

News from ICTP

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The Proposal for the Creation of an International Centre for Science

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and
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Third World Academy of Sciences

1. The Third World as a whole is slowly waking up to the realisation that Science and Technology are what distinguish the South from the North. On Science and Technology depend the standards of living of a nation. The widening gap in Economics and in Influence between the nations of the South and the North is basically the Science gap.

2. The creation of the International Centre for Theoretical Physics (ICTP) in 1964, has been an important influence in correcting this imbalance. There are three aspects of scientific research: 1) **basic scientific research**; 2) **applied scientific research**; and 3) **research and development in science-based technology**. The ICTP was initially created to help developing countries - together with those from the North - to make contributions to the Basic aspects of High Energy, Nuclear and Condensed Matter Physics, as well as Physics of the Earth and the relevant Mathematics. Since no new international centres with a similar mandate have been created for Applied Physics, or for Physics-based Technology, the ICTP has added over the years - within its programme - related areas of Applied Physics (Soil Physics, Cloud Physics, Physics of the Oceans and the Atmosphere, Seismology), as well as High Technology -

Microprocessors, Fibre Optics, Communication Physics and Physics of Materials for Non-conventional Energy Sources and has set up training laboratories for some of these.

3. The Centre, in addition, has pioneered new modalities - whose efficacy has come to be universally recognized for imparting the latest in sciences - in particular, sciences supporting high technology.

Besides its research functions, the Centre organises extended courses to which some 2,500 physicists come annually both from developing and developed countries, including some from Italy, the host country. As an anti-brain-drain device, it receives of the order of 150 associates a year (these are first-class men and women from developing countries who are given six-year appointments and who come to the Centre (at its expense) three times, for periods of up to three months, during these six years). There are additionally 334 institutions in the developing world which are federated to the Centre and are empowered to send their members to the Centre.

4. For experimental physicists, there is the modality, financed by the Government of Italy, through which 100 experimenters among the Centre's members, are accredited to experimental laboratories located in Italy, for a one year period. This experience enriches these laboratories as well as the countries of origin of the physicists. In addition, through a generous grant (again from the Italian Government) the Centre has embarked on external liaison which permits of help to Centres created in developing countries in the image of the Trieste Centre, and also help with the research and training activities in Physics held outside Italy.

All in all, the Centre has been extraordinarily fortunate, both in its

donors as well as in the service which it has been able to render to the Physics Community the world over and, in particular, to the building up of Physics communities in the developing countries.

5. It seems the time has come when the concept and modalities of the ICTP should be extended further to the other basic Sciences, like Biology, Chemistry and Geology. Regarding Biology, there is the proposed UNIDO Centre of Biotechnology (fashioned after the ICTP) in two components - one in Trieste, sponsored by the Italian Government and the other sponsored by the Indian Government in Delhi. On the High Technology (and Basic Physics, Basic Chemistry and Basic Biology) side, there is the proposal to create an Italian Synchrotron Radiation Laboratory in the Research Area of Trieste.

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6. The proposal which we are making is that an **International Centre for Science** should be created which should have as its units 1) the International Centre for Theoretical Physics (to take care of Physics and Mathematics); 2) the International Centre for Genetic Engineering and

Biotechnology (which should be extended to take care of fundamental advances in Biology); 3) an International Centre for High Technology and Material Sciences (of Microprocessors, Microelectronics, Lasers, Fibre Optics, Communication Physics, High Temperature Superconductors, Computational Sciences and Aspects of Space Sciences - this Centre may also have help, as one of its supporting laboratories, from the Synchrotron Radiation Laboratory in Trieste); 4) an International Centre for Chemistry, both Pure and Applied (for fine pharmaceutical as well as bulk chemicals); and finally, 5) an International Centre for Earth Sciences (which would take care of research in and of imparting the recent advances in geology, prospecting, soils, as well as the environmental aspects of Earth Sciences).

7. Such an **International Centre for Science**, although envisaged as a single entity, will function as a loose federation of existing and new centres in Trieste. 1) It may be constituted as an independent organisation under the Italian Government auspices; 2) Its units may be affiliated to the IAEA, UNIDO, FAO or WMO and UNEP; or 3) It may become affiliated to UNESCO. The Third World Academy of Sciences, through its Third World Fellowship, would play a crucial role in bringing this new Centre into existence.

