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INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS

Scientific Activities in 1983

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INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS:
SCIENTIFIC ACTIVITIES IN 1983
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A REVIEW

of the scientific activities of the ICTP, Trieste, Italy
during 1983

The main fields of research and training-for-research, divided into their programme components, at the International Centre for Theoretical Physics in 1983 were:

Physics and energy

Plasma physics; Non-conventional energy; Nuclear physics

Fundamental Physics

Elementary particles and Fundamental theory

Physics of the living state

Medical physics; Applications of physics to medicine and biology

Physics and Technology

Condensed matter physics and related; Atomic, molecular and laser physics; Physics of communications

Mathematics

Applicable mathematics

Physics of the Environment and of Natural Resources

Soil physics; Geophysics

Other fields

Physics and Energy

The Centre maintained a high level of activity in this component, commencing with a Spring College on Radiation in Plasmas, held from 24 May to 17 June and attended by 183 scientists -- 85 from developing Member States. This was followed by a conference and workshop on Non-Conventional Energy Sources, bringing together 168 scientists, 115 of whom were from developing nations.

The Conference (20-25 June) dealt with the general state of the art, as well as specific research projects; the Workshop (20 June - 8 July) was

dedicated to a review of recent developments in the main branches of non-conventional energy and to applications in developing as well as in industralized countries.

From 10 to 14 October, another workshop-cum-symposium was held, this time dedicated to Perspectives in Nuclear Physics at Intermediate Energies, and organized in collaboration with the Italian National Institute for Nuclear Physics (INFN); 95 scientists (21 from developing countries) attended the workshop.

Fundamental Physics

The research group in elementary particles and fundamental theory continued its activity throughout the year; 187 researchers took part in the 1983 programme. Their studies were enhanced by a topical conference on Radiative Corrections in $SU(2)_L xU(1)$, held from 6 to 8 June and by the Colloquium on Group Theoretical Methods in Physics, which took place from 5 to 10 September; besides those present at the time, respectively 26 and 154 additional scientists came to these conferences. The latter meeting was organized in collaboration with the International School for Advanced Studies and the INFN. From 20 June to 31 July, a workshop on Particle Physics was organized to allow the Centre's Associates, Affiliates and others working on related projects an opportunity to interact with the EP research group as well as with well-known leaders in the field; recent developments were presented and individual research reviewed and discussed in informal seminar sessions; 92 scientists participated in the workshop, 54 of them from developing countries.

Physics and the Living State

This year a workshop in Medical Physics was held from 17 October to 4 November. Its aim was to provide a basic, conceptual understanding and practical working experience to those wishing to collaborate in health programmes or to establish research activities in the field of medical physics. Of the 57 scientists who participated in this activity, 33 were from developing countries. The workshop was followed by the II International Conference on the Applications of Physics to Medicine and Biology, in which over 250 scientists and professionals took part.

Physics and Technology

The condensed matter physics research group also carried out its activity throughout the year; 67 scientists, of whom 44 were from developing countries, participated in the research projects. The annual Workshop in Condensed

Matter Physics was held from 20 June to 9 September and allowed for the fruitful interaction of 243 scientists, of whom 162 were from developing Member States. During the workshop, a working group on Solitons in Condensed Matter was organized; in addition two topical meetings were held. The first dealt with the Physics of Latent Image Formation in Silver Halides; this was attended by 37 scientists. The second was dedicated to Computer Simulation of Quantum Systems; 35 scientists participated in this activity. These figures refer to scientists in addition to those present for the workshop during the period when these conferences were being held.

Another activity in this programme component was the Winter College on Lasers, Atomic and Molecular Physics, held from 24 January to 25 March as a follow-up to courses in the same field held in previous years. Altogether 126 scientists, of whom 85 were from developing countries, took part in the course.

A new endeavour in this programme component was held from 14 November to 2 December, when for the first time the Centre held a workshop-cum-college on the Physics of Communications. The Workshop was intended to develop the fundamental mathematical and physical basis of modern communication systems, including the new directions emerging from the last two decades of significant advances in space research. Altogether 62 scientists took part in this activity, over 80% of them from developing countries.

Mathematics

The second college on Microprocessors: Technology and Applications in Physics was organized in collaboration with the CERN group in view of the great interest shown in the first course, held in 1981. This year's course brought together 134 researchers, 98 of whom were from developing Member States. A high-level of interest was shown, as well, in the Summer School on Dynamical Systems in which 211 scientists took part, the majority (138 scientists) representing developing nations.

Physics of the Environment and of Natural Resources

The Centre and the U.N. Financing System for Science and Technology for Development were co-sponsors this year of a regional activity in this component -- the Training Workshop on Monsoon Rainfall Prediction, held in Bangladesh in June. A college dedicated to another important subject of this component -- Soil Physics -- took place at the Centre from 19 September to 7 October. This activity was co-sponsored by the Italian Dipartimento per la Cooperazione allo Sviluppo, and attracted 79 scientists, 58 of whom were from developing countries. From 5 to 16 December a workshop was also organized on

Pattern Recognition and Analysis of Seismicity; 60 scientists, 36 of whom were from developing Member States, took part in the workshop.

Other fields

A. The Physics and Development programme, which began in 1982 with the aim of increasing the awareness of scientists of the role of physics in social and economic development, continued throughout the year. Lectures were delivered by invited speakers and by various scientists already present for the scheduled activities described above.

B. Once again a number of scientists wishing to carry out independent research projects, in fields in which no activity was scheduled during this year or in periods when the activity in their particular field was not being held, came to avail themselves of the Centre's facilities and to interact with other scientists present at that time. This year such independent researchers were 136, the majority of them (96) from developing nations.

In all, the Centre welcomed some 2,188 scientists during 1983, for a total of 1,811 man-months. The percentage of visitors from developing Member States was 53.0, representing 77.2% of the total man-months. Among the Member States Angola, Fiji, and the Democratic People's Republic of Korea were this year represented for the first time

The Centre gave financial or organizational support to numerous acitivites organized in the regions in response to the needs of scientists from developing countries. This year the Centre also hosted an International Conference on Calcium-Binding Proteins and a Congress on Clusters and Groups of Galaxies; these activities were organized by the University of Trieste.

Close collaboration has continued, as in past years, with the International School for Advanced Studies (SISSA) and the Institute of Physics of the University of Trieste.

INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS, TRIESTE
CALENDAR OF SCIENTIFIC ACTIVITIES, 1983

JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER

Spring College on Radiation in Plasmas (24.5-17.6) TOT=183 DEV=85

Conference & Workshop on Non-Conventional Energy Sources (20.6-8.7) TOT=168 D=115

Workshop on Perspectives in Nuclear Physics at Intermediate Energies (10-14.10) TOT=95 DEV=21

ELEMENTARY PARTICLE & FUNDAMENTAL THEORY RESEARCH (Throughout the year) TOT=187 DEV=101

Topical Meeting on Radiative Corrections in $SU(2)_L xU(1)$ (6-8.6) TOT=26 DEV=1

Summer Workshop in Particle Physics (21.6 - 31.7) TOT=92 DEV=54

XII International Colloquium on Group Theoretical Methods in Physics (5-10.9) TOT=154 DEV=63

Workshop in Medical Physics (17.10-4.11) TOT=55 DEV=33

II International Conference on Applications of Physics to Medicine & Biology (7-11.11) TOT=259 DEV=67

CONDENSED MATTER PHYSICS RESEARCH & RELATED (Throughout the year) TOT=67 DEV=44

Winter College on Lasers, Atomic & Molecular Physics (24.1-25.3) TOT=126 DEV=85

Workshop in Condensed Matter Physics (20.6-9.9) TOT=243 DEV=162

III Symposium on the Physics of Latent Image Formation in Silver Halides (11-14.7) TOT=37 DEV=1

IV Symposium on Computer Simulation (20-22.7) TOT=35 DEV=6

Workshop on Physics of Communications (14.11-2.12) TOT=62 DEV=51

II College on Microprocessors: Technology & Applications in Physics (18.4-13.5) TOT=134 DEV=98

Summer School on Dynamical Systems (1-26.8) TOT=211 DEV=138

College on Soil Physics (19.9-7.10) TOT=79 DEV=58

Workshop on Pattern Recognition & Analysis of Seismicity (5-16.12) TOT=60 DEV=36

NOTE: TOT=Total number of participants. DEV=Number of participants from developing Member States. TOTAL NUMBER OF PARTICIPANTS = 2,409, while TOTAL NUMBER OF VISITORS = 2,188, since certain scientists took part in more than one activity. The total of 2,409 is reached by adding above figures for scheduled activities, plus 136 who came for miscellaneous research and/or organizational activities (DEV=96). Of the total of 2,409 participants, DEV=1,340 while of the total of 2,188 visitors, DEV=1,160 (53.0%).

STATISTICAL SUMMARY OF PARTICIPATION IN THE RESEARCH AND TRAINING-FOR-RESEARCH ACTIVITIES AT THE ICTP DURING 1983

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	TOTALS
Developing countries in:																					
AFRICA	18	33	4	12	–	6	9	7	11	8	5	30	–	–	15	20	46	18	9	30	281
ASIA	39	36	4	40	–	24	15	13	18	46	18	51	–	3	26	49	27	29	12	49	499
EUROPE	16	24	13	36	1	18	30	5	31	12	16	69	1	3	5	10	33	2	5	12	342
INDONESIA & OCEANIA	1	2	–	2	–	1	–	2	2	3	–	–	–	–	–	3	1	1	1	–	19
NORTH & CENTRAL AMERICA	1	4	–	–	–	–	4	1	1	–	–	–	–	–	1	5	6	1	4	–	28
SOUTH AMERICA	10	16	–	11	–	5	5	5	4	16	5	12	–	–	4	11	25	7	4	4	144
INTERNATIONAL ORGANIZATIONS	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	2
Total A	85	115	21	101	1	54	63	33	67	85	44	162	1	6	51	98	138	58	36	96	1,315
Industrialized countries in:																					
ASIA	7	4	3	10	–	4	3	–	–	1	1	2	2	1	–	–	1	–	–	–	39
EUROPE	51	38	66	54	23	15	71	17	181	32	18	60	26	20	10	18	68	16	23	36	843
INDONESIA & OCEANIA	1	–	–	–	–	–	–	–	2	–	–	–	–	1	–	–	–	–	–	–	4
NORTH & CENTRAL AMERICA	33	7	4	18	2	19	17	2	8	8	3	18	8	–	1	3	4	3	1	3	162
INTERNATIONAL ORGANISATIONS	6	4	1	4	–	–	–	3	1	–	1	1	–	7	–	15	–	2	–	1	46
Total B	98	53	74	86	25	38	91	22	192	41	23	81	36	29	11	36	73	21	24	40	1,094
Total A + B	183	168	95	187	26	92	154	55	259	126	67	243	37	35	62	134	211	79	60	136	2,409

KEY:

I. Spring College on Radiation in Plasmas (24.5-17.6)
II. Conference on Non-Conventional Energy Sources (20.-25.6) and Summer Workshop on the Physics of Non-Conventional Energy Sources (27.6.-8.7)
III. Workshop on Perspectives in Nuclear Physics at Intermediate Energies (10.-14.10)
IV. Elementary Particle Physics & Fundamental Theory Research (throughout the year)
V. Topical Conference on Radiative Corrections in $SU(2)_L xU(1)$ (6.-8.6)
VI. Summer Workshop in Particle Physics (21.6.-31.7)
VII. XII International Colloquium on Group Theoretical Methods in Physics (5.-10.9)
VIII. Workshop in Medical Physics (17.10.-4.11)
IX. II International Conference on Applications of Physics to Medicine and Biology (7.-11.11)
X. Winter College on Lasers, Atomic and Molecular Physics (24.1.-25.3)
XI. Condensed Matter Physics Research (Throughout the year)
XII. Research Workshop in Condensed Matter Physics (20.6.-9.9)
XIII. Third Symposium on the Physics of Latent Image Formation in Silver Halides (11.-15.7)
XIV. Fourth Symposium on Computer Simulation of Quantum Systems (20.-22.7)
XV. Workshop on Physics on Communications (14.11.-2.12)
XVI. Second College on Microprocessors: Technology and Applications in Physics (18.4.-14.5)
XVII. Summer School on Dynamical Systems (1.-26.8)
XVIII. College on Soil Physics (19.9.-7.10)
XIX. Workshop on Pattern Recognition and Analysis of Seismicity (5.-16.12)
XX. Miscellaneous Research & Organizational Activities (Throughout the year)

