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INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS

Scientific Activities in 1984

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INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS:
SCIENTIFIC ACTIVITIES IN 1984
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of the scientific activities of the
International Centre for Theoretical Physics, Trieste, Italy
during 1984

HIGHLIGHTS

The International Centre for Theoretical Physics this year celebrated twenty years of activity. In view of the fact that the first course, held in 1964, was dedicated to plasma physics, a commemorative meeting in that field was held at the end of September. The actual celebration of the 20th Anniversary took place on 12 October, when the Minister of Foreign Affairs of the Government of Italy, Hon. G. Andreotti visited the Centre; at the time of his visit, three meetings were being held simultaneously: an International Conference on Physics for Development, a Symposium on the State of Physics and Mathematics in Africa and the IUPAP General Assembly. In addition, Professor C. Rubbia who shared the 1984 Nobel Prize for Physics with S. Van der Meer, gave his first lecture as a Nobel Laureate at the Centre.

In all, during 1984, 2,082 scientists visited the Centre, accounting for 1,870.35 man/months. The percentage of visitors from developing Member States was 52.2; these, however, accounted for 76.2 % of the total man/months.

The main fields of research and training-for-research, divided into their programme components, at the International Centre for Theoretical Physics in 1984 were:

Physics and Energy
Nuclear physics; Non-conventional energy; Plasma Physics

Fundamental Physics
Elementary particles and Fundamental theory; Cosmology

Physics and Technology
Condensed matter physics and related

Physics of the Living State
Biophysics

Physics of the Environment and of Natural Resources
Atmospheric physics; Geophysics

Physics and Development

Mathematics
Applicable mathematics

Training in Italian Laboratories

Other

Physics and Energy

The year began with a workshop on nuclear model computer codes (16 January - 3 March), in which 53 scientists participated; 37 of these represented developing Member States. This activity was organized in collaboration with the Nuclear Data Section of the International Atomic Energy Agency, Vienna, Austria, and was immediately followed by the biennial winter college in nuclear physics, the 1984 activity dealing with fundamental nuclear physics. Of the 158 scientists who took part in this activity, 94 were from developing countries. In September, the fourth seminar on solar energy, held entirely in the French language, took place, bringing together 73 scientists, 40 of whom represented French-speaking developing Member States. In consideration of the fact that the first activity of the Centre, twenty years ago, was a course on plasma physics, a 20th anniversary commemorative meeting in that field was held from 24 to 28 September. Thirty-five experts met to discuss the foreseen developments in plasma physics in the next two decades.

Fundamental Physics

Activity in elementary particle physics and fundamental theory was extremely high this year. A spring school on supergravity and supersymmetry, in which 178 scientists took part, was held from 4 to 14 April and was followed by a workshop dedicated to supergravity, supersymmetry and Kaluza-Klein theories (146 participants). In summer, from 11 June to 30 July, the Centre organized a workshop in high energy physics and cosmology which attracted 98 scientists; 61 of them were from developing countries. The group was strengthened by another 139 scientists taking part in the 8th Trieste conference on particle physics, held from 25 to 29 June. The permanent research group in elementary particles and fundamental theory was very active this year; 179 scientists, nearly half representing developing Member States, contributed to the research.

Physics and Technology

In this component as well, activity continued at a high pace. The biennial spring college, organized by the Advisory Committee on Condensed

Matter Physics, was held from 26 April until 22 June and dedicated to the physics of crystalline semiconducting materials and devices. It attracted 118 scientists, over 70% of them from developing countries. This extended course was immediately followed by the annual research workshop in condensed matter physics, in which 247 physicists took part. The workshop was enhanced by three topical meetings, the first dealing with surface spectroscopy of adsorbates. This symposium was attended by 81 scientists. The collaboration between the Centre and the IUPAP Semiconductor Physics Commission continued and, in its framework, a meeting on high excitation and short pulse phenomena was held from 2 to 6 July. In all, 83 physicists active in the field participated in this activity. The third meeting in condensed matter physics dealt with first order phase transitions: statics and dynamics. Another 55 scientists came to join the workshop during this symposium (23-27 July). In addition, a number of those participating in the workshop formed a working party on the physics of condensed matter at planetary pressures, active from 20 August to 7 September. Besides those coming for scheduled activities in the field, the permanent research group in condensed matter physics counted on the participation of a further 73 scientists this year.

In support of its programme of regional activities, the Centre organized the Asian regional college on microprocessors: technology and applications, held in Colombo, Sri Lanka in June. 92 scientists took part in this activity.

Physics of the Living State

As a follow-up to the course held in 1982, and in view of the high interest shown for the subject, the Centre organized the second summer college on biophysics from 30 July to 7 September. This year the activity attracted 115 scientists, 81 of them representing developing Member States. A small meeting on brain theory, organized in collaboration with the International School for Advanced Studies, was held from 1 to 5 October; some 15 scientists took part in this activity.

Physics of the Environment and of Natural Resources

From 10 September to 19 October, the autumn college on the troposphere, stratosphere and mesosphere took place at the Centre. Altogether 110 scientists working in atmospheric and geophysics participated in this extended course; 97 of them represented developing Member States.

Physics and Development

A conference on physics for development was held from 8 to 12 October and attracted 157 scientists of whom 108 were from developing nations. The main purpose of the meeting was to discuss in general the role of physics in development and to inform physics communities in Third World countries about potential sources of assistance for the development of physics research and its applications to the needs of their countries. A symposium on the state of physics and mathematics in Africa was held contemporaneously with the Conference and continued until 16 October; it brought together 83 scientists, nearly all from African countries. The symposium was intended to examine the situation in Africa in particular and make recommendations for future development in that part of the World. Concurrent with these activities, the Centre had the honour of hosting the IUPAP General Assembly (8-13 October).

As in the past, throughout the year, lecturers and participants in the scheduled activities mentioned above have delivered talks pertinent to the physics and development programme; in addition, some 20 experts in the field have taken part in this programme to date.

Mathematics

Mathematics research continued throughout the year; 15 scientists contributed to the research activities.

In continuation of its activities in applicable mathematics, the Centre held a workshop on dynamical systems from 22 October to 9 November. 66 scientists, over 2/3 from developing nations took part in the workshop, which was followed by an autumn college dedicated to semigroups, theory and applications (12 November - 14 December). Of the 142 scientists participating in this extended course, 76 were from developing Member States.

Training in Italian Labs

In 1984, 69 researchers representing 26 developing countries worked or are working - for periods of varying lengths - in 56 Italian institutions, with a grant under the Centre's programme for training and research in Italian laboratories. This programme began in Summer 1982 with the intent of giving experimental scientists from developing countries the opportunity to work in advanced Italian laboratories, as a complement to the theoretical work carried out at the Centre.

Other

This year 162 scientists, nearly 2/3 of whom from developing Member States, came to the Centre to carry out independent research projects in

fields in which there was no scheduled activity or in periods during which no activity in their particular field was being held. As in the past, they were able to interact with other scientists present at the Centre at that time and to avail themselves of the Centre's facilities.

Under the Associate Membership scheme, the Centre this year welcomed 56 Associates representing 28 developing nations. Visitors from Federated Institutes were 299 scientists, representing 35 developing Member States.

The Centre also co-sponsored 18 activities, organized in the various regions in response to the needs of scientists from developing countries.

INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS, TRIESTE
CALENDAR OF ACTIVITIES, 1984

January ' February 'March ' April ' May ' June ' July ' August ' September' October ' November ' December

Wkshp on Nuclear Model Computer Codes (16 1-3 2) TOT=53 DEV=37

Coll on Fundamental Nuclear Physics (7 2-30 3) TOT=158 DEV-94

Seminaire sur l'Energie Solaire (in French)(10 21 9) TOT-73 DEV=40

Mtg on the next 20 Years in Plasma Physics (24 28 9) TOT=35 DEV=17

ELEMENTARY PARTICLE & FUNDAMENTAL THEORY RESEARCH (Throughout the year)
TOT=179 DEV=87

8th Trieste Conf on Particle Physics (25 29 6) TOT-139 DEV=58

School on Supergravity & Supersymmetry (4 14 4) TOT=178 DEV=50

Wkshp on Supergravity, Supersymmetry & Kaluza Klein Theories (16-19 4) TOT=146 DEV-37

Wkshp in High Energy Physics & Cosmology (11 6 30 7) TOT=98 DEV=61

CONDENSED MATTER PHYSICS RESEARCH & RELATED (Throughout the year)
TOT=73 DEV=42

Coll on Physics of Crystalline Semiconducting Materials & Devices (26 4-22 6) TOT=118 DEV=84

Wkshp in Condensed Matter Physics (25 6-7 9)TOT=247 DEV=157

Mtg on Surface Spectroscopy of Adsorbates (27-29 6) TOT=81 DEV=14

IUPAP Mtg on Semiconductor Physics High Excitation & Short Pulse Phenomena (2-6 7) TOT=83 DEV=9

Mtg on First Order Phase Transitions Statics & Dynamics (23-27 7) TOT=55 DEV=20

2nd Coll in Biophysics (30 7-7 9) TOT=115 DEV=81

Coll on the Troposphere, Stratosphere & Mesosphere (10 9-19 10) TOT=110 DEV=97

PHYSICS FOR DEVELOPMENT PROGRAMME (Throughout the year)
TOT=23 DEV=6

Mtg on Physics for Development (8-12 10) TOT-157 DEV=108

Mtg on State of Physics & Mathematics in Africa (8-16 10) TOT= 83 DEV= 82

Wkshp on Dynamical Systems (22 10-9 11) TOT=66 DEV=47

Coll on Semigroups Theory & Applications (12 11-14 12) TOT=142 DEV=76

NOTE TOT=Total number of participants DEV=Number of participants from developing Member States TOTAL NUMBER OF PARTICIPANTS = 2,574, while TOTAL NUMBER OF VISITORS = 2,082*, since certain scientists took part in more than one activity The total of 2,574 is reached by adding above figures for scheduled activities, plus 162 who came for miscellaneous research and/or organizational activities (DEV=106) Of the total of 2,574 participants, DEV=1410, while of the total of 2,082* visitors, DEV=1,086 (52 2%)

*plus 36 scientists who came for a hosted meeting only

STATISTICAL SUMMARY OF PARTICIPATION IN THE RESEARCH AND TRAINING FOR RESEARCH ACTIVITIES AT THE ICTP, 1984

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	XXII	XXIII	TOTALS
AFRICA	10	14	25	4	14	1	-	5	7	11	10	28	-	-	1	14	28	1	32	82	2	16	33	338
ASIA	13	38	4	7	24	7	5	15	26	16	45	64	1	3	4	25	40	3	48	-	14	31	49	492
EUROPE	8	28	4	4	30	32	23	34	22	8	13	51	12	3	12	22	19	2	14	-	14	20	17	392
INDONESIA & OCEANIA	1	1	1	-	-	-	-	-	1	1	1	-	-	-	-	1	4	-	1	-	-	-	1	13
NORTH & CENTRAL AMERICA	2	-	1	1	2	1	1	1	2	2	3	3	1	-	1	1	1	-	5	-	5	1	1	35
SOUTH AMERICA	2	10	5	1	5	7	5	3	3	4	12	11	-	3	2	18	5	-	7	-	12	8	5	128
INTERNATIONAL ORGANIZATIONS	1	3	-	-	2	2	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	12
TOTAL A	37	94	40	17	87	50	37	58	61	42	84	157	14	9	20	81	97	6	108	82	47	76	106	1410
ASIA	-	5	-	-	8	1	1	2	-	1	1	1	-	1	-	1	-	-	3	-	-	3	-	28
EUROPE	9	52	31	7	67	106	83	49	17	22	32	70	51	54	25	21	13	13	28	1	17	46	47	861*
INDONESIA & OCEANIA	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
NORTH & CENTRAL AMERICA	3	6	1	11	13	18	19	19	18	8	1	19	15	19	10	11	-	4	16	-	2	17	4	234
INTERNATIONAL ORGANIZATIONS	4	1	1	-	3	3	6	11	1	-	-	-	1	-	-	1	-	-	2	-	-	-	5	39
TOTAL B	16	64	33	18	92	128	109	81	37	31	34	90	67	74	35	34	13	17	49	1	19	66	56	1164*
TOTAL A+B	53	158	73	35	179	178	146	139	98	73	118	247	81	83	55	115	110	23	157	83	66	142	162	2574*

*Plus 36 scientists coming for a hosted meeting only.