8. If the last suggestion regarding UNESCO involvement were accepted, UNESCO Science would be divided into two parts: firstly, the ICSU related global aspects of Science, which would be headquartered in Paris as is the case now (with its programmes on man and the biosphere plus classical engineering technologies). The second would be a Trieste type of operation set up in Italy which would concentrate on the **International Centre for Science** and have federation links with similar centres in the developing countries. This is the type of operation which UNESCO has not undertaken in a big way just now and would represent an additional programme area as far as UNESCO is concerned. (The International Centre for Sciences may become a University institution in its

own right - capable eventually of awarding doctoral degrees).

9. The need for such a Centre to take care of the developing countries' sciences, both basic and applied, as well as science-based high technology is clear. The modalities which the International Centre for Theoretical Physics has pioneered have become known all over the world, particularly, the Third World and their extension to other sciences would be deeply appreciated by the Third World countries. Such a Centre would also make a contribution to Italian Science in that it will bring to Italy some of the best and most prestigious names and techniques from all over the world. The utility of such a Centre for the European Science should also be clear when one recognises that already the International Centre for Theoretical Physics has played an important role, particularly in enhancing and consolidating Solid State Physics within Europe. Through the momentum which such a Centre will provide, Europe will benefit and so will world science as a whole.

10. The timeliness of the Centre's creation is also clear. Two of its units already exist, that is to say, the International Centre for Theoretical Physics and the International Centre for Genetic Engineering and Biotechnology. Of the other three units, the International Centre for High Technology and Material Sciences would be the most costly; it should have a budget of around 15-20 million dollars a year when fully operational. The Centres for Earth Sciences and for Chemistry need not cost that amount. They may be budgeted at the peak to cost of the order of 5-10 million dollars. A start could be made for all these three centres with funds of the order of about ten million dollars a year, if buildings could be contributed by the Region of Trieste. These buildings should ideally be near the ICTP.

11. The practical creation of an International Centre for Science may follow a three-phased gradual approach.

I. **Definition Phase**, lasting for approximately one year with roughly an expenditure of 1.5 million US dollars. During this phase, the project for setting up the three new Centres will be defined. The Third World Academy, through its Fellows from the developing countries,

would play a major role in providing the necessary scientific inputs while the relevant UN bodies will be contacted in order to obtain the broadest possible scope of cooperation in synergy with their present activities (each new Centre may receive a different mix of support from the competent UN bodies). At the same time, a basic joint managerial structure may be set up with a well-defined directive: three scientific committees to define programmes and scientific structures for each Centre as well as contact with possible scientists who may lead the three centres.

II. **Execution Phase**, lasting for approximately two to three years with an average expenditure of about 10 million US dollars each year. Each of the three Centres could start independently as soon as properly defined and would be financed through a Trust Fund. Interim programmes could start, if necessary, in provisional facilities: such activities would help in building up a good scientific staff and would constitute a tangible attraction for potential donors. During this execution phase funds should come mostly from the Italian Foreign Ministry as seed money and, to the extent possible, from other concerned UN organisations.

III. **Consolidation Phase**, lasting for a further few years during which the three new Centres should reach their full operational level. In parallel to this but without any interference with their harmonious development and scientific activities, a new legal framework could be defined to coordinate the activities of the ICTP, ICGEB, and the three new Centres. In this exercise, the "Central Centre" should be conceived in such a broad way that it would be able to attract the participation of all competent and interested international organisations as well as the goodwill of future potential donors such as governments, non-governmental organisations, private foundations, industry and others.

Finally, the International Centre for Science should operate an interdisciplinary Institute for Science and Technology Policy and Management, bringing together scientists, technologists and planners. These activities could grow together with those described above starting early in Phase II.

The definition phase has already started. The Government of Italy has entrusted the United Nations Industrial Development Organization (UNIDO, Vienna) in collaboration with the Third World Academy of Sciences (whose President is Professor Abdus Salam,) with the task of studying the feasibility of creating and operating the International Centre for Science (ICS). Several meetings with international experts have already taken place and others will follow in the near future. Counsellor Giorgio Rosso Cicogna, an Italian diplomat, is the Project Leader of the ICS.