Participation in the research and training-for-research activities of the ICTP
since January 1983

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 of visitors	Number of man-months
Africa	247	-	274.65	-	247	274.65
Asia	421	38	622.26	46.61	459	668.87
Europe	316	791	291.31	251.50	1107	542.81
Indonesia & Oceania	16	4	20.87	.65	20	21.52
North & Central America	27	156	19.28	103.63	183	122.91
South America	131	-	169.06	-	131	169.06
International Organizations	2	39	.49	10.68	41	11.17
Totals	1,160	1,028	1,397.92	413.07	2,188	1,810.99
Grand Totals	2,188		1,810.99			

Percentage representation from developing countries: Number of visitors = 53.0
Number of man-months = 77.2

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
since January 1983

Geographic area	Long-term activities		Short-term activities		T O T A L	
	Number of visitors	Number of man-months	Number of visitors	Number of man-months	Number of visitors	Number of man-months
Developing countries:						
Africa	225	266.65	22	8.00	247	274.65
Asia	392	611.16	29	11.10	421	622.26
Europe	241	272.46	75	18.85	316	291.31
Indonesia & Oceania	15	20.64	1	.23	16	20.87
North & Central America	19	16.78	8	2.50	27	19.28
South America	122	165.94	9	3.12	131	169.06
International Organizations	1	.39	1	.10	2	.49
Totals	1,015	1,354.02	145	43.90	1,160	1,397.92
Industrialized countries:						
Asia	30	45.08	8	1.53	38	46.61
Europe	394	195.31	397	56.19	791	251.50
Indonesia & Oceania	1	.26	3	.39	4	.65
North & Central America	114	95.49	42	8.14	156	103.63
International Organizations	37	10.51	2	.17	39	10.68
Totals	576	346.65	452	66.42	1,028	413.07
Grand Totals	1,591	1,700.67	597	110.32	2,188	1,810.99

Percentage representation from developing countries: Number of visitors = 53.0
Number of man-months = 77.2

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.

SCIENTIFIC PROGRAMME

Physics and Energy

Title: Spring College on Radiation in Plasma

Dates: 24 May - 17 June 1983

Organizers: Directed by:
B.B. Kadomtsev (Kurchatov Institute, Moscow, USSR),
B. McNamara (Lawrence Livemore National Laboratory, California, USA), and M. N. Rosenbluth (University of Texas, Austin, USA) with the assistance of an International Advisory Group comprising: M. A. Abdallah (USA), M. N. Bussac (France), E. M. Campbell (USA), W. Grossman (USA), C. Kennel (USA), R. L. Morse (USA), K. Nishikawa (Japan), A. Nocentini (Italy), P.H. Sakanaka (Brazil) and R. K. Varma (India).

Purpose: The aim of this course was to provide depth by focussing on the special interest of the various interactions of radiation with plasma.

Programme: Topics:
- Wavelength scaling of laser-plasma interactions
- Electromagnetic fluctuations in space plasmas
- Heating, instabilities and radiation in magnetized plasmas
- Plasmas physics teaching and research in developing countries

The following lectures were given:
Transport processes in laser plasmas; Shocks and particle acceleration; Nonlinear stability of bounded astrophysical plasmas; Loss-cone beam parametric instability in magnetosphere; Alfven solitons in solar wind; Collective accelerators; High energy accelerator needs; Particle aaceleration by laser light; Laser beat accelerator for ultrahigh energies; Beat wave accelerators; Possible instabil-

ities in the beat wave accelerator; A beat wave accelerator design; The Wisconsin beat wave proton accelerator; A compact toroid plasma accelerator; Laser and REB Plasmas; Convective effects within diffusive processes in a magnetized plasma; UV and X-ray lasers; Summary of wavelength scaling experiments; Absorption of laser radiation by turbulent plasma; Generation of non-thermal electrons in laser plasma interactions: Stochasticity and nonlinear dynamics; Plasma waves in space; Collisionless shock theory; Cosmic rays; Symposium on space plasmas; Modern concepts of collisionless shock waves; Relativistic acceleration of cosmic rays; Reconnection in space plasma; Nonlinear relativistic, Langmuri waves in astrophysical magnetospheres; Nonlinear wave transformation due to harmonic generation in magnetoactive plasma; Large amplitude electromagnetic waves and their astrophysical applications; Radiation from plasmas; Solitary waves in plasmas; Nonlinear waves in astrophysical plasmas; CO_2 Laser plasma experiments; High-intensity laser interaction with longer-scalelength plasmas; Studies of laser-ablative acceleration of foil targets; High power laser and laser plasma; Non-classical effects on laser heating; Generation of quasi stationary magnetic fields by strong E.M. waves; Stochastic motion of a charged particle in E.M. waves, strongly reflected from inhomogenous plasma; Displacement of the 2W line in CO_2 laser plasma interaction: Theory of wavelength scaling of laser-plasma coupling; Wavelength scaling of parametric instabilities in laser-plasma experiments; Wavelength effects on laser absorption and target compression; Laser studies at Soreq using Gaussian and shaped pulses; Lateral energy transport in laser plasmas; Hamiltonian formulation of Ponderomotive effects in fusion plasmas; Thermal smoothing measurements by shock transits in foil targets; Numerical simulation of laser plasmas; Laser experiments in Garching and FDR.

Participation:	Total visitors:		183
	From developing countries:		85
Representation:	Africa	developing:	18
	Asia	developing:	39
		industrialized:	7
	Europe	developing	16
		industrialized:	51
	Indonesia & Oceania	developing:	1
		industrialized:	1
	North & Central America	developing:	1
		industrialized:	33
	South America		10
	International organizations representing industrialized:		6

Title: Conference on Non-Conventional Energy Sources
and
Summer Workshop on the Physics of Non-Conventional Energy Sources

Dates: 20 June - 8 July 1983

Organizers: Professors G. Furlan (University of Trieste/ICTP, Italy) N.A. Mancini (University of Catania, Italy), and A.A.M. Sayigh (Kuwait Institute for Scientific Research, Safat, Kuwait).

PART I Conference on Non-Conventional Energy Sources

20 June - 25 June 1983

Purpose: The Conference was based on plenary lectures on the state of the art, while invited papers and communications were devoted to the presentation of specific research projects.

Programme: Topics:
- Solar Energy Conversion
- Materials Science Aspects
- Advanced Solar Energy Technology in Building Climatization and in Rural applications
- Power Generations
- Energy Planning and Management

The following lectures were given:

Energy scenario and the role of the microclimatological parameter; Energy planning with special reference to developing countries; Solar radiation fundamentals and data presentation; Activities of the International Energy Agency; Photothermal energy conversion progress and future prespectives; The Eurelios project: operational experience and prespectives of solar power plants; Some materials science aspects of photothermal conversion; Solar mapping of the Arab world; Solar radiation instruments, calibration and maintenance; Photovoltaic power production of amorphous semiconductors; Photovoltaic conversion technology; Relevance of photovoltaic for developing countries; Solar cells from poly and semi-crystalline silicon; Pumping water with solar cells; Bioclimatic design; Efficient uses of energy in building; Design and planning; Solar ponds; Rural applications; Power generation from wind; Geothermal energy; Hydrogen energy systems.

PART II Summer Workshop on the Physics of Non-Conventional Energy Sources

27 June - 8 July 1983

Purpose: To review from the highest scientific standpoint, recent developments in the main branches underlying non-conventional energy problems. Applications in developing as well as in industrialized countries were also discussed.

Programme: Topics:
- Solar Energy Conversion
- Materials Science Aspects
- Advanced Solar Energy Technology in Building Climatization and in Rural applications
- Power Generations
- Energy Planning and Management

The following lectures were given:

Wind energy; Electro-optical characterization of solar cells; Photothermal energy conversion; Solar in the energy crisis; Usual applications of hydrogen; Photovoltaic conversion technology; Wind energy conversion systems - horizontal and vertical axis machines; Some new approaches to spectral selectivity; Small wind systems for remote locations; Chemical aspects of bioconversion; The wind: a promising energy source; Biomass for energy in developing countries; Lecture on Max Planck; Modelling of energy economy interaction; Solar energy components and systems; Photoelectrochemical aspects of solar energy conversion; Sun finder and tracker; Nature and modelling of energy demand; Modelling and simulation of solar energy systems; An overview of design methods for solar water heating systems; Assessment of long term energy demand and role of renewables; Design of small power photovoltaic systems; Thermal storage; Modelling of energy supply system; Hydrogen production by thermochemical decomposition of water; Realization of simple photovoltaic systems; Solar thermal devices - 2nd law considerations;

Participation: for both the Conference and Workshop

Total visitors:		168
From developing countries:		115

Representation:

Africa	developing:	33
Asia	developing:	36
	industrialized:	4
Europe	developing:	24
	industrialized:	38
Indonesia & Oceania	developing:	2
North & Central America	developing:	4
	industrialized:	7
South America		16
International organizations representing industrialized:		4

Title: Workshop on Perspectives in Nuclear Physics at Intermediate Energies

Dates: 10 - 14 October 1983

Organizers: Professors S. Boffi (Univ. of Pavia, Italy), C. Ciofi degli Atti (INFN, Rome, Italy), and M.M. Giannini (Univ. of Genoa, Italy).

Purpose: The Workshop reviewed recent work and discussed the trends in nuclear physics at intermediate energies.

Programme: Topics:
- Fundamental interactions and the many-body problems
- Electromagnetic interactions with nuclei
- Hadronic interactions with nuclei
- Quarks in nuclei
- Hadronic matter under extreme conditions

The following lectures were given:

Elastic scattering of nucleons at intermediate energies; Momentum distribution in nuclear matter; Momentum distribution in finite nuclei; Solution of Schrodinger equation with two-body correlations included; Charge dependence of nuclear forces; e-d and/or N-d scattering; N-d polarization observables and NN off-shell interactions; The dependence on the mass number of the r.m.s. radius and the oscillator spacing for a hyperon in a nucleus; Phenomenological estimate of the Λ-well depth; Electromagnetic exchange currents in light and heavy nuclei; Subnuclear degrees of freedom in nuclear photon scattering; Photon scattering and quantum electrodynamics; Mesonic contributions to photon scattering off the deuteron; Deuteron forward photodisintegration: πmeson currents and relativity; Relativistic effects in deuteron photodisintegration energies; Proton capture to the ground and excited states in light nuclei; Strength distribution of giant resonances at high excitation energy; A critical discussion

of the one-body mechanism in electromagnetic knockout actions; Photoproduction of pions, radiative pion capture and nuclear structure; Single and coincidence experimental results of π absorption at rest in light nuclei; Planned experiments with polarized electrons at the MAMI facility in Mainz; Consideration of polarization in electron scattering; Deep inelastic scattering from nuclear constituents; Electromagnetic longitudinal and transverse response functions interaction effects and scaling behaviour; Electromagnetic interactions of nucleons in nuclei; Linear response in nuclei; Deep inelastic electron scattering from complex nuclei; Relativistic effects in quasi elastic electron scattering; Longitudinal and transverse form factors on $^{12}C(e,e')$ in RPA continum theory; The role of MEC and nuclear correlations in the spin-isospin nuclear response; Nuclear dynamics in spin-isospin excitations; Structure in elastic and total cross sections of antinucleons with nuclei; Electromagnetic disintegration of the deuteron with explicit deltas in coupled channel treatment; Strange and non-strange N^* excitation in nuclei - brief review and outlook; High energy approximation for nuclear knockout form factors; Δ propagation in nuclear matter and photoabsorption at intermediate energy; Exchange effects and the pion optical potential in photoabsorption on nuclei at intermediate energy; Photoproduction close to the production threshold on complex nuclei; Chiral symmetry breaking and the pion; Multiple scattering in pion production; Some recent developments in the quark model; Non-linear pion field effects in chiral bag models; Hadronic magnetic moments and bag size; A new proposal about the quark structure of nuclei; Electromagnetic properties of light nuclei and nucleon structure; Spin-isospin correlations at normal and high densities; Quark spin-flavour layered structure with condensed field in chiral bag model; Realistic NN interaction and the possibility of pion condensation in finite nuclei; On the coding of neutron star with a charged pion condensate; SM spin-isospin phases in nuclei at high densities; Anharmonic effects in pionic modes in neutron and symmetric nuclear matter; Dynamics of the quark bag vibration: validity of the adiabatic approximation; Variational approach to nucleon isobars in the framework of the cloudy bag model.