KEY:

I Workshop on Nuclear Model Computer Codes (16.1-3.2)
II Winter College on Fundamental Nuclear Physics (7.2-30.3)
III Seminaire sur l'Energie Solaire (Solar Energy, in French)(10-21.9)
IV ICTP Trieste Commemorative Meeting in Plasma Physics (1964-1984) on The Next Twenty Years in Plasma Physics (24-28.9)
V Elementary Particle & Fundamental Theory Research (throughout the year)
VI Spring School on Supergravity & Supersymmetry (4-14.4)
VII Workshop on Supergravity, Supersymmetry & Kaluza-Klein Theories (16-19.4)
VIII 8th Trieste Conference on Particle Physics (25-29.6)
IX Summer Workshop in High Energy Physics & Cosmology (11.6-30.7)
X Condensed Matter Physics Research (throughout the year)
XI Spring College on Physics of Crystalline Semiconducting Materials & Devices (26.4-22.6)
XII Research Workshop in Condensed Matter Physics (25.6-7.9)
XIII Trieste international Symposium on Surface Spectroscopy of Adsorbates (27-29.6)
XIV 3rd IUPAP Trieste International Symposium on Semiconductor Physics: High Excitation & Short Pulse Phenomena (2-6.7)
XV 5th Trieste International Symposium on First Order Phase Transitions: Statics & Dynamics (23-27.7)
XVI 2nd Summer College in Biophysics (30.7-7.9)
XVII "Antonio Marussi Geophysics College" Autumn College on the Troposhere, Stratosphere & Mesosphere (10.9-19.10)
XVIII Physics for Development Programme (throughout the year)
XIX International Conference on Physics for Development (8-12.10)
XX Symposium on the State of Physics & Mathematics in Africa (8-16.10)
XXI Workshop on Dynamical Systems (22.10-9.11)
XXII Autumn College on Semigroups, Theory & Applications (12.11-14.12)
XXIII Miscellaneous independent research (throughout the year)

Participation in the research and training-for-research activities of the ICTP during 1984

Geographic area	Number of Visitors		Number of Man/months		Total for area	
	from developing countries	from industrialized countries	for developing countries	for industrialized countries	Number Visitors	Number Man/months
Africa	227	-	285.31	-	227	285.31
Asia	378	26	648.89	32.45	404	681.34
Europe	322	731	281.70	291.37	1,053	573.07
Indonesia & Oceania	12	1	15.86	2.83	13	18.69
North & Central America	26	203	27.74	112.28	229	140.02
South America	111	-	161.58	-	111	161.58
International Organizations	10	35	3.71	6.63	45	10.34
	1,086	996	1,424.79	445.56	2,082	1,870.35
GRAND TOTALS	2,082		1,870.35			

Percentage representation from developing countries: Number of visitors = 52.2
Number of man-months = 76.2

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

Participation in the research and training-for-research activities of the ICTP during 1984

Geographic Area	Long-term activities		Short-term activities		T O T A L	
	Number Scientists	Number Man/months	Number Scientists	Number Man/months	Number Scientists	Number Man/months
Developing countries						
Africa	186	272.25	41	13.06	227	285.31
Asia	322	636.48	56	12.41	378	648.89
Europe	257	270.48	65	11.22	322	281.70
Indonesia & Oceania	11	15.10	1	.76	12	15.86
North & Central America	20	25.64	6	2.10	26	27.74
South America	98	155.54	13	6.04	111	161.58
International Organizations	9	3.48	1	.23	10	3.71
Totals	903	1,378.97	183	45.82	1,086	1,424.79
Industrialized countries						
Asia	20	31.30	6	1.15	26	32.45
Europe	525	260.50	206	30.87	731*	291.37
Indonesia & Oceania	1	2.83	-	-	1	2.83
North & Central America	121	97.54	82	14.74	203	112.28
International Organizations	22	5.26	13	1.37	35	6.63
Totals	689	397.43	307	48.13	996	445.56
GRAND TOTALS	1,592	1,776.40	490	93.95	2,082	1,870.35

Percentage representation from developing countries: Number of visitors = 52.2
Number of man-months = 76.2

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

T H E S C I E N T I F I C P R O G R A M M E

Physics and Energy

Title: WORKSHOP ON NUCLEAR MODEL COMPUTER CODES

Dates: 16 January - 3 February 1984

Organizers: In co-operation with the Nuclear Data Section of the Division of Research and Laboratories of the International Atomic Energy Agency (IAEA), Vienna, Austria. Directed by: Dr. J.J. Schmidt, Dr. D.E. Cullen and Dr. V. Pronyaev, (Nuclear Data Section, IAEA, Vienna, Austria) with the assistance of a local Organizing Committee headed by Profs. L. Fonda (ICTP/Univ. of Trieste, Italy) and H.R. Dalafi (ICTP, Italy)

Purpose: Complementary to earlier Winter Colleges on Advances in Nuclear Theory and Nuclear Data for Reactor Applications held at ICTP in 1978, 1980 and 1982, this workshop was designed to familiarize participants with nuclear model computer codes which are being widely used for the computation of neutron cross sections needed for nuclear technology applications. This workshop also gave participants the opportunity to discuss their operating experience and problems encountered in the use of nuclear model computer codes.

Programme: Topics:
- Nuclear model computer codes without fission
- Nuclear model computer codes including fission

The following lectures were given:

Spherical optical model of nuclear reactions; Strong channel coupling method for neutron cross section calculations; Effects of width fluctuations and channel-channel correlations in statistical model of nuclear reactions; DWBA methods for direct process calculations; Statistical model of nuclear reactions for calculations of capture cross sections and gamma-yields; NEA data bank

activity in the computer nuclear model code field; Pre-equilibrium decay models in cross section calculations; Presentations by participants based on experience using nuclear model codes.

Participation:	Total visitors:		53
	From developing countries:		37
Representation:	Africa	developing:	10
	Asia	developing:	13
	Europe	developing:	8
		industrialized:	9
	Indonesia & Oceania	developing:	1
	North & Central America	developing:	2
		industrialized:	3
	South America	developing:	2
	International organizations representing	developing:	1
		industrialized:	4

Title: WINTER COLLEGE ON FUNDAMENTAL NUCLEAR PHYSICS

Dates: 7 February - 30 March 1984

Organizers: Directed by: Profs. K. Dietrich (Technical Univ. of Munich, W. Germany), M. Di Toro (Univ. of Catania, Italy), H.J. Mang (Technical Univ. of Munich, Fed. Rep. of Germany) and M.K. Pal (Saha Inst., Calcutta, India), with the assistance of Profs. L. Fonda (ICTP/Univ. of Trieste, Italy) and H.R. Dalafi (ICTP, Italy).

Purpose: The purpose of the College was to provide the opportunity to nuclear physicists from developing countries to meet at the Centre in order to become acquainted with the newest developments in the field, to strengthen their collaboration and to exchange ideas and research plans.

Programme: Topics:

- Preliminary Basic Lectures on Microscopic Study of Nuclear Structure and Nuclear Reactions
- Nuclear Structure and Nuclear Dynamics
- Heavy Ion Collisions

The following lectures were given:

Shell model; Basic concepts on nuclear reactions; Second quantization; HF + HFB; Theory of direct reactions; Path integrals and semi-classical approximations; Deep inelastic HIR; TDHF; Quark model and nuclear forces; Colloquium; Chaotic behaviour of nuclei; RPA; Nakazima-Zwangzig formalism Markoff approximation; Kinetic equations; Sum rule approach to collective motions; Randum matrix approximation to HIR; Rotating nuclei: review on empirical evidence and interpretation; Advanced IBM; Fluid dynamics approach to giant resonances; Rotating shell model, Inglis model; HFB with cranking constraints, projection on angular momentum eigen states; The IBM for even nuclei; Optical model potential; Mesonic degrees of freedom in nuclei; Statistical nuclear spectroscopy; Experimental reviews of giant resonances; Giant resonances; Quark structure of nucleons; Cascade models; Hydrodynamical description of HIR; Damping of collective modes; Surface modes and deep

inelastic reactions; TDHF with collision terms; Landau equation and theory of giant resonances; Classical description of HIR; Fast fission; Nuclear transfer in heavy ion collisions; Theory of HIR; Diabatic versus adiabatic dynamics; Introduction to QCD; Pionic fusion; Review on HIR at medium energies; Statistical multi-step nuclear reactions; Mesons in nuclei and pion condensation; Phase transition in QCD; Subthreshold production of pion in HIR; Microscopic study of low-lying nuclear collective states; Boltzmann equation and HIR; Clusters in nuclei; Review on HIR at high energies; Nuclear physics in Rome during the 30's; Behaviour of highly excited nuclear systems resulting from energetic nucleus-nucleus central collisions; Heavy ion reactions; Interacting boson model; TDHF results on HIR.

Participation:

Total visitors:	158
From developing countries:	94

Representation:

Africa	developing:	14
Asia	developing:	38
	industrialized:	5
Europe	developing:	28
	industrialized:	52
Indonesia & Oceania	developing:	1
North & Central America	industrialized:	6
South America	developing:	10
International organizations representing	developing:	3
	industrialized:	1

Title: COLLEGE ON SOLAR ENERGY (in French)

Dates: 10 - 21 September 1984

Organizers: Directed by: Profs. M. Averous (Ecole normale superieure, Paris, France), M. Cadene (Univ. des sciences et techniques, Montpellier, France), A. Donnadieu (Univ. des sciences et techniques, Montpellier, France), J. Flechon (Univ. de Nancy, France), and A. Moyse (Univ. de Paris-Sud, France).

Purpose: The purpose of the College was to bring together physicists, engineers and technicians of the French speaking countries, and give them the opportunity to meet and discuss the latest developments in the field of Solar Energy.

Programme: The following lecture series were given:

Economy; Radiation and surfaces; Photovoltaic conversion; Bioconversion; Fields and captors; Photovoltaic solar cells, lines of research, new developments; The habitat; Economic modelling; Captor biomass; Refrigeration; Genetics; Solar drying; Electrochemical storage; Desalination of salt waters; Polycrystalline silicon; Water pumping; Bio-methane; Wood approach.

Specialized lectures were as follows:

Photovoltaics: Simple model for polycrystalline solar cells with preferential dopage. Modelling of a photovoltaic cell. Determination of the current-tension characteristic under lighting. Photovoltaic applications to the electrical energy needs of small isolated communities (project). Manufacture of Si and CdS-Cu_2S solar cells. An optimisation model of the parameters of amorphous solar cells from an optics point of view. Optic and electronic properties of thin layers of amorphous Silicon deposited by cathode pulverization. Passivation of grain junctures in polycrystalline Silicon. Preparation of thin films of AsGa by OMCVD. Characterisation by transmission electronic microscopy and AES-ESCA spectrometry of thin films of CdS obtained by evaporation under

vacuum. Germanium solar cells in plane and interdigited multi-junctions. Use of the short-distance reactive transport (TRCD) technique for epitaxial growth of GaAs.

Photothermics: Fields - captors; Greenhouse passive heating; Drying - distallation; Concentration; Refrigeration - Selectivity heat transfers. General problems P.V.D.

During the College, various industries working in the field also held expositions.

Participation:

Total visitors:	73
From developing countries:	40

Representation:

Africa	developing:	25
Asia	developing:	4
Europe	developing:	4
	industrialized:	31
Indonesia & Oceania	developing:	1
North & Central America	developing:	1
	industrialized:	1
South America	developing:	5
International organizations representing	industrialized:	1

Title: ICTP TRIESTE COMMEMORATIVE MEETING (1964 - 1984) ON "THE NEXT TWENTY YEARS IN PLASMA PHYSICS"

Dates: 24 - 28 September 1984

Organizers: Directed by: Profs. B. McNamara (Lawrence Livermore National Lab., Livermore, USA), M. Hassan (Univ. of Khartoum, Khartoum, Sudan).

Purpose: The technical objective of the meeting was to review recent progress in plasma theory and its relation to observations and experiments, with emphasis on projecting key developments in the next one to five years. Three or four talks were given to advance more speculative ideas for the more distant future. An important element of the first ICTP meeting at Trieste in 1964 was the exchange of ideas and results between East and West. This was a primary objective of this commemorative meeting and it was hoped, to improve the present situation through the talks and personal contacts.

Programme: Topics:
- Space Plasma
- Fusion Plasma
- Laser Plasma

The following lectures were given:

First JET results and its prospects. Tokamak scaling to ignition. Magnetic fusion: lack of money, lack of engineering, lack of ideas - Can it be done?; New ideas from Rutherford. Magnetic topology, nonequilibrium, dissipation; Space missions, orbiting laboratories, super-computers; Is space plasma physics expanding or steady state?; Toroidal plasmas physics and Hamiltonian mechanics; Major advances in mirror equilibrium theory; Problems in laser fusion; The causes of the stellar X-ray corona; Predictions on the behaviour of magnetospheres; Nonlinear temporal modulation of pulsar; Supercomputers and computational plasma physics; The next 5 years for laser produced high-energy density plasmas; Stochasticity; Surface erosion in future CTR machines. Nonlinear tearing

modes in Tokamaks. Compact torus formation with rotating relativistic electron beams; Trends in dense plasma focus research; Reversed field pich research; Ponderomotive interactions in collisionless plasmas; Excitation of highly nonlinear plasma waves and wave pressure; Astrophysical applications of MHD; On the structure of astrophysical fields; Spontaneous and induced symmetry breaking in ICF fusion; Evolution of the mirror approach to fusion: some conjectures; Axisymmetric mirror systems; The plasma equilibrium problem; Progress and prospects from Rochester.