Next Time Remember Ramanujan

by Ian Stewart,
University of Warwick, Coventry, UK

by courtesy of "The Scientist"

One hundred years ago on December 22, a most extraordinary mathematician was born in the town of Erode, 160 miles from Madras in Southern India. Srinivasa Ramanujan Aiyangar was the son of a petty accountant and a bailiff's daughter. He grew up in Kumbakonam, where his father worked. At the age of 15 he borrowed a copy of "A Synopsis of Elementary Results in Pure Mathematics" by G.S. Carr, which lists some 6,000 theorems but gives no proofs. Captivated, Ramanujan set about finding the proofs for himself, and progressed to independent research. Too poor to afford paper, he did his calculations on a slate and jotted down the results in a series of notebooks. In 1913, Godfrey H. Hardy, an outstanding mathematician at Cambridge University, England, received a letter. "Dear Sir, I beg to introduce myself to you as a clerk in the Accounts Department of the Port Trust Office at Madras." Ramanujan enclosed some of his discoveries. "This man is either a crank or a genius," said Hardy. A few hours later Hardy and his colleague J.E. Littlewood emerged from the Trinity College chess room with the verdict: *genius*.

With some difficulty, Hardy persuaded Ramanujan to leave India for

Cambridge, and in March 1914 he set sail for England. But after three years his health deteriorated severely, and in 1919 he returned to India. In the meantime he had been elected a Fellow of the Royal Society, the first Indian to receive this high scientific honor. He died on April 26, 1920, leaving a mathematical legacy that still holds many deep secrets.

Where did he get his remarkable ideas? It often is said that Ramanujan's formulas were inspired in dreams by the goddess Namagiri. However, according to his widow, S. Janaki Ammal Ramanujan, her husband "never had time to go to the temple because he was constantly obsessed with mathematics." Hardy thought that "all mathematicians think, at bottom, in the same way, and Ramanujan was no exception," but added, "He combined a power of generalisation, a feeling for form, and a capacity for rapid modification of his hypotheses, that were often really startling."

Ramanujan's genius was in a style of mathematics that is no longer fashionable: the manipulation and invention of formulas. "It was his insight into algebraical formulae, transformations of infinite series, and so forth, that was most amazing," Hardy writes. In this respect, "most certainly I have never met his equal, and I can compare him only to Euler or Jacobi." There always seemed to be some special quirk, some unexpected twist, to Ramanujan's formulas that made them very much his own.

Some of his best work is in the theory of partitions. In how many ways

Some of his best work is in the theory of partitions. In how many ways can a given number be written as a sum of smaller ones? Ramanujan noticed that whenever the original number leaves remainder 4 on division by 5, then the number of its partitions is divisible by 5. There are similar results for the numbers 7 and 11 in place of 5, and no others. The proof is tricky in the extreme, and before Ramanujan, nobody had suspected that partitions might have arithmetical properties of this kind.

In analytic number theory, approximate formulas are sought for quantities such as the number of primes less than a given value. In collaboration with Hardy, Ramanujan applied these methods to the number of partition. Not

only did they find an approximate formula: they found an exact one!

Ramanujan left three notebooks, a fourth "lost" notebook consisting of loose sheets that was rediscovered in 1976 by George Andrews of Pennsylvania State University, and various manuscripts, some of which are still missing. Bruce Berndt, at the University of Illinois, recently published the first part of a three-volume work entitled *Ramanujan's Notebooks* (Springer-Verlag, New York, 1985), aiming to supply proofs of all his formulas. Berndt thinks that Ramanujan, far from being old-fashioned, was ahead of his time. "I may be able to prove [a formula], but I don't know where it comes from and where it fits into the rest of mathematics," Berndt said. Ramanujan left unsolved problems that still tax the power of mathematics. One, the Ramanujan Conjecture, was proved in 1975. It was a spinoff from one of the major mathematical events of this century - a dramatic breakthrough in algebraic geometry by the Belgian mathematician Pierre Deligne.

Genius can flower in the most unlikely habitat. Before Hardy, two other prominent British mathematicians had received letters from Ramanujan, and had ignored them. The next time you get an unsolicited manuscript from a "crank," think of them, of Hardy, and of Ramanujan.

