI - A Weiszacker-Bethe type mass formula for hypernuclei.

[36] S.K. SHARMA - On the suppression of magnetic octupole moments in nuclei with closed j-j shell plus or minus one nucleon.

[37] A.N. ANTONOV, V.A. NIKOLAEV and I.Zh. PETKOV - Nucleon momentum and density distributions of nuclei.

[41] Z.A. KHAN - Elastic scattering of intermediate energy protons on He-4 and C-12.

[42] J. THAKUR - Consistent treatment of pion condensation and optical potential.

[44] AHMED OSMAN - Two-nucleon transfer reactions with form factor models.

[51] O. DUMITRESCU, L. FONDA and N. MANKOČ-BORŠTNIK - Alpha decay of coherent rotational states.

[53] R. BECK, M.V. MIHAILOVIĆ and M. POLJŠAK - Calculations of nuclear reaction parameters with the generator co-ordinate method and their interaction.

[69] T. PERSI - Time dispersion relations and small-time behaviour in the decay of an unstable system.

[149] R. PARTHASARATHY and V.N. SRIDHAR - Effect of meson exchange corrections on allowed muon capture.

[154] W. WADIA and F. EL-BATANONY - Alpha clustering in Ne-20.

[159] A. RABIE, M.A. EL-GAZZAR and A.Y. ABUL-MAGD - The Watanabe model for Li-6-nucleus optical potential.

[160] A. RABIE, M.A. EL-GAZZAR and A.Y. ABUL-MAGD - A correction to the Watanabe potential.

[174] A. RABIE, M.A. EL-GAZZAR and A.Y. ABUL-MAGD _ Diffraction model analysis of vector polarized Li-6 elastic scattering on C-12, O-16, Si-38 and Ni-58 nuclei.

Physics and Technology

Title: Research in Condensed Matter Physics and related areas.

Dates: Throughout the year.

Organization: The research programme is organized by Professors M. Tosi and E. Tosatti (both University of Trieste) in collaboration with the Advisory Committe on Condensed Matter Physics.

Purpose: To carry out research at the highest possible level in condensed matter physics and to stimulate scientific interaction between physicists from the developing world and from advanced countries.

Programme: Electrons on a liquid helium surface. Geometry of adsorbed atoms and molecules on metal surfaces. Magnetism at the surface of metals in layered alloys - new experiments. Possible mechanisms of chemical carcinogenesis. Semiconducting and metallic polymers: polyacetylene, solitons in polyacetylene. One-dimensional doped $(CH)_x$. Effects of electron/atom ratio on the phase stability in alpha and beta brasses. Defects in nematic liquid crystals. Local spin density, pseudopotentials and the electronic structure of small clusters. Some recent results concerning the Jahn-Teller effect. The coil-globule transition in macromolecules. Magnetic resonance in incommensurate systems. The liquid-crystalline state of polymers. Electronic structure of grain boundaries. Phase transitions in liquid crystals and biological membranes. Selective laser light action on molecules. Equation of state of two-dimensional Wigner model. Laser resonance light pressure on free atoms. Dynamics of classical one-component plasma by the memory function formalism. Some aspects of an anisotropic electron gas. Phase and amplitude modes of charge-density waves. Exactly soluble models in quantum statistical mechanics. Principle of thermodynamical equivalence.

Participation:

Total visitors: 31, in addition to scientists present for scheduled activities in various periods.

From developing countries: 9 as above.

Representation:

Asia	- developing:	5
	- advanced:	1
Europe	- developing:	4
	- advanced:	13
North & Central America	- advanced:	8

Results and follow-up: 64 preprints and internal reports were issued in 1980. A permanent research group is present throughout the year each year. In alternate years, a winter college is held in this and related fields, while every summer a workshop is organized and strengthened for brief periods by a topical meeting.

Title: Research Workshop in Condensed Matter Research

Dates: 23 June-12 September 1980

Organization: Profs. P.N. Butcher (UK), S. Lundqvist (Sweden), N. March (UK), E. Tosatti and M. Tosi (both ICTP and University of Trieste).

Purpose: To join the permanent research group in carrying out research at the highest possible level in condensed matter physics and to stimulate scientific interaction between physicists from the developing and the advanced nations. The workshop is also meant to host the research work of Associate Members and of visitors from Federated Institues who have felt isolated for some time.

Programme: Electrical conductivity of a strongly coupled hydrogen plasma. Diamagnetism of electrons in high-magnetic fields. A unified picture of shallow impurity states in doped semiconductors. Surface energy and its temperature dependence in electron-hole liquids: simple considerations. Order-disorder transition in lithium ferro-spinel. Scaling and crossover in dilute and anisotropic magnets. Chemical bonds outside metal surfaces. Pseudopotential interpretation of short-range order in metallic solid solutions. Study of adsorbed microclusters by molecular dynamics. A model of hydrogen diffusion in metals. A Monte Carlo study of ^{3}He-^{4}He mixtures. Experimental study of short-range order in binary metallic alloys. Electronic structure of ferromagnetic transition metals. Adatom interactions and adlayer phases. Conservation laws and transport in disordered systems. Landau theory and the Ginzburg criterion for interacting bosons. Theory of change fluctuations in ionic liquids. Compressible ion theory and its application to rare earth chalcogenide transformations. Superconductivity with repulsive interactions. Interface optics for spatially dispersive media. Combined diffusion and drift. Anderson localization and minimum metallic conductivity. Mass transport in solids by a Kubo method. Dynamics of point defects, application to MgO. Angle-resolved photoemission from oriented atoms on surfaces. Amorphous semiconductors: introductive survey. Photoemission from alloys. Peierls transition in the Hubbard model. Phonon conductivity and phonon relaxation rate in solids with harmonic disturbances by Green's function method. Point defects and atomic transport in crystals. A new phase transition in the Dicke Hamiltonian. Conservation laws for response functions. Dynamic response of intermediate valence systems. Lattice instability of disordered electronic systems.

