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INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS

NEWS FROM ICTP

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P.O. Box 586
Strada Costiera, 11
I-34136 Trieste
Italy

Tel. (040) 22401
Cable: CENTRATOM
Telex: 460392 ICTP I
Facsimile: (040) 224163

N E W S   F R O M   I C T P

SIR FRED AT THE ICTP

Professor Fred Hoyle was the distinguished guest of the ICTP for one week in November. While in Trieste, Sir Fred was available for discussion with the scientists of the Centre. On 13 November, he gave a lecture on the nature of the interstellar grains which we reproduce here together with an introduction by Professor M. Abramowicz.

"We are honoured today by the presence of Professor Fred Hoyle who will lecture on the origin of interstellar grains. Professor Hoyle belongs to a small élite of the most gifted and influential men of science in our time. His important, fundamental works in astrophysics and cosmology are too numerous to be listed during a short presentation. I will mention only two: the steady state theory, which he established in the late forties with Bondi and Gold, and the theory of the origin of elements or nucleogenesis, which he developed with Fowler, Wagoner and others about twenty years later.

When I was a student of astronomy, the discussions between supporters of the steady state theory and the big bang theories formed the core of cosmology. Many observational tests which were proposed at that time are still today a very important occupation of astronomers who probe the large scale structure of the universe. The discovery of the microwave cosmic background radiation by Penzias and Wilson in the mid-sixties proved, almost certainly, that the big bang happened in our universe. Professor Hoyle's fundamental contributions to understanding the physics of the big bang are connected with nucleogenesis. His works with Fowler and others on this subject form a landmark in the development of astrophysics and cosmology.

On the astrophysical side, it provided a coherent explanation of nucleogenesis, it settled once and for all the problem of the direction of stellar evolution in the Herzsprung-Russell diagram and it provided the objective basis for the calculation of the internal constitution of stars as well as for the general understanding that the end-point of the evolution of a massive star is a supernova explosion. On the cosmological side, it provided us with the theory of helium formation in the hot big bang, promoting the recent understanding that helium may have been formed in the early dense stages of the expanding universe, whereas the heavier elements may have been formed in stars or massive objects after the development of galaxies.

In addition to his research and academic appointments which included (to mention only a few) a fellowship at St. John's College in Cambridge, professorships at the Universities of Cambridge, Caltech and Cardiff, the directorship of the Institute of Theoretical Astrophysics in Cambridge and the Presidency of the Royal Astronomical Society, he also wrote a score of well-known text books and popular books. He is also a successful science-fiction writer. His books have been translated into many languages.

Today's lecture is connected with his most recent interest in the origin of life.

Professor Hoyle, we should be happy if you would like to start".

THE NATURE OF THE INTERSTELLAR GRAINS

by Sir Fred Hoyle

"In the vast regions between the stars, there are many clouds of gas and of tiny dust particles, referred to by astronomers as grains. For as long as fifty years, astronomers have been concerned in observing these grains, and in finding out how they interact with radiation of many kinds ultraviolet light, ordinary visible light and heat rays. So by now a great deal is known about the behaviour of grains.

It has been a long continuing surprise that nobody has been able to find in the laboratory small particles that are closely similar in their properties to interstellar grains. Until recently that is to say. Recently, however, there came the still greater surprise that particles of a biological nature do indeed match the interstellar grains exceedingly closely. The match between the grains and the microorganisms which inhabit a river and which are contained in the water flowing out of a household tap, is exceedingly close, as close as identical twins one might say.

Nobody has been more astonished by this result than my colleague Chandra Wickramasinghe and myself when we first established this result in a series of experiments and calculations done at University College, Cardiff, a section of the University of Wales. Once one has the idea, the experiments are mostly fairly easy to do, so that there can hardly be any question of their correctness, and nobody has in several years challenged their accuracy.

What people do challenge is the inference that because interstellar grains behave like microorganisms they <u>are</u> microorganisms. And the challenge would have substance to it if other kinds of particles of a non-biological type could be found with an equally good correspondence to the grains. But in many years of effort this has not been done. The effort has been particularly great in recent years, because many scientists are emotionally opposed to the concept that life could exist outside the Earth, especially on the huge scale that would be required if the interstellar grains really are microorganisms. Yet no non-biological type of particle giving even a modest correspondence to the grains, let alone the essentially exact correspondence to microorganisms, has been found. Despite the almost desperate desire of many scientists, keyed to orthodox biological theories, to find an alternative possibility they have not succeeded.

To protect ourselves in a highly unorthodox situation, it was a matter of common sense to try ourselves for an alternative possibility. We were cautious enough to try very hard over several years before announcing our results. Only when we had failed many times to find anything but a biological type of particle that fitted the facts did we feel sufficiently confident to publish our results, and then to face up to the deep cultural prejudice which seeks to maintain that life began on the Earth and is unique to the Earth - a prejudice in biology which is somewhat similar to that which existed in physics and astronomy in the days before Copernicus.

There is actually a very simple way to see that microorganisms did not have their origin here on the Earth, for microorganisms possess many properties that have no relevance to conditions here on the Earth - properties which, however, would be crucial to their survival in space, as for instance their ability to repair the damage caused by immense doses of x-rays. Once the Earth acquired an atmosphere, there have been little or no x-rays in the terrestrial environment, so that there is nothing against which such a property could have been developed on the Earth. Yet colonies of bacteria have been recovered alive and well from the interior of a nuclear reactor. Bacteria can also withstand immense extremes of temperatures, down essentially to absolute zero as in interstellar space, and up to at least 500^{o} Celsius, according to our own experiments at Cardiff. The ability to withstand such remarkably high temperatures (when dry) would permit safe entry of microorganisms into the atmosphere of a planet like the Earth. Entry is accompanied by a short flash heating lasting a few seconds, and it is this experiment which shows they can withstand successfully. These are but a short selection of the many unearthly properties of microorganisms.

Present day thinking in biology is very much conditioned by ideas that were developed during the second half of the 19th century. This was at a time when plants and animals appeared to be rather simple structures with analogies in mechanical engineering. The heart was "only" a pump, the limbs were "only" levers, and so on. Nothing of the truly immense complexity of living organisms could be understood at that time, so that it seemed quite plausible to suppose that pumps and levers and joints and jaws could have originated and evolved by terrestrial means, without requiring any interference from outside the Earth. Modern microbiology has entirely destroyed this simplistic picture, however. Today we know that life, even at the level of bacteria, depends on thousands of exceedingly complex biosubstances. The degree of complexity of any one substance is about like the solution of an imaginary Rubik cube in four-dimensional space, rather than the actual Rubik cube in three-dimensional space. And as I have just said, there are thousands of such substances. So great is the complexity that if the complexity had been known long ago, instead of only recently, it is doubtful that the thought of life beginning on the Earth would ever have gained credence. People would have seen long ago from its immense complexity that life must surely be a cosmic phenomenon.

Another wrong early idea, which still permeates modern orthodox thinking, is that plants and animals evolve through many internally-generated small steps. If this were true, far more evidence of smoothly-varying evolution would be found in the fossil record. Today, we have a veritable army of trained geologists examining rock sequences all over the world, with the evidence for smooth evolution remaining essentially nil wherever major changes are concerned. Indeed in quite a number of instances, especially among invertebrate animals, there is no evidence that any appreciable evolution has ever occurred. Whereever evolution is suspected to have occurred, as with the emergence of mammals from reptiles, the evolution would need to happen in large sudden jumps, in genetic storms as we might call them.

A different concept for explaining evolution comes by analogy from the way in which computer programs are built out of subroutines. Plants and animals are collections of biological subroutines. As with computer programs, there are particular subroutines for producing an eye or a limb of the body. This is why the eye of an octopus has many similarities with the eye of man. Both animals use similar subroutines, even though there is no direct evolutionary
animals use similar subroutines, even though there is no direct evolutionary
connection between an octopus and a man.

Because of the extreme complexities of the genetic structures of subroutines, they cannot be of terrestrial origin. They must be showered onto the Earth from outside, with comets as their most likely immediate source. The rate at which comets shower material onto the Earth is likely to vary greatly over long time spans, according to the stars and interstellar clouds which the solar system encounters in its motion in the Milky Way. At special times when the incidence of cometary material is exceptionally large, we have a genetic storm.

One of the greatest of all genetic storms occurred about 65 million years ago, when the fossil evidence for almost all the various kinds of mammals begins and when about half of all the species of animals over the entire Earth become extinct, including the great dinosaurs, but also including microorganisms living on the bed of the sea. The impact of new genetic material, new subroutines, seems to have been so immense that a great deal of animal life became hugely disturbed, some failing to survive, other species becoming entirely changed.

There is again a simple proof that ideas along these lines must be correct. Otherwise the modern development of genetic engineering would not have been possible. Genetic engineering is doing artificially what happens naturally in evolution, namely shifting about the subroutines that constitute the working program of a plant or animal.

Man is such an unusual animal that one can wonder if some special genetic storm might not have been involved in his appearance, a kind of graft made onto a more primitive hominid form. It is certainly curious that up to the appearance of modern man about 40,000 years ago the fossil record of our hominid ancestors is fragmentary and unsatisfactorily thin. Once modern man appears, however, the record becomes firm and clear. Indeed, within only a few thousand years of modern man's first appearance we have the execution of remarkable cave paintings, at so high an artistic level as to suggest that, if modern man was born in a genetic storm about 40 to 50 thousand years ago, then the subroutines which converted an earlier hominid into modern man were more intellectual than physical. The same storm can be said to have endowed modern man with his uncanny powers of abstraction, showing perhaps its highest level in the pursuit of mathematics.

Over extended periods of time, when little in the way of new genetic subroutines is incident from outside onto the Earth, the whole ensemble of plants and animals behaves pretty much in a classical biological manner. Competition fills out the niches of existence which the various habitats of the Earth provide. Slight genetic changes occur - a fine tuning process in which the niches of existence become more and more tightly occupied. But apart from the fine tuning, the hardening competition does not produce progress. Rather, it produces a static condition with little room for manoeuvre. This is in complete contradiction to classical biology which claims, despite overwhelming evidence from the fossil record to the contrary, that all progress comes from competition.

The difference is highly relevant to all social thinking. Most important today is the superpower confrontation. According to classical biology, progress should flow from this confrontation. According to the present idea, however, nothing will flow from the superpower confrontation except a strangulation of society, with fossilisation in a static condition at best, with destruction at worst."

STATISTICAL DIGEST ON THE 1985 SCIENTIFIC ACTIVITIES OF THE CENTRE

On the occasion of the 19th meeting of the Scientific Council of the ICTP, a first report of the 1985 activities was compiled and will be revised for publication in the series of the IAEA as in the past. In this newsletter we publish some of the statistical data as a quantitative illustration of the 1985 activities.

