

News from ICTP

No. 10
March 1988

A Review of the Scientific Activities at the ICTP in 1987

The main fields of research and training-for-research at the Centre in 1987 were:

- (a) Fundamental physics (high energy and particle physics, cosmology and astrophysics);
- (b) Condensed matter, atomic and molecular physics (atomic and molecular physics, materials science, surfaces and interfaces);
- (c) Mathematics (geometry, topology, differential equations, mathematical physics);
- (d) Physics and energy (nuclear physics and fission, plasma physics and nuclear fusion, non-conventional energies);
- (e) Physics and environment (soil physics, climatology and meteorology, physics of the atmosphere, magnetosphere, aeronomy);
- (f) Applied physics and high technology (applicable mathematics, microprocessors, communications, instrumentation) and
- (g) Physics and development.

Some 3700 scientists took part in the activities of the Centre, in three major projects outside Trieste and in the Programme for Training at Italian Laboratories, staying for a total of almost 3900 man/months. Over 58% of them were from developing countries, accounting for 83% of the total man/months. One-hundred and forty-nine of them were associated members from 45 developing countries and 576 of them were researchers from federated institutes in 56 developing countries.

Fundamental physics

Research in high-energy physics was carried out throughout the year, with the participation of 120 physicists from developing countries out of a total of 201. A two-week school and workshop on superstrings held in April was attended by 75 physicists from developing countries out of a total of 258. The now traditional Summer Workshop in High Energy Physics (including, this time, a topical conference on scalar fundamental particles) was held in June-August, with an audience of 125 physicists from developing countries (out of a total of 206); it was preceded by a meeting on new scale effects in low-energy precision experiments.

Condensed matter, atomic and molecular physics

Research was conducted throughout the year with the participation of 75 scientists from developing countries out of a total of 102. Three high-level training courses (the Winter College on Atomic and Molecular Physics, the Spring College on Metallic Materials and the School on Polymer Physics) were attended by 228 scientists from developing countries out of a total of 299.

The annual Research Workshop in Condensed Matter, Atomic and Molecular Physics, which was held from the end of June to the beginning of September, was attended by 190 physicists from developing countries out of a total of 227. Other activities included: the Third International Workshop on Total Energy and Force Methods, a workshop on surface science and catalysis, a working party on the physics of porous media, and a

workshop on non-linear charge density wave systems. They brought together 239 physicists, out of whom 99 were from developing countries.

Contents

Review of the Scientific Activities at ICTP in 1987	1
Facts and Figures on Publication Output	6
Report from Trieste: ICTP on the March	8
Revisiting an Intellectual Crossroads	11
Italy Grants Five Billion Dollars a Year to Help Third World	13
Activities at the ICTP from January to March 1988	13

Mathematics

Research in mathematics, carried out

Research in mathematics, carried out throughout the year, brought together 36 mathematicians from developing countries out of a total of 47. The scientific meetings organized by the Mathematics Group included a topical meeting on fibre bundles and the College on Riemann Surfaces, attended by 88 scientists from developing countries out of a total of 141.

Physics and energy

The Third Workshop on Perspectives in Nuclear Physics at Intermediate Energies, organized by the Centre in collaboration with the Italian National

Institute of Nuclear Physics (INFN, Rome), was attended by 22 scientists from developing countries out of a total of 115. The Spring College on Plasma Physics, which included an international conference on cometary plasma physics followed by a workshop on the subject, was attended by 99 physicists from developing countries out of a total of 153. At the end of August and in September, the following activities took place: the Workshop on Material Science and the Physics of Non-conventional Energy Sources, co-sponsored by the Italian Department for Cooperation to Development and the Italian National Research Council; the Workshop on the Economics, Modelling and Management of Energy, co-sponsored by the Kuwait Foundation for the Advancement of Science; and the Workshop on the Interaction between Physics and Architecture in Environment Conscious Design. Two hundred and fifty-four scientists from developing countries took part in these activities out of a total of 329.

Physics and environment

The Spring College on Geomagnetism and Acronomy, the Third College on Soil Physics and the Second Workshop on Cloud Physics and Climate were attended by 226 scientists from developing countries out of a total of 286.

Applied physics and high technology

The Second Workshop on Mathematics in Industry and the Workshop on Remote Sensing and Resource Exploration were held in February-March. In June, the International Committee for Future Accelerators held a School on Instrumentation in Elementary Particle Physics at the Centre. For the first time since its inception, the Centre organized a workshop on telematics, which was followed by the Fourth College on Microprocessors - Technology and

Applications in Physics. Five-hundred and twenty-six scientists, of whom 351 came from developing countries, participated in these meetings.

Adriatico research conferences

Seven "Adriatico Research Conferences" were held. They dealt with: one-dimensional organic conductors, vacuum in non-relativistic matter-radiation systems, scanning tunneling in microscopy, interatomic forces in relation to defects and disorder in condensed matter, high-temperature superconductors, path integral, and synchrotron radiation and free electron lasers. These meetings were attended by 133 scientists from developing countries out of a total of 503.

Physics and development

As in the past, a number of the experts and leading scientists taking part in the activities at the Centre lectured on physics and its relevance to development. Forty-nine lectures were given in 1987.

Training at Italian laboratories

One-hundred and four grants were awarded to scientists from developing countries for training at Italian academic and industrial laboratories under a programme which started in 1982 with the financial support of the Government of Italy.

External activities

External activities

A Workshop on Microcomputers in the Teaching of Physics and Mathematics was held in Sudan, the Workshop on the Fabrication of Low-cost Laboratory Equipment for Physics was held in Tanzania, and the Workshop on the Applicability of Environmental Physics and Meteorology in Africa was held in Ethiopia. In the field of training for physics and mathematics teachers, the Centre sponsored 79 courses, workshops and symposia in 33

countries. In addition, the Centre sponsored 5 scholarships for scientists wishing to work at 5 research institutions in developing countries; this programme was financed by the Government of Italy.

Meetings hosted by the Centre

The Centre hosted a meeting of the Initiative Committee of the International Foundation for Survival and a Workshop on Scientific and Technological Applications of Synchrotron Radiation.

Books and equipment donation programme

In 1987, the Centre distributed 10000 journals, 12000 sets of proceedings and 10000 books to more than 400 institutes in 96 developing countries.

Equipment from CERN (European Laboratory for Particle Physics) was sent to several universities in various developing countries.

Awards

The 1987 Dirac Medals were awarded to Professors Bryce DeWitt (University of Texas at Austin, USA) and Bruno Zumino (University of California at Berkeley, USA) for their outstanding contributions to theoretical physics.

Professor Li Jia Ming from the Institute of Physics of the Chinese Academy of Sciences was awarded the 1986 Alfred Kastler Prize for his outstanding contribution in the field of atomic and molecular physics.

Dr. Abdullah Sadiq of Pakistan was atomic and molecular physics.

Dr. Abdullah Sadiq of Pakistan was awarded the 1987 Nikolaj N. Bogolubov Prize in recognition of his contributions to scientific knowledge in the field of solid state physics.

Preprints and internal reports

The overall production amounted to 421.

The following tables deal with all activities combined, therefore they show the *actual* number of visitors, i.e. those scientists who participated in more than one activity are counted only once.

TABLE I
Summary of participation
1987 vs. 1986

	Visitors		Man/Months		Total		Percentage (Dev. vs. total)	
	Dev.	Ind.	Dev.	Ind.	Visitors	M/M	Visitors	M/M
1986	2180	1471	3146.02	674.49	3651	3820.51	59.70%	82.34%
1987	2171	1529	3247.27	652.01	3700	3899.28	58.68%	83.28%
Increase/ Decrease	-0.41%	+3.94%	+3.22%	-3.45%	+1.34%	+2.06%		

The above figures for 1986 include:

Regional college on microprocessors (Hefei, P.R. China)

95	29	64.45	6.58	124	71.03	76.61%	90.73%
----	----	-------	------	-----	-------	--------	--------

Workshop on curriculum development (Nairobi, Kenya)

116	10	48.72	4.20	126	52.92	92.10%	92.10%
-----	----	-------	------	-----	-------	--------	--------

Training in Italian laboratories

127	-	773.92	-	127	773.92	100.00%	100.00%
-----	---	--------	---	-----	--------	---------	---------

The above figures for 1987 include:

Workshop on microcomputers (Khartoum, Sudan)

24	3	7.92	0.99	27	8.91	88.89%	88.89%
----	---	------	------	----	------	--------	--------

Workshop on fabrication of low cost laboratory equipment (Dar-es-Salaam, Tanzania)