Participation:

Total visitors: 128
From developing countries: 85

Representation:

Africa		17
Asia	- developing:	35
	- advanced:	1
Europe	- developing:	27
	- advanced:	34
North and Central America	- advanced:	8
South America		6

Results and follow-up:

Many of the preprints and internal reports issued in this field were the result of collaborative efforts during the Workshop. A 3-month workshop in this field is held every year, in alternate years being preceded by a Winter College. In 1981 another Summer Workshop in condensed matter physics will be held.

Title: Spring College on the Physics of Polymers, Liquid Crystals and Low-dimensional Solids.

Dates: 9 April-20 June 1980

Organization: The course was part of the programme organized by the Advisory Committee on Condensed Matter Physics, under the chairmanship of Professor J.M. Ziman, H.H. Wills Physics Laboratory, Univ. of Bristol, UK.

Purpose: To bring together experimental observations and theoretical mechanisms, to provide a fundamental understanding of the structural, anisotropic forms of the condensed state and the technical applications of these properties.

Programme: Chemical bonding. Electron band theory. Electron-electron interactions. Electron transport and superconductivity. Phase transitions and dimensionality. Structural instability. Polymeric structures. Polymer solutions and gels. Polymeric materials. Biopolymers. Rubber elasticity. Physics of liquid crystals. Topological defects and disorder. Applications of liquid crystals. Quasi-one-dimensional conductors. Space-charge layers. Layer compounds. Heterostructures. Magnetic chains and layers.

Participation:
Total visitors: 138
From developing countries: 98

Representation:

Africa		10
Asia	- developing:	48
	- advanced:	1
Europe	- developing:	28
	- advanced:	36
Indonesia	- developing:	2
North and Central America	- developing:	1
	- advanced:	3
South America	- developing:	9

Title: Trieste Semiconductor Symposium on "Amorphous Silicon Physics and Applications".

Dates: 21-25 July 1980

Organization: The Symposium was jointly organized by the Italian National Research Council (CNR), IUPAP Semiconductor Commission, IBM-Italy, and International Centre for Theoretical Physics. The organizing committee included Professors M.H. Brodsky (Chairman), P.N. Butcher, A. Frova, E. Tosatti.

Purpose: The Symposium presented a state-of-the-art view of amorphous semiconductor physics and aevice potential for theorists and experimentalists who are active in the field.

Programme: Structural models and implications. Chemical bonding of alloy and doping atms in a-Si. Photoemission and electronic structure of a a-Si:H. Quantum wells in a-Si:H. Competitive models of defects. Characterization of defects. ESR and photoinduced ESR in a-Si. Transport experiments on glow discharge silicon. Transport experiments on sputtered Si. Hopping theories of electronic transport. Surface and field effects. Techniques for determining carrier properties. Recombination mechanisms in a-Si:H. Photoluminescence in a-Si:H: kinetics, influence of external fields. Novel aspects of luminescence in a-Si:H. CVD and hydrogenation of a-Si. Sputtered a-Si:H. Plasmas of Si+H. Fluorinated a-Si. New device possibilities. Sensors and photovoltaic devices. Solar cells with fluorinated a-Si. Status and potential of a-Si:H solar cells.

Participation:
Total visitors: 148
From developing countries: 50

Representation:

Africa		6
Asia:	- developing:	21
	- advanced:	6
Europe	- developing:	17
	- advanced:	80
North & Central America	- developing:	2
	- adavanced:	12
South America		4

Solid State Physics Preprints and Internal Reports
(In order of publication in 1980)

ICTP Ref. No.

[4] G. SENATORE and M.P. TOSI - Theory of the surface dipole layer and of surface tension in liquids of charged particles.

[7] A.M. KURBATOV and D.P. SANKOVICH - On the one variational principle in quantum statistical mechanics.

[22] T. NATTERMANN and J. PRZYSTAWA - Locking-in and incommensurability of the structural transition in $BaMnF_4$.

[27] D.K. CHANTURVEDI, U. MARINI BETTOLO MARCONI and M.P. TOSI - Mode-coupling theory of charge fluctuation spectrum in a binary ionic liquid.

[55] A.R. HASSAN - Phonon-assisted transitions in crossed electric and magnetic fields.

[56] A.R. HASSAN - Two-photon indirect transitions in crossed electric and magnetic fields.

[58] S. YOKSAN - Spatial variations of order parameter around Kondo impurity for $T \leqslant T_C$.

[59] J.K.A. AMUZU - Sliding friction of some metallic glasses.

[60] ZI-ZHAO GAN and GUO-ZHEN YANG - A theory of coherent propagation of light wave in semiconductors.

[63] H.B. SINGH and H. HAUG - Optical absorption spectrum of highly excited direct gap semiconductors.

[64] W. KLONOWSI - Living protein macromolecule as a non-equilibrium metastable system.

[65] H.G. REIK - An approximation to the ground state of $E \oplus \epsilon$ and $\Gamma_8 \oplus \tau_2$ Jahn-Teller systems based on Judd's isolated exact solutions.

[66] A.N. ERMILOV, A.N. KIREEV and A.M. KURBATOV - Spin glasses with non-Gaussian distributions. Frustration model.

[68] A. AYENSU - Dynamic dislocations in high quartz.

[70] M.F. KOTKATA, A.A. EL-ELA, E.A. MAHMOUD and M.K. EL-MOUSLY - Electrical transport and structural properties of Se-Te semiconductors.