SUMMARY OF PARTICIPATION IN THE RESEARCH AND TRAINING FOR RESEARCH ACTIVITIES AT THE ICTP 1985

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

.. 14XXXXX25 .... Microprocessors training session (TOT=37 DEV=18)
..... 21XXXXXXXXXXXXXXXXXXXXXXXXXXX22 .... College on lasers, atomic, molecular physics (TOT 159 DEV=80)
.... 25XXX29 .... 2nd Wrkshp on prosp.in nuclear phys.at inter.energies (TOT 98 DEV=20)
.... 15XXXXXXXXXXXX10 .... College on Soil physics (TOT=103 DEV=78)
.... 13XXX19 .... Workshop on quality control of X-Ray equipment (TOT 35 DEV=7)
.... 13XXXXX24 .... Workshop on mathematics in industry (TOT=83 DEV=62)
.... 20XX23 .... Test of electr.polar.processes and other phenomena (TOT=48 DEV=2)
.... 27XXXXXXXXXX21 .. Coll.plasma phys."Charged Part.trans.in plasmas" (TOT=138 DEV=90)
.... 10XXXXXXXXXXX5 .... Lat/am reg.coll.on micropr.tech.& appl.* (TOT=87 DEV=77)
.... 11XXXXXXXXXXXXXXX19 ..... Wrkshp on high energy phys.& cosm.(TOT=160 DEV=110)
Workshop in condensed matter physics (TOT=250 DEV=188).......... 24XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX6 ....
6th Trieste int.symposium on "Fractal in Physics" (TOT=125 DEV=15)....... 8XXXX12 ....
1st symposium on status of phys/maths. in Arab World (TOT=21 DEV=21)..... 10XXX12 ....
Ecole d'ete' on physics teaching at university level (TOT=42 DEV=32)........... 26XXXXX3 ....
Working party on mechanical properties (TOT=36 DEV=21)........................ 12XXXXXXX30 ....
7th Trieste int.symposium on "Hopping transport" (TOT=62 DEV=8)........................ 27XXX30 ....
Wrkshp on phys.of non-conven.energy sources and mat.sciences for energy (TOT=191 DEV=151)........ 2XXXXXXXX20 ....
Topical meeting on phase space approach to nuclear dynamics (TOT=95 DEV=22)........................ 30XXXX4 ....
3rd Trieste college on microprocessors: technology & applications in physics (TOT=134 DEV=102)........................ 7XXXXXXXXXX1 ....
Workshop on semigroups and applications (TOT=89 DEV=35)........................ 7XXXXXXXXXX1 ....
College on repres.theory of Lie groups (TOT=107 DEV=84)........................ 4XXXXXXXXXXX6 .....
Int. Workshop on sand transportation and desertification in arid lands*(TOT=134 DEV=117)........................ 18XXXXXXXXXXXX29
Workshop on Cloud physics & climate (TOT=88 DEV=77)........................ 23XXXXXXX20 ..
Workshop on graded differential geometry (TOT=108 DEV=67)........................ 9XX13 ..

* held outside ICTP

Totals:	DEV.	IND.	TOTAL
1. For the 24 above activities	1,484	946	2,430
2. Research	327	187	514
3. Training in Italian Labs.	74		74
	1,885	1,133	3,018

Research (Throughout the year):

Elementary particle research (TOT=216 DEV=130)
Condensed matter research (TOT=82 DEV=58)
Mathematics research (TOT=46 DEV=42)
Physics & development programm (TOT=17 DEV=6)
Miscellaneous research (TOT=153 DEV=91)

1XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX31

Training in Italian Laboratories (TOT=74 DEV=74)

1XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX31

SUMMARY OF PARTICIPATION: 1985 versus 1984

in the research and training-for-research activities of the ICTP during 1985

	Number of Visitors		Number of Man/months		T O T A L S		Percentage for developing countries	
	from developing countries	from industrialized countries	for developing countries	for industrialized countries	Number Visitors	Number Man/months	Number of Visitors	Number of Man/months
1 9 8 4	1,086	996	1,424.79	445.56	2,082	1,870.35	52.2	76.2
1 9 8 5	1,671	1,049	2,178.86	490.14	2,720	2,669.00	61.43	81.64
Increase	53.9%	5.3%	52.9%	10.1%	30.6%	42.7%		

The above 1985 figures include:

Regional Coll. on Microprocessor & Trainig on Micro. (Bogota' - Lisbona)	95	29	64.45	6.58	124	71.03	76.61	90.73
Wp.on Sand Transp.& Deser. in Arid Lands (Khartoum)	117	17	35.97	5.22	134	41.19	87.31	87.32
Italian Laboratories	74	-	352.17	-	74	352.17	100.00	100.00

Participation in the research and training-for-research activities of the ICTP
during 1985
(by Geographical Area)

Geographic area	Number of Visitors		Number of Man/months		Total for area	
	from developing countries	from industrialized countries	for developing countries	for industrialized countries	Number Visitors	Number Man/months
Africa	477	-	516.49	-	477	516.49
Asia	592	37	996.37	13.17	629	1,009.54
Europe	351	803	324.13	331.04	1,154	655.17
Indonesia & Oceania	14	2	12.23	3.42	16	15.65
North & Central America	42	192	56.50	138.07	234	194.57
South America	195	-	273.14	-	195	273.14
International Organizations	-	15	-	4.44	15	4.44
	1,671	1,049	2,178.86	490.14	2,720	2,669.00
GRAND TOTALS	2,720		2,669.00			

Percentage representation from developing countries: Number of visitors = 61.43
Number of man-months = 81.64

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.

Percentage representation from developing countries: Number of visitors = 61.43

Participation in the research and training-for-research activities of the ICTP
during 1985
(Long and short-term activities)

Geographic Area	Long-term activities		Short-term activities		T O T A L	
	Number Scientists	Number Man/months	Number Scientists	Number Man/months	Number Scientists	Number Man/months
Developing countries						
Africa	460	512.68	17	3.81	477	516.49
Asia	573	994.19	19	2.18	592	996.37
Europe	322	318.96	29	5.17	351	324.13
Indonesia & Oceania	14	12.23	-	-	14	12.23
North & Central America	41	56.34	1	.16	42	56.50
South America	192	272.48	3	.66	195	273.14
International Organizations	-	-		-	-	-
Totals	1,602	2,166.88	69	11.98	1,671	2,178.86
Industrialized countries						
Asia	20	10.33	17	2.84	37	13.17
Europe	595	299.54	208	31.50	803	331.04
Indonesia & Oceania	2	3.42	-	-	2	3.42
North & Central America	148	130.99	44	7.08	192	138.07
International Organizations	15	4.37	-	.07	15	4.44
Totals	780	448.65	269	41.49	1,049	490.14
GRAND TOTALS	2,382	2,615.53	338	53.47	2,720	2,669.00

Percentage representation from developing countries: Number of visitors = 61.43
Number of man-months = 81.84

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.

Breakdown of the ber of scientists who worked at the ICTP in 1985 nd of "man/months" per activity

Other tables show that the total number of scientists who came to the ICTP is 2,720 while the total number of man/months is 2,669.00.
In the tables which follow the number of scientists will be higher since several of them took part in more than one activity.

Table I shows a summary of the breakdown while Table III shows the details.

Table I Summarized Breakdown

Activity	No.of Visitors				No.man/months			
	Dev.	Ind.	Total	%	Dev.	Ind.	Total	%
1. Physics and energy	283	239	522	17.3	194.47	56.84	251.31	9.4
2. Fundamental physics	242	182	424	14.0	402.29	167.61	569.90	21.4
3. Physics and technology	567	405	972	32.1	648.51	139.67	788.18	29.5
4. Physics of the environment	272	53	325	10.8	175.56	15.29	190.85	7.2
5. Mathematics	290	143	433	14.3	243.14	42.38	285.52	10.7
6. Physics teaching	32	10	42	1.4	20.36	6.24	26.60	1.0
7. Physics and development	27	11	38	1.3	4.00	0.69	4.69	0.2
8. Physics of the living state	7	28	35	1.2	1.31	3.60	4.91	0.2
9. Others research	91	62	153	5.1	137.90	57.00	194.90	7.3
10. Training in It.Labor.	74	-	74	2.5	352.14	-	352.14	13.0
TOTAL	1885	1133	3018	100.00	2179.68	489.32	2669.00	100.00

The above figures include the data for two activities organized outside i.e.:

	Dev.	Ind.	Total	Dev.	Ind.	Total
1. Latin American regional college on microprocessor (Bogotà) including training session on microprocessors in Lisbona (Portugal)	77	10	87	64.45	6.58	71.03
2. Int.workshop on sand transportation and desert.in arid lands (Khartoum)	117	17	134	35.97	5.22	41.19
TOTAL	194	27	221	100.42	11.80	112.22

In addition, the Centre supported 39 regional courses, workshops and conferences in all region of World. They are listed in the Report on p. 101.

Hosted Activities

1. Conference on South-South and South-North coop. in Sciences (5-10.7)	114	58	172	23.74	9.09	32.83
2. Workshop on drought desertification & food deficit & foundation of the African Academy of Sciences (9-10.12)	15	9	24	1.98	0.69	2.67
3. Workshop on nuclear and particle phys. at intermediate energies	-	50	50	-	-	-
4. Mini workshop on total energy & force method (12-13.12)	-	10	10	-	1.09	1.09
	129	127	256	25.72	10.87	36.59

5. Structure and evolution of active galactic nuclei (10-13.4) (University of Trieste et al) — no data available
6. School on industrial applications of Synchrotron radiation (Trieste Research Area)
7. International conference on Variation Calculus (9-14.9 SISSA)

and other Committee meetings (Society for International Development, Italian National Institute of Nuclear Physics, United Nations University, International Centre for Astrophysics).

In addition, the Centre supported 39 regional courses, workshops and conferences in all

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

Table II
Statistical summary on activities held inside and outside the ICTP

	No.of Visitors			No.man/months		
	Dev.	Ind.	Total	Dev.	Ind.	Total
1. At I.C.T.P.:						
a) Research*: High energy	130	86	216	317.34	134.33	451.67
Condensed matter	58	24	82	150.41	34.45	184.86
Mathematics	42	4	46	93.35	1.42	94.77
Others	91	62	153	137.90	57.00	194.90
TOTALS	321	176	497 (15.2%)	699.00	227.20	926.20 (34.2%)
b) Training for research (Courses, workshop and conferences)	1296	930	2226 (75.9%)	1028.12	250.32	1278.44 (48.6%)
2. Outside** I.C.T.P.:						
a) Training in Italian Labs.	74	-	74	352.14	-	352.14
b) Latin American regional college on microprocessor (Bogotà) including training session on microprocessors in Lisbona (Portugal)	77	10	87	64.45	6.58	71.03
c) Int.workshop on sand transportation and desert.in arid lands (Khartoum)	117	17	134	35.97	5.22	41.19
TOTALS	268	27	295 (8.9%)	452.56	11.80	464.36 (17.2%)
TOTALS	1885	1133	3018	2179.68	489.32	2669.00

* Figures on research include long and short-term scientists as well as Associates, scientists from federated institutes and seminar lecturers.
** The 39 outside activities sponsored but not organized by ICTP are not included

TABLE III

SUMMARY OF PARTICIPATION IN THE RESEARCH AND TRAINING FOR RESEARCH ACTIVITIES AT THE ICTP 1985

ACTIVITY	No. of Visitors			No. man/months		
	Devel.	Indus.	Total	Devel.	Indus.	Total
PHYSICS AND ENERGY						
1. 2nd Workshop on prospectives in nuclear physics at intermediate energies (25-29.3)	20	78	98	6.21	13.23	19.44
2. Spring college on plasma physics "Charged Particle transport in plasmas" (27.5-21.6)	90	48	138	82.64	16.72	99.36
3. Workshop on physics of non-conventional energy sources and material sciences for energy (2-20.9)	151	40	191	100.85	14.03	114.88
4. Topical meeting on phase space approach to nuclear dynamics (30.9-4.10)	22	73	95	4.77	12.86	17.63
	283	239	522 (17.3%)	194.47	56.84	251.31 (9.4%)
FUNDAMENTAL PHYSICS						
1. Elementary particle research (all year)	130	86	216	317.34	134.33	451.67
2. Test of electroweak polarized processes and other phenomena (20-23.5)	2	46	48	0.26	4.18	4.44
3. Summer workshop on high energy physics & cosmology (11.6-19.7)	110	50	160	84.69	29.10	113.79
	242	182	424 (14.0%)	402.29	167.61	569.90 (21.4%)
PHYSICS AND TECHNOLOGY						
1. Condensed matter research (all year)	58	24	82	150.41	34.45	184.86
2. College on lasers, atomic, molecular physics (21.1-22.3)	80	79	159	124.84	18.26	143.10
3. Workshop in condensed matter physics (24.6-6.9)	188	62	250	199.90	32.98	232.88
4. 3rd Trieste college on microprocessors: technology & applications in physics (7.10-1.11)	102	32	134	86.08	15.32	101.40
5. Working party on mechanical properties (12-30.8)	21	15	36	17.99	7.63	25.62
6. Microprocessors training session (14-25.1)	18	19	37	included in Latin Am.Reg.College		
*7. Latin american regional college on microprocessors technology & applications (10.6-5.7) including Training session in Lisbona (Portugal) (11-14.5)	77	10	87	64.45	6.58	71.03
8. 6th Trieste int.symposium on "Fractal in Physics" (8-12.7)	15	110	125	2.25	16.61	18.86
9. 7th Trieste int.symposium on "Hopping transport" (27-30.8)	8	54	62	2.59	7.84	10.43
	567	405	972 (32.1%)	648.51	139.37	788.18 (29.4%)
PHYSICS OF THE ENVIRONMENT						
1. College on Soil physics (15.4-10.5)	78	25	103	70.74	6.67	77.41
2. Workshop on Cloud physics & climate (23.11-20.12)	77	11	88	68.85	3.40	72.25
*3. Int. Workshop on sand transportation and desertification in arid lands Khartoum (Sudan) (18-29.11)	117	17	134	35.97	5.22	41.19
	272	53	325 (10.8%)	175.56	15.29	190.85 (7.2%)

Contd.