37	-	36.63	-	37	36.63	100.00%	100.00%
----	---	-------	---	----	-------	---------	---------

Workshop on the applicability of environmental physics and mathematics (Addis Ababa, Ethiopia)

60	8	21.60	2.88	68	24.48	88.24%	88.24%
----	---	-------	------	----	-------	--------	--------

Training in Italian laboratories

108	-	730.10	-	108	730.10	100.00%	100.00%
-----	---	--------	---	-----	--------	---------	---------

TABLE II

Participation by geographical areas
in the research and training-for-research activities
in the research and training-for-research activities
of the ICTP in 1987

Geographical Areas	Visitors		Man/months		Total for Area	
	Dev.	Ind.	Dev.	Ind.	Visitors	Man/Months
Africa	547	-	690.56	-	547	690.56
Asia	873	48	1589.28	38.45	921	1627.73
Europe	393	1108	359.66	416.83	1501	776.49
Indonesia and Oceania	19	14	18.47	21.44	33	39.91
North and Central America	88	323	113.86	166.14	411	280.00
South America	251	-	475.44	-	251	475.44
International Organizations	-	36	-	9.15	36	9.15
TOTAL	2171	1529	3247.27	652.01	3700	3899.28
% Developing vs. Total					58.68%	83.28%

**Breakdown of the number of scientists
who worked at the ICTP in 1987
and of man/months per activity**

The above tables show that the total number of scientists who came to the ICTP is 3700 while the total number of man/months is 3899.28. In the tables which follow the number of scientists will be higher since several of them took part in more than one activity.

Table III shows a summary of the breakdown. Percentages refer to the total participation in the field vs. the grand total.

TABLE III
Summarized breakdown by field of activity

Activity	Number of Visitors				Number of Man/months			
	Dev.	Ind.	Total	%	Dev.	Ind.	Total	%
1. Fundamental Physics	322	380	702	16.77%	467.14	254.63	721.77	18.51%
2. Condensed Matter	592	275	867	20.71%	600.03	119.08	719.11	18.44%
3. Mathematics	124	64	188	4.49%	304.51	77.26	381.77	9.79%
4. Physics & Energy	375	222	597	14.26%	201.39	49.99	251.38	6.45%
5. Physics & Environment	226	60	286	6.83%	172.19	20.15	192.34	4.93%
6. Applied Physics	351	175	526	12.57%	315.23	60.10	375.33	9.63%
7. Adriatico Conferences	133	370	503	12.02%	27.33	57.00	84.33	2.16%
8. Other research	227	50	277	6.62%	363.20	9.93	373.13	9.57%
TOTAL	2350	1596	3946	94.27%	2451.02	648.14	3099.16	79.48%
Outside activities*								
1. Italian laboratories	108	-	108	2.58%	730.10	-	730.10	18.72%
2. Microcomputers (Sudan)	24	3	27	0.65%	7.92	0.99	8.91	0.23%
3. Low-cost equip. (Tanzania)	37	-	37	0.88%	36.63	-	36.63	0.94%
4. Applicability of environmental physics and meteorology (Ethiopia)	60	8	68	1.62%	21.60	2.88	24.48	0.63%
TOTAL	229	11	240	5.73%	796.25	3.87	800.12	20.52%
TOTAL	229	11	240	5.73%	796.25	3.87	800.12	20.52%
GRAND TOTAL	2579	1607	4186		3247.27	652.01	3899.28	

Hosted activities

1. Workshop on scientific and technological applications of synchrotron radiation
2. Initiative Committee of the International Foundation for Survival

* In addition, the Centre supported 79 regional courses, workshops and conferences in all regions of the world (see pages 67-68).

Table IV shows a statistical summary of the activities at the ICTP itself and outside its premises.

TABLE IV
Statistical summary on activities
held at and outside the ICTP

Figures on research include long- and short-term scientists as well as Associate Members, some scientists from Federated Institutes and seminar lecturers.

As regards the activities held outside the ICTP, the 79 courses sponsored but not organized by ICTP are not included.

Activity	Number of Visitors			Number of Man/months		
	Dev.	Ind.	Total	Dev.	Ind.	Total
1. At the ICTP:						
(a) Research:						
Fundamental Physics	120	81	201	350.17	137.00	487.17
Condensed Matter	75	27	102	166.56	25.85	192.41
Mathematics	36	11	47	218.13	52.63	270.76
Microprocessors Lab	6	9	15	38.99	3.64	42.63
Other	227	50	277	363.20	9.93	373.13
Total	464	178	642	1137.05	229.05	1366.10
% Total vs. Grand Total			15.34%			35.03%
(b) Training for research (courses, workshops and conferences)						
Total	1886	1418	3304	1313.97	419.09	1733.06
% Total vs. Grand Total			78.93%			44.45%
2. Outside activities:						
(a) Italian laboratories	108	-	108	730.10	-	730.10
(b) Microcomputers (Sudan)	24	3	27	7.92	0.99	8.91
(a) Italian laboratories	108	-	108	730.10	-	730.10
(b) Microcomputers (Sudan)	24	3	27	7.92	0.99	8.91
(c) Low-cost equip. (Tanzania)	37	-	37	36.63	-	36.63
(d) Applicability of environmental physics and meteorology (Ethiopia)	60	8	68	21.60	2.88	24.48
Total	229	11	240	796.25	3.87	800.12
% Total vs. Grand Total			5.73%			20.52%
GRAND TOTAL	2579	1607	4186	3247.27	652.01	3899.28

**One More Version of the Facts and Figures
on Publication Output
and Relative Citation Impact of 107 Countries**

1978-1980

by T. Braun, W. Glänzel, A. Schubert,
Hungarian Academy of Sciences,
Budapest, Hungary

by courtesy of
Scientometrics, Vol. 11 Nos 1-2 (1987)

Table 1

Total publication output -
All science fields combined
(1978 - 1980)

1	USA.....	407726
2	UK.....	100051
3	USSR.....	87999
4	Japan.....	70794
5	Germany Fed. Rep.....	69542
6	France.....	58015
7	Canada.....	45608
8	India.....	35322
9	Australia.....	25142
10	Italy.....	22721
11	Netherlands.....	17294
12	Sweden.....	17013
13	Switzerland.....	14592
14	Poland.....	12369
15	Israel.....	11237
16	German Dem.Rep.....	10803
17	Czechoslovakia.....	9900
18	Belgium.....	9662
19	Denmark.....	9233
20	Finland.....	6590
21	Spain.....	6510
22	Hungary.....	6498
23	Austria.....	6491
24	South African Rep.....	6093
25	Norway.....	5877
26	New Zealand.....	5594
27	Brazil.....	4142
28	Egypt.....	2924
29	Bulgaria.....	2868
30	Yugoslavia.....	2647
31	Argentina.....	2595
32	China.....	2457
33	Nigeria.....	2217
34	Ireland.....	2130
35	Greece.....	2107
36	Romania.....	2015
35	Greece.....	2107
36	Romania.....	2015
37	Mexico.....	1736
38	Chile.....	1449
39	Taiwan.....	1060
40	Venezuela.....	1001
41	Hong Kong.....	786
42	Turkey.....	731
43	Iran.....	720
44	Kenya.....	704
45	Thailand.....	530
46	Portugal.....	524
47	Malaysia.....	520
48	Iraq.....	517
49	Saudi Arabia.....	468
50	Pakistan.....	422
51	Korea Rep.....	354
52	Singapore.....	332

Comments to the tables

Previous basics: Details and additional information on the scientometric principles and procedures underlying the data outlined in this flash can be found in the following publications:

- (a) T. Braun, W. Glänzel, A. Schubert, *Scientometric Indicators. A 32-Country Comparative Evaluation of Publishing Performance and Citation Impact*, World Scientific Publishing Co., Singapore, Philadelphia, 1985.
- (b) A. Schubert, T. Braun, Relative indicators and relational charts for comparative assessment of publication output and citation impact, *Scientometrics*, 9 (1987) 281.

Data sources: as main data source, annual cumulations of the magnetic tapes of the *Science Citation Index (SCI)* database of the Institute for Scientific Information (Philadelphia, PA) were used. Database of the Institute for Scientific Information (Philadelphia, PA) were used.

Source and citation periods: original papers, review papers, notes, and letters published in the *SCI* source journals in 1978-80 were considered source items, and citations to them in the two years following their publication were counted. Thus, e.g., mean citation rate per publication was calculated as 1979-80 citations to 1978 publications plus 1980-81 citations to 1979 publications plus 1981-82 citations to 1980 publications divided by the number of publications in 1978-80.