[71] A.Yu. GROSBERG and A.R. KHOKHLOV - Some problems of the statistical theory of polymeric lyotropic liquid crystals.

[75] J. SPAŁEK and K.A. CHAO - Kinetic exchange interaction in a doubly degenerate narrow band and its applications to $Fe_{1-x}Co_xS_2$ and $Co_{1-x}Ni_xS_2$.

[78] A. AYENSU - The dependence of mechanical, electrical, thermal and acoustic properties of tropical hardwood on moisture content.

[79] J.S. NKOMA - Effect of impurities on the two-dimensional electron gas polarizability.

[80] A.M. JAYANNAWAR and N. KUMAR - Orbital diamagnetism of a charged Brownian particle undergoing birth-death process.

[84] L. OLUMEKOR - Substrate temperature and resistivity of Mn and Mn/MgF_2 thin film resistors.

[85] TAO RUIBAO and PU FUCHO - A proof of the absence of modulated phase transition and spin density wave phase transition in one- and two-dimensional systems.

[86] PU FUCHO - Density of states, Poisson's formula of summation and Walfisz's formula.

[87] A.K. BANDYOPADHYAY, S.K. CHATTERJEE, S.V. SUBRAMANYAM and B.R. BULKA - Electrical resistivity study of some organic charge transfer complexes under pressure.

[90] A.R. HASSAN and F. ABU-ALALLA - Exciton-polaritons by two-photon absorption in semicondutors.

[91] A.R. HASSAN - Phonon-polaritons by two-photon absorption in solids.
[92] L. LONGA and J. KONIOR - Exact results for some 2D-Ising models with periodical distributed impurities.
[97] K.K. SINGH - Renormalization group and the ideal Bose gas.
[98] N. DADHICH - The Pensore process of energy extraction in electrodynamics.
[99] G. MUKHOPADHYAY and S. LUNDQVIST - Dynamical polarizability of atoms.
[102] Kh.I. PUSHKAROV - Solitary excitations in one-dimensional ferromagnets at $T \neq 0$.
[103] Kh.I. PUSHKAROV and D.I. PUSHKAROV - Solitary clusters in one-dimensional ferromagnet.
[111] A. BREZINI and G. OLIVIER - Localization on weakly disordered Cayley tree.
[117] P. FAZEKAS - Laser induced switching phenomena in amorphous $GeSe_2$: A phase transition model.
[119] G. CAMPAGNOLI and E. TOSATTI - AsF_5-intercalated graphite: Self-consistent band structure, optical properties and structural energy.
[120] SOE YIN and E. TOSATTI - Core level shifts in group IV semiconductors and semimetals.
[121] D.K. CHATURVEDI, G. SENATORE and M.P. TOSI - Structure of liquid alkali metals as electron-ion plasma.
[128] FARID A. KHWAJA - Temperature dependence of the short-range order parameter and the concentration dependence of the order-disorder temperature for Ni-Pt and Ni-Fe systems in the improved statistical pseudopotential approximation.
[131] S. ROBASZKIEWICZ, R. MICNAS and K.A. CHAO - Ground-state phase diagram of extended attractive Hubbard model.
[132] L.N. SHEHATA - Pinning by macroscopic spherical cavity in type II superconductor.
[133] K.K. SINGH - Landau theory and Ginzburg criterion for interacting bosons.
[134] R.P. HAZOUME - Reconstruction of the molecular distribution functions from the site-site distribution functions in classical molecular fluids at equilibrium.
[135] R.P. HAZOUME - A theory of the nematic liquid crystals.
[137] MAHIRADHWAJ SINGH - Phonon conductivity and relaxation rate in solids with disturbances by the Green function method.
[138] F.A. KATOUT - Mott excitons in ferrodielectrics.
[139] F. BROUERS and O.L.T. DE MENEZES - Electron-phonon interaction in mixed valence systems.
[140] T.C. CHOY - Some exact results for a degenerate Hubbard model in one dimension.
[142] VIJAY KUMAR, A. MOOKERJEE and V.K. SRIVASTAVA - Electronic structure of disordered alloys - I: Self-consistent cluster CPA incorporating off-diagonal disorder and short-range order.
[143] A. MOOKERJEE and V. CHAUDHRY - Electronic structure of disordered alloys - II: Self-consistent CCPA calculations for III-V semiconducting alloys.
[144] FARID A. KHWAJA and A.A. KATSNELSON - The experimental study of the establishment of local order in binary metallic solid solutions.
[150] N.H. MARCH and M.P. TOSI - Interpretation of X-ray diffraction from liquid alkali metals.
[151] K.S. SINGWI and M.P. TOSI - Simple considerations on the surface tension and the critical temperature of the electron-hole liquids.
[152] Z. AKDENIZ, G. SENATORE and M.P. TOSI - Concentration fluctuations and ionic core polarization in molten salt mixtures.
[153] FARID A. KHWAJA and ANIS ALAM - Concentration and temperature

dependence of short-range order in Ni-Ta solid solution using X-ray diffraction method.

[155] M. STĚSLICKA and L. PERKAL - Effect of the field penetration on surface states.

[156] I.Y. YANCHEV, Z.G. KOINOV and A.M. PETKOVA - Density of states in heavily doped strongly compensated semiconductors with correlated impurity distribution.

[162] A. SADIQ, R.A. TAHIR-KHELI, M. WORTIS and N.A. BHATTI - Percolation and spin glass transition.

[165] D.K. CHATURVEDI, G. SENATORE and M.P. TOSI - Structure of the strongly coupled classical plasma in the self-consistent mean spherical approximation.

[166] M. YUSSOUFF and R. ZELLER - An efficient Korringa-Kohn-Rostoker method for "complex" lattices.