ACTIVITY	No. of Visitors			No. man/months		
	Devel.	Indus.	Total	Devel.	Indus.	Total
MATHEMATICS						
1. Mathematics research (all year)	42	4	46	93.35	1.42	94.77
2. Workshop on mathematics in industry (13-24.5)	62	21	83	31.37	6.70	38.07
3. Workshop on semigroups and applications (7.10-1.11)	35	54	89	25.99	13.58	39.57
4. College on repres.theory of Lie groups (4.11-6.12)	84	23	107	88.77	14.67	103.44
5. Workshop on graded differential geometry (9-13.12)	67	41	108	3.66	6.01	9.67
	290	143	433 (14.3%)	243.14	42.38	285.52 (10.7%)
PHYSICS TEACHING						
1. Ecole d'ete' on physics teaching at university level (26.7-13.8)	32	10	42	20.36	6.24	26.60
	32	10	42 (1.4%)	20.36	6.24	26.60 (1.0%)
PHYSICS AND DEVELOPMENT						
1. Physics & development programm (all year)	6	11	17	1.89	0.69	2.58
2. 1st symposium on status of physical/maths. in Arab World (10-12.7)	21	-	21	2.11	-	2.11
	27	11	38 (1.3%)	4.00	0.69	4.69 (0.2%)
PHYSICS OF LIVING STATE						
1. Workshop on quality control of X-Ray equipment (13-19.5)	7	28	35	1.31	3.60	4.91
	7	28	35 (1.2%)	1.31	3.60	4.91 (0.2%)
Other research (all year)	91	62	153	137.90	57.00	194.90
	91	62	153 (5.1%)	137.90	57.00	194.90 (7.3%)
*Training in Italian Laboratories (all year)	74	-	74	352.14	-	352.14
	74	-	74 (2.5%)	352.14	-	352.14 (13.2%)
TOTALS			3,018			2,669.00

* Activities held outside ICTP

Contd.

ACTIVITY	No. of Visitors Devel.	Indus.	Total	No. man/months Devel.	Indus.	Total
Hosted Activities						
1. Conference on South-South and South-North coop. in Sciences (5-10.7)	114	58	172	23.74	9.09	32.83
2. Workshop on drought desertification & food deficit & foundation of the African Academy of Sciences (9-10.12)	15	9	24	1.98	0.69	2.67
3. Workshop on nuclear and particle phys. at intermediate energies	-	50	50	-	-	-
4. Mini workshop on total energy & force method (12-13.12)	-	10	10	-	1.09	1.09
	129	127	256	25.72	10.87	36.59
5. Structure and evolution of active galactic nuclei (10-13.4) (University of Trieste et al)	no data available					
6. School on industrial applications of Synchrotron radiation (Trieste Research Area)						
7. International conference on Variation Calculus (9-14.9 SISSA)						

and other Committee meetings (Society for International Development, Italian National Institute of Nuclear Physics, United Nations University, International Centre for Astrophysics).

NOTE ON THE PANAMERICAN COLLABORATION

We reproduce this note by Dr. Carlos Aguirre (Academia Nacional de Ciencias, La Paz, Bolivia) with his permission. The views expressed are those of the author.

1. Objectives of a Pan American Collaboration

In this note, I would like to offer some comments which hopefully will contribute to further define some of the objectives of a Pan American collaboration in the field of physics, and suggest some ways to implement them.

To this effect it should be borne in mind the important differences among the Latinamerican countries (and therefore different requirements and needs in science). Also, there are many questions to be addressed, such as, is it possible to develop physics in environments such as those of most countries of the region; what kind of physics can be advanced; what are the requirements that should be fullfilled; how can these be met by local efforts or by external cooperation, and so on.

These are topics that have aroused much debate in the past two decades among planners, decision makers and scientific communities, in Latin America, the USA, and worldwide. As expected, there are many valid but differing opinions and answers. There is coincidence however in pointing out, that a science effort is necessary. What is probably now in question regards its intensity and orientation.

Both these aspects are matters of national policies, and in Latin America, most countries have drawn up policies and plans, which provide some insight as to where a given country wishes to go in science (and therefore physics).

Sometimes, these plans are too ambitious or general; at times many of them seem not to realize that developing science, and specially capabilities in science, is a long term process which must be nurtured patiently and constantly.

Such limitations in policy formulation and those associated with lack of infraestructure, human resources, and further the existance of a non-functional education system, and lack of tradition in science have been extensively discussed by many authors (1). The point of mentioning them here is to highlight the fact that they do impose restrictions on a regional collaborative effort.

Some of the limitations occuring at the national level, have been in the past years circunvented by regional, multilateral or bilateral approaches, such as those used by the Organization of American States, the Interamerican Development Bank, NSF, and other private or public organizations, or of institutions such as the Latinamerican Center of Physics (CLAF), and the Association for the International Physics Center (ASIF).

At the international level, the United Nations through its different agencies have also approached the problem, with shortcomings, which have called many times for the need of restructuring the system (and other international organizations) dealing with science cooperation.

Without substituting other types of collaborative or cooperative arrangements already inexistance, the value of a new collaboration in physics would reside in the fact that the development of a basic science will again be the main objective. In the past years, the North-South dialogue discussion about basic human needs, "pragmatic" approaches, needs to deal with socio-economic problems, and so forth, have relegated the support to basic sciences to a minimun at the national, regional or international level, creating a grave danger of erosion of the system for developing human resources and knowledge.

The development of physics in Latin America requires the building up of high level capabilities, that is, establishment of the capacity of a given community to take the appropiate decisions, which will influence the allocation of resources and the efficiency to produce knowledge, with due regard to their effect on the different multidimensional aspects which model the living conditions of its people.

This development is also closely related with creativity, which may be defined as a way by which a man or group of men, looks for original solutions to their problems or situations that confront them. It is finally linked with the creation of the proper infraestructure, human and finantial resources, and the excellence and quality of the work carried out.

The building up of an internal capability has to be primarily a national effort. It has to be a component of policies aimed at the development of science.

This local effort however, can be accelerated by external means, and to this end, the world has created an unprecedental and unaccountable number of institutions, organizations, programmes of action and international projects. In some cases the effectivenes of such work may be questionable, in others, such as for example the IGY or IQSY projects of the 50's have helped tremendously in the creation of capabilities and particularly infraestructure.

Under this general context, recognizing: the requirements of science in the region; the need for a new approach regarding the situations to the different problems that confront the US-Latin America relationship in science and technology (2); and considering the importance to bridge the knowledge gaps, the objective of a Pan American collaboration in physics should be the building up of a strong local capabilities, as defined above.

2. <u>Orientation of the collaborative effort</u>

Once the general objective can be set, there are several considerations to be taken into account in order to analyze the ways the collaboration might be developed.

One question that comes out in all debates is that of relevance (orientation of the science effort). Although this is a point, which as mentioned above pertains to the domain of national policies, some considerations on this matter are in order here.

One of the best recognized limitations to the growth of physics in Latin America is that of isolation of its scientific community (except in the larger countries of the region). This isolation induces frustation to any creative mind as it is unable to view new ideas or new knowledge. An active cadre of scientific personnel cannot develop or exist in isolation. A collaborative project is most certainly the best way to attack this problem.

The second point to be mentioned is that related to the field of physics which could be developed under a collaborative effort, and here there are many possibilities which might be discussed.

The fundamental aspect however is the fact that the Latinamerican countries should not be satisfied with a derived science which is continually dependant on that of the developed countries. For this reason, a national capability for basic research is important for all countries, although the the problems dealt with and the criteria of choice will no doubt be different.

In this respect the Latinamerican countries will do well in trying to establish the areas or fields of physics in which they might be competitive with the larger countries. For this purpose, they might want to consider the scientific comparative advantages which they have, geographical, cultural, and so on. The role of the larger partner in a collaboration effort would then be to help with solutions to the problems but without being over zealous in defining them (3).

One aspect of physics development which is very often pointed out, is that of the need to carry out research in areas which might eventually have a wider and more important impact on the social development of the countries (4).

It is true and most obvious that developing countries should pursue goals related to their socio-economic problems. In this sense, experience has shown that supply oriented policies and programmes in science and technology cannot be aplicable to them as they lack two critical prerequisites:

(a) the existance of explicity defined government objectives with a capacity to execute them, and

(b) the presence of firms or institutions whose business strategy is matched by the commitment and possibility of translating them into viable technological and commercial projects.

Under these circumstances, what is of greater relevance is the need to keep the minimum base of human resources already existing and creating critical masses to produce good science.

The needs of science in any developing country are enormous. Practically all areas need to be strengthen or developed. However, the point is where can a country give a qualitative jump which will really influence the development of science and at the same time impact on its socio-economic (in particular technological) system. Here a good example might be formed in the experience of the Mt. Chacaltaya Cosmic Ray Laboratory in Bolivia.

As recognized for example by Linsley (5) or Jones (6) to mention two late examples, a small country such as Bolivia, because of a single facility, has made contributions towards the understanding of cosmic ray physics at high energies, and also to other fields of physics that are great out of all proportion compared to countries with similarly developed resources.

Also, major advances for example in the field of Extensive Air Showers studies could be obtained if the present experimental array is expanded and some more observational techniques are incorporated.

Within Bolivia, in the thirty one years of activity of the Laboratory, tens of young Bolivian (and foreign) physicsts, engeneers, technitians, studentes, have taken part in the research activities and have latter translated the knowledge and experience obtained in a center of excellence into other activities in the productive-economic, government sectors of the country.

On the other hand, the existance of such facility allowed the creation of other research, educative and policy organization of more applied nature, such as the Atomic Energy Commission, the first Computer Center, the Faculty of Science in La Paz, the National Committee for Geophysics and so on. It also permitted the introduction of new technologies, specially electronics and promoted paralely others such as those related to solar energy and satelite techniques for prospection and evaluation of natural resources.

It is quite certain that most of these institutions and activities would have eventually been created or established anyhow but, it was the vigorous presence of the Laboratory and its human resources which allowed a faster and coherent growth.

Institutions such as these constitute a powerfull tool, which is so badly needed for the development of science in Latin America, and can be found in many countries of the region. They constitute an important network on which to base a solid collaborative effort, provided they in turn receive the support needed to their continuing efforts to develop scientific capabilities.

The possibilities of developing science by these institutions have been permanently demostrated. In spite of the sometimes highly adverse political and economical environments, it has been possible to produce important, if limited, contributions. Under this condition there is no doubt that the adoption of concrete measures both a national and regional level can accelerate the process of physics development of most countries of the region.

One particular benefit that become of the collaboration, is the stimulous it could provide to a larger number of researchers in both the US and Latin America in the programme such as that of Mt. Chacaltaya, where according to Jones (6) in no other area of physics could a Latin America be more competitive with ongoing programs at world level.

Finally, it should be mentioned the value of a collaborative effort for the development of human resources, as no single country in the region, except the larger ones, will be able in the foreseable future to prepare this high level, specialized personnel needed.

3. Comments on the proposed collaboration

The above considerations are of course of a rather broad nature. Taking into account the fact that the idea of a collaboration comes from discussions among researchers in the field of high energy physics (HEP) some further remarks are necessary.

There is no doubt that the strong HEP community in the US can provide much support to a collaborative effort such as that outlined in by Lederman (7). I would like to make a few comments on some of his proposals.

The first relates the fact that the Pan American collaboration should not concentrate only in high energy physics (in the accelerator energy ranges). It should be broadened to areas related to high energy physics at first first and later expanded to other fields.