Selection and classification of countries: all countries, which produced at least 10 first authored papers in the source period were included. (Papers were assigned to countries according to the corporate address of the first author as indicated in the byline of the publication.)

Indicator definitions: "Publication output" and "Percentage annual change in publication output" are self-explaining. Indicators of the type "Citation rate per publication" are to be interpreted as mentioned above, i.e., considering counts of three two years citation periods each and one three-year source period (1978-80).

Expected citation rates were calculated from the average citation rates of the journals involved. Actual citation rates were the results of direct citation counts. Relative citation rate means the ratio of actual to expected citation rates.

Reliability of indicators and rankings: most of the figures reported here can be credited by acceptable statistical "reliabilities" or "confidence limits". It is however feared that enumerating these data here would make this flash completely overquantified. Instead it is stated as a simple rule of thumb, that no indicator or rank position which is based on less than 100 publications be taken as statistically reliable. This does not mean, of course, that all such values are meaningless. However, they must be handled with care, and have to be regarded as "informatory indicators", as indicators, which inform or hint to something rather than assert or prove.

53	Philippines	281
54	Sudan	260
55	Jamaica	233
56	Lebanon	221
57	Kuwait	218
58	Sri Lanka	218
59	Zimbabwe	203
60	Colombia	196
61	Côte d'Ivoire	188
62	Tanzania	186
63	Tunisia	186
64	Bangladesh	182
65	Costa Rica	164
66	Algeria	151
67	Morocco	151
68	Ghana	143
69	Papua New Guinea	132
70	Senegal	129
71	Libya	125
72	Cuba	123
73	Indonesia	116
74	Iceland	114
75	Peru	109
76	Jordan	107
77	Trinidad & Tobago	105
78	Zambia	103
79	Uruguay	90
80	Ethiopia	88
81	Vietnam	87
82	Uganda	85
83	Guatemala	72
84	Cameroon	63
85	Zaire	56
86	Malawi	51
87	Sierra Leone	39
88	Panama	34
89	Burkina Faso	29
90	Nepal	26
91	Burma	22
92	Bolivia	21
93	El Salvador	21
94	Afghanistan	20
95	Ecuador	20
96	United Arab Emirates	18
97	Central African Rep.	15
98	Somalia	15
99	Congo	14
100	Mongolia	14
101	Paraguay	14
102	Syria	14
103	Niger	13
104	Dominica	12
105	Liberia	11
106	Togo	11
107	Mozambique	10

Table 2

Percentage annual change
in publication output -
All science fields combined
(1978 - 1980)

* Indicator is based on a sparse population of papers (N<100) and is therefore of informatory character only.

1	China	62.13%
2	Congo*	60.66%
3	Panama*	52.74%
4	Korea Rep.	52.56%
5	Nepal*	47.90%
6	Liberia*	43.86%
7	Saudi Arabia	37.26%
8	Zimbabwe	36.47%
9	Vietnam*	34.08%
10	Ecuador*	32.18%
11	Tunisia	26.40%
12	Dominica*	25.54%
13	Mongolia*	25.00%
14	Algeria	22.22%
15	Chr. African Rep.*	20.27%
16	Spain	17.54%
17	Greece	16.97%
18	Tanzania	15.51%
19	Malawi*	15.16%
20	Togo*	14.62%
21	Senegal	14.24%
22	Morocco	14.12%
23	Chile	13.76%
24	Argentina	13.55%
25	Lebanon	12.97%
26	Portugal	12.66%
27	Sri Lanka	11.76%
28	Kenya	11.56%
29	Peru	11.07%
30	Guatemala*	10.70%
31	Kuwait	10.37%
32	Nigeria	10.26%
33	Somalia*	10.14%
34	Japan	9.81%
35	Ireland	9.47%
36	Pakistan	9.28%
37	Mexico	9.27%
38	Brazil	8.75%
39	Ethiopia*	8.54%
40	Turkey	7.83%
41	Colombia	7.67%
42	Taiwan	7.66%
43	Philippines	7.49%
44	Libya	7.22%
45	Italy	7.21%
46	Trinidad & Tobago	7.16%

47	Egypt	7.14%
48	Singapore	6.83%
49	Netherlands	6.13%
50	Cuba	6.11%
51	Israel	5.83%
52	Australia	5.60%
53	Indonesia	5.25%
54	Belgium	4.66%
55	Hong Kong	4.58%
56	Bangladesh	4.13%
57	Sudan	4.04%
58	UK	3.95%
59	USA	3.93%
60	USSR	3.79%
61	Iraq	3.77%
62	Sweden	2.72%
63	Venezuela	2.70%
64	Denmark	2.44%
65	Germany Fed.Rep.	2.24%
66	Finland	1.84%
67	Switzerland	1.72%
68	France	1.50%
69	Austria	1.46%
70	Poland	1.32%
71	Hungary	1.32%
72	New Zealand	1.10%
73	Norway	0.69%
74	India	0.64%
75	Canada	0.58%
76	South African Rep.	0.37%
77	Thailand	0.28%
78	Ghana	0.00%
79	Côte d'Ivoire	0.00%
80	Sierra Leone*	0.00%
81	Syria*	0.00%
82	United Arab Em.*	0.00%
83	Papua New Guinea	-1.16%
84	Bulgaria	-1.20%
85	Czechoslovakia	-1.89%
86	German Dem.Rep.	-2.32%
87	Jamaica	-3.88%
88	Yugoslavia	-4.88%
89	Romania	-5.74%
90	Malaysia	-6.66%
91	Iceland	-9.25%
92	Uganda*	-9.68%
93	Jordan	-11.31%
94	Zaire*	-13.49%
95	Bolivia*	-14.70%
96	Costa Rica	-15.22%
97	Burkina Faso*	-15.65%
98	Cameroon*	-17.10%
99	Mozambique*	-18.42%
100	Uruguay*	-20.33%
101	El Salvador*	-21.84%
102	Burma*	-24.34%
103	Niger*	-26.14%

104	Iran.....	-30.04%
105	Zambia.....	-39.82%
106	Paraguay*.....	-75.00%
107	Afghanistan*.....	-92.88%

Table 3

**Observed citation rate
per publication -
All science fields combined
(1979-1980/1978 +
1980-81/1979 +
1981-82/1980)**

* Indicator is based on a sparse population of papers (N<100) and is therefore of informatory character only.

1	USA.....	3.82
2	Switzerland.....	3.77
3	Sweden.....	3.42
4	Netherlands.....	3.26
5	Denmark.....	3.25
6	UK.....	2.93
7	Canada.....	2.72
8	Belgium.....	2.67
9	Finland.....	2.63
10	Germany Fed.Rep.....	2.60
11	Israel.....	2.55
12	Norway.....	2.47
13	Australia.....	2.46
14	Japan.....	2.35
15	France.....	2.32
16	Italy.....	2.19
17	Guatemala*.....	2.13
18	Panama*.....	2.06
19	Mexico.....	1.93
20	Hong Kong.....	1.72
21	New Zealand.....	1.71
22	Austria.....	1.71
23	Jamaica.....	1.58
24	Argentina.....	1.57
23	Jamaica.....	1.58
24	Argentina.....	1.57
25	Portugal.....	1.55
26	Spain.....	1.53
27	Chile.....	1.53
28	Burkina Faso*.....	1.52
29	Ireland.....	1.51
30	Korea Rep.....	1.51
31	Senegal.....	1.49
32	Ethiopia*.....	1.47
33	Iceland.....	1.46
34	South African Rep.....	1.46
35	Taiwan.....	1.44
36	Uruguay*.....	1.43
37	Hungary.....	1.39
38	Venezuela.....	1.39
39	Colombia.....	1.38
40	Bangladesh.....	1.37

41	Brazil.....	1.33
42	Greece.....	1.32
43	Kenya.....	1.31
44	Yugoslavia.....	1.24
45	German Dem.Rep.....	1.15
46	Poland.....	1.09
47	Sri Lanka.....	1.09
48	Singapore.....	1.09
49	Czechoslovakia.....	1.03
50	Kuwait.....	1.03
51	Philippines.....	1.03
52	Thailand.....	1.01
53	Liberia*.....	1.00
54	Trinidad & Tobago.....	1.00
55	Turkey.....	1.00
56	Lebanon.....	0.99
57	Malaysia.....	0.95
58	Malawi*.....	0.92
59	Zimbabwe.....	0.92
60	Indonesia.....	0.91
61	Algeria.....	0.87
62	Congo*.....	0.86
63	Romania.....	0.84
64	Pakistan.....	0.84
65	Costa Rica.....	0.84
66	Dominica*.....	0.83
67	Tanzania.....	0.83
68	Nepal*.....	0.81
69	India.....	0.80
70	Peru.....	0.80
71	Tunisia.....	0.78
72	Sierra Leone*.....	0.77
73	Bolivia*.....	0.76
74	Cameroon*.....	0.76
75	Iran.....	0.76
76	Ghana.....	0.76
77	Saudi Arabia.....	0.75
78	Côte d'Ivoire.....	0.71
79	Iraq.....	0.67
80	Nigeria.....	0.67
81	Jordan.....	0.65
82	Ecuador*.....	0.65
81	Jordan.....	0.65
82	Ecuador*.....	0.65
83	Papua New Guinea.....	0.64
84	Zaire*.....	0.64
85	Cuba.....	0.63
86	USSR.....	0.62
87	Bulgaria.....	0.61
88	Egypt.....	0.60
89	Sudan.....	0.60
90	Morocco.....	0.58
91	Zambia.....	0.57
92	El Salvador*.....	0.57
93	Libya.....	0.52
94	Burma*.....	0.50
95	China.....	0.43
96	Syria*.....	0.43
97	Ctr. African Rep.*.....	0.40
98	Uganda*.....	0.38

99	Paraguay*.....	0.36
100	Afghanistan*.....	0.35
101	Vietnam*.....	0.32
102	United Arab Em.*.....	0.28
103	Somalia*.....	0.20
104	Niger*.....	0.15
105	Mozambique*.....	0.10
106	Togo*.....	0.09
107	Mongolia*.....	0.00

**Report from Trieste:
ICTP on the March**

**Why Have More than 22,000
Scientists Studied at the
International Centre
for Theoretical Physics**

*by Akhtar Mahmud Faruqi,
Pakistan Atomic Energy Commission*

*By courtesy of
IAEA Bulletin, 1,1987*

A small Roman town under the Caesars, an independent municipality in the Middle Ages, a flourishing international port and trading centre between the West and East after 1700, and an Italian entity since 1918, Trieste is a city of entrancing scenic attractions. Tucked away in the northeast of Italy on the Adriatic Sea, the city stands on tree-dotted hills resembling a sunlit sea-washed amphitheatre, with the surrounding Carso plateau rated as one of the most enchanting landscapes in Europe.

But Trieste is now known not just for its scenic splendours or past grandeurs.

But Trieste is now known not just for its scenic splendours or past grandeurs. It is identified increasingly as a meeting place of bright scientific minds from the West and the East, from the North and the South. It has come to play a leading role in a new enterprise: the promotion of physics, of the scientific ethos, in the science-deficient developing world. Year after year, eager young physicists dash to the International Centre for Theoretical Physics (ICTP) to re-establish their bearings in the fast developing world of contemporary physics. The last few years have been among the most exciting periods — they have witnessed the most fundamental breakthroughs in understanding — since the early days of

quantum mechanics. More than 22 000 researchers from developed and developing countries have made their pilgrimage to ICTP since its inception and have contributed to the mainstream of physics, besides enriching their own scientific communities at home. The ICTP's Director, Abdus Salam, shared the 1979 Nobel Prize in Physics for his unifying theory of the electro-weak force.

Physics and Development

The discipline of physics, according to Salam "is an incredibly rich discipline, ... a science of wealth creation par excellence" because of its implicit connection with high technology and materials exploitation. The view is widely shared. "As perhaps the most truly international of all the sciences, physics has the opportunity and the responsibility to continue this flow of benefits to society and, most important, to extend them to the very large fraction of the world's burgeoning populations that have thus far — for whatever reason — been denied them," D. Allan Bromley has noted¹. The report, *Physics in Perspective*, strengthens Salam and Bromley's view: "Science is knowing. What man knows about inanimate nature is physics, or rather the most lasting and universal things that he knows make up physics. As he gains more knowledge, what would have appeared complicated or capricious can be seen as essentially simple and in a deep sense orderly. And, to understand how things work is to see how, within environmental constraints and the limitations of wisdom, better to accommodate nature to man and man to nature"².

The Early Years

But the ICTP was conceived by Salam, a gifted Pakistani physicist, not so much to create economic wealth in developing countries as to enrich their intellectual stock. "Salam's strength is that he believes miracles are possible provided one goes out and helps them on their way," Nigel Calder has stated³. Thus, Salam remained unruffled when

his proposal for the creation of an international centre for theoretical physics got a polite rebuff in UN circles. Some comments were particularly harsh and stinging: "Theoretical physics is the Rolls-Royce of sciences — the developing countries need only bullock carts". Salam recalls: "People took it (the proposal for ICTP) half-jokingly and many delegations abstained on the vote when it was approved for a preliminary study. I found out that the idea interested the poor countries. What I wanted to do was to give the poor a place of their own where they would not have to beg anybody. Why should not a bright youngster in Pakistan have the right to receive the same stimulating atmosphere as an Englishman or an American, provided he deserves it?"

Why should a developing country scientist be confronted with the cruel choice of either giving up physics or his country? Salam's unrelenting campaign, later ably supported by Italian Professor Budinich, was eventually crowned with success. In 1962, the General Conference of the IAEA approved the creation of the ICTP. "That was the most momentous day of my life," Salam exuberantly declares. "I seldom smoke, but I must have smoked 50 cigarettes that day and I went through a kilo of grapes. At the end of the debate, 60 hands went up in favour — and we had won".

The Doors Open

In 1964, the ICTP opened its doors at Trieste. It is now jointly sponsored by the IAEA and the United Nations Educational, Scientific, and Cultural Organization (UNESCO), and generously supported by the Italian Government and the hospitable Triestines. Today, the ICTP serves as an important point of convergence, a meeting place, for physicists of all nationalities. It welcomes scientists from Africa, Asia, North and South America, Europe, and Australia. For East European physicists, ICTP is one of the only places in the world for effective collaboration with the West. Salam has vividly demonstrated that various interactions of nations and

cultures are no obstacle to the brotherhood of man in science. In the words of Prof. John Ziman of Bristol University, he has acted as "a sort of one-man multi-national corporation, busily transferring intellectual technology to the less developed countries of the world".

The Centre Today

Starting with an annual budget of US \$0.5 million, the ICTP's funds have risen to US \$8.7 million in 1985, reflecting the increase in its activities and the growing multiplicity of its programme. Gradually, coverage has broadened from fundamental physics to encompass physics that may be more relevant to the needs of the developing countries: for example, physics of materials and microprocessors, physics of energy, physics of fusion, physics of reactors, physics of solar and non-conventional energy, geophysics, biophysics, neurophysics, laser physics, physics of oceans and deserts, and systems analysis. But the Centre has not committed the blunder (which is all too often committed in less-developed countries) of neglecting basic frontier physics, such as high-energy physics, astrophysics, quantum gravity, cosmology, atomic and nuclear physics, and mathematics. Such broadening of the programme was made simply because there was not, and still is not, as Salam explains, any other international institute responding to the scientific hunger of developing country physicists.

Growth in Programmes

The year 1985 has been rated the "best" — most productive — in the Centre's 21 years of life. During that year, 2720 scientists visited the ICTP marking an increase of 30.6% over 1984. In terms of man-months, this marked an increase of 42.7%. The developing country share registered an increase from 1424 to 2178 physicists, a growth of 52.9% (with a similar increase for man-months). "Training for research" courses also went up from 23 in 1984 to 30 in 1985. Three hundred and thirteen research papers were

published in 1985, as against the average of around 200 for the past years. The number of associates — high-level physicists who can come to the Centre when they choose for periods of up to 9 months in 6 years (provided they continue to work in their own countries) — climbed up from 206 to 378. The number of federated institutes grew from 106 to 195. The number of external activities supported by the Centre also rose from 12 to 39, and are expected to approach 70 in 1986. The expenditure on these activities has correspondingly increased from US \$0.4 million to US \$1.3 million.

On the experimental side, the ICTP's training programme for experimental physicists (from developing countries who work in Italian laboratories) registered an increase from 30 to 74 trainee-physicists. As against the US \$0.35 million spent on this programme in 1983 and 1984, an amount of US \$1.15 million was spent during 1985 alone. The Centre's first training laboratory in microprocessors was also commissioned during this period with the help of the United Nations University. (A training laboratory on fibre optics is expected to be in operation in 1987. There are also plans for setting up training laboratories for laser physics, neurophysics, and for solar physics and silicon physics at a later stage). During 1985, half a million dollars worth of books and US \$1.5 million worth of equipment were distributed among Third World institutions.

"Just because we exist, we serve as a nucleation and distribution centre," just because we exist, we serve as a nucleation and distribution centre," Salam explains.

The increased level of activity has been possible "by the extraordinary and generous benefaction of the Italian Government", he says. Due to the "zero-growth" situation prevailing in UN organizations, contributions from the IAEA and UNESCO are proportionally getting smaller as the Italian Government (Ministry of Foreign Affairs and Department of Co-operation to Development) increases its participation in the Centre. However, the fact that the Centre belongs to the United Nations family is extraordinarily important for its international character,

and is a precondition of the contribution the Italian Government makes to the Centre, Salam says. The Third World thus owes its gratitude both to Salam who has conceived and successfully run the ICTP, and to the science-sponsoring Italians who willingly and generously support it.

Besides various programmes aimed at enhancing the individual capabilities of physicists from developing countries, the ICTP supported developing country science by extending financial grants to seminars and symposia held outside Trieste. The Centre also holds full-fledged sessions for training and research outside Trieste, such as courses on condensed matter physics (Ghana), monsoon dynamics (Bangladesh), physics of energy (Colombia), and microprocessors (Sri Lanka, Colombia and China). In addition, the ICTP helps initiatives of local spring or summer colleges in Nathiagali in Pakistan, Petra in Jordan, Khartoum in Sudan, and Cuzco in Peru, as well as regional networks, such as ASPEN in Southeast Asia and SAMSA in Southern Africa.

Positions for Scientists

Since its inception, the ICTP has produced results of outstanding merit. Its contributions are highly rated. To ensure the continuity of this effort, the creation of 20 positions for "long-term" scientists was recommended "urgently and without fail" by a committee appointed by the IAEA, UNESCO and the Italian Government and chaired by Professor P.T. Matthews. These are the Italian Government and chaired by Professor P.T. Matthews. These positions are to be supported by the three agencies responsible for running the Centre — 10 jointly by the IAEA and UNESCO and 10 by the Italian Government. The IAEA has already made available four positions. The Italian Government has not been able to meet this obligation, not because it lacks the will to undertake the responsibility, but because the modalities are harder. A way out, according to Italian Government representatives, could be to make extra funds available for the Agency to take care of all 20 positions.

The "Floating" Scientists Contribution

Ambassadors of various countries who drove from Vienna to Trieste in May 1986 were pleasantly surprised at the effusive enthusiasm and exuding confidence among scientists working at the ICTP. Some gleefully acknowledged their easy access to current literature (scientific journals and books, a prime requirement for research, are sadly lacking in many developing countries). Others spoke of the fruitful and intellectually rewarding discussions they shared with co-researchers, while some mentioned a feeling of exhilaration in interacting with "top-notchers" in their field. A surprised ambassador exclaimed, *"We are used to listening to pessimists and egocentrics when it comes to a dialogue with the scientific community. The ICTP mood is certainly very different"*.

Dr. Julian Chela-Flores, a biophysicist from Venezuela, feels the Centre demonstrates "a successful model of international co-operation not tried before", one which should be emulated in other fields of science, but on a regional basis, particularly in Third World settings. The transfer of information at ICTP, he affirms, is quick, a false start in a research undertaking is timely corrected, and the preprints of papers sent to thousands of research centres all over the world are a signal contribution to global research. The floating population of scientists that passes through the ICTP produces results "comparable with the best centres of research in frontier sciences particularly in high-energy physics, of research in frontier sciences particularly in high-energy physics, condensed matter physics, nuclear physics and plasma physics", he says. He is convinced the developing world has also contributed to the developed world in the ICTP association. Some course directors from developing countries, brilliant academicians and men of erudition, have often sharpened the perception of participants from developed countries. The ICTP, he sums up, "has exceeded the expectations of its founding fathers".

Dr. Anis Alam, a physicist from Pakistan, regards the ICTP as "a second home for physicists" where developing country scientists meet their peers from

the developed world with "the minimum of restrictions". To him the Centre is the "only place in the world" where the universal nature of science transcends geographical and ideological frontiers.

Dr. Peter Mbaeyi, a Nigerian mathematician, finds the "information exchange, focussing particularly on overviews of major thrust lines of scientific theories, novel developments, and new areas of concentration" are of especially high quality. Trieste, he acknowledges, has been "the biggest boost to my endeavour to generate self-consistent fields for biological phenomena".

Dr. Thomas W. Kephart, a physicist from the USA, regards the ICTP as "a visionary enterprise now attaining many of its goals. The research performance at the Centre and the conferences held there are making a substantial contribution to international physics", he says. "Since the number of visitors is large, the chance of meeting a colleague with similar interests is also great, thus enhancing the probability of collaboration", he adds. Dr. Kephart is convinced that the scientist who visit the Centre "gains from both the scientific and cultural experience independently of whether he or she is from the East or West, North or South, or from a developed or developing country". In his view, the effectiveness of interactions between scientists in the developed and developing countries, as with any other human interaction, demands effort by individuals. This effort is so apparent at the Centre and has resulted in many rewards for all. Its congenial and intellectual atmosphere provides opportunity, and "the scientists who come from all parts of the world are making the most of it", he says.

Looking to the Future

The ICTP is on the march. It has certainly created a stir, both in the developing and the developed world. In years to come, as the "visionary enterprise's" laudable undertaking ramify, the physics of developing countries will gradually be rescued and rejuvenated. The following proposals could perhaps figure in a futuristic perspective of the

Centre's programme:

- The Centre could encourage and find innovative projects aimed at improving the teaching of physics in developing countries. The Centre could locate individuals/groups who are doing something on their own already. A group of teachers in Delhi is said to have undertaken fabrication of teaching aids using local expertise and indigenous material. They were reported to be very successful. In Pakistan, a research group at the Pakistan Institute of Nuclear Science and Technology has developed computer simulation of several dynamical phenomena.

- The Centre may try to locate good physicists/writers in developing countries and "commission" them to write text-book-style monographs on different topics from the perspective of less-developed countries. These could supplement the woefully inadequate school/college texts being used in many developing countries.

- The Centre has so far laid emphasis on nurturing individual research works. Perhaps the time has come to consolidate this effort and to try to develop groups of productive researchers. Again, this is a question of locating prospective active groups and supporting them *in situ*, so to speak.

- The Centre may consider instituting "South-South Associateships" to enable scientists of a developing country to spend some time with an active group in a neighbouring/regional country (rather than at the ICTP). This would be cheaper than normal associateships and have the advantage of helping two developing countries in one go.

- 1 Bromley, Allan D., "The Frontiers of Physics and Their Roles in Society", *Physica Scripta*, Vol. 19, pp. 204-229 (1979).
- 2 *Physics in Perspective*, US National Academy of Science, Washington, DC (1972).
- 3 Calder, Nigel, "A man of science — Abdus Salam", *Science Year: The World Book Science annual* (1967).

Revisiting an Intellectual Crossroads

by J. Ziman,
Chairman, Science Policy Support Group,
London, UK

by courtesy of
The Scientist, Vol. 2. No. 6, 1988

8 p.m. Only two hours late. Not like arriving at 5 a.m. by car from Udine or Venice or somewhere, after winter fog in Milan. The Italian government had hoped that the Centre would help revive Trieste, once the great port of the Austro-Hungarian Empire, but in the summer of 1987 it is still off the main air routes.

I'm glad to get a lift along the spectacular coast road to the tiny resort of Grignano — but not, this time, to the homely Hotel Mignon. Surprisingly, the luxurious Adriatico has been taken over as a palace hostel for the Centre. A discursive dinner with old physics cronies in the fish restaurant by the harbor rounds off the day.

Heavy rain (in August!) prevents my usual morning walk up the Centre through the park. The trees planted by the hapless Maximilian around his hideous new castle of Miramare have matured gracefully in 150 years. The Centre itself, stylishly sculpted in gray concrete, stretches across a scrubby hollow at the far edge of the park, looking out over the trees to the sea. It also has matured gracefully in its 20 years.

The International Centre for Theoretical Physics that Abdus Salam magically coaxed out of the International Atomic Energy Agency came into being in a cramped building in the city. For a long time after the move out to Miramare, the new building created through Italy's munificence seemed too grand, too roomy. Few of the Northern physicists who would cheerfully scrum in for a summer semi-vacation cared to stay and face the notorious "Bora", Trieste's icy winter wind. For long winter months the place was half-empty.

Paolo Budini, the shrewd Triestino professor who had originally spoken up

so boldly to have the Centre situated in Italy, doesn't seem to be around today. He was deputy director, and we used to go through the applications together. How few there were from the less developed countries, especially in Africa! Were the applicants' formal qualifications – often no more than an M.Sc. from a provincial university and a couple of experimental notes – outweighed by intelligence and dedication? Did they have enough English? How to balance their needs against those of all the enthusiastic Indian Ph.Ds, each with a score of publications brimming with theoretical formulae?

Salam's original plan was for a Centre where promising young physicists could come in out of the cold for intense periods of very advanced, very theoretical research. He had not reckoned on his own uniqueness. Most of the applicants would need to learn a great deal more about their subject before they could hope to start on research. But their interests and experience were obviously too diverse for the conventionally short and sophisticated "summer school".

We invented three-month "winter colleges", authoritative and broad in scope but comprehensible rather than comprehensive. Salam grumbled a bit at the liberties we took in interpreting "Theoretical Physics" as "any good talk about physics." We taught him eventually that even in Indonesia or Nigeria there might be some value in getting to know about the useful properties of matter in the condensed state. Anyway, the explanation of the plasticity of polyethylene or the optoelectronic behavior of amorphous silicon is beautiful, even if it can't be calculated algebraically.

I miss the lively planning sessions with Stig Lundquist, Federico Garcia Moliner, Norman March and the others. Our lecturers had to be world authorities, but we chose them for their humanity as well as for their science. They would have to express themselves clearly in the two languages of theoretical physics - mathematics and broken English - and give themselves sympathetically to the strivings of the participants.

The best moment was at the beginning of a course, when a newcomer

shyly would enter my little office. What is it he or she is trying to say so haltingly? "I working on electron-phonon interaction in some the Al-Kali metal." But here is a colleague! It's the very person with the clever idea in the last year's *Physics Letters*! At once we share the language, the world, of theoretical physics.

In due time we talk about being a physicist "in my country." Once again I hear of the struggle to stay alive as a scientist in a anti-scientific culture, in a lethargic, poverty-stricken university, amid economic chaos and political corruption. They are too grateful for the little we are able to do for them, through the Centre and beyond. The privilege is ours, to know such noble and upright spirits.

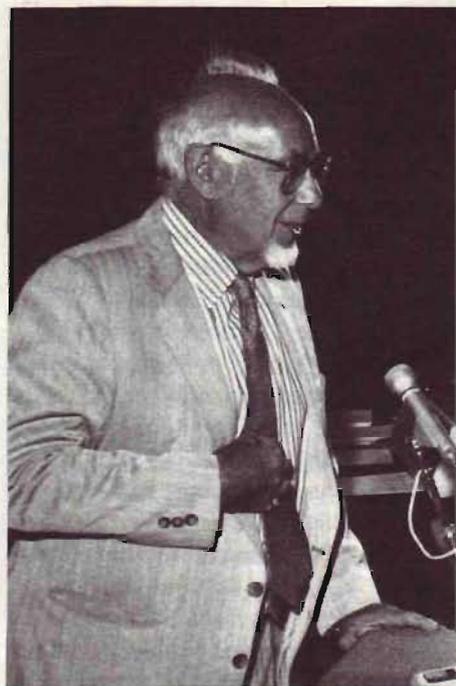
Now they all seem to be coming to Trieste in the hundreds. The old building is crowded. Soon it will be twinned into the empty concrete shell that stands beside it. The Italian Government is heavily backing the scientific and technological development of the region. Other new buildings up the hill already house a companion institution. The Adriatico contains satellite lecture rooms and a library. Grand occasions, such as the tercentenary of Newton's *Principia*, fill the great amphitheater that Salam demanded.

Salam and I exchange the hopes and fears of 30 years of friendship. The Centre is flourishing, but still what a terrible world! How desperate, still, are the prospects of so many peoples! How little, still, is science understood by the politicians! But, as always, he has plans. the only thing that is changed about him is that he can't find time for physics any more.

As always, I am moved by his self-dedication. Should I join him here in Trieste? And, as always, I resist his appeal, saying that the Centre is for theoretical physics, not for social and political analysis. On the plane home (three hours delayed, of course) I am chastened by the thought that I am too attached to my country, my family and my garden.

▲ Professor John Ziman, FRS, is Visiting Professor at the Department of

Social and Economic Studies at Imperial College, London. He was born in 1925, and was brought up in New Zealand, where he took his first university degree. He then studied at Oxford, where he completed a D.Phil. in theoretical physics in 1952. In 1954 he became a lecturer at the Cavendish Laboratory, Cambridge, and later a Fellow of King's College. In 1964 he was appointed to a chair at Bristol where he was the



Professor J.M. Ziman, FRS, was a Member of the Scientific Council of the ICTP for many years. He has also been a Co-Director of several colleges in condensed matter physics in Trieste.

condensed matter physics in Trieste.

*Director of the H.H. Wills Physics Laboratory from 1976 to 1981. His researches in the theory of the electrical magnetic properties of solid and liquid metals have been published in a number of scientific papers and books, and earned his election to the Royal Society in 1967. In recent years, his interests and activities have been mainly concerned with various aspects of the social relations of science – philosophically though his books, *Public Knowledge* (1968) and *Reliable Knowledge* (1978); educationally through lectures on*

"Science and Society" (published as *The Force of Knowledge* (1976), *Teaching and Learning about Science and Society* (1980), *An Introduction to Science Studies* (1985) and most recently "Knowing Everything about Nothing" (1987); 'politically' as Chairman of the Council for Science and Society; internationally as a former member of the Scientific Council of the International Centre for Theoretical Physics in Trieste and Chairman of the European Association for the Study of Science and Technology; journalistically by articles, book reviews and radio broadcasts. His present position as Chairman of the Science Policy Support Group in London involves him in the planning of research on official science policy and in the dissemination and implementation of its results.

Italy Grants Five Billion Dollars a Year to Help Third World

from
Special United Nations Service,
23 March 1988

Italy grants five billion dollars a year to the Third World to help its development, making it the fifth largest donor country after the United States, West Germany, Japan and Sweden.

It is taken into account that Italy has 57 million inhabitants, each Italian contributes 80 dollars a year to the aid programme.

According to official figures, Italy

According to official figures, Italy dedicates 0.40 % of its gross national product to foreign help, which is higher than the usual 0.36%.

While in other countries help to poor nations is declining, in Italy "It continues to grow rapidly since 1979 when the Department for Development cooperation started its operations," said its Director, Patrizio Schmidlin.

Of the 80 dollars each Italian contributes, 40% goes to the international agencies such as the Food and Agricultural Organisation (FAO), the International Fund for Agricultural Development (IFAD), UNICEF, the Programme for Food Help of the United

Nations and others.

Foreign Minister Giulio Andreotti defined foreign help as "A privileged form of foreign policy because the money used in it always comes back to Italy. All the programmes we finance require the use of Italian material, technologies and personnel."

"It's not interested charity, since it's a common practice among countries with help programmes. The main requirement is that of development, but it is correct cooperation logic that we obtain something in return," said Schmidlin.

Since its creation and until 1985, the Department of Development Cooperation of the Foreign Ministry has granted, just in specific assistance and cooperation to Third World countries, more than 7 billion dollars.

Two years ago, in view of the drought and hunger in Africa, the fund of Italian help (FAI) was created by an initiative from Parliament.

In 18 months the FAI gave 1.75 billion dollars and launched more than 100 programmes in immediate help against hunger in 24 of the 32 poorest countries in the world, 26 of which are in Africa.

FAI and the Department for Development Cooperation were merged into one directed by Schmidlin and supervised by Andreotti, but, with only 400 employees, they found that they lacked enough personnel.

According to international practices, "We would need one person for each million spent, in other works we should increase our personnel at least tenfold, but, according to our budget we will hire only 120 technicians," explained Schmidlin.

Besides Ethiopia, where 650 million dollars will be invested in three years, 280 million will be invested in Somalia, 120 million in Sudan, 90 million in Senegal, 500 million in three years in the eight nations in the Sub-Sahara region and Tanzania and Mozambique, the last one with 180 million dollars.

As Andreotti said, in Asia (specifically China) and Latin America (Peru and Argentina mostly), "cooperation will not only contribute to progress but also to democratic

consolidation."

Schmidlin said that up until 1992 the tendency will be to invest up to 45% of the aid to Africa and countries with medium income "where perspective to influence development are best."

Activities at the ICTP from January to March 1988

From January to March, the ICTP organized 8 colleges, workshops and conferences which are described below.

Title: COLLEGE ON VARIATIONAL PROBLEMS IN ANALYSIS (11 January - 5 February 1988).

Organizers: Professors A. Ambrosetti (Scuola Normale Superiore, Pisa, Italy), K.C. Chang (University of Peking, P.R. China) and I. Ekeland (University of Paris IX, France).

Lectures: Introduction to variational analysis. An introduction to critical point theory: free and constrained extrema, Lusternik-Schnirelman theory, critical points under symmetry, applications (ODE, second order systems, eigenvalues). Morse-Conley theory: introduction to cohomology, finite dimensional M-C theory, infinite dimensional M-C theory, applications. Linking theorems and applications: model problems, linking theorems, applications to elliptic equations and Hamiltonian systems (periodic solutions, subharmonics). The concentration-compactness method and its applications to mathematical physics. Evolution of harmonic maps and applications. Periodic solutions on a Hamiltonian surface. Minimal periods for non-convex HS. Elliptic problems. Singular dynamical systems. An index theory for HS. Oscillations for Keplerian systems. Symplectic topology. Nonlinear subdifferential analysis. Equivariant Morse theory. Second order problems with change of sign in the potential. Elliptic equations with harmonic maps. Problems with obstacle.

Nonresonance conditions for semilinear elliptic problems. Bifurcation for nonlinear elliptic variational inequalities. Introduction to algebraic topology. Positive solutions to some non-positrone problems. Variational bicomplex in quantum electrodynamics. Lagrangian theory in fibred spaces. Bifurcation for nonlinear elliptic variational inequalities. Some remarks on periodic solutions of singular Hamiltonian systems. On the periodic nonlinearity and the multiplicity of solutions. Asymptotic analysis of minimal surfaces with obstacles. Existence and regularity results for elliptic equations and systems. Elliptic equations of variational type. Periodic bounce trajectories with a low number of bounce points. Semi-coercive variational problems. On a class of nonlinear problems at resonance. Some examples and counter examples in the calculus of variations. Quasilinear elliptic equations with discontinuous coefficients. The existence of multiple solutions of semi-elliptic equations on \mathbb{R}^n . Nonlinear elliptic problems with an external magnetic field. Bifurcation from the essential spectrum for some non compact nonlinearities. Symmetries and the calculations of degree. Nonlinear PDE with lower order terms having natural growth. Singular potentials and existence of periodic solutions of elliptic type for Hamiltonian systems. Morse index of a saddle point. Multiplicity results for superlinear boundary value problems. An index theory and existence of multiple brake orbits for star-shaped Hamiltonian systems. Static equilibrium for an elastoplastic body with a rigid obstacle. Static equilibrium for an elastoplastic body with a rigid obstacle. Oscillations for singular potentials. A class of semilinear elliptic systems with lack of compactness. Prescribing Gaussian curvature on S^2 . Harmonic maps into an ellipsoid. KAM theory in configurations spaces. On a boundary value problem for the Hamilton-Jacobi equation. Limit cycles of the gradient flow of Yang-Mills functionals. Morse index of mini-max critical points. Local linking theory and some applications. Imbedding problems in symplectic geometry.

The College was attended by 177 lecturers and participants (80 from

developing countries).

Title: ADRIATICO RESEARCH CONFERENCE ON "SPIN AND POLARIZATION DYNAMICS IN NUCLEAR AND PARTICLE PHYSICS" (12 - 15 January 1988).

Organizers: Under the chairmanship of Professor S. Lundqvist (Chalmers University of Technology, Göteborg, Sweden); Professors A.O. Barut (University of Colorado, Boulder, USA, and ICTP), Y. Onel (University of Texas, Austin, USA) and A. Penzo (Istituto Nazionale di Fisica Nucleare, INFN, Trieste, Italy, and CERN, Geneva, Switzerland), with the co-sponsorship of the International School for Advanced Studies (ISAS-SISSA, Trieste, Italy), and of the Department of Theoretical Physics of the Trieste University and the INFN (Trieste, Italy).

Lectures: Spin physics in perspective. Polarization in hyperon production. Quark-diquark model in exclusive processes. Status of planar - transverse amplitude - phase patterns. Orbital angular momentum effects. Hyperon polarization and final state interactions. η -c decay in $\bar{p}p$ and quark-diquark model. Spin searches for SUSY and substructure. Polarization and confinement. Physics with polarized jet targets. Polarized quarks in polarized protons. Plans for polarization at HERA. Polarization physics with e^+e^- rings. Polarized beams in LEP. Polarization measurements in LEP. Linear and non-linear effects: is quantum mechanics really necessary? Spin structure functions. Spin in nuclear physics and NN phenomenological potentials. Polarization in few nucleon systems. Evidence against broad dibaryons in $pp \rightarrow NA$. Spin physics at LAMPF. Spin effects at intermediate energies. Polarization in $\bar{p}p \rightarrow \bar{L}L$ and CP test. Polarization measurements at LEAR. Physics with polarized neutrons at SATURNE. Experimental program with polarized neutrons at SIN. Polarized $p\bar{p}$ beams at Tevatron. Spin physics at LHC and SSC energies. High density polarized gaseous targets. Spin dynamics in $p(\bar{p})$ rings. Polarized (p,\bar{p}) beam handling techniques. A model of polarization asymmetries in pp -scattering. Parity nonconservation and

nuclear spin effects.

The Conference was attended by 54 lecturers and participants (6 from developing countries).

Title: SECOND SCHOOL ON ADVANCED TECHNIQUES OF COMPUTING IN PHYSICS (18 January - 12 February 1988).

Organizers: Drs. F. James (CERN, Geneva, Switzerland), A. Nobile (International School for Advanced Studies, ISAS-SISSA, Trieste, Italy) and C. Rebbi (Brookhaven National Laboratory, Upton, USA), with the co-sponsorship of the Direzione Generale per la Cooperazione allo Sviluppo (Ministry of Foreign Affairs, Rome, Italy), International School for Advanced Studies (ISAS-SISSA, Trieste, Italy) and Olivetti S.p.A. (Ivrea, Italy).

Lectures: MS-DOS. UNIX. Software engineering. FORTRAN 77. Numerical integration. VMS. LISP and REDUCE. Monte Carlo. Sorting and searching. Pascal and Modula-2. Algebraic methods for PDE. Computer graphics. EARN and bitnet. Computer architecture. Linear algebra. Theory of algorithms. Toolpack. Programme libraries. Applications to pure mathematics. Integral equations. QFT and statistical physics. Accelerator physics. Finite elements for PDE. Molecular dynamics. Solid state physics. Geophysics. Computing and teaching of physics.

The School was attended by 99 lecturers and participants (67 from developing countries).

(67 from developing countries).

Title: WORKSHOP ON FUNCTIONAL-ANALYTIC METHODS IN COMPLEX ANALYSIS AND APPLICATIONS TO PARTIAL DIFFERENTIAL EQUATIONS (8 - 19 February 1988).

Organizers: Professors G.F. Mandzhavidse (University of Tbilisi, USSR), A.S.A. Mshimba (University of Dar-es-Salaam, Tanzania) and W. Tutschke (Martin-Luther-Universität, Halle-Wittenberg, German Democratic Republic).

Lectures: Introductions to complex analysis. Function spaces. Weyl's

lemma. The T_D operator. Potential vectors. The JLD operator. Complex normal form of PDE. Singular integral equations. Generalized analytic functions. Extension of holomorphic functions and generalization for Vekua systems. Generalized potential vectors. General solution to elliptic systems. Introduction to Clifford analysis. Beltrami equations - old and new. Monogenic functions. Transversal elliptic operators on Riemannian manifolds and applications. Cousin problems. The Cauchy-Riemann theory - a new branch of complex analysis. Boundary value problems for holomorphic functions in $C_\infty^1(D)$ and in $C_p^1(D)$. Explicit solutions of boundary value problems in special cases. Generalized monogenic functions. Colombeau's generalized functions and solutions of the problem of multiplications of distributions. Uniform algebras: analytic structure in the spectra. Boundary value problems for elliptic differential equations. Geometry of Cauchy-Riemann manifolds - Levi form. Cauchy-Kowalewski theorems. Recent results on generalized analytic functions in the sense of Arens-Singer. Holomorphic extension and approximations of Cauchy-Riemann functions.

The Workshop was attended by 78 lecturers and participants (69 from developing countries).

Title: WORKSHOP ON NUCLEAR THEORY AND NUCLEAR MODEL CALCULATIONS FOR NUCLEAR TECHNOLOGY MODEL CALCULATIONS FOR NUCLEAR TECHNOLOGY APPLICATIONS (15 February - 18 March 1988).

Organizers: Dr. J.J. Schmidt, Dr. D.E. Cullen (Nuclear Data Section, IAEA, Vienna) and Professor M.K. Mehta (Bhabha Atomic Research Centre, Bombay, India), with the assistance of Professor H.R. Dalafi (ICTP) and Professor L. Fonda (ICTP and University of Trieste, Italy). The computing equipment was made available by Olivetti S.p.A. (Ivrea, Italy).

Lectures: Statistical model. Resolved and unresolved resonance

region cross sections calculations. Recent progress and current status of theories on nuclear fission. Optical model and evaluation of fissile nuclide data. Computer code GNASH. Computer code SCAT-2. Computer code STAPRE. Computer code ABAREX. Resonance self-shielding. Bulk properties of nuclei: level densities. Combinatorial approach to few quasiparticle state densities. Single particle and shell effects at finite temperature. Liquid drop model at finite temperature. Fission neutron emission spectrum calculations. Giant resonances at high T and I. Compound nucleus temperatures and nuclear stratosphere at finite temperature. Recent progress and current status of semiempirical theories of nuclear level densities and associated calculations. Statistical multistep reactions at incidence energies below 30 MeV (SMD/SMC-theory). Recent progress and current status of pre-equilibrium reaction theories and computer code ALICE. Computer code for cross section calculations on direct, compound and pre-equilibrium models. Coupled channel calculations and computer codes ECIS. Starting the ECIS code input/output explanation. Current status of nuclear reaction theories with emphasis on optical model and multistep direct/compound theory. Computer code EMPIRE. International nuclear model codes comparison exercises. Computer programme service to I.A.E.A. member countries.

The Workshop was attended by 91 lecturers and participants (67 from developing countries).

Title: WINTER COLLEGE ON LASER PHYSICS: SEMICONDUCTOR LASERS AND INTEGRATED OPTICS (22 February - 11 March 1988).

Organizers: Professors B. Costa (Centro Studi e Laboratori Telecomunicazioni, CSELT, Turin, Italy), W. Gadomski (University of Warsaw, Poland) and H. Winful (University of Michigan, USA), with the co-sponsorship of the Direzione Generale per la Cooperazione allo Sviluppo (Ministry of Foreign Affairs, Rome, Italy). The computing

equipment was made available by Olivetti S.p.A. (Ivrea, Italy).

Lectures: A survey of modern optics and its applications. Chaos in semiconductor lasers. Survey of applications of lasers and nonlinear optics. Theory of planar guided wave structures. Chaos in semiconductor lasers. The theory and practice of lateral-effect position-sensitive silicon photodetector. Light matter interaction in semiconductors. The physics of semiconductor light sources and detectors. Optical semiconductor devices. Advanced structures of semiconductor devices for telecommunications: laser diodes, LEDs and photodetectors. Fabrication technology of semiconductor devices. Characterization of semiconductor materials and devices. Physics and properties of semiconductor quantum well heterostructures. Quantum well devices: structures and applications. Dynamics of laser diodes: mode stability (time and space). The instrumentation of an optical laboratory. Acousto-, electro-, magneto-optic effects in materials. Introduction to integrated optics. Integrated optics, materials and processing techniques: thin films, diffusion, ion exchanges, miscellaneous. Integrated optics, components and devices: directional couplers, filters, switches, modulators, active devices, multifunctional devices, characterization techniques, applications for telecommunications. Nonlinear integrated optics. Optoelectronic integration.

The College was attended by 113 lecturers and participants (90 from developing countries).

Title: SECOND WORKSHOP ON OPTICAL FIBRE COMMUNICATION (14 - 25 March 1988).

Organizers: Professors G. Guekos (Swiss Federal Institute of Technology, ETH, Zürich, Switzerland), J.M. Leal Costa (ABC XTAL, Campinas, Brazil) and F. Tosco (Centro Studi e Laboratori Telecomunicazioni, CSELT, Turin, Italy), with the co-sponsorship of the Direzione Generale per la Cooperazione allo Sviluppo (Ministry of Foreign Affairs, Rome, Italy). The computing

equipment was made available by Olivetti S.p.A. (Ivrea, Italy).

Lectures: Optical fibre communications. Optical properties and characterization of fibres. Transmission system devices: sources, detectors, circuits. Splices, connectors and passive devices. Fabrication technology of optical fibres. Fibre transmission systems. Broad band subscriber loops. Advanced fibre communication systems. Ultrashort pulses in fibres. Advanced fibre communication systems and future prospects on optical communications.

Seminars: GaP-Al Ga P heterostructure waveguides. Prism coupling technique for the measurement of mode spectra of fibres. Optical coupler loss calculation by numerical simulation. Analysis of a fibre directional coupler with a buffer layer. Realization of the refracted near-field method. Fibre-optic Sagnac interferometer. HF - electronics for terrestrial and satellite communications. Optical fibres for transmission of images. 100-fold compression of laser pulses using single-mode optical fibres. An easy approach to the design of digital optical links. Geometrical characterization of liquid core fibres by measurement of thermally induced mode cutoffs and interference. The CERN host interface optical interconnect.

The Workshop was attended by 83 lecturers and participants (73 from developing countries).

Title: ADRIATICO RESEARCH CONFERENCE ON THE IMPACT OF DIGITAL MICROELECTRONICS
DIGITAL MICROELECTRONICS AND MICROPROCESSORS ON PARTICLE PHYSICS (28 - 30 March

1988).

Organizers: Under the chairmanship of Professor S. Lundqvist (Chalmers University of Technology, Göteborg, Sweden): Professors L. Bertocchi (ICTP, Trieste, Italy), M. Budinich (University of Trieste, Italy), E. Castelli (University of Trieste and Istituto Nazionale di Fisica Nucleare, INFN, Trieste, Italy), S. Centro (University of Padua, Italy), A. Colavita (Argentina, ICTP and INFN, Trieste, Italy), Ph. Gavillet (CERN, Geneva, Switzerland), C. Verkerk (CERN, Geneva, Switzerland) and L. Zanello (University of Rome "La Sapienza", Italy), with the co-sponsorship of Istituto Nazionale di Fisica Nucleare (INFN, Trieste, Italy) and the European Organization for Nuclear Research (CERN, Geneva, Switzerland).

Lectures: Multi-processor developments in the USA for the future HEP experiments and accelerators. Trigger for LEP experiments. The Delphi first and second level trigger. Trigger problems for future accelerators. Design automation for SSC data acquisition. Fastbus based software trigger for Mark II at SLC. From APE to APE-100: present and future of the APE project. Special purpose processors for high energy physics. The second level trigger of L3 experiment. Multiprocessor event filtering at the Heidelberg/Darmstadt Crystal Ball. EVI: a high speed interface between fastbus and VAX-BI. Microprocessors in LEP accelerator control. Data acquisition hardware for the D0 Micro VAX Farm. The Aleph event processor. A multiuser data acquisition based on the Macintosh data acquisition based on the Macintosh Computer. The LEP OPAL event selection system. Multiprocessor

systems in Fastbus. Use of digital signal processor (DSP) in high energy physics experiments. SIROCCO IV: front end readout processor for the Delphi Microvertex. Charged particle trigger for the L3 detector. A Fast Track trigger processor for OPAL experiment. The new UA1 first level trigger processor. Neural networks. On-line application the ACP. Neural networks and cellular automata in experimental high energy physics. Cellular automata. Use of optical data transmission in HEP. The data acquisition system for the Crystal Ball at LNS. The CERN host interface optical interconnect. Data processing for particle physics in a silicon detector environment. An OPAL 32 bit coincidence array integrated circuit. Application of bipolar cell array technology to the development of a time digitizer. The contiguity processor - A SIMD architecture for a second level track trigger. Transputers and Occam. Recent experience with transputer based processor farm. A transputer based second-level calorimeter trigger system for the ZEUS experiment. A site oriented supercomputer for theoretical physics. Integrated microsystems as a driving force in future detector design. VLSI structures for track finding. The UA2 data acquisition system. The XOP trigger processor integrated into a high energy physics experiment. SU(3) lattice gauge theory calculations on T800 transputer arrays.

The Conference was attended by 179 lecturers and participants (18 from developing countries).

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

International Centre for Theoretical Physics
of IAEA and UNESCO
Strada Costiera, 11
P.O. Box 586
34136 Trieste, Italy

Telephone: (40) 22.401
Cable: CENTRATOM
Telex: 460392 ICTP I
Telefax: (40) 22.41.63
Bitnet: ROOT@ITSSISSA.BITNET

EDITORIAL NOTE - *News from ICTP* is not an official document of the International Centre for Theoretical Physics. Its purpose is to keep scientists informed on past and future activities at the Centre and initiatives in their home countries. Suggestions and criticisms should be addressed to Dr. A.M. Hamende, Scientific Information Officer.