[171] N.H. MARCH and M.P. TOSI - Charge-charge liquid structure factor and the freezing of alkali halides.

[173] M. YUSSOUFF - Generalized structural theory of freezing.

[176] M.R. MONGA and K.N. PATHAK - Dispersion and damping of plasmons in metals.

[177] N.H. MARCH and M.P. TOSI - Interacting Frenkel defects at high concentration and the superionic transition in fluorite crystals.

[182] L. MIGLIO, M.P. TOSI and N.H. MARCH - Exchange energy of inhomogeneous electron gas near a metal surface.

[188] H.D. DIMITROV - On the one-electron theory of crystalline solids in a homogeneous electric field.

[189] H.D. DIMITROV - On the theory of electron states connected with semiconductor-dielectric interface.

Title: Elementary Particle Physics and Fundamental Theory Research.

Dates: Throughout the year.

Organization: This research programme is organized by the Director of the Centre, Prof. Abdus Salam (Pakistan), the Resident Physicist, J. Strathdee (ICTP/New Zealand), the Head of Training Courses and Scientific Porgrammes, Prof. L. Bertocchi (ICTP and University of Trieste), the Research Adviser, Prof. N. Craigie (UK/Trieste) and the University of Trieste Consultants Profs. P. Budini, L. Fonda, G. Furlan, G. Ghirardi and R. Jengo.

Purpose: To contribute to the advancement of physics at an international standard through individual and team research, stimulate interaction between physicists from developing and advanced nations and create a genuine research condition that will encourage Associate Members, visitors from Federated Institutes in their work after their return home.

Programme: Lectures or lecture series were held on: Instanton-antiinstanton interaction in the O(3) non-linear o-model. Deuteron form-factor and di-baryon resonances. Quark mass ratios and the Cabibbo angle in an $SU(5)xS_4$ model. Electromagnetic detectors of gravitational waves. Phenomenology and theory of diffraction. Path integral measure and the boson-fermion equivalence in the Schwinger model. Monte Carlo studies of non-Abelian lattice gauge theories. Instantons and the 1/N expansion. Chiral symmetry breaking and perturbative QCD. Multijets in QCD. Quark propagators in confining theories, a query. Soft hadron physics as colour chemistry. Finite temperature approach to confinement. Gauge field propagators and the number of fermion fields. Higgs bosons. Superfields in extended supersymmetric gauge theories and extended supergravity. Classical and quantum 2-body problem in general relativity. Conformal group, De-Sitter group and massless particle physics. Some remarks on η' mesons. Reggeization of non-Abelian gauge theories and related topics. On the origin of the leading particle effect in hadronic reactions. Separable solutions of Dirac's equation for the electron. Production of lepton pairs in hadronic collisions. A survey of what aspects of QCD can be tested with polarized beams and targets. On dynamical symmetry breaking. Gauge formulation of gravitation theories and many other topics in the field.
Informal discussion meetings included, among other subjects: Some phenomenological applications of

QCD. Neutrino oscillations. Feynman integrals and the action function. A survey of topology and models of quantum field theory. Functional integration and Dirac boundary value problem. Quadratic gauge fixing in Yang-Mills theories. Generation of baryon excess in an SU(2)xSU(2)xSU(4) model. A new solution for the Schwinger model. Possible radiative stability of vacuum expectation values in spontaneously broken theories. Renormalization and short-distance properties of string-type equations in QCD. A Euclidean method in quantizing about curved space time. Thermodynamics with inernal symmetries and phase transitions in hadronic matter. Calculation of the baryon-octet magnetic moments in an integer charge quark model. An exact fractionally charged selfdual solution.

Participation:

Total visitors: 198
From developing countries: 108

Representation:

Africa		11
Asia	- developing:	45
	- advanced:	10
Europe	- developing:	45
	- advanced:	67
Indonesia & Oceania	- developing:	1
North & Central America	- developing:	1
	- advanced:	10
South America		5
International Organizations	- from advanced:	3

Results and follow-up:

81 preprints and internal reports were issued in this field. Research in high-energy phsyics and fundamental theory is carried out throughout the year every year.

Title: The Seventh Trieste Conference on Particle Physics.

Dates: 30 June-4 July 1980

Organization: The Conference was organized by the International Centre for Theoretical Physics and the Instituto Nazionale di Fisica Nucleare, Italy.

Purpose: To review the theoretical as well as the experimental developments in e^+e^- physics, lepton initiated reactions, hadron interactions, quantum chromodynamics and to discuss recent experiments in other related fields.

Programme: Difficulties and perspectives of subcomponent models. Inelastic muon scattering. Results from the Na4 experiment on the deep inelastic scattering of muons on carbon. Deep inelastic muon scattering from EMC. Recent results from MARK-J. Infrared sensitive quantities in perturbative QCD. Non-perturbative results in quantum chromodynamics. Muon pair production at FNAL. Hadronic dimuon production at the CERN SPS. Strong QCD corrections to the annihilation of heavy quark-antiquark systems. Some aspects of e^+e^- physics at high energy. Quark news: CLEO results at CESR. New results from DCI in e^+e^- interactions: Observation of p' (1.64 GeV). Search for Baryonium. Starters of n_c from inclusive and exclusive studies. Single pass collider project at SLAC. The LEP programme. Future plans at DESY. Results at ISR. Coherent photoproduction of DD pairs and D-lifetime. Lifetime of charmed particles. Recent results on charm production in strong interactions. New results on structure functions from the CDHS experiment. Last results from the CERN beam dump experiments. Deep inelastic neutrino and antineutrino scattering. Neutrino oscillations. Neutron-antineutron oscillations. Majorana neutrinos and neutron oscillations as tests of unification models. Grand unified theories.