Fermilab as coordinator of a collaboration whose main activity could still be in the area of high energy physics (or a consortium of similar facilities) can provide the mechanisms necessary to pursue a more ample type of collaboration. What is needed from the point of view of a medium or small size country in Latin America is a permanent contact (a focal point), someone who will be dedicated to assist in matters of all ranges, from proposing joint experiments to indicating where a given piece of equipment can be bought or mantained.

A extended "Office of Pan American Collaboration" at Fermilab could take care of such consultations, promotion and establishing contacts with the institutions and individuals in the different countries.

As mentioned by Linsley, the value of participation by Latin America scientists in experiments at major US facilities is valid beyond doubt. However, I wonder how many countries in the region will be able to propose and carry out experiments in these HEP facilities, maybe three or at best four. Of course this situation may be improved if use of HEP facilities would also imply training programmes in the use of the advanced technology associated with the laboratories. In turn, this situation would be further improved if such a programme could be carried out in a Latin America country.

One valuable and positive experience of this kind is that of the International Centre on Theoretical Physics, at Trieste, which organized in 1981 a "College on Microprocessors: Technology and Application in 1981 a "College on Microprocessors: Technology and Application in Physics".

It is possible to improve on this idea if such a "College" could be organized as part of the ongoing Latin American Schools organized by the different countries with auspices of the Latin America Centre of Physics (CLAF), and provide demostration courses at permanent locations such as that of The Association for the International Centre of Physics in Bogota, Colombia.

Further, HEP laboratories in the US could provide additional equipment to the network of institutions mentioned before where it can be used both for research and training.

The best improvement could then come if the US partners could help their conterparts in the design, construction and software development of new products which would then be applicable to the needs of the scientific, technological and productive sectors.

One other idea put forward by Lederman is the creation of a Pan America Accelerator Laboratory: a hemispheric Centro Americano de Investigación Nuclear. I am convinced that such an organization already "exists". It is composed of a series of national institutions, each specializing in a particular field.

What is now needed is some mechanism of coordination, that is, some kind of permanent agency which will serve physics in Latin America. In a way such organization also exists, it is for example the Centro Latino Americano de Física (CLAF).

A serious support of CLAF both by National Governments and institutions in Latin America and a strong support from outside, and in this particular case the Pan American collaboration, would permit an important saving in time and efforts.

This mechanism then, would see that the best facilities in the world, wherever located, can be reached by Latin America physicists. In some cases the mechanism could permit the construction, strenghthening, improvement of facilities in the Latin America countries, specially in those areas where as mentioned before, a science effort can provide real and effective results.

In general, the idea of an "experimental Trieste" is fine, but it can only be usefull if it is located in the place where techniques developed will be used, and the knowledge produced will be translated more rapidly into the educational-cultural-economic environment. The ideal again is the development of many such "experimental Triestes".

4. Some concrete steps in the collaboration

Some of the concrete steps that could be taken in the near future, besides those already under way, could be:

(a) to establish functional ties with the Centro Latinoamericano de Fisica and the Asociación pro Centro Internacional de Física, and assist them in the implementation of their programs,

(b) to support regional post-graduate, post-doctoral and research programmes, which will include fellowships, multinational research programmes, exchange of researchers, etc. (see also 8),

(c) to establish a given periodicity to the Symposium of Pan American Collaboration and use it apart from its scientific content, as a vehicle for permanent consultation among the physics community of Latin America, the US and Canada,

(d) to establish, in consultation and cooperation with US Government and no government Agencies, a scheme of direct support to specialized institutions in Latin America, selected on the basis of its potencial contribution to the advancement of physics, whether HEP or in other fields. Such support will involve: equipment, bibliography, researchers, operation, finantial resources, travel grants, etc.,

(e) to establish a steering committee which will identify areas of common interest. For each area the committee could set a programme in which it could detail the scientific questions, the approach, the implementation schedule, propose the management structure, and criteria by which implementing institutions will be selected and budgetary,

(f) the steering committee could be also charged with the task of coordinating activities with non-governmental institutions, which as ICSU or IUPAP have some activities in the region. A close linkage with them would enhance and benefit every one,

(g) to promote the establishment of a consortium of donors to fund the activities recommended by the committee. This consortium should involve regional, subregional, international, national organizations at all levels,

(h) to channel grants from private or government funding to the institution participating in the collaboration,

(i) to promote further ties among the physical societies of the region,

(j) to establish an office of Pan American Collaboration which among other duties, it could serve as a "clearing house" for consultations by the (Latin American) physics community at large.

Finally, I will rephrase, one of L. Lederman's guest comments (7). I have the feeling that we are trying to face something very serious and perhaps historic. Understanding and collaboration among the scientific communities of America are certainly ways to disminish not only a technological gap, but also a cultural one.

The effort ahead is inmense, and here we should remember the words of John Stuart Mill (XIX Century) "For a great evil, a small remedy does not produce a small result; it simply does not produce any result at all".

The leadership that could be provided by the foremost institutions of the region in the endeavor of building up capabilities in physics can certainly constitute a large remedy.

Notes and References

(1) See for example Moravsik, M.: Science Development: The building of Science in less development countries. Bloomington, Indiana; International Development Research Centre, 1975.

(2) See for example Segal, A.: (NSF) Comercio Exterior. Vol. 33 N°1 Mexico. January 1983. pp. 34-41

(3) For an interesting comments on the topic of relevance related in particular to education, see the invited lecture of P.J. Kennedy (Department of Physics, University of Edimburgh) delivered at the 1981 Symposium on "American Physicists and Science in Developing Countries", sponsored by The America Association of Physics Teachers Committee on International Education and The American Physical Society Committee on International Scientific Affairs.

(4) The literature on this topic is extensive, but here I would like to refer to the Letter of M.J. Yacaman to Physics Today. February 1983, regarding the Pan American Collaboration as suggested by L. Lederman.

(5) Linsley, J. Letter. Physics Today. November 1982.

(6) Jones, L. "Remarks Concerning Cosmic Ray Physics in Latin America". Talk presented at the Workshop on High Energy Interactions. Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brasil. July 1982.

(7) Lederman, L. Guest Comments Physics Today. August 1982.

(8) Discussion Group on a Regional Framework for the Development of Basic Science in Latin America. United Nations Development Programme. Mexico City, 1979.

ASSOCIATION FOR THE ADVANCEMENT OF PHYSICS IN THE CARIBBEAN BASIN

We reproduce this note by Dr. Plinio Negrete (Chairman, Executive Committee, APCB, Caracas, Venezuela) with his permission. The views expressed are those of the author.

"The Physicists from the Caribbean Basin countries present at the International Centre for Theoretical Physics, after consultation have recognized the necessity of creating an ASSOCIATION FOR THE ADVANCEMENT OF PHYSICS IN THE CARIBBEAN BASIN (APCB).

They agree that the objectives of the Association should be:

1. to promote scientific collaboration among members;
2. to exchange information on laboratory, library facilities, scientific activities and programs in the region;
3. to help in improving the level of members in research and development by organizing or supporting scientific meetings and other forms of scientific exchange;
4. to help in setting common policies in research and development and to work towards the establishment of funds for research and the implementation of this research for the benefit of the people of the region in the spirit of the ICTP activities;
5. to popularize, strengthen and support the action of the ICTP by informing the local governments, agencies and educational institutions of the region of its activities and efforts.

It is agreed that an ADVISORY COMMITTEE should be set up. It should be formed by the Associates, Senior Associates and Honorary Associates of the ICTP, along with one member from each country. These members should be elected for two years by the Member Countries of the Association.

The natural members are:

1. all Caribbean countries member of the ICTP (United Nations and UNESCO), following formal application, and
2. affiliated members: members of other countries approved by the Advisory Committee.

NOTE - By 'country', one means local Organization Committee of three members who ascribe to the objectives and regulations of APCB.

EXECUTIVE COMMITTEE

This committee should be formed of:

a. an executive Secretary, Editor of the Bulletin,
b. a Chairman,
c. a Deputy Chairman,
d. a Treasurer and
e. a Deputy Secretary.

The role of the Executive Secretary: he should collect information, edit the Bulletin, organize Committee elections and report to the Executive Committee. He should maintain a permanent contact with the ICTP.

The role of the Chairman: he should coordinate and harmonize the activities of the Advisory and Executive Committees. He should report to the Advisory Committee.

A compromise should be found between too much geographical dispersion and too much geographical concentration in the Executive Committee.

For the first year (1985-1986), a PROVISIONAL COMMITTEE is set up.

The Executive Secretary has the task of collecting the maximum information on the activities in physics in the region and of preparing the first Bulletin of the Association which should be ready for the beginning of the summer activities of the ICTP.

The role of the Chairman is to prepare a report on the organization of the Association.

The role of the Treasurer is to prepare a finance organization for the Association.

The Members of the Provisional Committee will work in close collaboration and prepare the scheme for the next Committee elections. They will communicate by telephone and telex when necessary and will meet at least once a year in the Caribbean. A General Assembly will meet in Trieste in Summer 1986 to establish the definite basis of the Association.

The Founding Members will communicate the present information to their colleagues and help the members of the Provisional Committee to achieve the goals defined in this resolution. They have agreed on the following Provisional Committee:

Executive Secretary:	Dr. F. Brouers, University of the West Indies, Kingston, Jamaica;
Chairman:	Dr. P. Negrete, Universidad Central, Caracas, Venezuela;
Treasurer:	Dr. F. Gonzalez, Universidad Nacional, Bogota, Colombia;
Deputy Secretary:	Dr. C. Lopez-Pineda, Honduras, presently at CRE-CASACCIA-CNR, Roma.

ICTP, Trieste, 13 September, 1985."

PROFESSOR ANTONIO MARUSSI

We have recently received a copy of an obituary in memory of the late Professor Antonio Marussi († 1984) which we publish in these news for those who had the privilege of meeting him at the ICTP. Professor Marussi was associated with all ICTP scientific activities in the field of geophysics - the Autumn College on the Troposphere, Stratosphere and Mesosphere (10 September - 19 October 1984) was dedicated to his memory. The obituary is excerpted from the Quarterly Journal of the Royal Astronomical Society.

> Antonio Marussi, an Associate of the Society, died in his home in Trieste on 1984 April 24. He was pre-eminent among geodesists for introducing the technique of non-Euclidean geometry into geodesy and among geophysicists for his pioneering investigations in the high mountains of the Hindu Kush and the Karakoram. Marussi, who was born in Trieste on 1907 October 12, was the son of Gustavo Marussig and Maria Leutheuser and the nephew of the painter Pietro Marussig who was one of .he founders of the Novocento Italiano school of painting in Rome. Marussi was educated at the University of Bologna and was from 1932 to 1952 on the staff of the Military Geographic Institute in Florence, although between 1933 and 1937 he worked as an actuary in the Assicurazioni Generali di Trieste e Venezia. During this period he took part in surveys in

Ethiopia. Marussi married, in 1943, Dolores de Finetti, the sister of Professor Bruno de Finetti of the University of Rome. In 1952 Marussi moved to the University of Trieste as Professor of Geodesy and Surveying and set up the Institute of Geodesy and Geophysics of which he was the first Director, serving from 1967 to 1973 as Dean of the Faculty of Mathematical, Physical and Natural Sciences.

In 1948 Marussi described to the meeting of the International Association of Geodesy in Oslo his formulation of geodesy in terms of the geometry of the actual equi-potential surfaces of gravity, in which he used the methods of the Ricci calculus to establish the local properties of the gravity field and the coordinates appropriate to it. His paper, 'Fondements de géométrie differentielle absolue du champ potentiel terrestre' which was published in the *Bulletin geodesique* in 1949 was the basis for a far-reaching recasting of geodetic theory carried out by Marussi himself and also by Brigadier Hotine. Two features of this work are outstanding – it uses the actual gravity field of the Earth as the basis of a coordinate system rather than using a simplified reference surface as had previously been the case, and it was set out in a completely three-dimensional way, so that when measurements by and to spacecraft came to be made, Marussi's framework was ready to express and interpret them. His first visit to the USA came from an invitation to lecture on this work.