Participation:	Total visitors:		95
	From developing countries:		21
Representation:	Africa	developing:	4
	Asia	developing:	4
		industrialized:	3
	Europe	developing:	13
		industrialized:	66
	North & Central America	industrialized:	4
	International organizations representing industrialized:		1

Nuclear Physics preprints and internal reports issued in 1983

[4] A.M. HARUN-ar-RASHID and T.K. CHAUDHURY - Low-energy proton Compton scattering

[5] A.M. HARUN ar RASHID and T.K. CHAUDHURY - Effect of two-pion exchange in nucleon-nucleon scattering in high partial waves

[15] IL-TONG CHEON - Electron scattering from ^{13}C

[26] A. AMUSA - Comparison of model Hartree-Fock schemes involving quasi-degenerate intrinsic Hamiltonians

[27] A. AMUSA and R.D. LAWSON - Low-lying negative parity states in the nucleus $^{90}_{40}Zr$

[68] LALI CHATTERJEE and S. BHATTACHARYYA - Muon decay from μ-molecular states

[197] M.Y.M. HASSAN and S. RAMADAN - On the properties of nuclear matter with an excess of neutrons, of spin-up neutrons and of spin-up protons using Skyrme interactions

[198] M.Y.M. HASSAN and S. RAMADAN - On the spin saturation and thermal properties of nuclear matter

[203] S.A.E. KHALLAF, A.L. ELATTAR and M. El-AZAB FARID - ^{6}Li elastic scattering

[222] I. AHMAD, M. MIAN and M.Z. RAHMAN KHAN - Ground state binding energies of Λ particle in hypernuclei.

[223] I. AHMAD and S.K. SINGH - Breathing mode effect in p-^{4}He elastic scattering at intermediate energies

Fundamental Physics

Title: Topical Conference on Radiative Corrections in $SU(2)_L xU(1)$

Dates: 6 June - 8 June 1983

Organizers: Norman Dombey (Univ. of Sussex, UK), G. Furlan (Univ., of Trieste/ICTP, Trieste, Italy) and Bryan Lynn (Univ. of Oxford/ICTP, Trieste, Italy).

Purpose: The purpose of the Conference was to bring together theoretical physicists who are active in calculations of higher order effects in the standard model and experimental physicists who require these calculations in order to measure processes to within an accuracy of a few per cent. Measurement of such radiative corrections would provide firm evidence that the non-Abelian gauge invariance required for renormalization of the model is a principle of Nature.

Programme: Topics:
- Uniqueness of results within a given renormalization scheme
- Radiative corrections to present and intended experiments
- BRS symmetry: renormalization in covariant gauges and Ward identities
- Low energy and large mass theorems
- Bound state processes
- Renormalization group and scaling in $SU(2)_L xU(1)$
- Use of algebraic manipulation computer programmes in calculation of higher order effects
- Infra-red divergences and the Lee-Nauenberg theorem
- Current algebra and QCD effects

In the three days of this Conference 18 lectures were given on Radiative Corrections in $SU(2)_L xU(1)$.

Participation:

Total visitors		26
From developing countries:		1

Representation:

Europe	developing:	1
	industrialized:	23
North & Central America	industrialized:	2

Title: Summer Workshop in Particle Physics

Dates: 20 June - 31 July 1983

Organizers: Professors N. Craigie (INFN, Italy), G. Furlan (SISSA, Italy) I. Jengo (SISSA, Italy). Local programme co-ordinators were, Drs. S. Mukhi (ICTP, Italy), E. Katznelson (ICTP, Italy/ Univ. of Tel-Aviv, Israel), J. Zanelli (ICTP, Italy/Univ. of Santiago, Chile).

Purpose: The main idea was to provide an opportunity for Associates and Affiliates, as well as the now numerous younger physicists who come to the Centre each summer from all over the world, to learn about the recent developments in the subject, and to be able to involve themselves in new projects on the basis of what they learn. Keeping this aim in mind, a number of Discussion Leaders were invited who were intimately involved in the latest developments of the subject. They kindly agreed to spend two or more weeks as a part of the High Energy group present at the Centre and to share the views of these developments by contributing to a series of seminars, as well as organizing informal discussions and lectures as they saw fit, according to the interest of the participants. All participants were free to contact any of the Discussion Leaders for advice, etc. The Discussion Leaders also arranged talks by the participants, where relevant to the field they were covering, this being also an essential component of the High Energy Workshop.

Programme: A research group of 98 scientists was formed and lectures were delivered extempore on individual research projects.

The following lectures and seminars were given:

Applied N=1 supergravity; Preons and composite supergravity; The magnetic monopole fifty years later; The interplay of monopoles and strings; Kaluza-Klein supergravity; Topological model of baryons; Non-breaking of vector-like symmetries; Introduction to superstrings; Fermions on the lattice; Solitons and charge fractionalization; Design of new computers; Monopoles on the lattice; Physics of the early universe; Review of cosmology and the inflationary universe; Construction of N=1 S.G. lagrangian; Quark statics; Rubakov-Callan effect;

Preons; Do chromodyons exist?; Kaluza-Klein and the seven-sphere; Supersymmetry and experiments; Left-right symmetry; Stochastic properties of relativistic cosmologies; Charmed quarks and Λ QCD ; Gauge theories on the lattice; Field theory in cured space time; Superspace formulation of new non-linear sigma-model; Self consistent reduction in Kaluza-Klein theory.

Participation:

Total visitors:	92
From developing countries:	54

Representation:

Africa	developing:	6
Asia	developing:	24
	industrialized:	4
Europe	developing:	18
	industrialized:	15
Indonesia & Oceania	developing:	1
North & Central America	industrialized:	19
South America	developing:	5

Title: Elementary Particle Physics and Fundamental Theory Research

Dates: Throughout the year

Organization: This research programme is organized by the Director of the Centre, Professor Abdus Salam (Pakistan), the Resident Physicist, J. Strathdee (ICPT/New Zealand), the Deputy Director, Professor L. Bertocchi (ICTP/Univ. of Trieste), the Research Advisor, Professor N. Craigie (UK/Trieste) and the University of Trieste Consultants Professors P. Budinich, L. Fonda, G. Furlan, G. Ghirardi 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 genuine research condition that will encourage Associate Members and visitors from Federated Institutes in their work after their return home.

Programme: Lectures or lecture series were held on:

The asymptotic pion from factor beyond the leading order; Interpretation of effective potential at 1 loop level; New ideas about the vanishing of the photon mass and the cosmological constant; Quantum mechanics on tori; Infra-red problem in QED; New solutions of D = 11 supergravity and their symmetries; Path integrals in the physics of liquids; Possible origin of spontaneous breakdown of chiral symmetry in gauge theories; Baryon catalysis; Higer space-time dimension towards a solution of the cosmological constant problem; Difficulties in applying the Wilson expansion to the Tranverse-spin structure functions in Deep inelastic scattering dueto spectator interactions; Failure of Bloch Nordsieck mechanism in perturbative QCD; Confinement implies magnetic screening('t Hooft proof) + probable progress on the mass gap 2 + 1 dimension gauge theories; Elementary approach to instanton and self dual monopoles; Sigma models and self-dual gauge fields; Higher dimensional renormalization group invariant operator in QCD; Phase transition and the early universe; Some particle physics experiments away from the big machine; Statistical mechanics of random lattice gauge theory; Lagrangian fromulation for Weis constraints in supersymmetric Yang-Mills theory; Jet phenomena at collider energies; Composite gravity and supergravity; Axial-gauge quantum gravity; Conformal structure of trilineal operators in the Wilson expansion; Electroweak asymmetries in deep inelastic muon scattering, recent results and possible developments; Supersymmetry breaking through instantons; Path-integral representation for constrained systems; Electroweak phenomenology in composite

models; On complex-valued simply-progressive scalar waves; Large N and mean field expansions on the lattice: what we learn from two-dimensional models; What are "exotic" spinors; Exact solution of the infra-red problems; Description of seven dimensional supergravity theory; Hierarchy of Fermionic masses in supersymmetric composite models; quantization of spinor fields (mostly in 1 + 1); Radiation of colour; Anastigmatic optics in a Riemannian space-time; Quantization of gravity coupled to Fermionic matter; Relation between different auxiliary field formulations of N = 1 supergravity coupled to matter; In search of mechanism of confinement; Dynamical systmes and stability; Time-energy uncertainty relation and irreversibility in quantum mechanics; On renormalization of gauge invariant baryon trilocal operators in QCD; Glueballs and hermophrodites: New forms of hadronic matter; Primordial inflation + supercosmology; Pauli-Gürsey symmetry in gauge theory; Kac-Moody algebras for physics; Dynamical symmetry breakdown for superconductivity, nuclear pairing and chiral symmetry; Gravity and supergravity in 2 + 1 dimensions; A derivation of Kaluza-Klein metric; Significance of a certain restriction in the derivation of Bell's inequality from quantum mechanics; Einstein-Podolsky-Rosen argument and analysis of teh 'no-interaction' assumption; Composition gluons and magnetic monopoles; Constant configurations and the evaluation of the Witten Index; Sonic searches for monopoles; Universality conditions for the Lorentz Invariance of an anisotropic lattice gauge theory; Neutrino mixing without scalars; Can experiment pin down the proton wave function; Aspects of compactification of higher dimensional theories; Supersymmetry and instantons; Graviton loops; b-Meson lifetime, $k^0 - k^0$ system and the Kobayashi-Maskawa matrix; Intense coherent radiation from free relativistic electrons; Quantum knots and lambda transition; A new high energy scale;

Complete integrability in supersymmetric gauge theories, dimensional reduction and Bogomolny equations in dimensions greater than four.

Participation:	Total visitors:		187
	From developing countries:		101
Representation:	Africa	developing:	12
	Asia	developing:	40
		industrialized:	10
	Europe	developing:	36
		industrialized:	54
	Indonesia & Oceania	developing:	2
	North & Central America	Industrialized:	18
	South America		11
	International organizations representing industrialized:		4

High-energy preprints and internal reports issued in 1983

[1] N.S. CRAIGIE - Polarization asymmetries and gauge theory interactions at short distances

[3] J. STRATHDEE - Symmetry aspects of Kaluza-Klein theories.

[6] S. RANDJBAR-DAEMI, ABDUS SALAM and J. STRATHDEE - Instability of higher dimensional Yang-Mills systems

[7] S. RANDJBAR DAEMI, ABDUS SALAM and J. STRATHDEE - Compactification of supergravity plus Yang-Mills in ten dimensions

[11] V.A. RUBAKOV and M.E. SHAPOSHNIKOV - Extra space-time dimensions towards a solution to the cosmological constant problem

[16] V.A. BEREZIN, V.A. KUZMIN and I.I. TKACHEV - On a metastable vacuum burning phenomenon

[17] V.A. KUZMIN and V.A. RUBAKOV - On the fate of superheavy magnetic monopoles in a neutron star

[18] C. MUKKU and W.A. SAYED - Finite temperature effects of quantum gravity

[24] K. ISHIDA and S. SAITO - Transfer matrix for the lattice Thirring model

[28] SHOGO AOYAMA and YASUSHI FUJIMOTO - Fermion coupled with vortex with dyon excitation

[32] W. MECKLENBURG - The Kaluza-Klein idea: status and prospects

[33] M. CHAICHIAN, M. HAYASHI and K. YAMAGISHI - Angular distributions of dileptons in polarized hadronic collisions. Test of electroweak gauge models

[34] ABDUS SALAM and E. SEZGIN - SO(4) gauging of N = 2 supergravity in seven dimensions

[35] N.S. CRAIGIE, V.K. DOBREV and I.T. TODOROV - Conformally covariant composite operators in quantum chromodynamics

[36] V.K. DOBREV - Elementary representations and intertwining operators for SU(2,2) - I

[39] N.S. CRAIGIE and V.K. DOBREV - Renormalization of gauge invariant baryon trilocal operators

[40] J. WERLE - In search for a mechanicsm of confinement

[42] S.C. LIM - Nelson's stochastic quantization of free linearized gravitational field and its Markovian structure.

[43] N.S. CRAIGIE, K. HIDAKA and P. RATCLIFFE - The role helicity asymmetries could play in the search for supersymmetric interactions

[44] J. MICKELSSON and J. NIEDERLE - Infinite sets of conservation laws for linear and non-linear field equations

[47] N.S. CRAIGIE - A derivation of the U(1) radial Schwinger model action used in the analysis of monopole-induced fermion number violating processes.

[48] G. DENARDO and E. SPALLUCCI - Finite temperature spinor pregeometry

[52] E. KATZNELSON - Phase structure of Abelian Higgs model with mixed action

[53] L. FONDA, G.C. GHIRARDI and T. WEBER - On the proton decay

[61] G.C. GHIRARDI and T. WEBER - Quantum mechanics and faster-than-light communication methodological considerations

[62] T. CHRISTODOULAKIS and J. ZANELLI - Quantization of Robertson-Walker geometry coupled to fermionic matter

[63] M.D. SCADRON - Dynamical resolution of the U(1) problem in QCD

[75] S. RANDJBAR-DAEMI, ABDUS SALAM and J. STRATHDEE - Instanton induced compactification and fermion chirality

[78] J.C. PATI and ABDUS SALAM - Supersymmetric flavon-chromon models

[81] S.J. GATES Jr. - Superspace formulation of new non-linear sigma models

[87] N.I. KARCHEV - On the large-N dynamics of gauge symmetry breaking

[88] L. GIRARDELLO, C. IMBIMBO and S. MUKKI - On constant configurations and the evaluation of the Witten index

[89] B. GRZADKOWSKI - Flavour non-conservation induced by Higgs particle exchange in $SU(2)_L \times SU(2)_R \times U(1)$ model

[92] A.N. MITRA - Relativistic few quark dynamics for hadrons

[97] M.D. MAIA - Geometrical aspects of Kaluza-Klein theory

[102] B.B. DEO and UTPAL SARKAR - Low energy supersymmetric models for several generations and proton decay

[105] JIHN E. KIM and MURAT OZER - A role of 75_H in fermion mass hierarchy

[109] A.N. MITRA and R. RAMANATHAN - Role of hadronic dynamics in proton decay

[116] IRSHADULLAH KHAN - New solutions of Euclidean SU(2) gauge theory

[120] A. HOSSAIN, T.K. CHAUDHURY and L.M. NATH - The asymmetry in electroproduction of the $\Delta(1232)$ by polarized electrons and the structure of the weak neutral current

[122] F. HUSSAIN and M. SCADRON - Non-leptonic weak decays of charmed baryons

[126] F. HUSSAIN and N.K. PAK - Does the SU(5) monopole catalyze proton decay

[131] N.S. CRAIGIE - Status of the Rubakov-Callan effect (extended write-up, includes 134 internal report)

[132] A.N. MITRA - Lattice fermions and tomography

[134] N.S. CRAIGIE - Status of the Rubakov-Callan effect (included in 131)

[139] H. BOHR, E. KATZNELSON and K.S. NARAIN - On supersymmetry breaking by instanton effects

[140] M. HUQ - On supersymmetric field theories

[143] P.T. CHRUSCIEL - On the relation between the Einstein and the Komar expressions for the energy of the gravitational field

[144] O. GHERMAN and G. STEINBRECHER - Symmetries of the semiclassical solutions of the vacuum tunneling problem

[147] N.K. PAK and I. SOKMEN - General new time formalism in the path integral

[148] N.K. PAK and I. SOKMEN - A new exact path integral treatment of the hydrogen atom

[149] N.K. PAK and I. SOKMEN - Exact path integral solution of the Morse potential

[155] G. ALDAZABAL and N. PARGA - Quantization of O(N) non-linear sigma models as the stochastic motion on S^{N-1}

[156] J. WERLE - Inseparability of colours resulting from dynamical breaking of $SU_c(3)$

[159] JIHN E. KIM and HITOSHI NISHINO - Supergravity and upper bound on scale of supersymmetry breaking

[163] MEHMET KOCA - Dimensional reduction of exceptional E_6, E_8 gauge groups and flavour chirality

[170] B.G. SIDHARTH - A lower bound and estimates for resonances

[177] P. KOLAR and J. FISCHER - On the validity and practical applicability of derivative analyticity relations

[178] I.H. DURU - Path integral representation of the symmetric Rosen-Morse potential

[180] N.S. CRAIGIE, W. NAHM and V.A. RUBAKOV - Towards a complete and solvable QFT treatment of monopole induced baryon number violating transitions

[181] D. PARASHAR - Charge radii of Σ^0 and Ξ^0

[183] N.S. CRAIGIE - Spontaneously broken gauge theories as weakly coupled low energy effective Lagrangians for ASF confining gauge theories

[185] A. ROY CHOWDHURY and J. MUKHERJEE - An inverse scattering approach to the soliton solution of SO(2,1) non-linear sigma model

[187] R. JENGO and N. PARGA - Stochastic quantization and mean field approximation

[188] J. LUKIERSKI and A. NOWICKI - Quaternionic supergroup and D=4 Euclidean extended supersymmetries

[189] J. LUKIERSKI and P. MINNAERT - Seven-spheres from octonions

[190] R. RACZKA and L. ROSZKOWSKI - Analysis of Green's functions and stability problem in models of quantum field theory with solitons

[200] E. BRODA - Max Planck in the social context

[201] A. ROY CHOWDHURY - A new approach to supersolitons of supersymmetric non-linear equations

[204] K.S. NARAIN - Instantons and condensate in supersymmetric CP^{N-1} models

[206] A. PRAMUDITA - Radiative Dalitz decays of pseudoscalar mesons

[207] Y. FUJIMOTO, R. GRIGJANIS and H. NISHINO - Thermo-field theory versus imaginary time formalism

[208] S. RANDJBAR-DAEMI, ABDUS SALAM and J. STRATHDEE - On Kaluza-Klein theory

[209] J. TARSKI - Free massless fields with low spin values on the Einstein-static universe

[210] M. HUQ and M.A. NAMAZIE - Kaluza-Klein supergravity in ten dimensions

[214] V.A. MATVEEV, M.E. SHAPOSHNIKOV and A.N. TAVKHELIDZE - The symmetry properties and dynamics in the gauge theories with scalar fields.

[218] ECKEHARD W. MIELKE - On pseudoparticle solutions in the Poincaré gauge theory of gravity

[219] F. HUSSAIN, K. KHAN, SAJJAD MAHMOOD and K. RASHID - Inclusive $F(c\bar{s})$ hadroproduction

[220] E. SEZGIN - The spectrum of the eleven dimensional supergravity compactified on the round seven sphere

[221] COLLECTED LECTURES of the Third Annual ICTP Workshop on Particle Physics, 20 June - 31 July 1983

[224] R.M. GODBOLE, T. JAYARAMAN, J.C. PATI, G. RAJASEKARAN and S.D. RINDANI - The recent single tag two photon experiments at PETRA and the issue of quark charges

[225] N.S. CRAIGIE - On the QFT of monopole induced baryon-number violating processes including non-Abelian forces

[226] S. RANDJBAR-DAEMI, ABDUS SALAM and J. STRATHDEE - Stability of instanton-induced compactification in 8-dimensions

[227] T. CHRISTODOULAKIS and J. ZANELLI - Quantum mechanics of the Robertson-Walker geometry

[228] S.K. SINGH and I. AHMAD - Parity violating asymmetry in high energy proton nucleon scattering

[230] DAI YUAN-BEN - A supersymmetrical preon model with $SU(2)_L \times SU(2)_R \times U(1)_{B-L}$ symmetry broken by coupling to supergravity

[233] G.C. GHIRARDI and T. WEBER - Finite difference evolution equations and quantum dynamical semigroups

[236] I.H. DURU - Path integrals over SU(2) manifold and related potentials

[238] A. AURILIA, G. DENARDO, F. LEGOVINI and E. SPALLUCCI - An effective action functional for the inflationary cosmology

Title: Workshop on Medical Physics

Dates: 17 October - 4 November 1983

Organizers: Professors J. Cameron (Univ. of Wisconsin, USA), S. Mascarenhas (Univ, of San Paulo, San Carlos, Brazil), and R. Renzi (Univ. of Florence, Italy).

Purpose: This Workshop was a continuation of the programme in Biophysics, Medical Physics and Neurophysics, started at the ICTP in 1982. Its aim was to provide a basic, conceptual understanding and practical working experience for physicists from developing countries who wished to collaborate with health programmes and/or establish research activities in the field of medical physics. The basic outline of the Workshop was as follows:

Initial activities were related to the fundamentals of medical physics, physics of radiation and its interaction with matter and living systems, radiation dosimetry and the necessary basis from biology and physiology to apply physics to the following areas: physics in radiology, radiotherapy, nuclear medicine and applications of ultrasound.

Experimental work was held in conjunction with a local public health institution in Trieste and consisted of individual experiments and practical demonstrations on quality control in radiodiagnostics, radiotherapy and nuclear medicine, as well as in ultrasound and physical dosimetry (ionization chambers, film and thermoluminescent dosimetry, electret dosimetry and other techniques). Emphasis was put on radiation dosimetry and radiodiagnostic quality control.

Programme: Topics:

- Survey of radiation physics and nuclear physics
- Interactions of charged particles with matter; X-ray production
- Interactions of X-rays and γ -rays with matter
- Radioactivity and Isotope production
- Interaction of Radiation with Living Matter
- Physical Principles of Radiation Dosimetry

- Ultrasound and NIR
- Principles and methods of Nuclear Medicine

The following lectures were given:
Basic radiation physics; Interaction of radiation with matter; Evolution of X-ray diagnosis and anatomy; Rad. quantities and units; Measurement of radiation, instrumentation and techniques; Physics of nuclear medicine, instrumentation; Characteristics of photon beams; Absorbed dose, f-factor, cavity theory; Physics of radiobiology; Exposures and diagnostic radiology; Dosimetry in nuclear medicine; Physics of radiotherapy; Physics diagnostic radiology; Tissues and tumour response to radiation; Radiation protection: quantities and units; Personal and environmental monitoring; Radiation protection shielding and surveys; Dosimetry and protection in radiodiagnosis; Dosimetry in radiotherapy; Laboratory preparation lectures; Laboratory experiments; Res. orientation in dosimetry, electrets, photoacoustics, piezo electric and ESR; Principles of digital imaging; Phantoms for radiodiagnosis and radiotherapy; Dosimetry programme of IAEA, Vienna; Computerized tomography; Ultrasound in medicine; Computerized tomography and nuclear magnetic resonance imaging; Physics of physiology; Cardiovascular system; Positron-emmission tomography; Information on medical physics, societies and associations; Equipment building, buying and maintenance; IAEA programme on radiation protection; Round table and evaluation of Workshop.

Participation:	Total visitors:		55
	From developing countries:		33
Representation:	Africa	developing:	7
	Asia	developing:	13
	Europe	developing:	5
		industrialized:	17
	Indonesia & Oceania	developing:	2
	North & Central America	developing:	1
		industrialized:	2
	South America	developing:	5
	International organizations representing industrialized:		3

Title: II International Conference on Applications of Physics to Medicine and Biology

Dates: 7 - 11 November 1983

Organizers: The Conference was sponsored by the University of Trieste, I.N.F.N., C.N.R., Regione Friuli-Venezia Giulia and Comune and Provincia di Trieste.