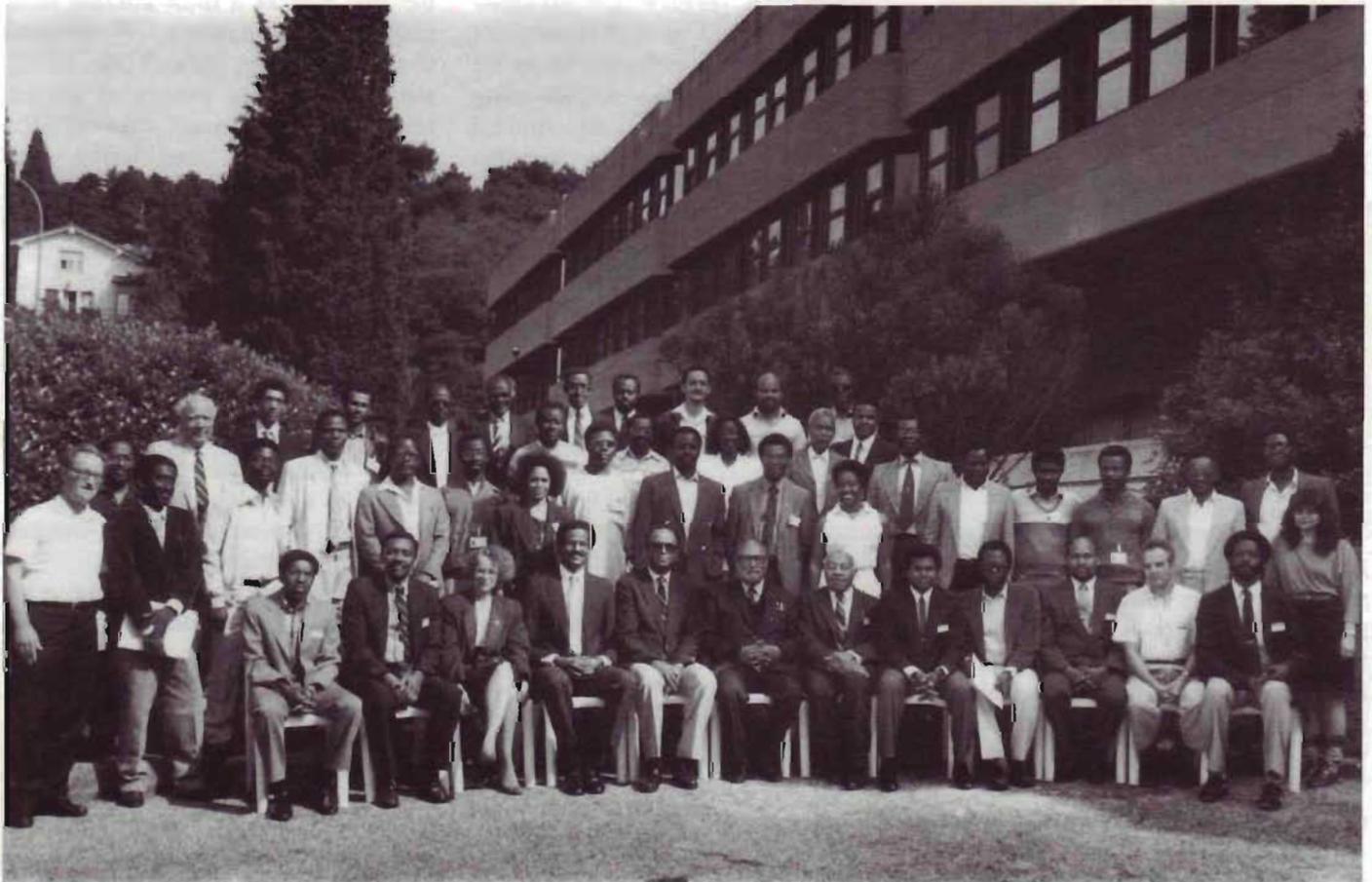
First Edward Bouchet International Conference on Physics and Technology International Conference on Physics and Technology

On 9-11 June 1988, the ICTP hosted the First Edward Bouchet International Conference on Physics and Technology organized by Black American physicists in honour of Edward Bouchet, the first Black American physicist, whose biography is given below. The audience was welcomed by Professor Abdus Salam, Director of the ICTP. The programme of lectures included "Pulse Compression and Ultrafast Optoelectronics" by Dr. A.M. Johnson, "Polarization Behavior of Optical Signals in Single-Mode Optical Fibres: Theory, Experiment and Applications" by Dr. C. Brown, "Temperature