Shortly after returning to Trieste, Marussi took part in the 1954–55 expedition led by Ardito Desio to the Karakoram and the Hindu Kush with the task of making geophysical measurements. Marussi always loved the high mountains and he made gravity and magnetic measurements at points higher than ever before surveyed and made the first ascent of Sella dei Venti (6320 m). He was also a member of a further expedition in 1961; the effect of the three expeditions was to join the English geodetic surveys in India with the Russian ones in the Pamirs. In some ways these surveys were out of time, for in those years the attention of most geophysicists in Britain and the US was upon the geophysics of the oceans with the subsequent development of the scheme of plate tectonics. Marussi however was convinced of the importance of the very high mountains for understanding tectonic processes and in 1974, 1975 and 1978, he organized cooperative programmes in which geophysicists from Italy, the USSR, India and Pakistan observed a long seismic profile from Lake Karakul in Pamir to the Indian and Kashmiri plains across the Karakorum. This was a remarkable achievement, requiring all his great powers of organization, planning and indeed diplomacy to bring it about. The results, recently published, are of the utmost importance for the understanding of the structure and origin of the Himalaya and the high plateaux to the north, and have become available just as attention is turning generally from the tectonics of ocean structure to that of the continents; here, as in his geodetic work, Marussi anticipated developments elsewhere.

In his own country, Marussi set up a geophysical laboratory in the Grotta Gigante near Trieste with the aim of studying Earth tides, but the most interesting applications were to the investigation of gravitational shielding of the Sun by the Moon at an eclipse (none was detected) and to the detection of free oscillations of the Earth – the latter led to an important collaboration with B.A.Bolt. Marussi also organized studies of tectonics in Friuli and of the geoid over the Alps. In his last years, and already struck down by the disease that was to kill him, he planned and organized geophysical measurements in Nepal and in Tibet.

Marussi was deeply attached to Trieste but he was also cosmopolitan. He travelled extensively in pursuit of science, he knew most countries of Europe very well, he was a welcome visitor in the USA but, above all, he returned time and again to the East, including three visits to China in 1975, 1977 and 1981. He also was very active in the International Association of Geodesy and the International Union of Geodesy and Geophysics. He was President of the International Association of Geodesy in 1967 and the National Delegate to the IUGG in 1977 and 1979. With these interests it is not surprising that Marussi was a strong supporter of the International Centre of Theoretical Physics from its inception at Trieste and he took a very active part in the arrangements for courses in geophysics right up to his last months.

Marussi received many honours. He was a National Fellow of the Academia Nazionale dei Lincei, from which he received the prize for geodesy in 1962, a Life Fellow of the American Geophysical Union and an Honorary Laureate of the University of Graz. He was President of the Italian Geodetic Commission from 1964 to 1977 and a member of the Council of the United Nations University. He took great pride in the fact that few could say as he could, that he had shaken hands with Pope Pius XII, the Dalai Lama, the Emperor of Japan, Indira Ghandi, General Zia and Deng Xiaoping, and that he had heard M.Molotov address the Peace Conference in Paris.

Antonio Marussi was intensely active and voraciously curious. His mind was always questing for new ways of looking at the Earth and he always seemed to be going somewhere, to China or to the Dolomites, or to his little country cottage near Trieste, or after a new way of studying the gravity field or doing a satellite experiment or bringing some new activity to Trieste or a new course to the International Centre. I first met him after the meeting of the IUGG in Toronto in 1957 and with so many others of his friends, lament his untimely, unlooked-for passing. He was proud of being a Triestino and his appreciation of other lands and peoples was grounded in that pride; we treasure with gratitude those works with which he has enriched us, we are proud to have been of his company and grateful for the privilege of his friendship.

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TECHNOLOGY BRIEF

This article was published in "The Economist" after the closure of the Workshop on Optical Fiber Communication (24 February - 21 March). We thought it could be of interest not only to those who attended the course but to many others as well.

Optical fibres straddle the globe

The world's telecommunications are going on a high-fibre diet. Within two years, optical fibres will carry telephone calls beneath the Atlantic and the Pacific. They will also link computers, robots and telephones in many more offices and factories. In the United States, telecoms firms are trailing a spider's web of optical-fibre networks across the country. In Britain, British Telecom thinks that half of its long-distance telephone routes will be optical by 1990.

The appeal of optical fibres is easily explained. Light is a better messenger than electricity. It is immune to electromagnetic interference from lightning, vacuum cleaners or anything else. It dispenses with the high voltages and powers which generate heat and cause electrical systems to fail.

Light also has a higher bandwidth than electricity. By spanning more frequencies, it squeezes more information into less space. Slender cables can be packed with scores of individual fibres. Light travels through cheap silica (glass), not costly copper. A single sliver of optical fibre could soon let families run more high-definition televisions, video-telephones and computers than they are ever likely to want to own.

Such recitals of the merits of optical fibres can mislead. The full exploitation of their many technical advantages is years away. For the moment, tele- away. For the moment, telephone companies are choosing them to reduce costs.

The copper cables used today to carry telephone calls are fitted with repeaters every few miles or so, to freshen up fading signals. Most of the repeaters are housed in cramped manholes. The repeaters for optical fibres can be spaced 15 or 20 miles apart in comfortable buildings. This is why big telephone providers are switching to optical fibres and why British Telecom in 1984 stopped laying copper wires on its long-distance routes.

The optical-fibre technology they are opting for is still in its infancy, and sounds deceptively simple. Pulses of light are shot through long whiskers of exceptionally pure glass. The light encodes the ones and zeroes of digital information by pulsing on and off.

Two things happen to light as its rays run along a fibre: some of the energy is absorbed by the material from which the fibre is made; and the light tends to become dispersed into its component wavelengths, thereby jumbling up the message its carries.

Researchers are trying to improve the quality of optical-fibre communications in three ways. First, by reducing the absorption and dispersion of light inside the fibre. Second, by increasing the power of whatever device sends the pulses of light down the fibre. Third, by sharpening the sensitivity of the detector that collects the light at the other end.

They have had most success in improving the performance of the fibre itself. The amount of information that can be sent along the fibres has soared while the number of repeaters needed has plunged.

These successes followed changes in the way the fibres are designed. All optical fibres carry rays of light along an inner core of glass inside a cladding. The cladding is also made of glass, but glass with subtly different optical properties that prevent the light from escaping from the core.

In the earliest fibres, called multi-mode fibres, the rays travelled along the core in a hectic zigzag, bouncing off the inner surfaces of the cladding. Because this chaotic tumble along the fi- bre allowed the light to become bre allowed the light to become absorbed too quickly, the cables had to be sown with frequent repeaters to keep freshening the fading signal.

The first solution was to blur the boundaries between the core of the fibre and its cladding. These fibres, called graded-index fibres, helped to reduce distortion by bunching the paths taken by the rays closer together. Graded-index fibres were the first optical fibres to go into commercial production.

A bigger breakthrough came when researchers switched from multi-mode to single-mode fibre. A single-mode fibre has a core with a tiny diameter—one that is about the same size as the wavelength of the light that passes along it. In consequence, the rays follow a single, direct path through the core.

The switch to single mode has stretched the interval between repeaters and pushed up the volume of data that can be carried as well as the speed at which it is transmitted. Experimental optical fibres, installed in 1977, transmitted up to 140 megabits of data a second, with three to six miles between repeaters. Those being installed now can handle many hundreds of megabits a second, with intervals of 20 miles or so. British Telecom has installed an experimental cable in the English Midlands that transmits telephone traffic at 1,200 megabits a second, with 30 miles between repeaters.

Most researchers accept that silica fibres now perform as well as they will ever need to for most inland telecommunications purposes. Interest in the fibres themselves is switching to special applications—eg, for small optical networks designed for a single office where plastic fibres could take the place of silica. A disadvantage of plastic is that it is more opaque than glass, but that need not matter when signals are travelling short distances. Its offsetting advantages are that it is easier to cut and handle, and could last longer than its glass counterparts.

Another special application is for long-haul networks, such as transoceanic cables. The materials under investigation include oxide- and halide-based fibres. In theory, both types ought to be theory, both types ought to be many times more transparent than silica, but laboratory results have disappointed.

Wiring the world

Optical fibres could dent the market for communications satellites when optical-fibre cables cross both the Atlantic and Pacific oceans in 1988 (see box).

Meanwhile, terrestrial networks are expanding fast. In the United States, telecoms companies are linking up with businesses which own rights of way—eg, railway and pipeline companies—to install extensive fibre networks capable of transmitting either telephone calls or data. American Telephone & Telegraph's (AT&T) optical-fibre routes will stretch over about 10,000 miles by 1988.

By then, if all goes to plan, United Telecommunications will have built a network of its own covering about 23,000 miles, and MCI Communications one of 8,000 miles. There are several smaller ventures, including one involving Britain's Cable & Wireless. It has teamed up with the Missouri-Kansas-Texas Railroad to form the Electra Telecommunications Corporation. Electra is laying optical fibres along Texas railway tracks to form a 550-mile network.

Geography helps dictate the speed at which optical networks displace their copper predecessors. In a country as big as the United States, progress is necessarily slow: AT&T has to live with a legacy of more than 800m miles of installed copper wires. In Britain, however, the proportion of telephone calls that is carried by light is increasing rapidly. British Telecom wants at least half of its long-distance network to run on optical fibres by 1990. Its competitor, Mercury, is laying optical-fibre routes along British Rail's tracks.

In long-and-thin Japan, the scope for a big increase in optical networks is limited now that Nippon Telegraph & Telephone (NTT) has installed a high-capacity optical-fibre network that runs along the country's Hokkaido-Kyushu backbone. But optical fibres will play a large part in NTT's Intelligent Network Sys- tem, a futuristic plan to link tem, a futuristic plan to link voice, data, television and facsimile services in a single system. France recently finished laying an underwater optical cable from Marseilles to Corsica.

Though long-distance telecommunication is the first technology to benefit widely from optical fibres, it will not be the last. Researchers are now particularly interested in using optical fibres for local area networks (LANs)—networks that wire up telephones, televisions, computers or robots in cities, offices or factories.

Optical fibres are obvious candidates for LANs. Their high bandwidth is a blessing for information-hungry computers and video terminals. Their immunity to interference is attractive in factories with heavy machinery; their immunity to eavesdropping useful in offices.

The snag is that optical-fibre networks are generally still too expensive for LANs. The fibres themselves are cheap enough but detectors, receivers and other devices needed to make the network function remain expensive. Their price, too, is expected to fall.

Improving the fibres themselves is, remember, only one of three ways of improving fibre communications. The others are to increase the power of the transmitters or to sharpen the sensitivity of the receivers. Researchers see potential for great improvement. They are particularly intrigued by the possibility of shooting signals down optical fibres by using transmitters and detectors that are "coherent".

At present, the transmitters used for optical fibres are semiconductor lasers or light-emitting diodes. The intensity of the beams they send is modulated in order to spell out the ones and zeroes of the digital information being transmitted. The system works, but crudely: the light transmitted consists of a jumble of poorly-defined wavelengths.

Coherent light

Coherent light sources, by contrast, have a narrow spread of wavelengths. That is crucial. If wavelengths can be tightly defined, many transmitters, each using a different wavelength, could send signals simultaneously through a single fibre. In principle, this technique—called wavelength multiplexing—lets a single fibre carry between 1,000 and 10,000 wavelength channels. At the other end of the fibre, a tunable receiver would select the wavelength required, sorting out the separate streams of data.

Progress towards coherent transmitters and detectors has been fast—in the laboratory. But, because the laser devices needed for them entail a lot of extra paraphernalia, such as mirrors and electrical control units, they are still expensive.

Switching is another area where optical-fibre research is concentrated. Existing optical-fibre networks are clumsy mixtures of optics and electronics: switching telephone calls on them means converting relatively slow electronic pulses into speedy optical ones and then back again.

Ideas for speeding up switching abound. Many companies are investigating the use of lithium niobate, a material whose optical properties change when it is exposed to an electrical field. By varying the strength of an electromagnetic field around a piece of lithium niobate, light beams can be shunted from one optical fibre to another.

Ideally, researchers would like to squeeze electro-optical switches on to a single chip. They have made experimental chips from lithium niobate, gallium arsenide and indium phosphide. On them, light travels along grooves, called optical waveguides, etched on the chips' surface.