Participation:

Total visitors:	35
From developing countries:	17

Representation:

Africa	developing:	4
Asia	developing:	7
Europe	developing:	4
	industrialized:	7
North & Central America	developing:	1
	industrialized:	11
South America	developing:	1

Fundamental Physics

Title: ELEMENTARY PARTICLE PHYSICS AND FUNDAMENTAL THEORY RESEARCH

Dates: (throughout the year)

Organizers: This research programme is organized by the Director of the Centre, Prof. Abdus Salam (Pakistan), the Resident Physicist, J. Strathdee (ICTP/New Zealand), the Deputy Director, Prof. L. Bertocchi (ICTP/Univ. of Trieste, Italy) and the University of Trieste Consultants Profs. G. Furlan and R. Iengo.

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 geniune research condition that will encourage Associate Members and visitors from Federated Institutes in their work after their return home.

Programme: Lectures and lecture series were held on:

Dynamical generation of fermion mass; Realistic D=6 N=2 Kaluza-Klein supergravity with $E_7/SO(12) \times Sp(1)$ coset; Informal report on certain highlights of Leipzig conference; Effective potential in QCD; Superstring theories; Loop dynamics for gauge theories: a numerical algorithm; Scaling behaviour of self-avoiding random surfaces; The Cauchy problem for the Yang Mills problem; Properties of the W boson in some composite models; Present evidence on experimental gluonium searches; Enlarged space time and anomalies; Multidimensional unification; Weak interactions on the lattice; Direct determination of gluon condensate parameters; Finite temperature perturbation theory: introduction to thermo field theory; The 1/N expansion and the continuum limit of a QCD-like lattice Lagrangian; Topological invariance in supersymmetric theories with a continuous spectrum; Scaling violation in SU(3) lattice gauge theories; On the dynamical chiral symmetry breaking in N=1 pure super Yang-Mills theory; Solitons in super-

symmetric theories. Trace theorems and the Bogomolny bound; Gravitation collapse in relativistic quantum theory; Further developments on the confining properties 1 + 2 dimensional Yang Mills theories; Finite time QCD sum rules and chiral symmetry breaking order parameters on the lattice; Relativist's view of quantum gravity; Spontaneous soldering: an alternative to Kaluza-Klein; Hawking wave function; Recent developments in supergravity; Radiative corrections to low-energy physics in SUSY $SU_2 \times U_1$: N=1 sugra models; On the 'Continuum' regularization of quantum chromodynamics; Supergraph techniques extended to spontaneously broken theories; On the role of various exactly solvable 2-dimensional QFT's in determining the Rubakov-Callan effect; MonteCarlo renormalization group: method and results on the continuum limit of lattice QCD; EP collisions at very high energy - the panned EP storage ring at DESY; Hard collisions in hadron-hadron physics - present status and future perspectives; Electroweak fields in a magnetic field; Non-perturbative aspects in super-symmetric gauge theories; Stochastic identities in supersymmetric theories; Radiative residues from grand unification in N=1 SUGRY GUTS; On QCD phase transition in the early Universe; A new mechanism for $Z_0 \to l\bar{l}\gamma$; The massive Schwinger model on the lattice; Canonical quantization of gravity; Discussion of anomalies in supersymmetric theories; Generalized coherent states for soft gluon emission; Anomalous Skyrme models; Onsager principle of microreversibility and supersymmetry. A remarkable bosonization of the SU(2) Kac-Moody algebra with minimal central charge which coincides with the current algebra of QCD_2 with SU(2) colour; Fitting of hadron masses in 5-D conformal relativity; Scaling and low energy aspects of two scale regularization of quantum chromo-dynamics. Scaling and caos. Dynamical compactification of D-dimensional gravity in 1/D expansion. Deformation theory and its application in physics. Replacing a gauge group G by its covering $\bar{G}$ in globally non-trivial space-times. Towards an explicitly supersymmetric and gauge invariant regularization scheme.

Chiral model, Wess-Zumino term, the supersymmetric extension and the issue of non-abelian bosonization. Friedmann universe: The attractor universe in 6-dimensional supergravity. Proton decay, gravitational theories. Pion come-back in modelling low energy QCD. Reduction of the Poincare' gauge field equations. Towards a realistic K-K cosmology. Non-perturbative analysis of QCD stability. Auxiliary fields in extended supersymmetry. On the inconsistency of the Wess-Zumino model. The QCD sum rules and asymptotic expansions. Inverse scattering transform method and singular solutions of essentially non-linear equations. On the renormalization of γ_5-anomalous theories. Sypersymmetric skyrmions in four dimensions. Order and chaos in quantum optics. Dynamical symmetry breaking and generation of fermion mass matrix from colour forces. Testing electroweak interactions in SLC and LEP. Manifolds in N=2 supergravity matter couplings. Cohomologies and anomalies in QFT. $B-\bar{B}$ mixing and consequences for e^+-e^- annihilation and $P\bar{P}$ collisions. Extended supergravity and the cosmological constant. Phase factors of SUSY QCD and the $q\bar{q}$ potential. Virton-quark model and strong, weak and electromagnetic interactions of hadrons. An anomaly-free model in six dimensions.

Participation:

Total visitors:	179	
From developing countries:	87	

Representation:

Africa	developing:	14
Asia	developing:	34
	industrialized:	8
Europe	developing:	30
	industrialized:	67
Indonesia and Oceania	industrialized:	1
North & Central America	developing:	2
	industrialized:	13
South America	developing:	5
International organizations representing	developing:	2
	industrialized:	3

Title: SPRING SCHOOL ON SUPERGRAVITY AND SUPERSYMMETRY

Dates: 4 - 14 April 1984

Organizers: Directed by: Profs. B. de Wit (NIKHEF-H, Amsterdam, The Netherlands), P. Fayet (Ecole Normale Superieure, Paris, France) and P. van Nieuwenhuizen (State Univ. of New York, Stony Brook, N.Y. USA).

Purpose: The aim of the School was to introduce the subject of supergravity and supersymmetry to those interested in entering the field or learning its techniques in detail. The subject was covered from its foundations to the more recent developments.

Programme: Topics:

- Introduction to rigid and local supersymmetry
- Superspace supergravity
- Kaluza-Klein approach in supergravity
- Geometry of coset manifolds
- Superunified theories
- Spontaneous supersymmetry breaking
- Finiteness of supersymmetry quantum theories
- Quantum supergravity
- Superstrings

The following lectures were given:

Introduction to rigid supersymmetry; Introduction to local supersymmetry; Introduction to superspace supergravity; Introduction to Kaluza-Klein approach in supergravity; Supersymmetric theories of particles and their consequences; Geometry of coset mainfolds; Chiral superspace; Aspects of Kaluza-Klein theory in supergravity; Supergravity models with spontaneous supersymmetry breaking; Supersymmetric grand unification; Finiteness of supersymmetric quantum theories; Introduction to supersymmetric strings.

Participation:

Total visitors:	178
From developing countries:	50

Representation:	Africa	developing:	1
	Asia	developing:	7
		industrialized:	1
	Europe	developing:	32
		industrialized:	106
	North & Central America	developing:	1
		industrialized:	18
	South America	developing:	7
	International organizations representing	developing:	2
		industrialized:	3

Title: WORKSHOP ON SUPERSYMMETRY, SUPERGRAVITY AND KALUZA-KLEIN THEORIES

Dates: 16 - 19 April 1984

Organizers: Directed by: Profs. Abdus Salam (ICTP, Trieste, Italy), T. Applequist (Yale Univ., New Haven, USA), A. Chodos (Yale Univ., New Haven, USA), B. de Wit (NIKHEF-H, Amsterdam, The Netherlands), M. Duff (Imperial College, London, UK), F. Englert (Univ. Libre de Bruxelles, Brussels, Belgium), P. Fayet (Ecole Normale Superieure, Paris, France), R. Iengo (ICTP/SISSA, Trieste, Italy),P. van Nieuwenhuizen (SUNY, Stony Brook, N.Y., USA).

Purpose: In continuation of the School, to present in depth the most recent theoretical and experimental results in the field and to discuss possible applications particularly of the Kaluza-Klein theories.

Programme: The following lectures were given:

On the relation between d=4 and d=11 supergravity; Non-symmetric spaces, supersymmetry and the squashed seven-sphere; On the supersymmetric extension of local current algebra; $\int F \wedge {}^*F$ instead of $\int F \wedge F$; Spontaneous soldering; Isometry in Kaluza-Klein theory; Strong electroweak interactions in Kaluza-Klein supergravities; Effective interactions in N=4 SYM with spontaneously broken SU(2) gauge symmetry; On Kaluza-Klein theories with torsion; On Witten's SU(3) x SU(2) x U(1) invariant spaces; Ultra-violet divergences in higher dimensional super-symmetric theories; Supersymmetry in the presence of positive cosmological constant; Breaking SUSY with gauge symmetries; Generation of composite operators in super-gravity; Supersymmetrized D=11 De-Sitter-like algebra from octonions; The dynamics of supersymmetric sigma models with central charges; Chiral two-loop-finite supersymmetric theories; Zero cosmological constant and spontaneously broken N=2 supersymmetry: an application of Jordan algebras; The scalar potential in N=1 supergravity with R invariance; The construction of Nicolai mappings; Superfield tadpole method for SUSY effective potential

(and chiral superfield potentials); N-Extended free superfields (N=2,4,6,8) from quantization of supersymmetric particle model; Composite goldstone supermultiplets; Vacuum states in supersymmetric Kaluza-Klein theory; The criterion for vacuum stability in d=11 supergravity; Matter and gauge couplings of N=2 supergravity in six dimensions; Fermion spectrum for Englert solutions of general coset manifolds; Gauged maximal d=7 supergravity; Infinite parameter symmetries in Kaluza-Klein theories; Non-gauge spin-3/2 fields from killing spinors; Radiative corrections to low-energy physics in SUSY $SU_2 \times U_1$: N=1 sugra models; Supersymmetric derivation of the Atiyah-Singer index and the chiral anomaly; Non-perturbative quantum gravity; A classification of compactifying solutionsfor d=11 supergravity; Local compactification; Homogenous Einstein metrics ("Standard" or not) on groups and homogeneous spaces; Chiral fermions from higher dimensions; Fun with Kaluza's idea; Geometry of super-manifolds and supersymmetry; Algebraic structure of quantum gravity and determination of the gravitational anomalies; From anti-De-Sitter space to Minkowski space via vacuum fluctuation; Constraints on partial super Higgs; No scale supergravity models; N=2 supergravity matter couplings; D=6 supergravity in superspace; Superstrings '84; Canonical quantization of supergravity; Fermions in Kaluza-Klein theories; Gravitational contribution to quantum compactification; Light gluinos; N=2 supergravity in harmonic superspace; Group theoretical aspects of dimensionally reduced (super) gravity theories; Sliding scales in minimally coupled supergravity; G*invariant dimensional reduction; Scalor manifolds and potentials in extended supergravities; Locally supersymmetric cosmology and the mass hierarchy; Supergravity unification; Quantum non-compact σ-models; Spontaneous compactification in 10-dimensions; The interpretation of gauging for free differential algebras and the 6 - index photon in D=11; The solution of N=2 supergravity constraints in terms of N=1 superfields; Spontaneous compactification in quantum Kaluza-Klein theories; Kaluza-Klein cosmology: techniques

for quantum computations; Some topics in low energy supergravity models; Mass spectrum, Dirac Singleton and the instability of the parallelized seven-sphere solution; N=1 superspace geometry of extended supergravity; New experimental results.

Participation:	Total visitors:		146
	From developing countries		37
Representation:	Asia	developing:	5
		industrialized:	1
	Europe	developing:	23
		industrialized:	83
	North & Central America	developing:	1
		industrialized:	19
	South America	developing:	5
	International organizations representing	developing:	3
		industrialized:	6

Title: THE EIGHTH TRIESTE CONFERENCE ON PARTICLE PHYSICS

Dates: 25 - 29 June 1984

Organizers: Directed by: Profs. U. Amaldi (CERN, Geneva, Switzerland), L. Bertocchi (ICTP, Trieste, Italy), G. Furlan (ICTP/Univ. of Trieste, Italy).

Purpose: In continuance of the Conference held in 1980, to present in depth the most recent theoretical and experimental results in this field.