Dependence of the Picosecond Photoconductive Response in Highly Oriented Trans-polyacetylene Films" by Mr. A. Walscr, "A General Approach to Multicenter Molecular Integrals Using Slater-Type Orbitals" by Prof. H. Jones, "Theory of Intrabeam Scattering in Strong-Focussing Accelerators" by Dr. S.K. Mtingwa, "Ultraviolet

Jackson, "Single Shot Real Time Resolved Phonon Dephasing Measurements using Ultrafast Transient Dynamical Gratings and Phase Conjugation" by Mr. P. Delfyett, "The Dynamics of Turbulent Shocklets" by Prof. J.A. Johnson III, "Advances in Computational Physics" by Prof. R. Mickens, "Positivity and the

Bouchet graduated valedictorian of his class from Hopkins Grammar School in June of 1870. He entered Yale College the following September. In June of 1874, he graduated from Yale College (B.A.) and he was elected subsequently a member of Yale's Chapter of the Phi Beta Kappa Honorary Society. Two years later, in June of 1876, he received



The participants in the First Edward Bouchet International Conference on Physics and Technology (ICTP, 9-11 June 1988)

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Measurements of the Interstellar Medium" by Dr. G. Carruthers, "Search for Dense in Nuclear Matter in Relativistic Nucleus-Nucleus Collisions" by Prof. S. McGuire, "The Algebraic Approach to QCD and its Application to the $J/\psi \rightarrow \eta c \gamma$ Decay" by Dr. M. Slaughter, "A Quantum Mechanical Model of the Bound Magnetic Polaron (BMP) in Semimagnetic Semiconductors" by Ms. C. McIntyre, "Estimation of Global Solar Radiation from Sunshine Hours, Geographical and Meteorological Parameters" by Prof. Y. Telahun, "Lightwave Technology" by Dr. D.

Quantization of Strongly Coupled Physical Systems: An Operations Research Approach to Modern Physics" by Prof. C.R. Handy, and "Investigations on Exact Discrete Models of Continuous Systems: Elimination of Instabilities" by Prof. R. Mickens. The moderators of the various sessions were Prof. J.A. Johnson III, Dr. A. Maclin, Prof. R. Catchings, Prof. S.J. Gates Jr., and Prof. W. Henry.

A second conference will hopefully take place next year.

Born in New Haven, Connecticut, on September 15, 1852, Edward Alexander

his Ph.D. in physics.

Dr. Bouchet's first position was at the Institute for Colored Youth in Philadelphia (later to become Cheney State Teachers College) where he taught physics and chemistry. He held this post for 26 years (1876-1902), until the school relocated and changed the major emphasis, for a period, from academic studies to vocational training. During the next six years, Dr. Bouchet held several positions (Teacher, Sumner High School, St. Louis, Mo., September 1902-November 1903; Business Manager Provident Hospital, St. Louis, November 1903-May 1904; U.S.

Inspector of Customs, Louisiana Purchase Exposition, St. Louis, May 1904-March 1905; Director of Academics, St. Paul Normal and Industrial School, Lawrenceville, Va. October 1906-June 1908) until he was appointed Principal and Teacher at Lincoln High School in Gallipolis, Ohio. He held this, his final position, for five years (September 1908-1913) until he returned, at age 61, home to New Haven in ill health. He died in New Haven on October 28, 1918.

Records suggest that there are no Bouchet descendants. Dr. Bouchet never married. His father died in 1885, his mother in 1920. He was survived by two of three sisters who were both deceased by 1934. His two married sisters each had a son. Both men are dead.

Professor-Emeritus Lillian Mitchell Allen of Howard University knew Dr. Bouchet personally when she was a grade-schooler in Gallipolis. She recalls the general consensus among Black people that Dr. Bouchet was "...a consummate scholar, one who seemed very knowledgeable in all areas (with extensive and vital musical knowledge) and yet was extremely modest and a person who set a wonderful standard of politeness and graciousness for the community."

Edward Alexander Bouchet was, therefore, the first Black American physicist. He was the first Black American Ph.D. in any subject and the first Black American member of Phi Beta Kappa. As such, he was also a pioneer scientist, being among the first 20 Ph.D.'s in physics (of any race) in pioneer scientist, being among the first 20 Ph.D.'s in physics (of any race) in the United States and only the sixth Ph.D. in physics from Yale. In this pioneering spirit and with great humility, the conference was dedicated to his memory and named in his honor.

Supergravity still Super?

by Fabio Pagan

This article was translated from the original by Dr. Fabio Pagan, published in the newspaper "Piccolo" of Trieste, Italy.

Twenty years ago, he was one of the heralds who opened the path to supersymmetries and supergravity, linking advanced mathematics with the old Einsteinian dream of unifying forces and particles of the physical world in one single theory. But earlier, in Germany and in the United States he had the opportunity to breathe the intellectual atmosphere of the scientific, philosophical and political revolution brought by physics to modern thinking.

Bruno Zumino, 65 years old, born in Rome (his father was an artist painter from Maiano in Friuli) and a professor at the University of California (Berkeley) is the first Italian scientist who has been awarded the Dirac Medal of the International Centre for Theoretical Physics of Trieste. Even though he lives and works outside Italy, he has still retained some Roman accent in his warm and slightly americanized Italian.

"When I got my doctorate in physics and mathematics in 1954 - he recalls - Fermi, Segrè and Rasetti had already left and the "group of Via Panisperna" had already disbanded. Their closest collaborators, Amaldi, Wick, Ferretti and Bernardini, were still there. Then Wick also went to the United States and Ferretti went to England. Therefore, for a couple of years, they asked us, the young theoreticians, to deliver the course of quantum mechanics. Gilberto Bernardini was the friend of the great Werner Heisenberg who was then in Göttingen and therefore, he arranged for exchanging with a physicist from his institute. I remained in Germany for two years".

"When I met him - Zumino remarks two years".

"When I met him - Zumino remarks - Heisenberg had already made his fundamental discoveries in quantum mechanics and in nuclear physics. He was still a great man, of course, but I learned much more from the young physicists who were around him, like Walter Thirring now in Vienna. Then a famous German-born American mathematician, Richard Courant, came to Göttingen as a talent scout and offered me to join him in his institute in New York. This was in 1951".

Zumino goes on: "American scientists were in those days strongly influenced by the charisma of Enrico Fermi and expected that an Italian physicist was to be very good on the

mere ground that he came from Fermi's country. I remember having met Fermi at one of the meetings of the American Physics Society: he wanted to meet me, we lunched together, he was extremely pleasant. Moreover, I still maintain close contacts with Emilio Segrè, now in his eighties but still extremely sharp, whom I frequently meet in Berkeley or in San Francisco.



Prof. B. Zumino

The American life of Zumino - after a period of teaching at New York University - was interrupted from 1968 to 1981 when he came back to Europe, at CERN in Geneva where he was also the Director of the Theory Division. Then he was appointed as a physics professor in Berkeley and went back to the States for good.

The name of Zumino is associated to those theories of supergravity which have been a decisive step in the attempt of linking the gravitation force to the other fundamental forces of nature (the electromagnetic-, strong- and weak force) representing the link between the gravitation of Einstein and quantum mechanics. This synthesis unifies all elementary particles which exist in nature and which are created in accelerators. Zumino has worked in these subjects with the Austrian Julius Wess, the American Stanley Deser and

the Italian Sergio Ferrara. But since some time, supergravity does not seem too convincing any more... Why is that, Professor Zumino?

"Until a few years ago, we thought that supergravity could solve all our problems. But this has not been so. Then, an extension of supergravity has been proposed, the theory of superstring which no longer considers elementary particles as points, but rather as infinitesimal strings rotating very rapidly. The theory of superstrings is also, like supergravity, an extension of the concepts of supersymmetry which correlate particles which are very different between themselves".

"With the superstrings many thought of having finally found the way for elaborating the long-sought unitary theory. But then multiple solutions to the relevant equations were found and there was another setback. The fact is - Zumino explains - that this research requires the knowledge of extremely complex mathematical techniques. The American Edward Witten has now left physics for mathematics".

But will it be possible one day to test experimentally the validity of such abstract theories?

"Certainly. It will not be necessary to reach very large energies, unthinkable also in future accelerators. A valid supergravity theory should be able to

determine those parameters which in the Salam, Glashow and Weinberg model are still theoretically open, predicting phenomena at very low energies. There is one more important thing. The supersymmetry theory are having unexpected repercussions on mathematics itself. Exactly like what happened in the past for general relativity and quantum mechanics."

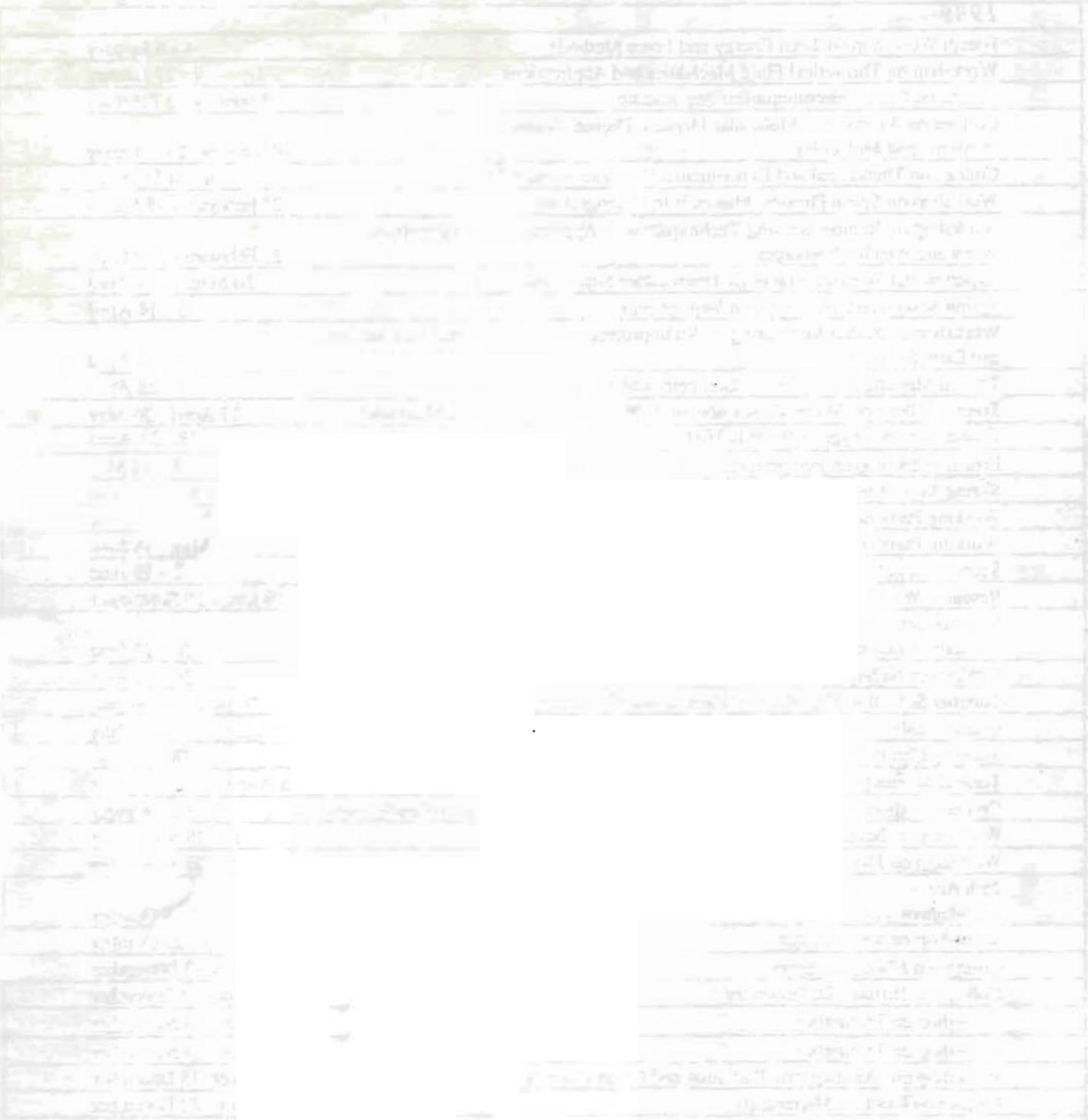
The citation for both Dirac Medals 1987 (Professor B. Zumino and Professor B. DeWitt) was published in News from ICTP No. 7/8.

Future Activities at ICTP

1988	
Fifth Trieste Semiconductor Symposium (IUPAP):	
4th International Conference on Superlattices, Microstructures and Microdevices	8 - 12 August
Summer School on Dynamical Systems	16 August - 9 September
The Application of Lasers in Surface Science	23 - 26 August
Working Party on "Electron Transport in Small Systems"	29 August - 16 September
Frontier Sources for Frontier Spectroscopy	30 August - 2 September
Summer Workshop on Dynamical Systems	5 - 23 September
Fourth Summer College in Biophysics	12 September - 7 October
Course on Ocean Waves and Tides	26 September - 28 October
College on Medical Physics	10 October - 4 November
First Autumn Workshop on Mathematical Ecology	31 October - 18 November
College on Neurophysics: "Development and Organization of the Brain"	7 November - 2 December
First Autumn Workshop on Mathematical Ecology	31 October - 18 November
College on Neurophysics: "Development and Organization of the Brain"	7 November - 2 December
Workshop on Global Geophysical Informatics with Applications to Research in Earthquake Predictions and Reduction of Seismic Risk	15 November - 16 December
College on Global Geometric and Topological Methods in Analysis	21 November - 16 December

1989	
Fourth Workshop on Total Energy and Force Methods	4 - 6 January
Workshop on Theoretical Fluid Mechanics and Applications	9 - 27 January
Course on Basic Telecommunications Science	9 January - 3 February
College on Atomic and Molecular Physics: Photon Assisted Collisions in Atoms and Molecules	30 January - 24 February
College on Theoretical and Experimental Radiopropagation Physics	6 - 24 February
Workshop on Space Physics: Materials in Microgravity	27 February - 17 March
Workshop on Remote Sensing Techniques with Applications to Agriculture, Water and Weather Resources	27 February - 21 March
Experimental Workshop on High Temperature Superconductors	30 March - 14 April
Spring School and Workshop on Superstrings	3 - 14 April
Workshop on Radon Monitoring on Radioprotection, Environmental Radioactivity and Earth Sciences	3 - 14 April
Topical Meeting on Hyperbolic Geometry and Ergodic Theory	17 - 28 April
Spring College on Materials Science on "Ceramics and Composite Materials"	17 April - 26 May
Conference on Oxygen Effects in High T_c Superconductors	18 - 21 April
Fourth Workshop on Perspectives in Nuclear Physics at Intermediate Energies	8 - 12 May
Spring School on Plasma Physics	15 May - 9 June
Working Party on Modelling Thermomechanical Behaviour of Materials	29 May - 16 June
Working Party on Fracture Physics	29 May - 16 June
Second ICFA School on Instrumentation in Elementary Particle Physics	12 - 23 June
Research Workshop in Condensed Matter, Atomic and Molecular Physics	19 June - 29 September
Interface between Quantum Field Theory and Condensed Matter Physics (Adriatico Conference)	20 - 23 June
Conference on Supermembranes	26 - 30 June
Summer School in High Energy Physics and Cosmology	26 June - 18 August
Quasicrystals (Adriatico Conference)	4 - 7 July
Strongly Correlated Electron Systems (Adriatico Conference)	18 - 21 July
Topical Meeting on Variational Problems in Analysis	28 August - 8 September
Computations in Physics and Physics in Computation (Adriatico Conference)	5 - 8 September
Workshop on Nonconventional Energy Sources	11 - 29 September
Workshop on Physics in Environment Conscious Design	25 - 29 September
25th Anniversary Conference on "Frontiers in Physics, High Technology and Mathematics"	2 - 6 October
Workshop on Soil Physics	9 - 27 October
College on Microprocessors	9 October - 3 November
College on Differential Geometry	30 October - 1 December
Workshop on Telematics	6 - 24 November
College on Differential Geometry	30 October - 1 December
Workshop on Telematics	6 - 24 November
Workshop on "Atmospheric Radiation and Cloud Physics"	27 November - 15 December
College on Electron Microscopy	27 November - 22 December

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



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