If optical circuits can ever be integrated on chips as efficiently as electrical circuits already are, optical fibres will become cheap enough to use in the smallest of LANs. Some engineers reckon that the development of high-performance optical chips could also spell the beginning of the end of electronics as the twentieth century's fastest-changing technology. Computers that run on light instead of electricity? Watch this space.

PUBLICATIONS FROM THE INTERNATIONAL ATOMIC ENERGY AGENCY

The IAEA has recently published a 203-page Technical Document entitled "Selected Topics in Nuclear Electronics" which will be of interest to many experimental physicists. The foreword says:

> "The intention of the textbook is to find a reasonable balance between the phenomenological description of electronic circuits and the full and correct mathematical description of the phenomena. Any higher mathematical concepts are avoided, or are exposed only to the extent that they build a bridge for the student for further in-depth studies. Many practical tips are included in the desire to ease the road to design and repair of nuclear electronics instruments.
>
> The present publication does not copy any available book on nuclear electronics and instrumentation. On purpose, it does not describe the elementary electronics circuits, as applied in nuclear instruments; they can be found in books. It starts the nuclear electronics study on the instruments level, continues to describe the technology and circuitries on the board level, and only in some exceptional cases investigates the circuits on the components level. It is believed that such an approach better reflects the advanced status of nuclear electronics and the philosophy of the modern design of nuclear instruments. For illustration, and wherever it appeared useful, some commercial instruments are described and analyzed".

The contents include chapters on functional approach, circuit design, noise and resolution, further analog signal processing before the analog-to-digital conversion, amplitude analysis, analog-to-digital conversion, multichannel analyzer, time measurement, power supplies.

The document is available free-of-charge from:

Publications Division
International Atomic Energy Agency
Wagramerstrasse 5
P.O. Box 100
A-1400 VIENNA
Austria.

FOR MATHEMATICIANS

The International Centre for Pure and Applied Mathematics (ICPAM, Nice, France) has sent us its programme for 1986 which is reproduced hereafter. Those interested in the programmes should contact ICPAM directly.

UNESCO ICPAM

INTERNATIONAL CENTRE FOR PURE AND APPLIED MATHEMATICS

NICE – FRANCE

Following the 22C/6.2 resolution adopted by the 22nd Session of the UNESCO General Conference (Paris, 1983), the main goals of ICPAM are :

- promotion of teaching mathematics and research in developing countries,
- high level training of mathematicians coming mainly from developing countries,
- improvement of the cooperation between mathematicians of the developed countries and mathematicians of the developing countries (north/south dialogue) as well as between mathematicians of developing countries (south/south dialogue),
- compilation, production and distribution of mathematical documentation in the developing countries.

PROGRAMME 1986

PROGRAMME I: INTERNATIONAL TRAINING SCHOOLS

A - SUMMER SCHOOL ON "FUNDAMENTALS OF COMPUTER SCIENCE"
Nice, France: June 16 - July 12, 1986

B - SUMMER SCHOOL ON "MATHEMATICS APPLIED TO MECHANICS"
Monastir, Tunisia: June 30 - July 26, 1986
(in cooperation with the Tunisian Ministry of Higher Education and Scientific Research)

C - AUTUMN SCHOOL ON "FUNCTIONAL ANALYSIS AND ITS APPLICATIONS"
Nice, France: August 25 - September 20, 1986

PROGRAMME II: JOURNAL "MATHEMATICS AND DEVELOPMENT"

PROGRAMME III: SELECTIVE BIBLIOGRAPHY OF MATHEMATICS

PROGRAMME IV: DIRECTORY OF MATHEMATICS IN DEVELOPING COUNTRIES

PROGRAMME V: CIMPA LECTURES NOTES

PROGRAMME VI: SOUTH-SOUTH AND NORTH-SOUTH COOPERATION IN MATHEMATICS

Cooperation with the International Mathematical Union's Commission on Development and Exchange (IMU/CDE), African Mathematical Union (AMU), South-East Asian Mathematical Society (SEAMS), Latin American School of Mathematics and others international institutions acting for mathematics in developing countries.

SECRETARIAT: CIMPA/ICPAM
1 avenue Edith Cavell - 06000 Nice - France
Tel: 93 53 18 43 - Telegram: CIMPANICE

CIMPA/ICPAM

SUMMER SCHOOL 1986

"Fundamentals of computer science"

June 16/July 12 - NICE - FRANCE

REQUEST FOR APPLICATION*

NAME ....

INSTITUTION ....

ADDRESS ....

....

* To be sent to: CIMPA/ICPAM
1 Avenue Edith Cavell - 06000 NICE - FRANCE

The participants are invited to apply for financial support as soon as possible, without waiting for their admission.

- to their university,
- to those proper national authorities which provide scholarships for studying abroad,
- to national scientific institutions,
- to the National Commission for UNESCO in their country,
- to either the French Mission for Cooperation, or the French Cultural Centre, at the French Embassy in their country,
- to international organizations or foundations.

Les candidats doivent déposer ces dossiers de demande de bourse par l'intermédiaire de leur Gouvernement auprès des différentes instances compétentes, et sont priés d'adresser au CIMPA une copie de toutes leurs demandes et des réponses obtenues.

En cas d'échec de ces démarches, le CIMPA pourra accorder exceptionnellement des subventions à un nombre limité de candidats, pour couvrir partiellement leurs frais (de séjour ou de voyage).

Des dispenses de frais d'inscription peuvent être accordées sous certaines conditions et sur demande écrite adressée au CIMPA.

These scholarship applications must be presented by their Government. Candidates should send to ICPAM copies of all their scholarship applications together with any replies. Should these applications fail, ICPAM will award a limited number of partial scholarships (to cover living or travel expenses).

Registration fees may be waived under certain conditions and upon written request sent to ICPAM.

Frais d'inscription/Registration fee:
FF. 1 000

RENSEIGNEMENTS ET INSCRIPTIONS/INFORMATION AND APPLICATION

CIMPA/ICPAM 1, Avenue Edith Cavell - 06000 NICE - FRANCE
Tél: 93.53.18.43. - Télégrammes/Cable: CIMPANICE

UNESCO

CIMPA ICPAM

ÉCOLE D'ÉTÉ 1986 "INFORMATIQUE FONDAMENTALE"

SUMMER SCHOOL 1986 "FUNDAMENTALS OF COMPUTER SCIENCE"

NICE - FRANCE

16 juin - 12 juillet 1986

Conformément à la résolution 22C/6.2 adoptée à la 22e Session de la Conférence Générale de l'UNESCO (Paris 1983), les objectifs essentiels du CIMPA sont les suivants:

- promotion de la formation et de la recherche mathématique dans les pays en voie de développement,
- formation de haut niveau des mathématiciens venant en priorité des pays en développement,
- amélioration de la coopération entre les mathématiciens des pays développés et des pays en développement (dialogue nord/sud) ainsi qu'entre les mathématiciens des pays en développement (dialogue sud/sud),
- recueil, production et diffusion de la documentation mathématique dans les pays en développement.

June 16 - July 12, 1986

Following the 22C/6.2 resolution adopted by the 22nd Session of the UNESCO General Conference (Paris 1983), the main goals of ICPAM are:

- promotion of teaching mathematics and research in developing countries,
- high level training of mathematicians coming mainly from developing countries,
- improvement of the cooperation between mathematicians of the developed countries and mathematicians of the developing countries (north/south dialogue) as well as between mathematicians of developing countries (south/south dialogue),
- compilation, production and distribution of mathematical documentation in the developing countries.

Centre International de Mathématiques Pures et Appliquées

International Centre for Pure and Applied Mathematics

1, Avenue Edith Cavell 06000 NICE - FRANCE

pays en développement.

developing countries.

COMITE DE PARRAINAGE SCIENTIFIQUE/SCIENTIFC SPONSORSHIP COMMITTE

R. SEDGEWICK (Princeton, USA),
L. GUIBAS (Stanford, USA),
K. MEHLHORN (Saarbrücken, RFA)
G. AUSIELLO (Rome, Italie),
B. CHAZELLE (Brown, USA).

Directeur Scientifique/Scientific Director: P. FLAJOLET (INRIA, Paris)

CONFERENCIERS/LECTURERS

K. APT (CNRS, Paris), J. BERSTEL (Paris 6), D. PERRIN (Paris 7), C. PUECH (Orsay & ENS, Paris), J.C. RAOULT (Orsay), B. VALLEE (Caen).

OBJECTIFS/OBJECTIVES

Aider les mathématiciens des pays en développement à acquérir les compétences de base en informatique fondamentale.

To help mathematicians from developing countries to develop a basic competence in the fundamentals of computer science.

LANGUE OFFICIELLE/OFFICIAL LANGUAGE

Anglais.
English

DATE ET LIEU/DATE AND LOCATION

Du 16 juin au 12 juillet 1986 à Nice, France.

From June 16 to July 12, 1986 at Nice, France.

PROGRAMME SCIENTIFIQUE/ SCIENTIFIC PROGRAM

A - Algorithmique: Brefs rappels de base des notions de liste, graphes, arbres, structures chainées, structures de données et procédures récursives (fondées sur le langage PASCAL). Méthode de recherche d'information: arbres de recherche, arbres B, recherche digitale, techniques de hachage. Tri: tri "rapide" (Quicksort), tris par tas (heapsort), files de priorité et tris fusions. Application aux méthodes d'accès à des fichiers, représentation hiérarchique des images.
Algorithmes arithmétiques et semi-numériques (algorithmique des entiers et des polynomes). Transformée de Fourier rapide (FFT), factorisation, tests de primalité et applications au codage et à la génération de nombres aléatoires.

Algorithms: Brief survey of basic notions of lists, graphs, trees, linked structures, data structures and recursive procedures (based on the PASCAL programming language). Searching methods search trees, B-trees, digital searching, hashing techniques. Sorting: quicksort, heapsort and priority queues, merge sort. Applications to physical file access methods, hierarchical representations of images.
Number-theoretic Algorithms: integer and polynomial algorithms. Fast Fourier transform, factorization, primality testing and applications to coding and random number generation.

B - Logique et Programmation: Calculobilité et fonctions récursives. Les principes du langage LISP. Complexité des calculs et problèmes NP. Manipulation symbolique de termes: unification et clauses de Horn; principes du langage PROLOG.
Programmes concurrents et sémantique: concurrence et synchronisation des programmes parallèles. Démonstration des propriétés de correction et notions sur les "deadlocks", l'équitabilité et la terminaison.

Logic and Programming: Computability and recursive functions. Principles of the LISP programming language. Complexity of computations and NP problems. Symbolic manipulation of terms, unification, Horn clauses and principles of the PROLOG programming language.
Concurrent programs and their correctness: concurrency and synchronization in parallel programs. Proof-theoretic approaches to correctness and notions of deadlock, fairness and termination.

C - Automates, Mots et Langages: Algorithmes de manipulation de Mots (string matching) et applications aux codes en longueur variable. Automates finis, expressions régulières et application à l'analyse lexicale. Grammaires non contextuelle (context-free), automates à pile et applications à la compilation. Transductions.

Automata, Words and Languages: Word manipulation algorithms (string-matching) and applications to variable length codes. Finite automata, regular expressions and applications to parsing. Transductions.

Les cours seront complétés par des conférences de spécialistes et des discussions informelles notamment sur les thèmes suivants: bases de données relationnelles, langages de programmation en temps réel et leur sémantique, introduction aux langages de manipulation de symboles.
Les participants utiliseront quelques microordinateurs (avec PASCAL, LISP et PROLOG) afin de mettre en application les théories exposées pendant les cours.

The course will be complemented by lectures from various specialists; the following topics should be discussed on the occasion of short lectures: the relational data base model; real-time programming languages and their semantics; introduction to symbolic manipulation languages.
Participants will have access to a few personal computers (with PASCAL, LISP and PROLOG) in order to experiment with some of the concepts presented in the course.

PREREQUIS/PREREQUISITES

Un cours de 4 semaines ne saurait être un cours complet de programmation. Il est donc indispensable que les participants aient déjà une certaine familiarité avec un langage de programmation tel que PASCAL.

For lack of time, the course cannot be a complete introduction to programming and it is anticiped that participants will have had some previous exposure to the essentials of programming in a language like PASCAL.