International Advisory Committee: C. Franconi (Italy) Conference Co-ordinator, J.R. Cameron (USA), J. Clifton (UK), A. Kaul (FRG) and S. Mascarenhas (Brazil).

Local Organizing Committee: Professors: Z. Bajzer (Yugoslavia), P. Baxa (Italy), L. Dalla Palma (Italy), S. Lin (Italy) and P. Schiavon (Italy).

Purpose: To give an audience of physicists, engineers, biologists and medical doctors a realistic picture of the stage of development of various fields of biomedical applications of physics.

Programme: Topics:
- Methods and Techniques of Hyperthermia
- Biomedical information from NMR Imaging Methods
- Models of the Cardiovascular System and the Engineering of Cardiac Prosthesis.

The following lectures were given:

Human speech and communication aids

Symposium TECHNOLOGIES FOR THE CARDIOVASCULAR SYSTEM: within this symposium the following lectures were given:

Implantation of total artificial heart on humans. Past, present and future developments; Technologies of the total artificial heart;

Symposium WORK IN PROGRESS IN MEDICAL PHYSICS IN ITALY 1983: within this symposium the following lectures were given: Physiological models and measurements; Medical informatics; Radioisotopes; Vascular system modelling fundamentals; Functional evaluation of the cardiovascular system; The design, development and assessment of heart valve substitutes; Ultrasound techniques for the vascular system; Biological materials; Technology, instrumentation and prosthetic devices;

Non-ionizing radiation; Education and training; Magnetic fields dependence of T_1 in tissues: implications for contrast enhancement in NMR imaging; Technical problems connected with imaging NMR and TMR equipment. Performance and quality assessment of NMR imaging systems. The latest development in ECT and PET: Ionizing radiation; Risk assessment and control; Hyperthermia; Experimental aspects of hyperthermia; Clinical hyperthermia and chemotherapy; Biological basis for clinical applications of combined hyperthermia and radiation.

Symposium NMR IN BIOMEDICINE: within this symposium the following lectures were given:

NMR studies of metabolism in vivo; Pulse technology. A basic requisite for biomedical applications of NMR; An introduction to the different measuring techniques in NMR imaging; New techniques and new applications of NMR zeugmatography; Clinical considerations in the design and application of NMR imaging systems.

Symposium NUCLEAR METHODS & TECHNIQUES: within this symposium the following lectures were given:

Cyclotrons for nuclear medicine; Functional imaging in nuclear medicine; Nuclear analytical techniques in medicine; New techniques in radiation dosimetry; Advanced radiation detectors.

Symposium HYPERTHERMIA AND CANCER: within this symposium the following lectures were given:

Biological and physiological basis of hyperthermia; Microwaves and ultrasound in clinical hyperthermia. Some physical aspects of heating and thermometry; Electromagnetics of hyperthermia; Planning and dosimetry in thermal therapy;

Symposium NEW DEVELOPMENTS IN MEDICAL PHYSICS: within this symposium the following lectures were given:

Computerized radiometry; Some biological effects of low-frequency magnetic and electric fields; Progress in tele-medicine; Advances in clinical evaluation of the biomagnetic method.

Participation:	Total visitors:		259
	From developing countries:		67
Representation:	Africa	developing:	11
	Asia	developing:	18
	Europe	developing:	31
		industrialized:	181
	Indonesia & Oceania	developing:	2
		industrialized:	2
	North & Central America	developing:	1
		industrialized:	8
	South America	developing:	4
	International organizations representing industrialized:		1

Title: Winter College on Lasers, Atomic and Molecular Physics

Dates: 24 January - 25 March 1983

INTRODUCTION

Dates: 24 January - 4 February 1983

Organizers: Professors G. Amat (Univ., of Paris, France), A. Dymanus (Catholic Univ., Nijmegen, The Netherlands), R. Bonifacio (Univ., of Milan, Italy) and O. Svelto (Polytechnic, Milan, Italy)

Purpose: The two weeks served to acquaint candidates with the theoretical techniques to be used in the two main parts of the course.

Programme: Topics:
- Basic theory of atomic and molecular spectroscopy
- Elements of group theory and angular momentum techniques
- Selected topics in quantum mechanics
- Quantum theory of light and photon statistics

The following lectures were given:

Quantum mechanics and interactions with weak E.M. waves; Angular momentum; Theory of point groups; Rotation-Vibration spectra; Atomic spectra; Electronic spectra.

PART I

Laser Principles and Techniques
Applications to Spectroscopy
Topics in Atomic and Molecular Physics

Dates: 7 February - 2 March 1983

Organizers: Professors G. Amat (Univ. of Paris, France) and A. Dymanus (Catholic Univ., Nijmegen, The Netherlands)

Purpose: To provide high level training in the field of laser principles and techniques, applications to spectroscopy and also topics in atomic and molecular physics.

Programme: Topics:
- Principles, techniques and construction of lasers in the IR
- Optical and UV regions
- Interaction of atomic systems with very strong radiation fields
- High resolution spectroscopy with lasers
- Polarization and Raman spectroscopy
- Spectroscopy of atomspheric and interstellar molecules
- Selected topics in atomic and molecular physics

The following lectures were given:

Molecular spectroscopy with IR and FIR lasers; Laser spectroscopy of Rydberg atoms, Spectroscopy of gaseous molecular irons; Molecular beams in high resolution spectroscopy; Laser principles; Interstellar molecules; Laser techniques in high resolution spectrocopy; Molecular spectroscopy with IR lasers; Coherence properties of lasers; Laser beam transformation; Rate equations; Solid state lasers; Transverse mode selection in solid state lasers; Single longitudinal mode selection; A new picosecond laser; Stimulated Raman scattering; Difference frequency generation; Cool-Q-Switching of solid state lasers; Dye lasers; Colour-Centre lasers; Gas lasers; Free-Electron lasers.

PART II

Short Laser Pulses with Applications in Physics, Chemistry and Biology

Dates: 7 March - 25 March 1983

Organizers: Professors R. Bonifacio (Univ., of Milan, Italy) and O. Svelto (Polytechnic, Milan, Italy)

Purpose: To review the exact semiclassical theory of radiation-matter interaction and coherent transient effects, the principles and techniques of Q-switched and mode-locked lasers.

Programme: Topics:
- Selected topics on Multiphoton excitation laser selective photochemistry
- Laser Photobiology

The following lectures were given:

Mode-locked lasers, Maxwell-Bloch equations; Coherent transient phenomena; Picosecond dynamics of polyatomic molecules; Nonlinear laser spectroscopy; Distributed-feedback dye lasers; CARS in chemistry and biology; Photophysics of polyatomic molecules; TEA gain-switched lasers; Nanosecond and piosecond flashphotolysis; Problems in fast fluorescence detection; Interaction of laser radiation with biological systems; A piosecond single-photon avalanche diode for flourescence detection; Laser annealing; Non-linear optics; Laser isotope separation.

Participation

Total visitors:		126
From developing countries:		85

Representation:

Africa	developing:	8
Asia	developing:	46
	industrialized:	1
Europe	developing:	12
	industrialized:	32
Indonesia & Oceania	developing:	3
North & Central America	industrialized:	8
South America		16

Title: Second College on Microprocessors: Technology and Applications in Physics

Dates: 18 April - 13 May 1983

Organizers: Professor A. Van Dam (Brown Univ., Providence, USA) Mr. C. Verkerk and Dr. P. Zanella (CERN, Geneva, Switzerland).

Purpose: Pursuant to a similar course held in 1981, this course has given a good working knowledge of hardware and software, through a large amount of practical exercises, to develop the use of microprocessors and to spread the knowledge of this technology and its applications in physics.

Programme: Topics:
- General Introduction to Microprocessors
- Microcomputer Hardware: Architecture, Interfacing etc.
- Basic and Application Software
- Applications of Microprocessors in Various Fields of Physics and related areas

The following lectures were given:

Introduction to (micro) computer structure and operation: Introduction to the kit; Digital logic circuits; Assembler language programming for the 6809; Characteristics of the 6809; Microprocessor interfacing; Development systems; Semiconductor technology; Software tools; Programming tools and methods; Bus systems; Water level monitoring; Solid state physics; Multi-processor systems; Social impact of microelectronics; Microprocessor-based scientific processors; Properties of instruction set processor; Use of micro-computers in self-teaching; Control of experiments; Introduction to bit-slice microprocessors; Applications of microprocessors in communication physics; Applications of microprocessors to astronomy; Applications of microprocessors in medical physics.

Participation:	Total visitors:		134
	From developing countries:		98
Representations:	Africa	developing:	20
	Asia	developing:	49
	Europe	developing:	10
		industrialized:	18
	Indonesia & Oceania	developing:	3
	North & Central America	developing:	5
		industrialized:	3
	South America		11
	International organizations representing industrialized:		15

Title: Research in Condensed Matter Physics
(throughout the year)

and

Research Workshop in Condensed Matter Physics

Dates: 20 June - 9 September 1983

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

Workshop: Professors P.N. Butcher (UK), S. Lundqvist (Sweden), N.H. March (UK), E. Tosatti (Univ. of Trieste/ICTP), M. Tosi (Univ. of Trieste/ICTP) and F. García-Moliner (Spain).

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: 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 took the major responsibility for the Workshop by spending one month or longer with the group. A large number of physicists came for shorter visits, from two weeks to a few days. The programme was relatively informal and was based on the general principle that everyone brings his own work, there was an attempt to group the research around three principal themes:

(1) Disordered systems

(2) Phase transitions, including metal-insulator phase changes

(3) Solid and liquid surfaces and interfaces

The programme was supplemented by two Symposia on:

Latent Image Formation in Silver Halides - 11-14 July 1983
Computer Simulation on Quantum Systems - 20-22 July 1983

Programme:

Research throughout the year: during the Research programme various lectures were delivered on the main themes of Electronic States in Solids, Phase transitions, Liquid State Theory and Surfaces and Interfaces.

Workshop: Crystallization of superfluid Helium; Electronic excitations of adsorbed atoms and molecules on surfaces; Superconducting microstructures; Static kink solutions and their properties in low-dimensional systems; Dynamical processes; Experimental implications and observations; Residual interactions; Solitons in higher dimensions: Superfluid ^{3}He; Superconductivity in disordered materials; Effect of electron interaction on soliton states in polyacetylene; Exact diagonalization of 2-photon Hamiltonians; Conducting polymers - Solitons or not?; Behaviour of the screening charge near an impurity; Surface influence on phonon focussing; Dynamical theory of electron films on surface of liquid Helium; Two-dimensional one-component plasmas in ℓn r potential; The Kosterlitz-Thouless transition in a NxN Josephson junction array; Electronic Debye-Waller effect in atom surface scattering; Ab initio approach to static, dynamic and dielectric properties of solids; The Coulomb gap and other Coulomb effects in disordered insulators; Theory for scanning tunneling microscopy; Ga As Field effect transistor for studies of dimensional cross-over; Surface segregation in Nobel-metal alloys; Coulomb forces and superconductivity in organic conductors; Macroscopic and microscopic dielectric response of solids; Phase stability of Hume-Rothery alloys; Decimation procedure in disordered systems; Dynamical scaling in disordered systems;

(Within the Workshop a Working Party on Solitons and Non-Linear Phenomena in Condensed Matter, was formed, and the following lectures were given

Solitons; Biomolecules; Fractionally charged solitons; Integrability; Tomography; Magnetic chains; Corner transfer matrices and lattice models; Josephson junctions; Bethe

Ansatz tutorial; Statistical mechanics of kinks; Solitons in a classical inhomogeneous Heisenberg ferromagnet).

Correclations and the possibility of a CDW instability in quantum electron liquids; Dynamical theory of quenched random systems and application to spin glasses; Electromagnetic effects in magnetic super-conductors; Higher-order electron-phonon couplings in tetrahedral semiconductors; Bose condensation in electron-hole system; Properties of surface electrons on a helium film; Possibility of tunable T_c super-conductivity under non-equilibrium conditions; Polytypic structures in MX compounds: ZnS and $Zn_{1-x}Cd_xS$; Embedding methods for surface electronic structure; Two-particle correlations in liquid Helium-4; Absence of localization in disordered chains observed in 2D area preserving stochastic maps; One the spinless Anderson model with a local phonon mode; Electrical resistivity of amorphous metals and alloys;

Participation:	Research throughout the year:		
	Total visitors:		67
	From developing countries:		44
Representation:	Africa	developing:	5
	Asia	developing:	18
		industrialized:	1
	Europe	developing:	16
		industrialized:	18
	North & Central America	industrialized:	3
	South America		5
	International organizations representing industrialized:		1

Participation:	Workshop:		
	Total visitors:		243
	From developing countries:		162
Representation:	Africa	developing:	30
	Asia	developing:	51
		industrialized:	2

Europe	developing:	69
	industrialized:	60
North & Central America	industrialized:	18
South America		12
International organizations representing industrialized:		1

Title: Third Trieste International Symposium on The Physics of Latent Image Formation in Silver Halides

Dates: 11 - 14 July 1983

Organizers: Professors A. Baldereschi (Institut de Physique Appliquée, Lausanne, Switzerland/Univ., of Trieste, Italy), W. Czaja (Institut de Physique Appliquée, Lausanne, Switzerland), E. Tosatti (SISSA/ICTP, Trieste, Italy), and M. Tosi, (Univ., of Trieste/ICTP, Trieste, Italy).

Purpose: The aim of the symposium was to demonstrate the continued interest in the physics of latent image formation and to stimulate further work. The symposia aim at bringing together specialists in the field of photography with solid state physicists, both experimentalists and theoreticians, to present and discuss their views on the topics.

Programme: Topics:
- Basic properties of Ag-Halides
- Surfaces and some special properties of Ag in crystals
- The Latent Image
- Related fields and outlook

The following lectures were given:

Electronic properties of silver halides; Lattice dynamics of silver halides; Electronic transport processes in silver halides; Phenomena at silver-halide interfaces requiring additional fundamental understanding; Photon stimulated desorption from silver-halide surfaces; Formation and

migration of the self trapped hole in AgCl; Ionic transport processes in silver halides; The experimental detection of latent images in silver halides; Model experiments on latent images in evaporated silver-halide layers; New apparatus for the study of the reciprocity law failure in the range 10^{-8}s - 10^{-6}c. First results; Concentration-induced spectral variations of luminescence in AgBr:I; Ag-clustering in silver-halide thin films induced by ion implantation; Experiments on the near-surface ionic space charge in silver-halide crystals; Self-trapping of free excitons in AgCl; The atomistic model (of latent image formation); The phase separation model of silver formation in silver-halides; Subsurface disorder and latent image formation; Ag-induced images in chalcogenide alloy glasses: A frontier of submicron photolithography; Nobel metal clusters; Superionic conductors amongst Ag-compounds, true and 'manqués'; Structural instability, ionic transport and Ag-clustering in Ag compounds: Some comments;

Participation:	Total visitors:		37
	From developing countries:		1
Representation:	Asia	industrialized:	2
	Europe	developing:	1
		industrialized:	26
	North & Central America	industrialized:	8

Title: Fourth Trieste International Symposium on Computer Simulation of Quantum Systems

Dates: 20 - 22 July 1983

Organizers: Professors M. Parrinello (Univ. of Trieste, Italy), E. Tosatti (SISSA/ICTP, Trieste, Italy), M.P. Tosi (Univ. of Trieste/ICTP, Italy)

Purpose: The purpose of the symposium was to review the most recent computational and theoretical developments in the field of computer simulation of quantum systems. Emphasis was given to the theoretical aspects of the calculations as opposed to technical details. To achieve this goal, computer specialists and people with a broader view of the subject were brought together. The main focus was on systems of interest to condensed matter physicists.

Programme: Topics:

- Bose fluids at zero and finite temperature
- Fermi systems at zero temperature
- He^3, electron gas, metallic hydrogen, small molecules
- Path integral Monte Carlo
- Electrons solvated in fluids
- Quantum spin models
- Lattice gauge models
- Dynamical properties of quantum systems

The following lectures were given:

Experiments in semiclassical and quantum corrected molecular dynamics; Almost classical properties of many-body systems; Computer simulation of electron vacuum tunnelling between corrugated surfaces; Dynamics of localized quantum systems in the condensed phase; Path integrals and hard spheres; Ground states of ^4He droplets by Monte Carlo methods; Electron solvation in molten salts; On condensed matter models being sampled with 'path-integral Monte-Carlo'; Path integrals, Monte-Carlo and quantum systems; Monte-Carlo calculations on quantum spin systems; Correlations in Bose fluids at zero and at finite temperature; Fast simulation of lattice systems; An alternative to Schrödinger; Quantum Lorentz gas; Numerical simulation of gauge theories;

Quantum mechanical simulation of electronic systems at zero temperature; Very large scientific calculations in the 80's;

Participation:	Total visitors:		35
	From developing countries:		6
Representation:	Asia	industrialized:	1
		developing:	3
	Europe	industrialized:	20
		developing:	3
	Indonesia & Oceania	industrialized:	1
	North & Central America	industrialized:	7

Title: Workshop on Physics of Communications

Dates: 14 November - 2 December 1983

Organizers: Professor U.R. Rao (ISRO Satellite Centre, Bangalore, India). Local Organizers: Professors G. Furlan (Univ. of Trieste/ICTP). The Workshop was co-sponsored by the Italian Dipartimento per la Cooperazione allo Sviluppo.

Purpose: The Workshop was intended to develop the fundamental mathematical and physical basis of modern communication systems, including the new directions emerging from the last two decades of significant advances in space research. It provided the necessary orientation to participants who, with strong backgrounds in physics and/or engineering, and having an interest in the field of communications, wanted to apply the related principles to specific research application areas.

Programme: Topics:
- mathematical basis for modern communication
- coding and information theory
- radar and microwave communication system
- data communication
- digital communication techniques

- communication systems and earth observations
- communication to aid navigation
- data transmission and geodesy
- space communication
- sociological aspects of modern communication
- interstellar communication
- optical communication system

The following lectures were given:

Mathematical basis for modern communication; Coding and information theory; Data communication; Radar and microwave communication system; Digital communication techniques; optical communication system; Space communication; Introduction to lectures on communication to aid navigation, data transmission and geodesy; Radar altimetry in its applications to oceanography; Laser ranging; Global positioning system (GPS) as aid to navigation; Communication systems and earth observations; The SIRIO 2 communication system; Sociological aspects of modern communication; Interstellar communication.

Participation:	Total visitors:		62
	From developing countries:		51
Representation:	Africa	developing:	15
	Asia	developing:	26
	Europe	developing:	5
		industrialized:	10
	North & Central America	developing:	1
		industrialized:	1
	South America		4

Solid-State preprints and internal reports issued
in 1983

[2] M. ANIS ALAM and M. TOMAK - Electrical resistivity of liquid Ag-Au alloy

[8] K. KUNC and R. RESTA - External fields in the self-consistent theory of electronic states: A new method for direct evaluation of macroscopic and microscopic dielectric response

[9] HA VINH TAN and NGUYEN TOAN THANG - On the equivalence of two approaches in the exciton-polariton theory

[10] HOANG NGOC CAM, NGUYEN VAN HIEU and HA VINH TAN - On the theory of the non-linear acousto-optical effect in semiconductor

[14] E. ROMAN and N. MAJLIS - Computer simulation model of the structure of ion implanted impurities in semiconductors

[19] D.C. KHAN and N.V. NAIR - Mössbauer and magnetization studies of $Fe_{.69}Pd_{.31}$ alloy

[23] A.-S.F. OBADA, A.M.M. ABU-SITTA and F.K. FARAMAWY - On the generalized linear response functions

[46] M. YUSSOUFF - Comments on microscopic mechanics, generalizations of classical mechanics and Planck's oscillators

[49] A. MOOKERJEE and D. CHOWDHURY - On the relaxation of magnetization in the percolation model of spin glass transition

[56] M. AHMED and R.I.M.A. RASHID - Effect of Anderson magnetic impurities on superconducting alloys

[57] VIPIN SRIVASTAVA - A new exponent in self-avoiding walks

[59] VIPIN SRIVASTAVA and MEENA CHATURVEDI - New scaling results in quantum percolation

[64] A. MOOKERJEE and S.B. ROY - Neutron scattering in AuFe (20% Fe) and the randomly canted ferromagnetic state

[65] A. MOOKERJEE and D. CHOWDHURY - Magnetoresistance of spin glass alloys - II: Effect of spin dynamics

[66] M. AHMED - Linearization of non-commuting operators in the partition function

[67] A. MOOKERJEE and M. YUSSOUFF - Electrical conductivity in random alloys

[69] A.M. JAYANNAVAR - Quantum diffusion in a dynamically disordered medium

[71] S.M. MUJIBAR RAHMAN, M. MAZIBAR RAHMAN and S.M.M.R. CHOWDHURY - Structural energetics of heavy alkali metals: pseudopotential theory revisited

[72] KHWAJA YALDRAM and M. AHSAN KHAN - Monte Carlo studies of a polymer chain confined to strips: concentration profile

[73] ZHU WEI-JIA - Proof of an energy gap existing in tetrahedrally bonded amorphous solids

[74] JAMIL M. KHALIFEH - Asymptotic elastic energy in simple metals

[76] S.R. SHENOY - Macroscopic weak superconductivity of an N x N Josephson junction array below the Kosterlitz-Thouless transition

[79] TAHIR ABBAS and FARID AKHTAR KHWAJA - Local atomic ordering in nickel based alloys

[80] H.B. GHASSIB and J. CHELA-FLORES - Towards a comprehensive theory for He II: A temperature-dependent field-theoretic approach

[82] KHWAJA YALDRAM and M. AHSAN KHAN - Monte Carlo studies of domain growth in two-dimensions

[90] K.M. KHANNA and R. SINHA - Structure factor for a degenerate Bose fluid

[91] LU DE-XIN and K.I. GOLDEN - Approximation scheme for classical surface plasma at strong coupling: progress in the formulation of a dynamical theory

[93] M.H.A. PRAMANIK - The rate equation formalism for the A.C. conductivity in amorphous semiconductors

[94] P. STREDA and H. OJI - Non-dissipative currents in the theory of thermo-magnetic properties of inversion layers

[96] M. EL SAWI - On the WKBJ approximation

[98] S. GOETTING - Conductivity of the electron impurity system

[99] M.F. KOTKATA and M.B. EL-DEN - Thermal transformation properties of some glasses in the system As_2Se_5-As_2Te_5

[103] M. DANIEL - The Painlevé property for one-dimensional anisotropic Heisenberg ferromagnetic spin chain

[104] ZHANG QIRUI, SONG SHENGNIAN and JIAO ZHENG KUAN - Theoretical and experimental studies of the stability in CVD superconducting composite tapes

[106] ZHONG XUE-FU - An improvement of Van Vechten's covalent radii

[107] L.N. SHEHATA and A.G. SAIF - Curved flux line near the edge of a type II superconductor

[110] P. ESQUINAZI, B. GUILLET, R. STEINMANN and H. DUSSELL - Flux pinning in $La_{70}Cu_{30}$ disordered system

[112] A. BREZINI and G. OLIVIER - Diffusion on a disordered Cayley tree

[113] W. WASILEWSKI - Theoretical description of the properties of magnetization fluctuations in the vicinity of phase transition from paramagnetic phase to ferromagnetic phase with domain structure

[114] P. PFEFFER, J. GORCZYCA and W. ZAWADZKI - Theory of free-electron optical absorption in n-GaAs

[115] L.N. SHEHATA and A.G. SAIF - Pinning of a curved flux line by macroscopic inclusions in a type II superconductor

[119] P. PAWLICKI - Selection rules for the spontaneous phase transitions in magnetoelastic metamagnets

[121] GUANG-ZHAO ZHOU, ZHAO-BIN SU, BAI-LIN HAO and LU YU - The closed time-path Green's function formalism in many-body theory

[123] J.A. CHROBOCZEK, F.H. POLLAK and H.F. STAUNTON - Impurity conduction in silicon; effect of uniaxial compression on p-type silicon

[124] P. NAGY - One electron density of states in chalcogenide glasses

[125] M.E. ELZAIN - On the density of states of random systems

[127] G. OLIVIER and M. MOSTEFA - Temperature dependence of electrical conductivity in granular metals

[133] J. ZIELINSKI - On the polaronic reduction of the resonance level half-width

[136] N.M. RAVINDRA, F. DE CHELLE, C. ANCE, J.P. FERRATON, J.M. BERGER and S.P. COULIBALY - Optical properties of amorphous silicon -Some problem areas

[137] S.M. MUJIBAR RAHMAN - Electrical resistivity of noble-metal alloys: roles of pseudopotential refinements

[141] M. ANIS ALAM and M. TOMAK - Electrical resistivity of liquid noble metal alloys

[145] W. BORGIEŁ - The two bands model for the high temperature conductivity of the binary rare earth alloys

[150] P. BALLONE, G. PASTORE and M.P. TOSI - Theory of the interface between a classical plasma and a hard wall

[151] W. PAŁOSZ - Polytypic structures in MX compounds: ZnS and $Zn_{1-x}Cd_xS$

[152] H.B. GHASSIB and R. SRIDHAR - On the Fröhlich decomposition and the condensate fraction in He II

[153] G. TUNCAY and M. TOMAK - Ideal vacancy states in Si: A study of the empirical-tight-binding method

[154] M. TOMAK, B.E. SERNELIUS and K.-F. BERGGREN - Elementary excitations and quasi-two-dimensional behaviour in a GaAs field effect transistor

[157] E. ROMAN, G. SENATORE and M.P. TOSI - Ground-state properties and optical excitations of a solvated electron in molten alkali halides

[158] V.E. GODWIN and M. TOMAK - Impurity states in the presence of an interface

[160] H. NENCKA-FICEK - Topological excitations and their properties in the d-dimensional U(1) invariant models

[161] W. WASILEWSKI - The properties of the magnetization fluctuations in thin ferro-magnetic film near the critical thickness

[162] C. WIECKO and E. ROMAN - Renormalization group decimation technique for spectra, wave functions and density of states

[164] H. NENCKA-FICEK - Duality in fractals

[167] N. MONTELLA, G. SENATORE and M.P. TOSI - Thermodynamic properties of liquid alkali metals using a classical-plasma reference system

[168] Kh.I. PUSHKAROV and M.T.PRIMATAROWA - Solitary clusters consisting of magnons and phonons

[169] I.S. STOIANOVA - Effect of thermal oscillations of molecules on the properties of solitons in one-dimensional molecular lattices

[171] J. SZNAJD - Effective Hamiltonian for 2-dimensional arbitrary spin Ising model

[172] H. GRINBERG - Projected interaction-picture of field operators and memory superoperators. A master equation for the single-particle Green's function

[173] S. SRIDHAR - A new prescription to determine the two-roton parameters in liquid He II

[175] I.Z. KOSTADINOV - Hopping absorption edge in silicon inversion layers

[179] R. BALAKRISHNAN - Soliton propagation in non-uniform media

[182] P. BALLONE, G. PASTORE, M.P. TOSI, K.R. PAINTER, P.G. GROUT and N.H. MARCH Dependence of capacitance of metal-molten salt interface on local density profiles near electrode

[192] C. WIECKO and E. ROMAN - Renormalization group decimation technique for disordered binary harmonic chains

[211] G. BASKARAN and NEELIMA GUPTE - An equivalence between the discrete Gaussian model and a generalized Sine-Gordon theory on a lattice

[212] NARENDRA SINGH and B.K. AGARWAL - Susceptibility of a Heisenberg antiferromagnet

[215] NARENDRA SINGH and B.K. AGARWAL - Basic extended X-ray absorption fine structure formula with spin correlations

[216] G. PASTORE and M.P. TOSI - Structure factor of liquid alkali metals using a classical-plasma reference system

[217] G. CHABRIER, G. SENATORE and M.P. TOSI - Structure of the $K_{0.8}$-$(KCl)_{0.2}$ liquid mixture

[232] A.M. JAYANNAVAR - A note on macroscopic quantum tunneling with dissipation

[234] A.M. KIREEV, A.M. KURBATOV and A.M. MELESHKO - Random model of two-level atoms interacting with electromagnetic field

[235] N.N. BOGOLUBOV, Jr. and A.M. KURBATOV - Dynamics of the Dicke model and superradiant state

[237] R. BUCZKO and J.A. CHROBOCZEK - Effect of uniaxial stress on the acceptor ground state and on the hopping conduction in p-type germanium and silicon

Mathematics

Title: Summer School on Dynamical Systems

Dates: 1 - 26 August 1983

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

Purpose: The aim of this School was to introduce the modern theory of dynamical systems, to survey part of the current mathematical knowledge, to draw attention to research problems and to give examples of applications.

Programme: Topics:
- Bifurcation theory
- Ergodic theory of dynamical systems
- Holomorphic dynamical systems
- Catastrophe theory
- Selected applications
- Strange attractors
- Asymptotic measures

The following lecture series were given:

Holomorphic dynamical systems; Ergodic theory of dynamical systems; Introduction to dynamical systems with applications; Introduction to bifurcation theory; Universality and renormalisation in dynamical systems; Catastrophe theory and applications.

Participation:

Total visitors:		211
From developing countries:		138

Representation:

Africa	developing:	46
Asia	developing:	27
	industrialized:	1
Europe	developing:	33
	industrialized:	68
Indonesia & Oceania	developing:	1
North & Central America	developing:	6
	industrialized:	4
South America		25

Title: XII International Colloquium on Group Theoretical Methods in Physics

Dates: 5 - 10 September 1983

Organizers: The Colloquium was jointly sponsored by the ICTP and the International School for Advanced Studies, Trieste, the Istituto Nazionale di Fisica Nucleare, Italy also lent its support.

Directed by: T. Weber, G. Denardo and G.C. Ghirardi, (Univ. of Trieste)

Advisory Committee: M.F. Atiyah (Oxford), H. Bacry (Marseille), L.C. Biedenharn (Durham, USA), K. Bleuler (Bonn), A.P. Cracknell (Dundee), H.D. Boebner (Clausthal), M. Hamermesh (Minneapolis), A. Janner (Nijmegen), M. Lax (New York), M. Moshinsky (Mexico City), Y Ne'eman (Tel Aviv), I. Prigogine (Austin and Brussels), T. Regge (Turin), Abdus Salam (Trieste), I.E. Segal (MIT), S. Sternberg (Harvard), G. 't Hooft (Utrecht), J. Wess (Karlsruhe), E.P. Wigner (Princeton), P. Winternitz (Montreal), B.G. Wybourne (Canterbury)

Purpose: The aim of the Colloquium was to offer physicists and mathematicans the opportunity of acquiring a general and up-to-date view of the use of group theoretical methods in various branches of physics.

Programme: Topics:
- Group representations, group extensions, contractions and bifurcations
- Completely integrable systems and group theory
- Elementary particles and gauge theories
- Supersymmetry and supergravity
- Atomic and nuclear physics
- Symmetries in condensed matter physics
- Canonical transformations and quantum mechanics
- Relativity
- Statistical mechanics

The following lectures were given:

From supersymmetry to Kaluza-Klein Theories; Pure spinors and internal symmetry groups; Indecomposable finite-dimensional

representations of the Poincaré group, and associated fields; Irreducibile representations of the basic classical Lie superalgebras; Hierarchies of non-linear evolution equations Kac-Moody algebras and analytic linearization: Chomology and group contraction; The algebra of the quantum non-local charges in the non-linear sigma model; Massive vector superfields with SU(2) internal symmetry; Eculidean supersymmetries in three and four dimensions; Seven spheres from octonions; Gauge theories in higher dimensions: linear relations for the gauge fields, integrability conditions, spherical symmetry in eight dimensions; The quark structure of nuclei from a group theoretical viewpoint; Advances in the theory of collective motion in nuclei; Degeneracies in the Zeeman effect and the symmetry group; Quantum vortices in diff [R3[; On tensor operator realizations of the classic Lie algebras and non-trivial zeros of the 6-j-symbol; Group contractions and the E(2)-like little group for massless particles as an infinite-momentum/zero-mass limit of the O(3)-like little group for massive particles; Indecomposable representations of graded algebras; Some recent results on the SU(3) SO(3) state labelling problem; Extended harmonic analysis on phase space and Born's quantum metric for space-time; Integrals of motion of non-stationary quantum systems; Group theory algebras and bosonization; Phase competition in a three-phase system; The symmetry group of a differential equation; Tensor operators as an extension of universal enveloping algebra; The use and validity of invariance principle; Anderson transition and non-linear ó-model; Symmetry breaking in solid state and particle physics; Some mathematical aspects of the renormalization group; Conformally invariant solution of Yang-Mills equations in Minkowski space; Two body relativistic scattering with an O(1,1) symmetric square well potential; Study of Michel's conjecture on a specific example; Invariants for physically irreducible representations of space groups; Self-dual monopoles and calorons; Renormalization group approach to lattice models; Emerging of the centre of the Kac-Moody algebra; Subgroups of Lie groups and symmetry reduction for non-linear partial differential equations; Counter examples to the maximality conjecture of Landau-Higgs models; Gamow

states in momentum representation; Integrable dynamical systems.

Participation:	Total visitors:		154
	From developing countries:		63
Representation:	Africa	developing:	9
	Asia	developing:	15
		industrialized:	3
	Europe	developing:	30
		industrialized:	71
	North & Central America	developing:	4
		industrialized:	17
	South America		5

Mathematics internal reports issued
in 1983

[20] W. OGANA - Calculation of flows past lifting airfoils

[21] W. OGANA - Choosing the decay function in the transonic integral equation

[22] M. BORGES and G. PIO - A sketch to the geometrical N = 2 - d - 5 Yang-Mills theory over a supersymmetric group manifold

[37] E.C. NJAU - Distortions in frequency spectra of signals associated with sampling pulse shapes

[38] E.C. NJAU - A theoretical procedure for studying distortions in frequency spectra of signals

[50] P.S. CHEE - Extending $(LH)^p$ functions from certain subvarieties in the bidisc

[54] TU GUI-ZHANG - Hamiltonian structures of some non-linear evolution equations

[55] SUDARSAN NANDA - Matrix transformations and sequence spaces

[60] P.A. LEE - Randomized random walk on a random walk

[70] N.H. PAVEL - Some problems on non-linear semi-groups and the blow-up of integral solutions

[83] TU GUI-ZHANG - On a hierarchy of evolution equations relating to the spectral $\psi_x = (\lambda A + P + \lambda^{-1}Q)$

[84] G.E. TANYI - Degenerate critical equilibrium states of hyperelastic systems - I: Geometry of degenerate critical states

[85] G.E. TANYI - Degenerate critical equilibrium states of hyperelastic systems - II: The mathematical structure of phase transition

[101] N.H. PAVEL - Positivity and stability of some different systems from biomathematics

[108] I.E. SHARKAWI and M.A. EL-SABAGH - On the solution of non-linear differential equations over the field of Mikusinski operators

[117] I.E. SHARKAWI - On the solution of the Stankovic problem in the theory of Mikusinski operators

[129] ALY A. ASAR - The integral solutions of the diophantine equation $7y^2 = x^3 + \gamma 2^n, \gamma = \pm 1, n \geq 0$

[130] ALY A. ASAR - The integral solutions of the diophantine equation $7y^2 = x^3 + \gamma 3^n, \gamma = \pm 1, n \geq 0$

[135] JAN TARSKI - Some dual relations in Twistor theory

[138] ALY A. ASAR - The integral solutions of the diophantine equation $7y^2 = x^3 + \gamma 5^n, \gamma = \pm 1, n \geq 0$

[142] MUHAMMAD ZAFRULLAH - The $D + XD_S[X]$ construction from GCD domains

[165] G.E. TANYI - Non-linear variational models for reaction and diffusion systems

[166] A. ROY CHOWDHURY - Inverse scattering equations for the non-linear SO(1,2)/SO(1,1) σ-model in two dimensions

[174] A. ROY CHOWDHURY and S. PAUL - Liouville surface and new non-linear integrable equations

[186] JIONG RUAN - Oscillations of first order retarded and advanced functional differential equations

[191] A. ROY CHOWDHURY, K. ROY CHOWDHURY and S. PAUL - Higher order Lie-Bäcklund symmetries of evolution equations

[194] A.-S.F. OBADA and AHMED B. MAYOUP - On the duffusion of pollutants in the atmospheric Ekman boundary layer

[195] K.R. YACOUB - On finite groups with four independent generators three of which being of an odd prime order

[196] A. ROY CHOWDHURY and SHANKAR BASAK - On some cnoidal wave solutions of some non-linear equations in one and one dimension

[199] M. SEWERYNSKI - Differential equation for the generalized Bell function

[202] JIONG RUAN - Non-oscillatory behaviour caused by retarded and advanced arguments for even-order functional differential inequalities and equations

[229] M. SAEED-UL-ISLAM - On the projective representation of finite Abelian groups

[231] M. SAEED-UL-ISLAM - A computational note on finite groups with two generators

Title: College on Soil Physics

Dates: 19 September - 7 October 1983

Organizers: Drs. D. Gabriels (State Univ. Ghent, Belgium) and E.L. Skidmore (U.S. Dept., of Agriculture, Manhattan, Kansas, USA), and co-sponsored by the Italian Dipartimento per la Cooperazione allo Sviluppo.

Purpose: The purpose of the College was to provide participants with a fundamental understanding of soil physical properties and processes so that they could apply knowledge gained to solving problems in soil physics. Agronomic and engineering activities such as tillage, water management, soil conservation, fertilization, drainage, irrigation and erosion control, require an understanding of the physical conditions and the physical processes in the soil. Although the course was descriptive and theoretical, special attention was given to the measurement of soil physical properties and the physical processes in the soil and to the practical interpretation and application of the different subjects.

Programme: Topics:

- General properties of soil
- Soil-Water
- Soil temperature, flow of heat and gas in the soil
- Soil-Water-Plant-Atmosphere Continuum
- Soil erosion (wind and water)

The following lectures were given at the College:

Soil aeration; Irrigation and reclamation of salt-affected soils; Thermal conduction through sands and 2-phase systems; Soil structure: formation and degradation; Heat Flow; Thermal properties of soil; Drainage of agricultural lands; Soil conservation; Soil consistency; Soil-water potential; Water-balance in rootzone; Impact of science and soil physics on development; Movement of solutes: convection, diffusion,

dispersion; Movement of solutes - miscible displacement; Soilwater determinations; Nuclear techniques in soil physics studies; Porosity; Mechanics of wind-erosion process and wind erosion control; Physics of evaporation; Mechanics of water erosion process; Spatial variability of soil physical properties; The soil resource: soil origins, soil classification; The faith of the forest; Water movement; Water transmission properties of soils; Soil structure - aggregation.

Participation:	Total visitors:		79
	From developing countries:		58
Representation:	Africa	developing:	18
	Asia	developing:	29
	Europe	developing:	2
		industrialized:	16
	Indonesia & Oceania	developing:	1
	North & Central America	developing:	1
		industrialized:	3
	South America		7
	International organizations representing industrialized:		2

The Centre supported the participation of 9 Scientists in the Course: "The Climatological Aspects of Desertification: Facts, Theories and Methods" (in Sicily), held immediately after the closure of the ICTP College on Soil Physics.

Title: Workshop on Pattern Recognition and Analysis of Seismicity

Dates: 5 - 16 December 1983

Organizers: Professors V.I. Keilis-Borok (Institute of Physics of the Earth, Academy of Sciences, USSR), G. Panza (Institute of Geodesy and Geophysics, Univ. of Trieste, Italy) and M. Zadro (Institute of Geodesy and Geophysics, Univ. of Trieste, Italy), and co-sponsored by the Italian Dipartimento per la Cooperazione allo Sviluppo, and the Consiglio Nazionale delle Ricerche.

Purpose: The Workshop was designed for scientists at post-graduate or M.Sc. level, interested in seismicity analysis and earthquake predictions. Its purpose was to facilitate and promote research in these fields, rather than provide some ready-made "prediction methods". Participants were given the necessary starting background for carrying out research on seismicity and earthquake prediction problems. Participants were trained in the use of modern exploratory data analysis and the corresponding computer software, through practical working sessions using terminals. Emphasis was put on the use of already existing data and also on the use of global observational systems for regional studies.

Programme: Topics:

- Pattern Recognition: Algorithms; Software; Numerical tests; Parameters used for the recognition of earthquake-prone areas.
- Seismicity Patterns: Algorithms; Software; Case histories.
- Related Topics: Seismicity models; Instability of large systems; Exploratory data analysis; Global observational systems; Structural modelling.

The following lectures were given:

Bursts of aftershocks: Long term premonitory seismicity pattern; Formal morphostructural zoning; Deformations in seismic zones; Premonitory seismicity patterns; Global seismic risk; Statistical analysis of seismicity;

Stochastic models of seismicity; Fracture dynamics: models of the earthquake source; Physical causes of aftershocks; Crack fusion dynamics: earthquake as a problem in statistical mechanics; Structure of lithosphere inferred from surface waves; On statistics of seismicity relevant to prediction studies; Instability of large systems; Contribution of geophysical knowledge to pattern recognition; UNESCO activities concerning natural hazards in developing countries; Recognition of earthquake prone areas; Behaviour of animals and the occurrence of the earthquakes.

Participation:	Total visitors:		60
	From developing countries:		36
Representation:	Africa	developing:	9
	Asia	developing:	12
	Europe	developing:	5
		industrialized:	23
	Indonesia & Oceania	developing:	1
	North & Central America	developing:	4
		industrialized:	1
	South America		4
	International organizations representing developing.		1

ACTIVITIES OUTSIDE THE SCHEDULED PROGRAMME

Title: Miscellaneous research

Dates: Throughout the year

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

Participation:	Total visitors:		136
	From developing countries:		96
Representation:	Africa	developing:	30
	Asia	developing:	49
	Europe	developing:	12
		industrialized:	36
	North & Central America	industrialized:	3
	South America		4
	International organizations representing	developing:	1
		industrialized:	1

Title: Hosted Activities

- Fourth International Symposium on Calcium Binding Proteins in Health and Disease. 16 - 19 May 1983
  - organized by Professor B. Bernard, University of Trieste, Italy.
- Meeting of Clusters and Groups of Galaxies
  13 - 16 September 1983.
  - organized by Astronomical Observatory, Trieste, Italy.

Title: 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. Workshop on Mathematical Physics
   Adelaide, Australia, 17 - 19 February 1983

2. College on Microprocessors
   Islamabad, Pakistan, April 1983

3. XXII International Schladming School
   Schladming, Austria, February 1983

4. International Days on Heliothermic Transfer
   Monastir, Tunisia, 4 - 10 April 1983

5. Confederation of International Scientific and Technological Organizations for Development (CISTOD) Congress
   Tunis, Tunisia, 11 - 15 April 1983

6. Topical Conference of Phenomenology of Unified Theories from Standard Model to Supersymmetries
   Dubrovnik, Yugoslavia, 22 - 28 May 1983

7. First Asian and Pacific Symposium in Physics
   Singapore, 12 - 18 June 1983

8. Workshop on Monsoon Rainfall Predicitions
   Dhaka, Bangladesh, 20 - 23 June 1983

9. Eighth International Nathiagali Summer College on Physics and Contemporary Needs
   Islamabad, Pakistan, 23 July - 11 August 1983

10. Summer Seminar Designed to Strengthen Organizations Skills of Physicists (Scientists) Returning to Developing Asian Countries
    Baddeck, Nova Scotia, Canada, 17 - 30 July 1983

11. Ecole d'Eté sur L'Enseignement de la Physique au Niveau Universitaire
    Bizerte, Tunisia, June - July 1983

12. Multicisncias 1983
    Cuzco, Peru, 29 August - 9 September 1983

13. Asian Regional Conference on Laboratory Physics Education - ASPEN
    Peking, China, 12 - 16 September 1983

14. XIV Yugoslav Symposium on Biophysics
    Opatjia, Yugoslavia, end of September 1983

15. 2nd Petra School of Physics
    Amman, Jordan, 24 - 30 September 1983

16. Second Seminar on Living State
    New Delhi, India, 13 - 19 November 1983

17. Third Rabat Rencontre on Grand Unification Theories, Supersymmetries, Supergravity and Phase Transitions
    Rabat, Morocco, 14 November - 3 December 1983

18. Workshop on Vacuum Thechniques
    Bogata, Colombia, Autumn 1983

19. Second Asian School on Solar Energy Harnessing
    Bangkok, Thailand, 6 - 16 December 1983

20. First Tropical College on Applied Physics
    Kuala Lumpur, Malaysia, 26 December 1983 - 14 January 1984

21. The Southern Africa Mathematical Sciences Association Conference
    Harare, Zimbabwe, December 1983

22. International Conference on the Role of Laboratory in Physics Education
    Jaipur, India, 29 December 1983 - 2 January 1984

Preprints and internal reports issued in other fields in 1983

Geo. [12] S.K. ADJEPONG - Observation of VLF atmospherics

Geo. [13] S.K. ADJEPONG - Measurement of ionospheric total electron content (TEC)

Q.O. [25] J. MOSTOWSKI and B. SOBOLEWSKA - Fresnel number dependence of the delay time statistics in superfluorescence

M.P. [29] A.N. PANDEY, A.R.M. AL-JUMALY, U.P. VERMA and D.R. SINGH - Bond properties of anionic halogenocadmate (II) complexes of the type CdX_3Y^{2-} (X ≠ Y = Cℓ,Br,I)

Q.O. [30] B. SOBOLEWSKA - Initiation of superfluorescence in a three-level "swept-gain" amplifier

Laser [31] V. RAMACHANDRAN - Theoretical analysis of the switching efficiency of a grating-based laser beam modulator

A.P. [41] R. BONIFACIO - Time-energy uncertainty relation and irreversibility in quantum mechanics

Geo. [45] M.H.A. HASSAN - Sand transport and desertification in arid lands

A.P. [51] R. BONIFACIO - A coarse grained description of time evolution: Irreversible state reduction and time-energy relation

A.P. [58] R.S. PUNDIR and K.C. MATHUR - Elastic scattering of positrons with hydrogen and lithium atoms at intermediate energies

A.P. [77] S.P. KHARE - On Born series for electron hydrogen molecule scattering

Pl. [86] I.A. ELTAYEB - On the progatation and stability of wave motions in rapidly rotating spherical shells - II: Hydromagnetic two-dimensional motions

Geo. [100] A.M. CHOUDHURY - The spiral structure of a tropical cyclone and computation of maximum wind speed in it

Energy[111] N.A. EISSA, M.M. ABDEL MEGIUD, A. DERIU and G. ALBANESE - Characterization of Egyptian coal from Sinai using Mössbauer spectroscopy

B.P. [118] M.I. EL GOHARY, M. BASSYONI and M.I. SHARAF - Effects of magnetic field on muscle performance abilities

Energy[128] O.D. CORBELLA and C.R. GARIBOTTI - Some comments about the comparison between a conventional and a solar powered absorption refrigeration system

B.P. [146] M.I. EL GOHARY, M. BASSYONI and M.I. SHARAF - Laser radiation in Carpal tunnel syndrome

A.P. [176] R.K. CHOUDHURY and B. GHOSH - Variable scaling method and Stark effect in hydrogen atom

Pl [184] M.H.A. HASSAN and M.K. WALLIS - Stochastic diffusion of dust grains by the interplanetary magnetic field

S.E. [193] P.C. JAIN - Study of the errors in the calculation of extraterrestrial radiation on horizontal surface (H_0) and recommended days for the calculation of $\bar{H}_0$

Grav. [205] IRSHADULLAH KHAN and ASGHAR QADIR - Upper bound on entropy

S.E. [213] P.C. JAIN - Solar irradiation over Zambia

A.P. Atomic physics

Q.O. Quantum optics

S.E. Solar energy

B.P. Biophysics

Geo. Geophysics

M.P. Molecular physics

Grav. Gravity

Pl. Plasma physics

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