Participation:
Total visitors: 153
From developing countries: 52

Representation:

Asia	- developing:	20
	- advanced:	6
Europe	- developing:	27
	- advanced:	71
North & Central America	- advanced:	15
South America		5
International Organizations	- from advanced:	9

Results and follow-up: The contributions to this meeting have been published as two internal reports. As is obvious from the title, this is one of a series of meetings in this field which are, normally, held each year.

Title: Session on Developments in Grand Unified Theories.

Dates: 25-29 August 1980

Organization: The research programme was organized by Prof. R. Barbieri (CERN and Scuola Normale Superiore, Pisa) and Professor R. Iengo (University of Trieste and ICTP, Trieste).

Purpose: To provide a review of the recent developments in the field.

Programme: Unification: a critical review. Superunification. Difficulties and perspectives for subcomponent models of Quarks and Leptons. Cosmological echoes in grand unified theories. Grand unification. Conservation of charges and the question of elementarity. Experimental implications of grand unified theories. Grand unification beyond SU (5). Primordial magnetic monopoles and unified gauge theories. Technicolour.

Participation: Total visitors: 69
From developing countries: 16

Representation:

Asia	- developing:	3
Europe	- developing:	11
	- advanced:	45
North & Central America	- advanced	5
South America		1
International Organizations	- developing	1
	- advanced	3

Elementary Particle Physics Preprints and Internal Reports
(In order of publication in 1980)

ICTP Ref. No.

[1] W. KRÓLIKOWSKI - Towards a dynamical preon model.
[2] A.P. BUKHVOSTOV and L.N. LIPATOV - Instanton-anti-instanton interaction in the O(3) non-linear σ-model and an exactly soluble fermion theory.
[3] RIAZUDDIN - $K \to 2\pi$ decays in non-relativistic quark-gluon model.
[5] RIAZUDDIN - Two-body D-meson decays in non-relativistic quark model.
[6] G. ALBERI, M. BLESZYNSKI, T. JAROSZEWICZ and S. SANTOS - Deuteron D-wave and the non-eikonal effects in tensor asymmetries in elastic proton-deuteron scattering.
[11] G.C. GHIRARDI, V. GORINI and G. PARRAVICINI - Spatial localization of quantum states and phsyical meaning of the matrix elements of the resolvent operators.
[14] W. KRÓLIKOWSKI - Lepton and quark families as quantum-dynamical systems.
[15] S. RAI CHOUDHURY - QCD effects in a model of non-leptonic hyperon decays.
[17] NAMIK K. PAK - Introduction to instantons in Yang-Mills theory (Part I).
[18] RIAZUDDIN - Neutral current weak interaction without electroweak unification.
[19] N.S. CRAIGIE, S. NARISON and RIAZUDDIN - An apparent inconsistency between the Dyson and renormalization group equations in QCD.
[21] NAMIK K. PAK - Electric charge as the source of CP violation.
[25] G. MAIELLA - Path-integral measure and the fermion-boson equivalence in the Schwinger model.
[26] N.S. CRAIGIE, S. NARISON and RIAZUDDIN - A critical analysis of the electromagnetic mass shift problem in QCD.
[28] ABDUS SALAM - Gauge unification of fundamental forces (Nobel lecture).
[29] E.W. MIELKE - On pseudoparticle solutions in Yang's theory of gravity.
[32] ABDUS SALAM and VICTOR ELIAS - Induced Higgs couplings and spontaneous symmetry breaking.
[39] ABDUS SALAM - The nature of the "ultimate" explanation in physics.
[40] W. KRÓLIKOWSKI - An integral transform of the Salpeter equation.
[43] V. de ALFARO, S. FUBINI and G. FURLAN - Classical solutions and extended supergravity.
[45] E.W. MIELKE - Towards exact solutions of the non-linear Heisenberg-Pauli-Weyl spinor equation.
[46] N.S. CRAIGIE - Catastrophe theory and disorders of the family system.
[47] J.C. PATI - Unity behind diversity in Nature.
[48] J. LUKIERSKI - Supersymmetric σ models and composite Yang-Mills theory.
[49] W. KRÓLIKOWSKI - Are lepton and quark families quantized dynamical systems?
[50] W. DEPPERT - The role of interaction in neutrino statistics.
[52] D. KUSNO and M.J. MORAVCSIK - On the problem of the deuteron smearing corrections - I: The conventional approach.
[54] E.W. MIELKE - The eight-fold way to colour geometrodynamics.
[57] S. NARISON - Techniques of dimensional renormalization and application to the two-point functions of QCD and QED.
[61] K.G. AKDENIZ and O. OGUZ - A new class of meronic solutions.
[62] N.S. CRAIGIE - Quantum chromodynamics - A theory of the nuclear force.
[67] ABDUS SALAM and J. STRATHDEE - Fermion masses and the gauge hierarchy problem.
[72] J.C. PATI and ABDUS SALAM - Quark-lepton unification and proton decay.
[73] ASHOK DAS - Are massless supersymmetric gauge theories really massless?
[74] G. MAIELLA - Chiral rotations and the fermion-boson equivalence in the Schwinger model.

[77] E. GAVA, R. JENGO and C. OMERO - Finite temperature approach to confinement.

[82] E.R. NISSIMOV - Higher quantum conserved current in a new completely integrable model.

[88] IN-GYU KOH and YONGDUK KIM - Global quantity for dyons with various charge distributions.

[89] K.G. AKDENITZ, M. GOODMAN and R. PERCACCI - Monopoles and twisted sigma models.

[93] S.P. MISRA and J.C. PATI - Is quantum chromodynamics effectively perturbative everywhere?

[94] ABDUS SALAM and J. STRATHDEE - On Witten's formula.

[95] ABDUS SALAM and J. STRATHDEE - Dynamical mass generation in $(U_L(1) \times U_R(1))^2$.

[96] N.S. CRAIGIE, F. BALDRACCHINI, V. ROBERTO and M. SOCOLOVSKY - Study of factorization in QCD with polarized beams and V production at large p_T.

[101] V.V. MOLOTKOV and I.T. TODOROV - Gauge dependence of World lines and invariance of the S-matrix in relativistic classical mechanics.

[104] V.V. MOLOTKOV - Equivalence between representations of conformal superalgebra from different subgroups. Invariant subspaces.

[105] MENDEL SACHS - A proton mass doublet from general relativity.

[107] T. KUNIMASA - The Casimir effect as a screening effect in quantized field theory.

[108] E. ADENIYI BANGUDU - The method of moments and nested Hilbert spaces in quantum mechanics.

[109] P. FURLAN and R. RACZKA - On higher dynamical symmetries in models of relativistic field theories.

[110] R. PARTHASARATHY - Composite quarks and their magnetic moments.

[112] S.K. OH - The Bjorken-Paschos relation in the unified gauge theory.

[114] P. BAEKLER, F.W. HEHL and E.W. MIELKE - Vacuum solutions with double duality properties of a quadratic Poincaré gauge field theory.

[116] M. SOCOLOVSKY - Spin-spin asymmetries with v and $\bar{v}$ beams and polarized nucleons.

[118] P. BUDINI - On spinor geometry: A genesis of extended supersymmetry.

[123] BELAL E. BAAQUIE - New solution for the Schwinger model.

[124] A. MAHESHWARI, E.R. NISSIMOV and I.T. TODOROV - Classical and quantum two-body problem in general relativity.

[125] B.B. DEO and V.B. PRASAD - Generation of baryon excess in $SU_L(2) \times SU_R(2) \times SU_C(4)$.

[126] The Seventh Trieste Conference on Particle Physics, 30 June-4 July 1980 (Contributions) - Part I.

[127] The Seventh Trieste Conference on Particle Physics, 30 June-4 July 1980 (Contributions) - Part II.

[129] I.H. DURU and E. KEYMAN - Hamilton-Jacobi formulation of path integrals.

[136] K.G. AKDENITZ and M. HORTACSU - Functional determinant for the Thirring model with instanton.

[141] AMOUZOU TÉKOU - Multiple scattering in the nuclear rearrangement reactions at medium energy.

[145] H. DORN and E. WIECZOREK - Renormalization and short distance properties of string-type equations in QDC.

[148] F. BALDRACCHINI, N.S. CRAIGIE, V. ROBERTO and M. SOCOLOVSKY - A survey of polarization asymmetries predicted by QCD.

[157] CAO XUAN CHUAN - A theorem on the separation of a system of coupled differential equations.

[158] E.W. MIELKE and R. SCHERZER - Geon-type solutions of the non-linear Heisenberg-Klein-Gordon equation.

[161] E.W. MIELKE - Empirical verification of recently proposed hadron mass formulas.

[163] E. GAVA, R. JENGO and C. OMERO - On the instanton contribution to the string tension.
[164] S. NARISON - QCD sum rule for light mesons.
[167] N.S. CRAIGIE and H. DORN - On the renormalization and short-distance properties of hadronic operators in QCD.
[168] D.S. KULSHRESHTHA and R.S. KAUSHAL - Heavy mesons in a simple quark-confing two-step potential model.
[169] D.S. KULSHRESHTHA and R.S. KAUSHAL - Form factor of K-meson and the meson radii in a quark-confining two-step potential model.
[170] J. TARSKI - Unitary symmetries in Budini's theory of quarks.
[172] W. DEPPERT - Remarks on the "beginning" and the "end" of the Universe.
[175] T. JAROSZEWICZ - High energy multi-gluon exchange amplitudes.
[178] J.C. PATI - Probing grand unification through conservation laws.
[179] J.C. PATI - Grand unification of quarks and leptons from one of preons.
[180] J.C. PATI, ABDUS SALAM and J. STRATHDEE - A preon model with hidden electric and magnetic type charges.
[181] P. FURLAN and R. RACZKA - A new approach to unified field theories.
[183] J.C. PATI, ABDUS SALAM and J. STRATHDEE - Probings through proton decay and n-n oscillations.
[184] D.S. KULSHRESHTHA - Anticipated tt states in the quark-confining two-step potential model.
[185] Jose A. MAGPANTAY - Some comments on Baluni's gauge.
[186] C. MUKKU and W.A. SAYED - O(5) X U(1) electroweak theory.
[187] NAMIK K. PAK and R. PERCACCI - On the topological equivalence of gauge and Higgs fields in the dyon sectors.
[190] I. CAPRINI, I. GUIASU and E.E. RADESCU - Model dependent dispersion approach to proton compton scattering.
[191] I. GUIASU and E.E. RADESCU - Sum rule inequalities for pion polarizabilities.
[192] K. TAHIR SHAH - Breakdown of predictability - an investigation on the nature of singularities.

Title: Workshop on Nonlinear Boundary Value Problems.

Dates: 9-20 June 1980

Organization: This workshop was organized by the Scuola Internazionale di Studi Avanzati (International School for Advanced Studies) in Trieste and the International Centre for Theoretical Physics, with the co-sponsorship of the Comitato Nazionale delle Ricerche (Italian National Research Council). It was directed by Professors A. Ambrosetti and A. Cellina of SISSA and G. Vidossich of the University of Trieste and ICTP.

Purpose: To review the present status of research of the theory of boundary value problems of differential equations and to define the future perspectives of the same, as well as to facilitate the meeting of people working in the same area.

Programme: Nonlinear age-dependent population models. Periodic solutions of time-dependent Hamiltonian systems. Waves and fluids. Existence and multiplicity results for a class of nonlinear problems. A continuation theorem for Hilbert spaces. Topological methods in nonlinear problems. On the fundamental theory of infinite-delay equations. Extensions of topological degree theory and some surjectivity theorems on spectral theory. Orlicz type results for differential equations in Banach spaces. Evolution equations with discontinuous coefficients. A perturbation method in critical point theory and applications. On the existence of solutions for non-linear equations with symmetries with respect to the Kernel of the linear part. Connectivity properties of the fixed point set of parametrized compact vector fields. Non-convex duality methods and applications. Remarks on the dual action principle.

Participation: Total visitors: 46
From developing countries: 9

Representation:

Africa		1
Asia	- developing:	2
Europe	- developing:	7
	- advanced:	30
North & Central America	- advanced:	5
South America		1

Title: Summer Seminar on Complex Analysis

Dates: 7-31 July 1980

Organization: The research programme is directed by Professors A. Andreotti (Scuola Normale Superiore, Pisa, Italy), J. Eells (University of Warwick, UK) and I.M. Singer (University of California, Berkeley, USA).

Purpose: To provide a panorama of the basic methods and techniques of the subject, to introduce the problems of current research and to survey the application and cover a variety of interests, from those wishing to begin research to the persons interested only in the applications and/or using the methods and results.

Programme: Complex Analysis and Geometry. Introduction to value distribution theory of meromorphic maps. An introduction to analysis on complex manifolds. Yang-Mills fields and holomorphic vector bundles. Functions of several complex variables. Volumes of geodesic balls. On variation of harmonic maps. Differential forms on real and complex manifolds. Convexity and complex boundary problems. On the Heisenberg nilmanifold and harmonic maps. Some applications of complex analysis to minimal surface theory. Feynman-type integrals of analytic functions. Twister theory. Introduction to deformations of complex structures and vector bundles. Introduction to several complex variables. Harmonic maps from the sphere to projective spaces. The topology of an holomorphic flow near a singularity. Regular solutions of CP^n models. Vector cross products and harmonic maps. The geometry of Weierstrauss polynomials. The topology of a linear C^m flow on C^n. The Heisenberg picture and semigroups in B-algebras. Passivity and equilibrium in classical statistical mechanics. Second variations. Froberius reciprocity and analysis on complex homogeneous manifolds. Kodaira vanishing theorems for pseudo convex Kählerian manifolds. Quasi-conformal deformations in several variables. Numerical invariants of singularities and Chern classes. Vector bundles over projective space. Scattering theory and the Penrose transform. A structure theorem in gauge theory. A physical interpretation of twistor flag space. Stochastic optimal control methods for solving Monge-Ampère equations. Smooth extensions of biholomorphic mappings. The mean curvative equation: interior regularity and irregularities. The geometry of Kepler's problem. Stable vector bundles over projective spaces. Stochastic optimal control methods for solving Monge-Ampère equations. Some recent results on (μ,ν) rational approximation to power series in C^n. Some variational problems in complex analysis. Schwarz lemma and projective mappings. The elliptic extension of the complex

plane. The space of maps inducing isomorphic connections. The stress energy tensor of harmonic and holomorphic maps. Introduction to the theory of periods of integrals on algebraic manifolds.

Participation:

Total visitors: 195
From developing countries: 121

Representation:

Africa		38
Asia	- developing:	42
	- advanced:	3
Europa	- developing:	26
	- advanced:	59
North and Central America	- developing:	8
	- advanced:	11
South America		7
International Organizations		1

Physics of the Environment and of Natural Resources

Title: Workshop on Earthquake Processes and Premonitory Phenomena

Dates: 5-10 May 1980

Organization: This workshop was organized by the International Centre for Theoretical Physics, the Istituto di Geodesia e Geofisica of the University of Trieste, and by the Scuola Internazionale Superiore di Studi Avanzati, Trieste. The organizing committee included Prof. Roman Teisseyre, Prof. Mara Zadro, Prof. Claudio Ebblin and Prof. Claudio Chiaruttini.

Purpose: To promote exchange of data and ideas concerning the physics of earthquakes and to stimulate research in the field through interdisciplinary discussion and debate.

Programme: Focal parameters and earthquake mechanisms. Models of fracturing in an earhtquake source. Earthquake processes in the two-component media. Models of premonitory processes. Research on earthquake prediction and tectonic processes in seismic areas. Strain determinations. Strains from geodetic measurements. Rheology of an earthquake source zone.

Participation: Total visitors: 38
From developing countries: 17

Representation:

Africa		1
Asia	- developing:	2
Europe	- developing:	14
	- advanced:	21

Title: Autumn Course on Physics of Flow in the Oceans, Atmosphere and Deserts

Dates: 30 September-28 November 1980

Organization: This Course was organized by the International Centre for Theoretical Physics and co-sponsored by the Regional Government of Friuli-Venezia Giulia and the International Union of Geodesy and Geophysics. It was prepared by Professor A.H. Cook (Cambridge, U.K.), Dr. M.H.A. Hassan (Khartoum, Sudan) and Professor A. Marussi (Trieste, Italy) in consultation with the Advisory Committee for Geophysics and Environmental Physics of the ICTP.

Purpose: To develop the mathematical and physical bases for the Workshop and Conferences on physics of desertification, physics of waterlogging and salinity and circulation and transport in the Mediterranean.

Programme: This activity was divided into four parts: Geophysical flow dynamics; waterlogging and salinity; circulation and transport in the Mediterranean; the physics of desertification. Lectures were delivered on: Waves. Porous media. Turbulence. Experimental aspects of wind-gravity waves and related prediction models. Transport of sediment by water and air. General circulation of the atmosphere. Marine geodesy. Ocean tides. Rotating systems. Satellite oceanography. Mathematical methods. Physical principles of fluid mechanics. Phenomena, area and typology of waterlogging and saline soils. Loss of soil fertility, technical and social causes and consequences. Physics and geochemistry of soils and of groundwater salinity. Biophysics and physiology of the toxicity of saline soils and brackish water. Hydrophysics of ground and soil capillarity; solutions mobility, water infiltration and evaporation, wilting, optimal moisture. Technical quality and efficiency of traditional and modern improved engineering of irrigation systems and methods of field watering: scientific, economic, social aspects. Quality of irrigation water possibility: hazards and predictions of brackish water application. Horizontal and vertical "tube wells" drainage as the fundamental tool of reclamation of waterlogged and saline soils and of water-salt balance management. Integrated methods of prediction of the possible hazards of waterlogging and salinity of irrigated land. Water, salt and heat budgets and main fluxes of the Mediterranean as a whole. The response of the sea to energy transfers across its surface. Long-term evolution of the Mediterranean climate: the Eastern Mediterranean, the Adriatic, with modelling, the middle Mediterranean, meridian of Malta to Sardinia and Corsica, the Western Mediterranean, Algero-Provencal

basis. Continental shelf regime and upwelling. Model of the Eastern Mediterranean. Model of the Western Mediterranean, the Straits of Gibraltar and adjacent areas. Desertification of arid and semi-arid lands. Sand dunes, application of space-age techniques. Dynamical study of live dunes. Wind tunnel and field experiments. Comparison of aeolian processes on Mars and Earth. Drift formation in sand and snow. Physics of particle motion. The physical mechanism of sand movement. Soil erosion by wind. Dust production. Mathematical models for sediment ripples and desert dunes. Channel flows. Evolution of sand dunes - nonlinear treatment.

Participation:

Total visitors: 140
From developing countries: 95

Representation:

Africa		37
Asia	- developing:	29
	- advanced:	1
Europe	- developing:	7
	- advanced:	34
Indonesia & Oceania	- developing:	4
	- advanced:	1
North & Central America	- developing:	6
	- advanced:	8
South America		10
International Organizations	- from developing:	2
	- advanced:	1

Activities Outside the Scheduled Programme

Title: Miscellaneous research

Dates: Throughout the year

Purpose: To allow scientists wishing to avail themselves of the Centre's facilities (Library, computing facilities, presence of ICTP Consultants and other experts) and have contacts with others, in their own or related fields of interest present at the Centre, to do so.

Participation: Total visitors: 74
From developing countries: 54

Representation:

Africa		24
Asia	- developing:	21
Europe	- developing:	11
	- advanced:	8
North & Central America	- developing:	4
	- advanced:	3
International Organizations	- from advanced:	3

Results and follow-up: Some 11 preprints and internal reports were issued in fields not directly covered in scheduled activities in 1980.

Title: Hosted activities

Meetings organized by other Institutions and hosted at the Centre in 1980 were:

1. International Conference on Education for Physics Teaching, organized by the International Commission on Physics Education and held from 1 to 6 September.

2. Conference on Quantitative Methods in Ecology, organized by the Botanical Institute of the University of Trieste, and held from 8 to 12 September.

3. Conference on Mass Loss from Stars, organized by the Astonomical Observatory of the University of Trieste and the Institute of Astronomy of the University of Padova and held from 15 to 19 September.

Title: Regional activities

The International Centre for Theoretical Physics was co-sponsor this year of the following activities, organized in the various regions in response to the needs of scientists from developing countries:

1. XIV CURCAF-Latin American Course of Physics, Panama, 6-26 January.
2. Advanced School of Physics, Yogyakarta, Indonesia, 7-25 January.
3. Indo-Rench School of Recent Advances in Computer Techniques in Meteorology, Bio-mechanics and Applied Systems, New Delhi, India, 4-13 February.
4. Fifth International Summer College on Physics and Contamporary Needs, Nathiagali, Pakistan, 14 June-2 July.
5. International Symposium on Solar Energy Utilization, London, Ontario, Canada, 10-24 August.
6. Ninth International Conference on the Few-Body Problem, Eugene, Oregon, USA, 17-23 August.

ICTP Ref. No.

[76] L.K. SHAYO - The generalized pressures on oscillating cantilever pipes conveying inviscid fluid.

[81] L.K. SHAYO - On the solution of the Laplace equation in the presence of a semi-infinite boundary - The case of an oscillating cantilever plate in uniform incompressible flow.

[83] L.K. CHAVDA and B.N. DESAI - Self-similar solutions for implosion and reflection of strong and weak shocks in a plasma.

[100] A. QADIR and A.A. MUFTI - Do neutron stars disprove multiplicative creation in Dirac's large number hypothesis?

[106] L.C. PAPALOUCAS - Uncertainty relations and semi-groups in B-algebras.

[113] A.A. FADALLA - On a boundary value problem in a strongly pseudoconvex domain.

[115] TEJ SRIVASTAVA - On the representation of generalized Dirac and Grassmann algebras.

[122] A. QADIR and R. RUFFINI - A comment on "dynamical role of light neutral leptons in cosmology".

[130] A. QADIR - Dirac's large number hypothesis and the red shifts of distant galaxies.

[146] A. QADIR - A criticism on Tiwari's paper on coupled zero mass and electromagnetic fields.

[147] H.W. MORSY, A.A. HILAL and M.A. EL-SABAGH - The scattering matrix element of the three-body reactive collision.

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