MODALITES D'INSCRIPTION/ APPLICATION PROCEDURE

• Chaque candidat devra envoyer au CIMPA, avant le 15 mars 1986, son curriculum vitae, deux lettres de recommandation et le mode de financement prévu pour sa participation à l'Ecole d'Eté (voyage + séjour + frais d'inscription).

Applicants should send to the ICPAM office before March 15 1986, their curriculum vitae together with two recommendation letters and a description of the financial arrangements for travel, lodging and registration fee.

• Il recevra une réponse d'acceptation ou de refus en avril 1986.

Admission letters will be sent in April 1986.

FINANCEMENT/FINANCIAL CONDITIONS

• Les frais d'inscription aux écoles ainsi que les déplacements et le séjour sont à la charge des participants.

The participants must pay registration fees, travel and living expenses.

• Un hébergement (de type cité universitaire) est possible pour une somme d'environ 150 francs par jour (lit + repas).

There is a possibility of dormitory style housing for approximately 150 francs per day for room and board.

Les candidats sont invités à essayer de trouver un financement, le plus tôt possible, sans attendre l'admission.

• auprès de leur université,
• auprès des autorités compétentes de leur pays qui peuvent octroyer des bourses pour effectuer des études à l'étranger,
• auprès d'organismes scientifiques nationaux,
• auprès de la Commission Nationale de l'UNESCO dans leur pays,
• auprès des services culturels et de coopération scientifique et technique de l'Ambassade de France,
• auprès de fondations ou d'organismes internationaux.

CIMPA/ICPAM

ECOLE D'ETE 1986

"Informatique fondamentale"

16 juin/12 juillet - NICE - FRANCE

DEMANDE D'INSCRIPTION*

NOM

INSTITUTION

ADRESSE

* à retourner à: CIMPA
1 Avenue Edith Cavell - 06000 NICE - FRANCE

LIST OF HIGH ENERGY VISITORS
As at 15 March 1986

The lists for Condensed Matter and Mathematics will be published in the next issue.

1.	Ahmad, W. Dar-us-Salam U(12) B-47, Block P Karachi-3301 Pakistan	Pakistan	1/4 - 15 May
2.	Alam, B. Department of Physics Aligarh Muslim University Aligarh UP India	India	3 mths summer
3.	Aldazabal, G. Centro Atomico Bariloche 8400 S.C. de Bariloche Rio Negro Argentina	Argentina	Dec 85-Dec 86
4.	Ametller, L. Dept. de Fisica Universidad de Barcelona Barcelona Spain	Spain	1 Oct 84 - 1 Oct 86
5.	Anane-Fenin, K. Department of Physics University of Cape Coast Cape Coast Ghana	Ghana	11/9/85 - 10/3/86
6.	Anini, Y. Physics Department Bir zeit University Birzeit, West Bank Israel	Jordan	1/11/85 - 31/10/86

7. Ansari, S. India 6wks 86
Dept. of History of Medicine & Science
I.H.M.M.R.
Hamdard Nagar PO
New Delhi
India

8. Anselm, A. USSR 1 mth 86
Leningrad Nuclear Physics Institute
Gatchina Leningrad District 188350
USSR

9. Assar, A.R. Iran 1/10/85 - 1/4/86
c/o ICTP
Trieste
Italy

10. Baldomir, D. Spain Jan-Dec 86
Universidad de Santiago
Departamento de Electricidad y Magnetismo
Santiago de Compostela
Spain

11. Barut, A. USA June 86-Aug 87
University of Colorado
Department of Physics
Boulder, Colorado 80309
USA

12. Bergshoeff, E. Netherlands 5/9/84-9/9 86
Brandeis Univ.
Waltham, MA
USA

13. Blagojevic, M. Yugo 2 mths late 86
Institute of Physics
Box 57
11001 Belgrade
Yugoslavia

14.	Blank, J. Nuclear Centre Charles University V Holesovickach 2 18040 Prague 8 Czechoslovakia	Czech	1 month 1986
15.	Bogomolny, E. Landau Inst. for Theortical Physics ul. Kosygina 2 117940 Moscow USSR	USSR	1 mth 1986
16.	Cao, Shen-Lin Physics Department Beijing Normal University Beijing People's Rep. China	China	3 mths June
17.	Chela-Flores, J. Departamento de Fisica Universidad Simon Bolivar Apartado 80659 Caracas Venezuela	Venezuela	1/6 - 30/11
18.	Chetyrkin, K. Inst. for Nuc. Res. Academy of Sciences 60th October Anniversary Prospect 7a Moscow 117312 USSR	USSR	1 month 86
19.	Cobra, B. Ludwigs Universitat Fakultat fur Physik 7800 Freiburg I FRG	Brazil	10-24 March

20.	Damgaard, P. CERN TH Division 1211 Geneva 4 Switzerland	Denmark	10-24 March
21.	Davis, S. DAMPT University of Cambridge Cambridge CB3 England	UK	Oct 86 - Oct 87
22.	Diallo, A. Ecole Normale Superieure B.P. 795 Conakry Rep. of Guinea	Guinea	2 mths 86
23.	Diaz, A. Bell Laboratories Murray Hill, N.J. USA	Colombia	Apr 86 - Apr 87
24.	Dobrev, V.K. Physik Inst. Technische Universitat Clausthal Fed. Rep. Germany	Bulgaria	3 mths 86
25.	Dominguez, C. Department of Physics Universidad Santa Maria Casilla 110 V Valparaiso Chile	Chile	7/10/85 - 7/10/86
26.	Drechsler, W. Max Planck Institut Fohringer Ring 6 4000 Munich 80 FRG	FRG	2 wks late 86
27.	Dubnicka, S. Institute of Physics Dubravska cesta 842 28 Bratislava Czechoslovakia	Czech.	2 wks 1986

28.	Ette, A. Department of Physics University of Ibadan Ibadan Nigeria	Nigeria	3 mths spring 1986
29.	Faruqui, A. 46-F/6 PECHS Karachi 2904 Pakistan	Pakistan	3 mths Mar-May
30.	Fradkin, E. Lebedev Institute of Physics Leninsky Prospekt 117 924 Moscow USSR	USSR	May/June
31.	Franco, V. Brooklyn College CUNY Brooklyn, N.Y. 11210 USA	USA	July-August
32.	Garg, H. Centre for Energy Studies Indian Institute of Technology Delhi 110016 India	India	15/4 - 15/8
33.	Gopalswamy, N. Institute of Astrophysics Kodaikanal 624103 India	India	3 months 1986
34.	Havlicek, M. Nuclear Centre Charles University V holesovickach 2 18040 Prague 8 Czecholovakia	Czech	1 month 1986
35.	Haymaker, R. c/o Tata Institute of Fundamental Research Homi Bhabha Road Bombay 400 005 India	USA	May-June

36.	Henneaux, M. Universite Libre Faculte des Sciences CP 231 1050 Brussels Belgium	Belgium	2-12 April
37.	Hull, C. DAMTP Cambridge University Cambridge CB3 England	UK	17-28 March
38.	Ignatiev, A. Institute for Nuclear Research USSR Academy of Sciences 60th October Anniversary Prospect 7a 117312 Moscow USSR	USSR	1 months 86
39.	Inami, T. Research Institute for Fundamental Physics Kyoto University Kyoto 606 Japan	Japan	3 wks July
40.	Ioffe, B.L. Institute of Theoretical and Experimental Physics Moscow USSR	USSR	1 mth 87
41.	Iyer, B.R. Raman Research Institute Bangalore 560 080 India	India	1-14 Aug
42.	Jayaraman, T. Department of Theoretical Physics University of Madras Guindy Campus Madras 600 025 India	India	1/4/87-31/3/88

43. Jordan, T. USA 19/3 - 2/4
University of Minnesota
10 University Drive
Duluth, Minnesota 55812-2496
USA

44. Kaiser, H. GDR 1 month 1986
Institute for High Energy Physics
Platanenallee 6
1615 Zeuthen
GDR

45. Kallies, W. DDR 2 wks 86
Humboldt-Universitat
under den Linden 6
1086 Berlin, PSF 1297
DDR

46. Karadayl, H.R. Turkey 1 mth Oct/Nov or 1986
Physics Department
Technical University
YeniLevent, Istanbul
Turkey

47. Keramat Ali, M. Canada June 86 - July 87
University of Lethbridge
4401 University Drive
Lethbridge, Alberta
Canada TlK 3M4

48. Khan, F.M. Pakistan 3 mths summer
Government College
Jhang
Pakistan

49. Korepin, V. USSR 1 mth 86
Leningrad Mathematical Institute
Fontanka 27
191011 Leningrad
USSR

50. Lhallabi, T. Morocco 4 mths summer
Laboratoire de Physique Theorique
Av. Ibn Batota
B.P. 1014
Rabat
Morocco

51. Lokajicek, M. — Czech — 1 mth Sept 1986
Institute of Physics
Na Slovance 2
18040 Prague 8
Czechoslovakia

52. Lu, Tan — China — 6 mths Sept
Astrophysics Institute
Najing University
Nanjing
People's Rep. China

53. Lukierski, J. — Poland — 9-17 April
Institute of Theoretical Physics
Wroclaw University
Wroclaw
Poland

54. MacDonald, J. — UK — 1 yr from Jan 86
School of Math. & Phys. Sc.
University of Brighton
Brighton BN1 9QH
UK

55. Maeda, K. — Japan — 16/12/85-15/12/86
c/o SISSA
Trieste

56. Mansouri, R. — Iran — 1 mth June
Sharif University
Box 11365-8639
Tehran
Tehran
Iran

57. Meshcheriakov, V. — USSR — 3 wks Mar
JINR
Moscow
USSR

58. Mir-Kasimov, R. — USSR — 3 wks Mar
JINR
Moscow
USSR

59. Mustafa, A. Syria 3 mths summer
Nuclear Magnetism & Energy Group
Box 4757
Damascus
Syria

60. Nafari, N. Iran July
Physics Department
Al-Fateh University
Tripoli
Libya

61. Neto, J. Brazil 28/7/84-31/8/86
c/o ICTP
Trieste

62. Nguyen van Hieu Vietnam 6 wks Apr-June
Vien Khoa hoc Vietnam
Nghia Do, Tu Liem
Hanoi
Vietnam

63. Okoye, S. Nigeria 6 mths 86/87
Faculty of Physical Sciences
University of Nigeria
Nsukka 6231
Nigeria

64. Pandey, S.N. India 1 mth summer
Department of Applied Sciences
M. Engg. College
Gorkhpur 273010
India
Gorkhpur 273010
India

65. Pernici, M. Italy 5-25 April
Institute of Theoretical Physics
State University of New York
Stony Brook, N.Y. 11794
USA

66. Pollock, M. UK 14/3/85-31/7/86
Res. Inst. for Fundamental Physics
Kyoto
Japan

67. Rahman, A. India 12-15 March
Tower A, Flat 30
Zakir Bagh, Okhla Road
New Delhi 110025
India

68. Rakowski, M. USA Oct 86 - Oct 87
Yale University
Physics Department
Box 6666
New Haven, CT 06511
USA

69. Ramachandran, R. India 15/6/85 - 14/5/86
Physics Dept.
Indian Institute of Technology
Kanpur 208016
India

70. Romans, L. USA June
Institute for Theoretical Physics
University of California
Santa Barbara, CA 93106
USA

71. Sahdev, D. India 1/10/84-30/9/86
Dept. of Physics
Pennsylvania Univ
Philadelphia, PA
USA

72. Saidi, E. Morocco 6 mths April
Laboratoire de Physique Theorique
72. Saidi, E. Morocco 6 mths April
Laboratoire de Physique Theorique
Av. Ibn Batota
B.P. 1014
Rabat
Morocco