Programme: Topics:

- Phenomenology of gauge theories
- Lepton initiated reactions
- Unification schemes and experimental consequences: supersymmetry and supergravity
- Jets and QCD
- Theoretical developments (cosmology and particle physics: field theories of the lattice)
- Future perspectives

The following lectures were given at the Conference:

The end of a myth: high p_t physics; Recent data on ν-e scattering; Experimental confirmation of gauge theories; Field theories on the lattice; Finite temperature QCD; The BNL experimental programme; Highlights of the UAI experiment; QCD at the collider; Grand unification and beyond; ν-oscillations with electronics at CERN; ν-oscillations with BEBC at CERN; ν-oscillations from the CCFR collaboration; ν-oscillations at reactors; PETRA - recent physics results; Recent results at DORIS; Gauge boson Higgs boson unification and experimental consequences of supersymmetry; What we know about the B-meson; Weak decays of heavy flavours; Recent results from Mark III at SPEAR; First physics results at LEAR; Neutrino and muon physics in the 90's; The status of the Frejus detector and future developments for proton decay detectors; Results on proton decay and future programmes; Proton decay experiment at Mont Blanc; Recent results of Kamioka nucleon decay experiment and future plan;

Charmonium spectroscopy from antiproton-proton annihilation at ISR; Recent physics results at Fermilab and the future Fermilab physics programme; Particle physics and cosmology; HERA, the accelerator and the physics programme; LEP - the machine; LEP - the experiments; Summary of the Tokyo Seminar of International Committee for future accelerators.

Participation:

Total visitors:	139
From developing countries:	58

Representation:

Africa	developing:	5
Asia	developing	15
	industrialized:	2
Europe	developing:	34
	industrialized:	49
North & Central America	developing:	1
	industrialized:	19
South America	developing:	3
International organizations representing	industrialized:	11

Title: SUMMER WORKSHOP IN HIGH ENERGY PHYSICS AND COSMOLOGY

Dates: 11 June - 30 July 1984

Organizers: Directed by: Profs. J. Pati (Univ. of Maryland, USA), Q. Shafi (Univ. of Delaware, USA), G. Furlan (ICTP/Univ. of Trieste, Trieste, Italy) R. Iengo (ICTP/SISSA, Trieste, Italy), D. Sciama (ICTP/SISSA, Trieste, Italy).

Purpose: The workshop was intended to be an informal environment for discussing topics of current interest in particle physics and related aspects of gravity and cosmology.

Programme: Topics:
- Supersymmetric theories and supergravity
- Unification schemes and composite models
- Cosmology and physics of the Earlier Universe
- Particle physics and galaxy formation
- Lattice and non-perturbative aspects of gauge theories

The following lectures were given:

The chaos in cosmology; Supergravity and supersymmetry; Spontaneous compactification of d=11 dimensions in supergravity; Dynamical symmetry breaking through preons and sizes of quarks and leptons; Renormalization in stochastic quantization; Introduction to standard big-bang cosmology; Solitons in general relativity; Realization of global symmetries in QCD; The inflationary universe 1,11; Point like monopole and fermions; Remarks on Kaluza-Klein theories; Unification of families; Recent developments in lattice gauge theories; A model of family-replication and fermion mass-hierarchy; The spectrum and global symmetries in supersymmetric gauge theories; Cosmology: introductory survey; Cosmology and particle physics, an introductory survey; Big bang nucleosynthesis; The abundances of light elements; Hidden mass and the density of matter; Galaxy formation; Why and how Max Planck got his Nobel Prize in physics; Monte Carlo, renormalization group methods; Family problem: should one remain single?; Introduction to lattice gauge theories and Monte Carlo simulations Baryon number of universe; Compactification and supersymmetry in

Kaluza- Klein theories; The spectrum and global symmetries in supersymmetric gauge theories; Cosmic nucleosynthesis; Symmetry out of chaos; Inflation; Extended structures in gauge theories; Neutrinos and other 'inos; Finiteness of gravitational corrections to magnetic moments and supergravity embedding; Introduction to spontaneous compactification of Einstein Yang Mills systems; Supersymmetry in topological non trivial sectors; Monopoles and cosmology; Isotopy of the Universe; Tests of a unified SO_{14} model with composites: Gaugeballs and the new CERN events; Chiral fermions from higher dimensions; The theory of monopole catalysis of proton decay covering; d=11 supergravity with flat 3-space; Kaluza-Klein supergravity; The equivalence principle vs the gauge principle; Introduction to lattice gauge theories and Monte Carlo simulations: calculation of observables and criteria for confinement; Constraints on partial breaking of extended supergravities; Baryons vs Skyrmions: beyond the semiclassical approximation; The long way: Tensor calculus and all that (N=1, N=2); Gauged maximal supergravity in seven dimensions; Matter multiplet coupling to supergravity; Pseudo-Newtonian formalism in relativity; New results in D=2 supersymmetric nonlinear sigma models; Stochastic quantization; The fate of global symmetries in supersymmetric gauge theories; Kaluza-Klein theories: Quasi-Riemannian or preonic?; Two into one won't go; Interdisciplinary lecture within physics; Introduction to conformal gravity; Spontaneous compactification and stability; Supersymmetric gauge theories and inverse scattering method; Flavour changing neutral currents and physics beyond the standard model; Derivation of the Skyrme model from QCD; A possible interpretation for $\mathcal{E}_5$ (2.22) (?).

Participation:	Total visitors:	98
	From developing countries:	61

Representation:	Africa	developing:	7
	Asia	developing:	26
	Europe	developing:	22
		industrialized:	17
	Indonesia and Oceania	developing:	1
		industrialized:	1
	North & Central America	developing:	2
		industrialized:	18
	South America	developing:	3
	International organizations representing	industrialized:	1

Physics and Technology

Title: SPRING COLLEGE ON THE PHYSICS OF CRYSTALLINE SEMICONDUCTING MATERIALS AND DEVICES

Dates: 26 April - 22 June 1984

Organizers: Profs. P.N. Butcher (Univ. of Warwick, Coventry, UK), G. Chiarotti (Istituto di Fisica "G. Marconi", Roma, Italy),F. Garcia-Moliner (Instituto Fisica Estado Solido, C.S.I.C., Madrid, Spain), F. Gautier (Univ. Louis Pasteur, L.M.S.E.S., Strasbourg, France), S. Lundqvist (Chalmers Univ. of Technology, Gotenborg, Sweden), N.H. March (Univ. of Oxford, Oxford, UK), H. Reik (Albert-Ludwigs-Univ, Freiburg, FRG), M. Tosi (Univ. of Trieste/ICTP, Trieste, Italy), H. Kamimura (Univ. of Tokyo, Tokyo, Japan), M. Tomak (Middle East Technical Univ., Ankara, Turkey).

Purpose: The College was held for experimental and theoretical physicists, material scientists and physical chemists, the aim being to present basic concepts and current problems from many different points of view including those of practical use. In addition to the scheduled lectures there were some formal and informal seminars on a variety of research topics by the lecturers, participants and visiting experts.

Programme: Topics:

- Basic Physics in electronic structure and transport properties of semiconductors
- Physics of semiconductor devices and materials technology
- Topics of special current interest for research and applications

The following lectures were given:

Classification and bonding of semiconductors; Electronic band structure of semiconductors; Optical properties of semiconductors; Shallow impurities; Electronic transport; Survey of linear chain conductors; Physical properties of $(TMTSF)_2X$ salts; Surfaces and interfaces (electronic transport); Modern techniques of semiconductor spectro-

scopy; Impurity bands; Basic processes in semiconducting devices; Boundary layers at surfaces and interfaces; Heterostructures, including super lattices; Surface waves; Surface wave devices; Quantum transport; Individual semiconductor devices; Economics and Development; Phonons and other excitations in amorphous silicon; Atomic diffusion in concentrated systems; Materials technology (including ion implantation, laser annealing and molecular beam epitaxy); The preparation and characterization of Langmuir-Blodgett films; The potential application of Langmuir-Blodgett films; Dynamics of localized centres; Optical devices; Semi-empirical tight binding approach to electronic properties; Additional light waves in the exciton resonance regions: Theoretical aspect; AC and DC hopping conductivity: Unified theory and a universal curve; Narrow gap and magnetic semiconductors; Amorphous and polycrystalline silicon devices; Graphite intercalation compounds; Inversion layers and quantum field Hall effect; Integrated circuits device modelling.

Participation:

Total visitors:	118
From developing countries:	84

Representation:

Africa	developing:	10
Asia	developing:	45
	industrialized:	1
Europe	developing:	13
	industrialized:	32
Indonesia & Oceania	developing:	1
North & Central America	developing:	3
	industrialized:	1
South America	developing:	12

Title: RESEARCH IN CONDENSED MATTER PHYSICS

Dates: (throughout the year)

and

RESEARCH WORKSHOP IN CONDENSED MATTER PHYSICS

Dates: 25 June - 7 September 1984

Organizers: Research throughout the year: Profs. M. Tosi and E. Tosatti (both Univ. of Trieste/ICTP) in collaboration with the Advisory Committee on Condensed Matter Physics.

Workshop: Profs. P.N. Butcher (Univ. of Warwick, Coventry, UK), G. Garcia-Moliner (CSIC, Madrid, Spain), S. Lundqvist (Chalmers Univ. of Technology, Goteborg, Sweden), N.H. March (Univ. of Oxford, Oxford, UK) and M.P. Tosi (Univ. of Trieste/ICTP, Trieste, Italy). Included in the Workshop: a Working Party on "Physics of Condensed Matter at Planetary Pressures" from 20 August to 7 September 1984: Organizer: Prof. A.H. Cook (Cavendish Laboratory, Cambridge, UK.).

Purpose: Research throughout the year: the research programme was organized 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 industrialized countries.

Workshop: The main idea of the Workshops, which have been held since 1970, was to support condensed matter research in developing countries by inviting a selected group of physicists from these countries for a three-month summer programme, under which they have the opportunity of interacting with a large number of leading physicists from all over the world. A core of senior physicists take the major responsibility for the Workshop by spending one month or longer with the group. A large number of physicists come for shorter visits, from two weeks to a few days. Interests in the 1984 Workshop were focussed on:

(a) Phase transitions
(b) Disordered systems
(c) Intermediate valence materials

In addition to the interdisciplinary Working Party on Physics of Condensed Matter at Planetary Pressures as mentioned above, the Workshop programme was supplemented by three Symposia on:
Surface spectroscopy of adsorbates - 27 - 29 June 1984
Laser-semiconductor interaction - 2 - 6 July 1984
First-order phase transitions - 23 - 27 July 1984

Programme:

Research throughout the year: during the Research programme, lectures were delivered on:

Macroscopic quantum tunnelling. Atom-surface interactions and the measurement of surface-phonon spectra. Correlation effects in ion-neutralization scattering from a metal surface. Beyond the local density approximation: eigenvalues and potentials in the 'exact' density functional theory. A model for liquid-vapour interface. Many-body theory for molecules: modern methods in configuration interaction.* Implanted positive muons: a review of their use in metal physics and magnetism. Some theoretical problems related to recent experiments with synchrotron radiation. Electronic properties of solid surfaces by the LAPW method. Statistical mechanics and scaling of quark gas. Variational perturbation method in configuration interaction theory.* Freezing theory of molten salts. Defects in semiconductors.* Spin dependent inelastic scattering in metals. Shake-up excitations in atoms and molecules. Band structure and Landau levels of semiconductor heterostructures. N+2nd time on density functional theory. Statistical mechanics and dynamics of surfaces.* Solid-like behaviour in liquid layers: the strange hydrodynamics of smectic liquid crystals. LSDX: local-spin-density with exact exchange-Atomic results.

The splitting of the bands of semiconductors under laser irradiation. Excitation energies in density functional theory. Phonon coherent states and response functions of

* lecture series.

elastic systems. Neutron scattering study of valence fluctuation systems. Birth and death description of chemical reactions. Exoemission. Hard sphere fluid: a model for the double layer. Semiconductor interfaces: new developments. Helium diffraction from Tungsten (100): preliminary results. Light scattering by acoustic modes in semiconductor superlattices. Strong and fragile liquid and plastic crystals. Ion-beam crystallography of surfaces. Kinetics of graphite intercalation. Vibronic quasi-one-dimensional systems: unusual new condensed states of matter. Electron glass in 2-dimensions. Electron energy levels in GaAs/$Ga_{1-x}Al_xAs$ heterostructures. Dynamical properties of Nitrogen overlayers adsorbed on graphite. A new equation of motion for spatial correlations in a one-component plasma. Geometrical properties of the Fermi energy. Physical criteria for laboratory and solid-state plasmas. Generalized kinetic equation for dynamical systems interacting with phonon field. Valence fluctuations between two magnetic configurations. Electronic structure of dilute alloys. Phase transitions on surfaces. Effect of intersite Coulomb interactions on the Peierls state.

Workshop: Exactly solvable models for 1D metals and their perturbations; Charge density waves dynamics in linear chain compounds; Exotic superconductors; Low temperature phenomena in 2D electron systems; Fractional quantum numbers and quantum Hall effect; Intrinsic and extrinsic losses in photoemission; Experimental aspects of the molecular structure of glass; Valence fluctuations described by single-impurity Anderson model; Optical properties of small metal particles; Impurities in semiconductors: Model potential approach applied to capacitance measurements and photoluminescence; Intrinsic surface phonons on reconstructed semiconductor surfaces; Heterostructures by MOCVD; Effect of core polarization on the plasmon frequency of metals; Electronic theory of grain boundary embrittlement; Lattice relaxation theory of multiphonon processes in polyacetylene; Valence fluctua-

tions between two magnetic configurations and extension to a transition metal compound; Unitary transformations to dressed atoms in quantum optics; Interaction of a dislocation with a crack; A dynamical theory of Sherrington-Kirkpatrick spin glass; Damped and over-damped quantum harmonic oscillator; Mechanism of structural transformations in some close-packed structures; Electronic properties of small clusters; Magnetic properties of anomalous rare-earth systems; Theory of incomplete crystals; Valence fluctuations at high temperatures; Dynamics of liquid-glass transition; Spectroscopic investigations of intermediate valence and Kondo compounds (light scattering, infrared, luminescence (BSI)); Valence fluctuations at low temperatures (phenomenological); Cerium; Ising model in the presence of a random magnetic field; Introduction to percolation theory; Magnetism at interfaces and surfaces as studied at neutron scattering; Dynamics response in an electron gas: quantum version of STLS theory; Chemical binding in binary and ternary metallic alloys; Low energy excitations in intermediate valence systems; Diffusion and percolation; Dynamic scaling; Effective two-body interaction in charged Fermi liquids; Energy conservation and phonon-drag effects in hopping transport phenomena; Field theory of localisation; Renormalisation group decimation technique for spectra, wave functions and density of states; Properties of terrestrial planets; Properties of major planets; Equations of state of terrestrial materials; Equations of state of hydrogenic materials; Polymorphic transitions; Liquid metals; Melting at high pressures; Solid state creep; Superfluids; Anderson localisation on the Bethe lattice; Plasmon dispersion in bulk and surface plasmas; Some aspects of density functional theory; Random systems, duality and gauge invariance; Shape of binodal curve at a critical end-point; Re-entrant phase transitions in liquid crystals; Phonons and neutron scattering in disordered systems; Magnetically disordered alloys AuFe: beyond the percolation threshold; Non-universal critical phenomena in random uniaxial systems; Space charge fluctuation and light

diffraction in the ionic conductor α-$LiIO_3$ under the action of a dc field; Theory of fractional quantum Hall effect; Field induced transitions in hexagonal ferromagnets. Electron-phonon interaction, superconductivity and transport properties of mixed valence systems; Large orbital degeneracy expansions for models of mixed valence; Rescaling method applied to the Heisenberg-Mattis random magnet; Fractals - objects with non-integer dimension; Numerical simulations of condensed matter quantum systems.

Participation: Research throughout the year:

Total visitors:	73
From developing countries:	42

Representation:

Africa	developing:	11
Asia	developing:	16
	industrialized:	1
Europe	developing:	8
	industrialized:	22
Indonesia & Oceania	developing:	1
North & Central America	developing:	2
	industrialized:	8
South America	developing:	4

Participation: Workshop:

Total visitors:	247
From developing countries:	157

Representation:

Africa	developing:	28
Asia	developing:	64
	industrialized:	1
Europe	developing:	51
	industrialized:	70
North & Central America	developing:	3
	industrialized:	19
South America	developing:	11

Title: TRIESTE INTERNATIONAL SYMPOSIUM ON SURFACE SPECTROSCOPY OF ADSORBATES

Dates: 27 - 29 June 1984

Organizers: Directed by: Profs. E. Burstein (Univ. of Pennsylvania, USA), S. Lundqvist (Chalmers Univ. of Technology, Goteborg, Sweden), E. Tosatti (ICTP/SISSA, Trieste, Italy), M.P. Tosi (ICTP/Univ. of Trieste, Trieste, Italy).

Purpose: The Symposium was held within the framework of the Summer Workshop in Condensed Matter Physics, and specifically to present recent developments and future possibilities for research in the field of spectroscopic data, particularly on bonding of adsorbates and substrates.

Programme: Topics:

- Valence electronic structure and bonding (theory and experiment)
- Electronic valence excitations and relation to electronic structure
- Density functional calculations of adsorbates
- Photoemission and inverse photoemission for adsorbates
- Optical and electronic Raman spectra of adsorbates
- Scattering from adsorbates

The following lectures were given:

Electronic properties of oxygen on simple metals; Surface geometry of adsorbates from extended energy loss fine structures; Realistic local-density calculations for adsorbates; Excitation spectrum of impurities adsorbed on metal surfaces; Many-body effects in adsorbed atoms and molecules; Dynamic effects in electronic excitation and molecular scattering; Inverse photoemission; Density functional calculation for adsorbates; Valence spectroscopy of carbon overlayers on transition metal surfaces; Electron energy loss spectroscopy of valence electron excitation of adsorbates; Scattering from adsorbates; Density-functional calculations for adsorbates; Adsorbate-

substrate valence excitations in Raman spectroscopy; Valence and core photoemission, core-bound transitions in adsorbates; Structural determination for adsorbates on semiconductors with optical, photoemission and EXAFS spectroscopies; Adsorption of biological molecules on non-biological surfaces; Surface studies with neutrons; Near-edge structures; Dynamical screening effects on valence excitations of adsorbates; Angular variation of Auger line shapes; Molecular calculations of adsorbates; Theory of X-ray spectroscopy and many-body effects in adsorbates; Valence spectroscopy of adsorbates.

Participation:

Total visitors:	81
From developing countries:	14

Representation:

Asia	developing:	1
Europe	developing:	12
	industrialized:	51
North & Central America	developing:	1
	industrialized:	15
International organizations representing	industrialized:	1

Title: THIRD IUPAP TRIESTE INTERNATIONAL SYMPOSIUM ON SEMICONDUCTOR PHYSICS: "HIGH EXCITATION AND SHORT PULSE PHENOMENA"

Dates: 2 - 6 July 1984

Organizers: Directors: Profs. A. Frova (Univ. of Roma, Roma, Italy), M.H. Pilkuhn (Univ. of Stuttgart, Stuttgart, FRG), and E. Tosatti (ICTP/SISSA, Trieste, Italy). The Symposium was co-sponsored by the Italian National Research Council (CNR), the IUPAP Semiconductor Commission and IBM-Italy.

Purpose: The third Symposium was devoted to the physics of highly excited semiconductors and to short pulse effects. Particular emphasis was placed on optical studies of the collective properties of the electron-hole plasma, on electron and hole thermalization, and on transport in three- and two- dimensional systems. The subject was treated critically by review talks from leading scientists, as well as by extensive discussions in which novel results were presented to the audience.

Programme: Topics:
- Femto- and Picosecond Spectroscopy
- Hot carrier transport
- Non-Equilibrium electron-hole plasma
- Plasma Confinement
- Quantum-well lasers
- Many-body effects
- Nonlinear optics
- Physical aspects of laser annealing

The following lectures were given:

Progress in femtosecond spectroscopy: Short pulse physics of quantum well structures; Chirped and chirp-free femtosecond laser pulses and applications to semiconductors; Ultrafast relaxation processes in non-equilibrium plasma in semiconductors; Non-equilibrium phonons; Imaging techniques of phonon induced transport; Energy-loss rates in InGaAs; Many-body theory of optical nonlinearities in semiconductors; Screening of indirect excitons in Ge; Excitonic versus plasma screening: The case of highly

excited GaAs; Luminescence and Raman investigations of GaAs; Nonlinear optics and plasma induced bistability in CdS; Optical bistability in CuCl; Optical nonlinearity and bistability in CdS; Auger effect and optical nonlinearity in III-V semiconductors; Theory of absorptive optical bistability; Subpicosecond spectroscopy of CuCl; Exciton localisation of picosecond time-scale in semimagnetic semiconductors; Picosecond studies of highly excited CdS; Theory of plasma generation and evolution in highly excited semiconductors; Ultra high density plasma in Si generated by femtosecond laser pulses; Picosecond deposition and relaxation of energy in Si and Ge; Hot carrier transient transport; Optical studies of fast plasma transport in Si; Non-equilibrium plasma - theory and experiment; Plasma expansion and band renormalization in CdTe; Transport in graded gap semiconductors; Transient anisotropy in the picosecond absorption of GaAs; Confined plasmas in III-V semiconductor heterostructures; Electronic structure of two-dimensional semiconductors; Quantum well lasers; Optical studies of GaAs quantum wells; Coulombic bound states in two-dimensional semiconductors; Experimental investigation of GaAs quantum wells; Two-dimensional semiconductors - recent developments; Excitons and electron-hole plasma in quasi - two-dimensional systems; Laser surface interaction; Thermal description of laser annealing; Non-thermal aspects of pulsed laser annealing; Time resolved Raman spectroscopy under laser annealing conditions; Time-resolved studies of the melting of amorphous silicon; Excitonic stability in semiconductor superlattices.

Participation:	Total visitors:	83	
	From developing countries:	9	
Representation:	Asia	developing:	3
		industrialized:	1
	Europe	developing:	3
		industrialized:	54
	North & Central America	industrialized:	19
	South America	developing:	3

Title: FIFTH TRIESTE INTERNATIONAL SYMPOSIUM ON FIRST-ORDER PHASE TRANSITIONS: STATICS AND DYNAMICS

Dates: 23 - 27 July 1984

Organizers: Directed by: Profs. T.V. Ramakrishnan (Indian Institute of Science, Banglore, India), E. Tosatti (ICTP/SISSA, Trieste, Italy), M.P. Tosi (ICTP/IFT, Trieste, Italy).

Purpose: The objective of the Symposium was to explore three aspects of first-order transitions, namely the liquid-solid transition in three dimensions, kinetics of first-order phase transitions, and structural transitions in solids, especially the martensitic transformation. The idea was to bring together physicists, chemists and metallurgists who had actively contributed to progress in these fields, so that there would be a sharper awareness of problems and future prospects.

Programme: Topics:
- Structural transformations in solids (particularly the martensitic transitions)
- Liquid-solid transition
- Kinetics of first-order transitions

The following lectures were given:

Diffusional nucleation in crystalline solids; Kinetics of transitions involving changes in conserved and non-conserved thermodynamic variables; Soliton-like models for interface / The problem of martensite structures; Structural phase transitions: Interplay of structure and dynamics; Nucleation vs. spinoidal decomposition: What is the significance of spinoidal curves?; Commensurate incommensurate phase transitions; Problems of nucleation and growth of martensitic transformations; Computer simulations of martensitic transformations; Kinetics of first-order phase transitions; The lattice mechanical stability and the nucleation problem of martensite; Mean field theory of melting; Phase transitions of internal surfaces in crystalline solids; Gauge theory of defects and the melting transition; Some aspects of the density wave theory of freezing; Mechanisms and kinetics of

martensitic nucleatic and growth; Computer simulation studies of structural transitions; Kinetics of domain growth in two dimensions; Theory of elastic phase transitions; Two dimensional melting of various objects;

Participation:	Total visitors:	55	
	From developing countries:	20	
Representation:	Africa	developing:	1
	Asia	developing:	4
	Europe	developing:	12
		industrialized:	25
	North & Central America	developing:	1
		industrialized:	10
	South America	developing:	2

Title: SECOND SUMMER COLLEGE IN BIOPHYSICS

Dates: 30 July - 7 September 1984

Organizers: Directed by: Profs. H.A. Farach (Univ. of South Carolina, Columbia, USA), S. Mascarenhas (Univ. of Sao Paulo, Sao Carlos, Brazil), F. Quadrifoglio (Univ. of Trieste, Trieste, Italy), A.H.-J Wang (Massachusetts Inst., of Technology, Cambridge, USA), and G. Ghirardi (ICTP/Univ. of Trieste, Trieste, Italy).

Purpose The College was intended for physicists and physical chemists, both theorists and experimentalists, with previous experience in the area of Molecular Biophysics.

Programme: Topics:
- Biophysical aspects of DNA and RNA
- Physical techniques in Biophysics

The following lectures were given:

Introduction to X-ray diffraction; Introduction to the NMR spectra of nucleic acids; Introduction to theoretical methods in biophysical chemistry; Nucleic acids structure; Introduction to the nuclear Overhauser effect; Introduction to theoretical methods in biophysical chemistry; Assigment of nucleic acid NMR spectra by means of NOE; Dynamics of DNA; Fundamentals of X-ray fiber diffraction theory; Experimental techniques for X-ray fiber diffraction; Application of X-ray fiber diffraction to polynucleotides; Structure and usage of a data base for the retrieval and analysis of nucleic acid sequence; Solvation of nucleic acids; Statistical thermodynamics of ligand binding to DNA; Stability of nucleic acid structures and proton exchange; Methods for the comparison of homologous genes; Physical properties of nucleic acids; Dynamics of conformational fluctuations in DNA from hydrogen exchange rate measurements; DNA conformational statistics, hydrodynamics, gel electrophoresis and DNA bending; Separation of large DNA molecules by gel electrophoresis; Conformational changes in DNA driven by

torsional stress; DNA packaging in viruses and E. Coli; Nucleosome structural changes as revealed by fluorescence; Eucaryotic chromosome structure: structure of the nucleosome; Characteristics of DNA junctions - models for intermediates in DNA recombination; RNA arrangement in ribosomes; Eucaryotic chromosome structure: the 300A fiber; Physical mechanisms of control of prokaryotic gene expression, with application to the LAC operon; Eucaryotic chromosome structure: further-folded structures; Chemical techniques for studying protein-nucleic acid interactions; Gene cloning; The logic of gene regulation; Thermodynamics of nucleic acid solutions; Synthesis of DNA fragments in solution; DNA-binding proteins; Thermodynamics of nucleic acid solutions; Enzymes and DNA for gene cloning; Synthesis of RNA fragments in solution; Synthesis of DNA fragments on *solid supports; Introduction of foreign genes into cells;* Radiation damage and DNA repair; Structure-function relationships in the helix-turn-helix class of DNA binding proteins; Solution NMR studies of proteins and nucleic acids; Expression of recombinant DNA in pro- and eucaryotes; Conformational calculations of nucleic acid structures; Use of DNA cloning to study DNA structure; NMR studies of protein DNA interactions; Liquid water: 2,3 and 4 body interactions potentials from quantum mechanics; Physical discussion of photoacoustic spectroscopy and signal detection modes; Electron paramagnetic resonance of copper proteins: Monte Carlo simulation of spectra; Liquid water: Monte Carlo and molecular dynamics simulation; DNA and proflavin crystals: determination of water structure. Complementarity of diffraction experiments and simulation; Models for photoacoustic spectroscopy signal generation; Solution scattering: size and molecular weight estimates; Molecular structure and dynamics of human cerulo-plasmin; Fibre diffraction: helical structures, helical repeat, electron density and other parameters; NMR parameters and structure and conformation of proteins and nucleic acids; Experimental

methods in photoacoustic spectroscopy; Hydration of DNA: position and orientation of water molecules and counter-ions (by Monte Carlo simulation); One- and two-dimensional NMR of biological macro-molecules - an introduction; Applications of photoacoustic spectroscopy to biological systems; Techniques for small angle scattering: sources, cameras, detectors, special electronics for time resolved measurements and data treatment; Sequence-specific NMR assignments in proteins; Sequence-specific NMR assignments in oligonucleotides; Application of small angle X-ray scattering in biophysics; Ion selectivity and trans-membrane channels; A new super-computer for biophysical simulations: proton transfer between base-pairs in DNA as an example; Secondary and tertiary polypeptide structure by NMR; The Frohlich Model and DNA studies; Excited states of nucleic acids; Fluorescence and phosphorescence of DNA bases and DNA (Theory and experimental techniques); Fluorescence of Dye-nucleic acids complexes; NMR studies of molecular dynamics and intermolecular interactions; Energy transfer processes in DNA and in Dye-DNA complexes; Pedestrian approach to Monte Carlo Technique; Basic concepts in light scattering spectroscopy; Circular dichroism; Radiation damage in DNA: models and experimental techniques; "Spectroscopic" description of collective systems; Survey of spectroscopic techniques; Repair mechanisms: physico-chemical detection techniques; Electron spin resonance; Experimental techniques in excitable membranes biophysics; Applications of light scattering to biological systems: Raman scattering; Results in selected systems; Correlation spectroscopy in biological systems; Experimental techniques of proof reading in protein synthesis; Physical techniques in biophysics; Memory mechanisms; Collective computation in biological networks of neurons (nerve cells); Functional order and stability of aqueous biosystems: roles of geometry, stereodynamics, topology and noise; Rapid reaction methods in the study of enzyme action.

Participation:	Total visitors:	115	
	From developing countries:	81	
Representation:	Africa	developing:	14
	Asia	developing:	25
		industrialized:	1
	Europe	developing:	22
		industrialized:	21
	Indonesia & Oceania	developing:	1
	North & Central America	developing:	1
		industrialized:	11
	South America	developing:	18
	International organizations representing	industrialized:	1

Title: MEETING ON BRAIN THEORY

Dates: 1 - 5 October 1984

Organizers: The meeting was organized in collaboration with the International School for Advanced Studies, and directed by Profs. V. Braitenberg (Institute for Biological Cybernetics, Tubingen, Fed. Rep. of Germany), G. Palm (Institute for Biological Cybernetics, Tubingen, Fed. Rep. of Germany), and A. Pellionisz (New York Medical Center, N.Y., USA).

Purpose: To review and discuss earlier papers on brain theory and to bring recent theoretical work into the perspective of the general development of neuroscience in the last decades.

Programme: The following lectures were given:

What kind of cortical anisotropy do we have to invoke in order to explain Hubel and Wiesel? Information processing in the visual cortex; Neuronic equations revisited and completely solved; Tensor network theory: a geometrical approach to the central nervous system; Theory of informational-structural organization of the working of the brain; Semantic atomism as a basis of brain theory; Strange attractors in the limbic system; Gravitational clustering: The detection of functional assemblies in a population of neurons; Neural assemblies and the interpretation of neural synchrony; The role of associative processing in brain theory and artificial intelligence; The trion model: A model of cortical organization embodying a basis for a theory of information processing and associative memory; Associative networks and cell assemblies; Discuussion of earlier models.

Participation:	Total visitors:	15	
	From developing countries:	-	
Representation:	Europe	industrialized:	12
	North & Central America:	industrialized:	3

Physics of the Environment

Title: "ANTONIO MARUSSI GEOPHYSICS COLLEGE" AUTUMN COLLEGE ON THE TROPOSPHERE, STRATOSPHERE AND MESOSPHERE

Dates: 10 September - 19 October 1984

Organizers: Directed by: Profs. Sir Granville Beynon (Univ. College of Wales, Aberystwyth, Wales, UK), A.H. Cook (Univ. of Cambridge, Cambridge, UK), A.P. Mitra (National Physical Lab., New Delhi, India).

Purpose The purpose of the College was to provide a general introduction to the properties of the neutral atmosphere, and included lectures on dynamics, chemistry, minor constituents and electrifications, as well as radio propagation. Special attention was given to methods of measurement and applications to pollution and tropical thunderstorms, and the Middle Atmosphere Programme was discussed.

Programme: Topics:

- Measuring techniques and measurements
- Radiowave propagation in the lower atmosphere
- Dynamics, mass motions, tides, waves
- Numerical modelling
- Pollution
- Atmospheric electricity, tropical thunderstorms
- Chemical composition, minor constituents, Middle atmosphere programmes

The following lectures and lecture series were given:

Outline of physical properties, chemical composition, thermal structure to 100 km; Radio propogation in lower atmosphere - Diffraction - scattering; Measuring techniques and measurements - ground based, lidar rockets; Measuring techniques and measurements - satellites, balloons, radio-sonde; Radio propagation in lower atmosphere - absorption - scattering; Radio propagation in lower atmosphere - refraction - ducting; Measuring techniques and measurements - radar; Dynamics - mass

motions, tides, waves; Radio propagation in lower atmosphere - sub-surface propagation; Chemical composition, minor constituents; Middle atmosphere programmes; Numerical modelling; Atmospheric electricity, tropical thunderstorms; Parameters determining maximum velocity in a tropical cyclone; Atmospheric tides and the internal gravity waves; International reference ionosphere; Discussions on scientific programmes in Nigeria and in India.

Participation:

Total visitors:	110
From developing countries:	97

Representation:

Africa	developing:	28
Asia	developing:	40
Europe	developing:	19
	industrialized:	13
Indonesia & Oceania	developing:	4
North & Central America	developing:	1
South America	developing:	5

Physics and Development

Title: PHYSICS AND DEVELOPMENT PROGRAMME

Dates: Throughout the year

Organizers: The programme is co-ordinated and directed by Prof. H.R. Dalafi (ICTP/Iran)

Purpose: The main purposes of this programme are to increase the awareness of scientists of the role of physics in social and economic development, and to inform Third World scientists of potential sources of assistance for physics research and its applications to the development needs of their countries.

Programme: The following lectures were given:

IAEA Nuclear data activities and services to developing countries; Development issues in the context of the current North-South relation: the last thirty years; the current issues; Science and technology for development; Development in South Korea; The project of European laboratory for syncrotron radiation; Inter-regional project on nuclear data technique and instrumentation: IAEA project; The role of physics in development in Bangladesh; Physics in microelectronics and micro-electronics in physics; Traditional technology and advanced technology together for development; Solid state physics and development; Solid state image sensors; What is genetic engineering?: Background and prospects; Development process and development theories; International dimension of the development process; Technology,, technology transfer and multi-national cooperation;
Direct and diffuse spectral and total solar radiation under cloudless skies; Social obstacles in the way of technical solutions; Practical guidelines for promoting science and technology in developing countries; Regional approach to development, theory and application; Balance of costs and benefits of the information technologies in developing countries; Physics, development and the IAEA laboratories in Vienna; Round table discussion on "The

nuclear arms race today"; The pecularities of science and technology in developing countries; 1974-1984 rise and decline of the new international economic order; Technology transfer to developing countries: International Centre for Genetic Engineering and Biotechnology in Trieste; Poor man's approach to research; Edmond Halley and early surveys of Trieste and Carniola; The nature of environmental problems facing developing countries with Ghana as an example; Marconi, radio waves, the ionosphere; Evolution of the atmosphere; Ancient astronomy and music in China; The physics of needs and the needs of physics; Technology and underdevelopment. Technology and development. Science and mathematics for development. South-South cooperation with particular reference to transfer of technology.

Participation:	Total visitors:	23*	
	From developing countries:	6*	
Representation:	Africa	developing:	1
	Asia	developing:	3
	Europe	developing:	2
		industrialized:	13
	North & Central America	industrialized:	4

*Figures do not include those who gave physics and development lectures while present as lecturers and/or participants in other scheduled activities.

Title: INTERNATIONAL CONFERENCE ON PHYSICS FOR DEVELOPMENT

Dates: 8 - 12 October 1984

Organizers: The Conference was organized by the I.C.T.P, in collaboration with The Third World Academy of Sciences and the IUPAP Commission on Physics for Development.

Purpose: The purpose of the Conference was to motivate physics communities in the industrialized countries to assist the growth of physics research in developing countries. Its aim was also to inform physics communities in Third World scientists about potential sources of assistance for the development of physics research and its application to the development needs of their countries.

Programme: Topics:

- Problems and Perspectives in Developing Countries
- The Role of Physics in Development
- Industrial Physics and International Development
- Possible Action in Favour of Research in Physics in Developing Countries

The following lectures were given:

Physics of materials; Applications of lasers; Microelectronics; Communications physics; Physics and energy; The role of physics in managing and protecting the environment; Physics and Medicine; Problems of research and education in physics as applied to development, with reference to various regions of the World; The possible action in favour of physics research and education in developing countries (Round table discussion)

In common sessions with the IUPAP General Conference, the following lectures were given:

Science and industry; The unification of fundamental forces; A strategy for the development of optical

communication in Brazil; The manufacture of Silicon based material: How a company grew out of the university; Micro-electronics research in Canada: The development of a national cooperation;

Within the Conference the following Workshops were held:

Workshop on physics of materials; Workshop on lasers, microelectronics and communication physics; Workshop on physics and energy; Workshop on the role of physics in managing and proctecting the environment; Workshop on physics and medicine.

Participation:

Total visitors:	157
From developing countries:	108

Representation:

Africa	developing:	32
Asia	developing:	48
	industrialized:	3
Europe	developing:	14
	industrialized:	28
Indonesia & Oceania	developing:	1
North & Central America	developing:	5
	industrialized:	16
South America	developing:	7
International organizations representing	developing:	1
	industrialized:	2

Title: SYMPOSIUM ON THE STATE OF PHYSICS AND MATHEMATICS IN AFRICA

Dates: 8 - 16 October 1984

Organizers: The Symposium was organized by the Society of African Friends of the ICTP.

Purpose: The aim of the Symposium was to examine the state of the Development of Physics in Africa at the present time, and to produce recommendations for its development and improvement.

Programme: Topics:

- Research and Teaching of Physics and Mathematics in Africa (Problems)
- Impact of Physics and Mathematics in the Development of Africa
- Regional Cooperation in Africa
- International Cooperation with Reference to Africa
- Follow-up Action

The following lectures were given:

On nonlocal elasticity and its relation with lattice dynamics; On noncommutative diffusion processes; Flood routing using finite difference and the fourth order Runge-Kutta method. Two feasibility studies and relevant realization in the energy sector in Africa; On the possibility of using spectral analysis methods to predict some climatic/weather variations in equatorial regions.

General Sessions were held on: Teaching of physics and mathematics in Africa; Regional and international cooperation in science and mathematics, with reference to Africa; Research in physics and mathematics in Africa; Impact of physics and mathematics in Africa. Future action and business.

Working Sessions on the same topics were held and the working groups presented their recommendations regarding teaching, research, impact and cooperation.

Participation:	Total visitors:	83	
	From developing countries:	82	
Representation:	Africa	developing:	82
	Europe	industrialized:	1

Applicable Mathematics

Title: MATHEMATICS RESEARCH

Dates: Throughout the year

Organizers: Professor G. Vidossich (ICTP/International School for Advanced Studies, Trieste, Italy)

Purpose: The intent is to give more continuity to the mathematics programmes which, in the past, were scheduled courses and workshops held once or twice per year, and to set up a mathematics research group in order to allow Associates and visitors from Federated Institutions to have the possibility of contact with high-level mathematicians throughout the year.

Programme: The following lectures and lecture series were given:

Critical points theory and applications; Fuzzy theory: Development and applications of modern mathematics; Fuzzy sets; F-lattice; Fuzzitor (modern structures of information).

Participation:

Total visitors:	15
From developing countries:	13

Representation:

Africa	developing:	5
Asia	developing:	5
Europe	developing:	3
	industrialized:	2

Title: WORKSHOP ON DYNAMICAL SYSTEMS

Dates: 22 October - 9 November 1984

Organizers: Professors E.C. Zeeman (Mathematics Institue, University of Warwick, UK) and J. Palis (IMPA, Rio de Janeiro, Brazil)

Purpose: A follow-up to the summer school held in August 1983, the main purpose of the Workshop is to bring together the scientists (from all over the World) that most profited from that activity to discuss the results of their current research and to give them the opportunity to conceive new plans. To help fulfil this purpose, in addition to the researchers participating, a few outstanding scientists were also invited; these include the physicist M. Feigenbaum and the mathematicians D. Sullivan, S. Newhouse and K. Schmidt.

Programme: Main topics:
- Bifurcation theory
- Ergodic theory
- Holomorphic dynamical systems
- Strange attractors and chaos
- Asymptotic measures
- Catastrophe theory

Lectures were given as follows:

Measuring bifurcation sets. A simple mechanical example of chaos; Entropy and volume*; Homoclinic births. Moduli for foliations with singularities; Geodesic flow and existence of totally geodesic foliations of hyperbolic manifolds*. Bifurcations in the Henon map. Topological invariance of projective holonomies. Non-stabilisable jets of diffeomorphisms in $\mathbb{R}^2$ and of vector fields in $\mathbb{R}^3$. Dynamics of iterated rational maps. On the geometry of complex vector fields. Renormalization of maps of the circle. Construction of singularities of holomorphic vector fields with a given projective holonomy. Using fractals to construct invariant sets. Persistence of rotation intervals of

* lecture series.

endomorphisms of the circle. Asymptotic invariance in ergodic theory. Equilibrium measures for rational maps. Algebraic invariants of holomorphic vector fields. On the topology of holomorphic flows with singularities. Universal breakdown of invariant circles. Qualitative analysis of the anisotropic Kepler problem. Game dynamics. Geometric realizations of Gibbs states and the analytical classification of expanding dynamical systems*. Coding of Markov shifts. Informal Brownian motion. Birth of homoclinic orbits. The C^r-closing lemma for flows on the torus T^2. Bifurcations in the Replicator system. Nonwandering sets of interval maps. Logarithmic forms. Shadowing lemma for family of ε-trajectories. Expansive diffeomorphisms of surfaces. Transverse holomorphic structures*. On the stability conjecture. Stochastic equilibria for deterministic systems. Realisation of rotation intervals of endomorphisms of the circle. Scaling in dynamical systems*. Hausdorff dimension of generic points. Metastability following Ventsell and Freidlin. Finite relative determinations. Some geometric features of the invariant manifolds of the periodic hyperbolic points. The saddle node. Splitting of separatrices for perturbed systems with high frequency. Stochastic perturbations of dynamical systems; half of a theorem. On a quasi periodic Hopf bifurcation. A view of rational maps. Foliations of surfaces.

Participation:	Total visitors:	66	
	From developing countries:	47	
Representation:	Africa	developing:	2
	Asia	developing:	14
	Europe	developing:	14
		industrialized:	17
	North & Central America	developing:	5
		industrialized:	2
	South America	developing:	12

* lecture series.

Title: AUTUMN COURSE ON SEMIGROUPS, THEORY AND APPLICATIONS

Dates: 12 November - 14 December 1984

Organizers: Directed by: Profs. H. Brezis (Univ. of Paris, France), M.G. Crandall (Univ. of Wisconsin, USA) and F. Kappel (Univ. of Graz, Austria)

Purpose: The aim of the course is to introduce the theory of seimgroups and evolution equations, to survey part of the current related knowledge, to draw attention to research problems and to show how to use the abstract results in practical questions related to partial and functional differential equations.

Programme: Topics:
- Basic theory of linear semigroups
- Theory of nonlinear semigroups
- Semilinear evolution equations
- Semigroups applied to partial differential equations
- Semigroups applied to delay equations
- Control theory
- Problems in mathematical physics and mechanics

The following lectures were given:

Basic abstract theory*. Partial differential equations*. Introduction to the equations of mathematical physics*. Control theory*. Applications to problems in mechanics and elasticity*. Semilinear problems*. Semigroups and delay equations*. Nonlinear evolution equations*. Optimal regularity for the linear problem and its applications*. Stochastic semigroups in deterministic and probabilistic models. Some topics on nonlinear diffusion*. A necessary and sufficient condition for the existence of positive solutions to sublinear elliptic equations. A compactness criterion in $C(o, \tau ; X)$ for subjects of solutions of nonlinear evolution equations governed by accretive operators. Second-order non-linearly perturbed equations of evolution with boundary conditions. Degenerate diffusion and the dispersal of biological populations. A class of

*lecture series.

nonlinear evolution operators and generation theory. Equivalent problems in saddle point and control theory. Time decay for positive energy solutions of sone nonlinear Schrodinger equations. Fluid flow in partially saturated porous media. Asymptotic properties of solutions of porous media equations with absorption. Product formulas with variable step-size. Motion of viscous fluids with diffusion. The semigroup approach to Hamilton-Jacobi equations in Hilbert spaces. Instability of nonlinear bound states. Singular sets, regularity and uniqueness for weak solutions of the Navier-Stokes equations. The development of singularities for the nonlinear heat equation. Pseudo-periodic solutions of du/dt = A(t)U or using the ergodic theorem in "big" Hilbert spaces. On two nonlinear parabolic equations and some qualitative properties of their solutions. Nonmonotone semi-linear elliptic equations. Some nonlinear evolution equations of variational type. Global theory of nonlinear wave equations and the nonlinear connection. Recent results on Hamilton-Jacobi equations. Nonlinear viscoelastic materials with memory (existence and blow-up). Recent results on the wave equation with dissipation in a bounded domain. Stationary states for the nonlinear Dirac equation. Optimization and continuation. Lyapunov stability of ground states on nonlinear dispersive equations. The Cauchy problem for the nonlinear Schrodinger equation and for the nonlinear Klein-Gordon equation in the energy space. Scattering theory in the energy space for the nonlinear Schrodinger equation. Some problems in flame theory. Singularity formation in a collisionless plasma could occur only at large velocities. Global existence question in reaction-diffusion systems. The Lie-Trotter formula and generators of nonlinear semigroups. Behaviour near t=o in nonlinear diffusion equations. The theory and applications of strongly order-preserving semi-dynamical systems. Singular solutions of the heat equation with absorption. A class of singular symmetric systems of partial differential equations. Partial regularity results for Hamilton-Jacobi equations. Anisotropic diffusion, examples and open problems.

Participation:	Total visitors:	142	
	From developing countries:	76	
Representation:	Africa	developing:	16
	Asia	developing:	31
		industrialized:	3
	Europe	developing:	20
		industrialized:	46
	North & Central America	developing:	1
		industrialized:	17
	South America	developing:	8

Training and Research in Italian Laboratories

Title: TRAINING AND RESEARCH IN ITALIAN LABORATORIES

Dates: Throughout the year

Organizers: The programme is co-ordinated by Profs. G. Furlan (ICTP/Univ. of Trieste, Italy), G. Denardo (ICTP/Univ. of Trieste, Italy) and E. Tosatti (ICTP/SISSA, Trieste, Italy), in collaboration with Advisory Committees in each of the interested fields.

Purpose: To give experimental scientists from developing countries the opportunity to work for extended periods in advanced Italian laboratories as a complement to the theoretical work carried out at the Centre, the programme of training in Italian laboratories was initiated in 1982.

Programme: This year, scientists representing 26 developing Member States worked - with grants from the Centre - in 56 Italian laboratories for periods of various lengths.

Participation:

Total visitors:	69
From developing countries:	69

Representation:

Africa	developing:	11
Asia	developing:	42
Europe	developing:	7
Indonesia & Oceania:	developing:	1
North & Central America	developing:	3
South America	developing:	5

Activities outside the scheduled programme

Title: A. MISCELLANEOUS INDEPENDENT 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) to carry out independent research in periods when no activity is scheduled in their field of interest, and to have contact with others at the Centre working in their own or related field, to do so.

Participation:

Total visitors to date:	162
From developing countries:	106

Representation:

Africa	developing:	33
Asia	developing:	49
Europe	developing:	17
	industrialized:	47
Indonesia & Oceania	developing:	1
North & Central America	developing:	1
	industrialized:	4
South America	developing:	5
International Organizations representing	industrialized:	5

Figures also include short-term visitors coming for organizational activities only.

B. Regional Activity, organized by the Centre

Title: ASIAN REGIONAL COLLEGE ON MICROPROCESSORS: TECHNOLOGY AND APPLICATIONS, held in Colombo, Sri Lanka.

Dates: 4 - 29 June 1984

Organizers: Directed by: Mr. C. Verkerk (CERN, Geneva, Switzerland), and Prof. V.K. Samaranayake (Univ. of Colombo, Sri Lanka). The College was organized by the ICTP in collaboration with the Computer and Information Technology Council of Sir Lanka and the University Grants Commission of Sri Lanka.

Purpose: As shown in the previous two Colleges on Microprocessors, organized at the ICTP in 1981 and 1983, a good working knowledge of hardware and software was obtained by an intensive training College of a few weeks duration, consisting of an intergrated hardware-software approach. As interest in this type of training continued to be considerable, the Centre decided to organize the Regional College on Microprocessors, in addition to those held inside the regular programme in Trieste, this being the first of such Regional Colleges.

Programme: Topics:

- General Introduction to Microprocessors
- Microcomputer Hardware: Architecture, Interfacing, etc.
- Basic and Application Software
- Applications of Microprocessors in various fields

The following lectures were given:

Introduction to (micro)processors; The 6809 microprocessor; Assembly language programming; Digital logic; Input/output and interfacing; Presentation of hardware of Colombo 84; Hardware debugging; I/O and interfacing; DAC, ADC and V/F conversion; Development systems; Software techniques; Floating point notation and operations; Software tools; Buses and data communications; Kernel for

Colombo 84; Advanced rosy features; Other microprocessors; Applications in other fields; Low cost microcomputer systems for teaching; The LEP experiments at CERN.

Participation:	Total visitors:	92	
	From developing countries:	77 (estimated)	
Representation:	Africa	developing:	2
	Asia	developing:	70
	Europe	developing:	1
		industrialized:	4
	Indonesia & Oceania	developing:	2
	North & Central America	industrialized:	1
	South America	developing:	1
	International Organizations representing	developing:	1
		industrialized:	10

C. Regional Activities, co-sponsored by the Centre

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

1. First Tropical College on Applied Physics (Laser & Plasma Technology),
   Kuala Lumpur, Malaysia, 26 December - 14 January 1983/84.

2. Conference on International Co-Operation in Science and Technology for Developing Countries,
   Dacca, Bangladesh, 14 - 19 January 1984.

3. International Workshop on Hyperfine Interactions
   Kanpur, India, 16 - 25 January 1984.

4. First Equatorial School of Relativistic Astrophysics on Galactic Structures,
   Bogota, Colombia, February 1984.

5. Project of Electret Radiation Dosimetry,
   Nigeria.

6. 23rd Schladming Winter School,
   Graz, Austria.

7. 9th International Nathiagali Summer College on Physics and Contemporary Needs,
   Islamabad, Pakistan, 14 - 30 July 1984.

8. Latin American School of Physics: Non-Linear Phenomena in Physics, ELAF,
   Santiago, Chile, 16 July - 3 August 1984.

9. International Conference on Luminescence,
   Madison, Wisconsin, USA. 13 - 17 August 1984.

10. Multiciencias,
    Lima, Peru, 13 - 24 August 1984.

11. Vacation School on "the Theory and Practice of Mathematical Modelling",
    Ibadan, Nigeria, 17 - 28 September 1984.

12. Winter School on Photovoltaic Technology,
    Bangkok, Thailand, 10 - 21 December 1984.

13. Winter Workshop on Recent Advances in Theoretical Physics,
    Kanpur, India, 10 - 22 December, 1984.

14. 2nd Symposium of SAMSA,
    Lusaka, Zambia, December 1984.

15. Course on Biophysics,
    Bogota, Colombia,

16. International Conference on Magnetic Resonance in Biological Systems,
    Bombay, India, Autumn 1984.

17. African Regional Seminar on the Role of Scientific and Engineering Societies in Development,
    Grand Bassam, Ivory Coast, 10 - 13 December 1984

18. International Bose Symposium on Statistical Physics,
    Calcutta, India, 27 December 1984 - 1 January 1985

D. Hosted Activities

- IUPAP General Assembly
  8-12 October 1984

- 3rd Meeting on ALGEDOP - Doppler Campaigns,
  17 February 1984.
  - organized by: Prof. M. Zadro and Dr. C. Marchesini, University of Trieste, and Institute for Geodesics and Geophysics, Trieste, Italy.

- Phenomenology of Elementary Particles,
  26 - 28 March, 1984.
  - organized by: INFN., Trieste, Italy.

- Workshop on New Perspectives in X-Ray Synchrotron Radiation,
  11 - 15 June 1984.
  - organized by: Prof. R. Rosei and L. Fonda, SISSA., Trieste, Italy.

- Ecology and Economy, 23 June 1984
  - organized by: DANECO, Italy.

- Course on "Data Treatment in Astronomy and Astrophysics", 9 - 13 July 1984.
  - organized by: Astronomical Observatory, Trieste, Italy.

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[16] IL-TONG CHEON - Electron scattering from ^{6}Li and ^{9}Be.

[17] H.M. HUSSEIN - Effect of the mass of odd-even nuclei on the quadrupole moments.

[18] G. MUKHERJEE and S.K. SHARMA - Inelastic electron scattering from factors involving the second excited 2^{+} levels in the nuclei ^{48}Ti and ^{50}Cr.

[19] M.S. CHOWDHURY, H.M. SEN GUPTA and M.A.M. SHAHABUDDIN - Bound levels in ^{29}P populated in the ^{28}Si (^{3}He,d) reaction.

[20] HORACIO S. WIO - Transformation law for response fluxes within the collision probability method.

[27] H.M. SEN GUPTA - Positive parity levels populated in the $^{17}O(^{3}He,p)^{19}F$ reaction.

[34] F. CARSTOIU, O. DUMITRESCU, G. STRATAN and M. BRAIC - On parity violation in alpha decay.

[41] S.B. KHADKIKAR and C.R. PRAHARAJ - Band crossing's in mercury nuclei: effect of occupation of i13/2 neutron orbits.

[45] G.K. UPADHYAYA and K.P. JOSHI - Effective interactions in p-shell nuclei and the realistic interactions - I.

[195] S. ALI, A.A.Z. AHMAD and N. FERDOUS - A survey of the alpha-nucleon interaction.

[206] S. ALI, A.M. KHAN and G. SCHIFFRER - Equivalent local potentials from non-local separable ones.

[230] A.N. ANTONOV, CHR.V. CHRISTOV and I.ZH. PETKOV - Generator coordinate calculations of ^{4}He and ^{16}O nuclei with Skyrme-like forces and square-well construction potential.

[1] N.S. CRAIGIE, U. KATZNELSON and C. REBBI - QCD sum rules, the spontaneous breakdown of chiral symmetry and short distance behaviour in lattice gauge theories.

[2] A. PRAMUDITA - $K_L \to \gamma\gamma$ in supersymmetric gauge theory.

[3] M.H. SARMADI - Spontaneous compactification in quantum Kaluza-Klein theories.

[4] G. DENARDO and E. SPALLUCCI - Coleman-Weinberg model in the Einstein space-time.

[5] IL-TONG CHEON - Mössbauer experiment to observe significance of vector potentials in quantum theory.

[11] N.S. CRAIGIE and W. NAHM - Non-linear sigma model and zero mass bound states of QCD_2.

[12] S. RAJPOOT - Neutral current interactions beyond the standard $SU(2)_L \times U(1)$ model.

[15] S. RANDJBAR-DAEMI, ABDUS SALAM and J. STRATHDEE - On $SU(3) \times SU(2) \times U(1)$ compactifying solutions to 11-dimensional supergravity.

[21] S. RANDJBAR-DAEMI, ABDUS SALAM and J. STRATHDEE - Towards a self-consistent computation of vacuum energy in 11-dimensional supergravity.

[26] CHANDRESEKHAR MUKKU - Gauge theories in external electromagnetic fields: the standard $SU(2) \times U(1)$ model.

[32] R. HOJMAN and J. ZANELLI - Constrained Hamilton formalism for unconstrained classical mechanics.

[36] N.S. CRAIGIE and J. STERN - Effective gauge theories of composite W, Z and massless fermions.

[37] E. MAHDAVI - On supersymmetric four-fermion interactions.

[39] R. HOJMAN and J. ZANELLI - A generalized conserved traces theorem for any classical system.

[40] V. ALDAYA and J.A. de AZCARRAGA - A note on the meaning of covariant derivatives in supersymmetry.

[42] A.Z. JADCZYK - Colour and Higgs charges in G/H Kaluza-Klein theory.

[43] A. GALPERIN, E. IVANOV, S. KALITZIN, V. OGIEVETSKY and E. SOKATCHEV - Unconstrained N=2 matter, Yang-Mills and supergravity theories in harmonic superspace.

[46] B.W. LYNN and R.G. STUART - Standard model electroweak radiative corrections to longitudinal polarization asymmetry A_{pol} and forward-backward asymmetry A_{FB} in $e^+e^- \to \mu^+\mu^-$ on and off the Z^0 resonance.

[47] P.T. CHRUSCIEL and J. KOWALSKI-GLIKMAN - The isometry group and Killing spinors for the pp-wave space-time in D=11 supergravity.

[48] T. CHRISTODOULAKIS and J. ZANELLI - Operator ordering in quantum mechanics and quantum gravity.

[50] H. NISHINO and E. SEZGIN - Matter and gauge couplings of N=2 supergravity in six dimensions.

[52] C.S. AULAKH - Towers and ladders: infinite parameter symmetries in Kaluza-Klein theories.

[53] IRSHADULLAH KHAN - A new Poincaré supersymmetric algebra and spontaneous generation of local gauge symmetry.

[54] H. NISHINO, J.A. HELAYEL-NETO and IN-GYU KOH - Stability of mass hierarchy in locally supersymmetric grand unification.

[55] C.O. NWACHUKU and M.A.RASHID - New expressions for the eigenvalues of the invariant operators of the general linear and the ortho-symplectic Lie superalgebras.

[57] ABDUS SALAM and E. SEZGIN - Chiral compactification on Minkowski x S^2 of N=2 Einstein-Maxwell supergravity in six dimensions.

[58] N.S. CRAIGIE - A composite model of electroweak interactions and its manifestation at current collider energies.

[60] N.S. CRAIGIE, W. NAHM and K.S. NARAIN - New selection rules for the SU(5) monopole catalyzed proton decay reactions.

[62] S. RANDJBAR-DAEMI, ABDUS SALAM and J. STRATHDEE - Chiral families and stable compactifications.

[64] I.M. KHALATNIKOV, E.M. LIFSHITZ, K.M. KHANIN, L.N. SHCHUR and Ya.G. SINAI - On the stochasticity in relativistic cosmology.

[65] E. SEZGIN - The spectrum of D-11 supergravity via harmonic expansions on $S^4 \times S^7$.

[66] OMAR FODA - The gravitational analogue of the Witten effect.

[67] B.B. DEO and S. JAMES GATES Jr. - Non-minimal N=11 supergravity and broken global supersymmetry.

[70] H.S. SHARATCHANDRA -Effective Lagrangians for SUSY QCD with properties seen in perturbation theory.

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[73] BARNANA ROY GHOSH and R.K. ROY CHOUDHURY - Group-theoretic approach to the potential $-\alpha/r + Kr$ in the relativistic case.

[75] H. AKCAY - Matter-antimatter oscillations and proton decay in E_6.

[77] P. CANDELAS - Compactification and supersymmetry of chiral N=2 D=10 supergravity.

[78] A. AURILIA, G. DENARDO, F. LEGOVINI and E. SPALLUCCI - Vacuum tension effects on the evolution of domain walls in the early universe.

[79] N.S. CRAIGIE and W. NAHM - The s-wave SU(5) monopole-fermion system reduces to a coupled set of exactly solvable QFTs.

[80] G. SENJANOVIC - Mirror fermions and cosmology.

[85] D.S. KULSHRESHTHA - The $c\bar{c}$ and $b\bar{b}$ spectroscopy in the two-step potential model.

[89] N.S. CRAIGIE, N. PAVER and RIAZUDDIN - QCD determination of the A_1-ρ-π system through vertex light cone sum rules.

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[101] OMER OGUZ - Instantons in six-dimensional Einstein-Yang-Mills system.

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[129] I.G. KOH and H. NISHINO - Towards realistic D=6, N=2 Kaluza-Klein supergravity on coset $E_7/SO(12) \times Sp(1)$ with chiral fermions.

[139] ASGHAR QADIR - The structure of the pseudo-Newtonian force about a rotating charged mass.

[140] M.A. RASHID - Evaluation of integrals involving powers of $(1-x^2)$ and two associated Legendre functions or Gegenbauer polynomials.

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[150] LING-LIE CHAU, GE MO-LIN and ROSY TEH - Regular Riemann-Hilbert transforms, Bäcklund transformations and hidden symmetry algebra for some linearization systems.

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[170] ABDUS SALAM - Kaluza-Klein proposal and electro-nuclear gravity.

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[172] IRSHADULLAH KHAN and ASGHAR QADIR - General relativistic singularity free description of matter.

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[179] AMITAVA DATTA - D^0-$\bar{D}^0$ mixing: standard vs. non-standard scenarios.

[180] C. MUKKU - Hot gauge theories in external electromagnetic fields II: phase structure of $SU(2)_L \times U(L)_Y$.

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[183] V. MOLOTKOV - Infinite dimensional $\mathbb{Z}_2^k$-supermanifolds.

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[210] N.V. KRASNIKOV - On the renormalization of the theories with γ_5 anomalies.

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[24] G. TUNCAY and M. TOMAK - Empirical tight-binding band structure of wurtzite semiconductors: SiC, ZnSe and ZnTe.

[25] E. ERBARUT and M. TOMAK - A localized orbital description of Si, Ge and GaAs.

[28] R. KUMARAVADIVEL and M.P. TOSI - Pair potentials and structure factors of liquid alkali metals.

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[61] P.A. TUPENEVICH, E.V. BUZANEVA and V.K. KONONENKO - Surface states in In-ZnTe structures.

[63] C.W. LUNG and WANG LI - The image force on the dislocation near a crack tip.

[68] C.W. LUNG - Interaction of a dislocation with a crack.

[69] R. KUMARAVADIVEL - Effective interionic pair potentials in liquid alkali metals.

[71] R. BAQUERO, J.G. IBARRA, K.E. KIHLSTROM and T.H. GEBALLE - Eliashberg theory applied to the study of the series Nb-Ge.

[74] S. BALASUBRAMANIAN and M.TOMAK - On the effective mass theory for shallow donors in many valley semiconductors.

[76] J.S. NKOMA - Surface polariton propagation along an interface between two metallized surfaces.

[81] A. PAJA and T. STOBIECKI - Electrical resistivity of amorphous $Fe_{1-x}B_x$ alloys.

[82] K. KUŁAKOWSKI - A note on D-dimensional Ising model, S = 1/2, with field.

[83] H. NENCKA-FICEK - Overblocking effect for 2-spin interactions in some 3-dimensional structure.

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[87] P.R. RAO and G. MUKHOPADHYAY - Van der Waals interaction between metal and atom.

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[93] SURENDRA SINGH - The effect of metal-non-metal transition on the low temperature magnetothermal conductivity of boron doped silicon.

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[97] SU ZHAO-BIN and YU LU - Soliton and polaron generation in polyacetylene.

[98] SU ZHAO-BIN, WANG YA-XIN and YU LU - Quantum fluctuation of the order parameter in polyacetylene.

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[104] C.W. LUNG - Analysis of K_{IC} and its temperature dependence of metals with a simplified dislocation model.

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[130] R. ASOKAMANI, M.B. SUVASINI, M. RAJAGOPALAN and V. SUNDARARAYAN - Phonon frequency shifts and the pressure dependence of Tc in lanthanum.

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[132] M. ROVERE and M.P. TOSI - On the density-wave theory of classical Wigner crystallization.

[133] R.J. RADWANSKI, J.J.M. FRANSE, K. KROP, R. DURAJ and R. ZACH - Pressure effect on the Curie temperature of $Dy_2Fe_{17-y}Al_y$ compounds.

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[135] M. YUSSOUFF and A. MOOKERJEE - Theory of neutron scattering in disordered alloys.

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[30] K.R. YACOUB - On classification of finite groups with four generators three of which having orders p,p,q (p < q) II.

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[44] XIONG JINCHENG - Sets of recurrent points of continuous maps of the interval.

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[190] A. ROY CHOWDHURY and PRANAB K. CHANDA - To the complete integrability of long wave-short-wave interaction equations.

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[192] M.A. HOSSAIN and A.C. MANDAL - Effects of mass transfer and free convection on the unsteady MHD flow past a vertical porous plate with variable suction.

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