73. Schlereth, H. FRG 1/2/86 for 4 mths
Niels Bohr Institute
Blegdamsvej 17
2100 Copenhagen 0
Denmark

74. Schwinger, J. USA Open - Aug
UCLA

75.	Sezgin, E. c/o ICTP Trieste	Turkey	1/10/84-30/9/86
76.	Shi, Tiai-yi Physics Department Beijing Normal University Beijing People's Rep. China	China	4 mths Sept
77.	Shigemitsu, J. Ohio State University 174 West 18th Av. Columbus, Ohio 43210-1106 USA	Japan	3 wks July
78.	Shin, H.-J. Physics Department Kyung Hee University Seoul 131 Korea	Korea	10 July 85- 10July
79.	Shintani, M. Yamaguchi Women's University 3-2-1 Sakurabatake Yamaguchi 753 Japan	Japan	Feb-Apr 87
80.	Shukla, P. Department of Physics The University Southampton S09 5NH England Southampton S09 5NH England	India	6 mths 1986
81.	Smailagic, A. Dzemala Bijedica 32/111 71000 Sarajevo Yugoslavia	Yugo	1/4 - 1/9
82.	Som, M. Instituto de Fisica Universidade Federal Caixa Postal 68528 Rio de Janeiro Brazil	Brazil	3 mths 1986

83.	Srivastava, T. School of Mathematics The University Leeds LS2 9JT England	UK	1/7 - 30/9
84.	Tauber, G. Department of Physics Tel Aviv University Tel Aviv Israel	Israel	
85.	Tekou, A. Laboratoire de recherche Universitaire 61 Avenue de Lattre-de-Tassigny 18014 Bourges France	Togo	4/7 - 4/9
86.	Tseytlin, A.A. Lebedev Physical Institute Leninsky Prospect 53 117924 Moscow USSR	USSR	upto 3 mths 1987
87.	Vernov, Y. Institute for Nuclear Research 60 October Anniversary Prospect 7A Moscow 117312 USSR	USSR	1 mth March

88. Ward, B. USA 1/7 - 1/9

88.	Ward, B. SLAC Box 4349 Stanford, CA. 94305 USA	USA	1/7 - 1/9
89.	Wiegmann, P. Landau Institute for Theoretical Physics Kosygina 2 117940 GSP-1 Moscow V-334 USSR	USSR	1 week 86

90. Xu, Chongming China 3 mths Sept
596 Lane, No. 2A
Fourth Floor, Huang
Pi Nan Road
Shanghai 200025
People's Rep. China

91. Zhang, R. China 19/9/85–19/9/86
Physics Department
University of Tasmania
Box 252, C, GPO
Hobart
Tasmania

92. Zhang, Y.Z. China Mar–June 1986
Institute of Theoretical Physics
Acadmia Sinica
Box 2735
Beijing
People's Rep. China

Nuclear Physics preprints and internal reports issued

in January-March 1986

(26) N. MANKOC BORSTNIK, L. FONDA and B. BORSTNIK - Coherent rotational states, their creation and time evolution in molecular and nuclear systems.

(30) Md. A. RAHMAN and S.N. RAHMAN - On the energy dependence of
(30) Md. A. RAHMAN and S.N. RAHMAN - On the energy dependence of
$^{12}C(^{3}He,^{7}Be)^{8}Be$ reaction and spectroscopic information using the same reaction on ^{12}C and ^{24}Mg nulcei.

(31) Md. A. RAHMAN, S.N. RAHMAN, H.M. SEN GUPTA, H.-J. TROST, P. LEZOCH and U. STROBUSCH - Alpha-spectroscopic factors from $(d,^{6}Li)$ and $(^{3}He,^{7}Be)$ reactions on ^{12}C, ^{24}Mg, ^{40}Ca and ^{58}Ni.

(34) P.C. SOOD and R.S. RAY - Allowed unhindered beta connected states in rare earth nuclei.

(41) H.D. BHARDURAJ and R. PRASAD - Excitation functions for $^{121,123}Sb(\alpha;x^{n})$, $(x = 1;4)$ reactions in $\approx$10-40 MeV range.

High Energy Physics preprints and internal reports issued in January-March 1986

(1) W.Q. CHEN and A.H. COOK - Spinors, tensors and the covariant form of Dirac's equation.

(3) SUBIR SARKAR - Cosmological and astrophysical constraints on particle physics.

(7) LI TIE-ZHONG - May quarks and leptons be interpreted as skyrmions?

(12) S. NARISON - On the two-photon width of the $\delta(980)$.

(13) G. DENARDO and E. SPALLUCCI - Curvature and torsion from matter.

(14) G.C. GHIRARDI, A. RIMINI and T. WEBER - Classical behaviour of macroscopic bodies and quantum measurements.

(18) LI TIE-ZHONG - Further interpretations of quarks as skyrmions.

(20) C.A. DOMINGUEZ and N. PAVER - Local duality constraints on scalar gluonium.

(24) E. BERGSHOEFF, ABDUS SALAM and E. SEZGIN - A supersymmetric R^2-action in six-dimensions and torsion.

(32) E. BERGSHOEFF, ABDUS SALAM and E. SEZGIN - Supersymmetric R^2-actions, conformal invariance and Lorentz Chern-Simons term in 6 and 10 dimensions.

(35) ABDUS SALAM - Overview of particle physics.

(36) E. SEZGIN - Structure of heterotic σ-models coupled to conformal supergravity.

(39) R. RAMACHANDRAN - Technology of multiloop calculations for closed bosonic strings.

Solid State Physics preprints and internal reports issued in January-March 1986

(2) J.S. THAKUR and K.N. PATHAK - Dynamical structure factor of electron liquid using mode-coupling theory.

(16) P. BALLONE, G. PASTORE, J.S. THAKUR and M.P. TOSI - Pair structure and interionic forces in molten zinc chloride.

(22) P. BALLONE, G. PASTORE and M.P. TOSI - Restricted primitive model for electrical double layers: Modified HNC theory of density profiles and Monte Carlo study of differential capacitance.

(23) YU. S. NECHAEV and M.H. YEWONDWOSSEN - Interpretation of the anomalies of transition impurity diffusion in aluminium.

(28) L.K. SINGH - Effect of excitation frequency temperature dependent electroluminescence of ZnS : Cu,Mn : (H).

(29) L.K. SINGH - Temperature dependence of electroluminescent emissions from | ZnS : Cu : Mn (H) | type luminophors.

(33) FU-CHO PU, YI-ZHONG WU and BAO-HENG ZHAO - Quantum inverse scattering method for multicomponent non-linear Schrödinger model for bosons or fermions with repulsive coupling.

(37) M. ROVERE and M.P. TOSI - Structure and dynamics of molten salts.

(38) YU LI-SHENG, LIU HONG-XUN, ZHANG BEI and WANG SHU-MIN - Some properties of GaAs-$A\ell_x Ga_{1-x} As$ heterojunction grown by low temperature liquid phase epitaxy.

(42) F. VERICAT and M.P. TOSI - Density functional theory for a model of non-uniform liquid metal in partially ionized states.

(43) F. VERICAT, G. PASTORE and M.P. TOSI - Pseudoclassical approach to electron and ion density correlations in simple liquid metals.

Mathematics Physics preprints and internal reports issued in January-March 1986

(4) TIAN CHOU - Symmetries and a hierarchy of general modified KdV equation.

(6) Y.L. XIN - Stable harmonic maps from complete manifolds.

(8) LI YI-SHEN and ZHANG LI-NING - Super-integrable systems and its infinite conserved currents.

(9) ZHANG LI-NING - Harmonic mapping actions and non-linear σ-model.

(17) HUANG WENGANG - The stability of the delay differential difference equations $\ddot{x}(t)+p_1(t)\dot{x}(t)+q_1(t)x(t)+p_2(t)\dot{x}(t-r(t))+q_2(t)x(t-r(t))=0$.

(19) TOMA V. TONEV - An infinite-dimensional generalization of Shilov boundary and infinite-dimensional analytic structures in the spectrum of a uniform algebra.

(21) M.A. HOSSAIN and L.K. SHAYO - The skin friction on the unsteady free convection flow past an accelerated vertical porous plate.

(25) JOHN R. MVUNGI - The effect of submerged obstacles on circular fronts propagating into water at rest.

Preprints and internal reports issued in other fields in January-March 1986

Cosmology (5) K. MAEDA, M.D. POLLOCK and C.E. VAYONAKIS - Inflation in a superstring model.
superstring model.

Cosmology (15) M.D. POLLOCK - A positive semi-definite action in a Kaluza-Klein theory with compactification into time-like extra dimensions.

Cosmology (27) M.D. POLLOCK - On the rôle of the Kahler-curvature Q term in the evolution of the early universe.

Atomic Phys. (40) YE BIQING and MA ZHONG LIN - Input fiber coupler transmitting 250 watt CW Nd : YAG laser beam.

Atomic Phys. (44) YANG YINGHAI, HUANG WEITONG, CAO JIANHUA and LI HUIXIANG - The imaging properties of Selfoc lens contained Li ions.

TENTATIVE CALENDAR OF 1987 ICTP ACTIVITIES

12 - 15 January	INTERNATIONAL CONFERENCE ON TOTAL ENERGY METHODS
2 - 27 February	SECOND WORKSHOP ON MATHEMATICS IN INDUSTRY
9 February - 6 March	WORKSHOP ON REMOTE SENSING AND RESOURCE EXPLORATION
2 - 27 March	COURSE ON GEOMAGNETISM AND AERONOMY
9 March - 3 April	COLLEGE ON ATOMIC PHYSICS
27 April - 15 May	WORKSHOP ON POLYMER PHYSICS
28 April - 8 May	WORKSHOP ON CATALYSIS AND CORROSION
18 - 22 May	WORKSHOP ON INTERMEDIATE NUCLEAR PHYSICS
11 May - 19 June	SPRING COLLEGE ON MATERIAL SCIENCE: METALLIC MATERIALS
25 May - 19 June	SPRING COLLEGE ON PLASMA PHYSICS
8 - 19 June	ICFA SCHOOL ON HIGH ENERGY PHYSICS INSTRUMENTATION
22 June - end August	SUMMER WORKSHOP ON HIGH ENERGY PHYSICS AND COSMOLOGY
22 June - 4 September	RESEARCH WORKSHOP IN CONDENSED MATTER, ATOMIC AND MOLECULAR PHYSICS
July - August	CONDENSED MATTER SUMMER CONFERENCES
Summer	ADRIATICO RESEARCH CONFERENCES
17 - 28 August	WORKING PARTY ON "PHYSICS OF POROUS MEDIA"
31 August - 18 September	WORKSHOP ON NON-CONVENTIONAL ENERGY MATERIALS

22 June - end August SUMMER WORKSHOP ON HIGH ENERGY PHYSICS AND

21 September - 2 October	WORKSHOP ON MODELLING IN ENERGY AND ENVIRONMENTAL PROBLEMS
7 September - 2 October	WORKSHOP ON TELEMATICS
5 - 30 October	FOURTH COLLEGE ON MICROPROCESSORS: TECHNOLOGY AND APPLICATIONS IN PHYSICS
12 October - 6 November	WORKSHOP ON MATHEMATICAL ECOLOGY
2 - 20 November	THIRD COLLEGE ON SOIL PHYSICS
9 November - 18 December	COLLEGE ON RIEMANN SURFACES
23 November - 18 December	SECOND COLLEGE ON CLOUD PHYSICS AND CLIMATE

DIRECTORY OF PHYSICISTS FROM DEVELOPING COUNTRIES

The ICTP is preparing a directory of scientists from developing countries. A first preliminary version will be circulated sometime in May. Those who have not been contacted directly by the ICTP, may fill out the last page of this issue and return it to:

DPWDC (Directory of Physicists Working in Developing Countries)
ICTP
Strada Costiera, 11
P.O. Box 586
34136 TRIESTE
Italy.

The form should be filled out as completely as possible in order to avoid delay.

The ICTP had already published a first Directory in the seventies. Word processors which are now used at the Centre make the production and revision of such a document much easier than in the past. We believe that, after a number of revisions and with the collaboration of the physics community, a comprehensive repertoire of names will be available to all those who are
comprehensive repertoire of names will be available to all those who are
interested in the international cooperation.

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 on initiatives in their home countries. Suggestions and criticisms should be addressed to Dr A.M. Hamende, Chief Administrative and Scientific Information Officer, ICTP.

DIRECTORY

NAME:

NATIONALITY:

DATE OF BIRTH:

PERMANENT ADDRESS:

POSTAL ADDRESS:

ACADEMIC QUALIFICATIONS: YEAR: PLACE:

RESEARCH INTERESTS:

RECENT PUBLICATIONS: