International Centre for Theoretical Physics

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The Role of Women in the Development of Science and Technology in the Third World

by
Akhtar Mahmud Faruqui,
Third World Academy of Sciences
and
Pakistan Atomic Energy Commission

Third World women scientists got some measure of their intellectual strength when they met at Trieste (Italy) from 3-7 October 1988. The occasion: the first-ever conference on the Role of Women in the Development of Science and Technology in the Third World jointly sponsored by the Canadian International Development Agency (CIDA) and the Third World Academy of Sciences (TWAS).

For five successive days, women scientists from the three developing continents — Africa, Asia and Latin America — representing diverse historical and cultural backgrounds — identified common problems, sought consensus on possible areas of collaboration, and debated the future course of action. For many participants, the Conference proved a stimulating experience. In the words of Dr. J. Wardlaw (Chairman, Board of Governors, International Development Research Centre) who chaired the opening session, the Conference signified *"an important initiative of TWAS. I expect the Conference will be viewed as a landmark."*

The Conference provided an opportunity to the participants to form new links, not only regionally or internationally, but sometimes at the national level, which would be helpful in the development of networks — both in discipline clusters and on a regional basis. The participants were also able to recognize their strength in terms of numbers and achievements, especially valuable for young scientists working either alone or as a part of a small minority of women. Outstanding researchers with successful careers emerged and were accorded recognition. *"This should be helpful in terms of promotion of women scientists to bodies such as TWAS"*, Dr. Wardlaw commented.

Distinguished guests at the chairman's desk with Professor Abdus Salam at the Conference on the Role of Women in the Development of Science and Technology in the Third World: (from left to right) Dr. R. Léger (Director, Division of International NGOs, CIDA, Canada), Prof. D.C. Hodgkin (Nobel Laureate for Chemistry, 1964, UK), Senator S. Agnelli (Under-Secretary of State for Foreign Affairs, Italy), Dr. J. Wardlaw (Chairman, Board of Governors, International Development Research Center, Canada), Prof. R. Levi-Montalcini (Nobel Laureate for Medicine, 1986, Italy) and Prof. J. Döbereiner (Chairman of the Organizing Committee and Founding Fellow of the Academy).

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Among the 250 participants were two Nobel Laureates — Professor Dorothy Crowfoot Hodgkin (United Kingdom, Nobel Laureate for Chemistry, 1964) and Professor Rita

Levi Montalcini (Italy, Nobel Laureate for Medicine, 1986) whose presence, coupled with the high quality of presentations, testified to the global strength of women scientists.

The participants recommended the urgency of developing an inventory of Third World women scientists to initiate South-South collaborative links. They also desired that an interim study group be formed to elaborate on the detailed objectives and work plans for an Association of Third World Women Scientists.

Third World Network of Scientific Organizations Formed

by
Akhtar Mahmud Faruqui,
Third World Academy of Sciences
and
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One hundred and twenty Ministers, Heads of Scientific Research Councils, and Presidents of Academies of Science from 45 developing countries met in Trieste (Italy) from 4-6 October to take the momentous decision of forming the Third World Network of Scientific Organizations (TWNSO). They succeeded in accomplishing what the United Nations and its science-sponsoring agencies have found an elusive goal for over four decades now.

The presence of Latin American, African and Asian Ministers responsible for science promotion in their respective countries, and their involvement in future developmental activity, is seen as a good omen for Third World science. *"Much would depend on the Ministers themselves,"* said Professor Abdus Salam, the newly-elected President of TWNSO. *"We didn't expect this success though,"* the Nobel Laureate who won the Prize in Physics in 1979 added, attributing the consensus on the Network's formation to the participants' faith in the Third World Academy of Sciences (TWAS), the host organization.

Founded in 1983 by Salam and inaugurated by the UN Secretary General in 1985, the Academy's initiatives and programmes are beginning to crystallize and gather steam. Said Dr. J.M. Aminu, Nigerian Minister of Education, *"The Academy's impact is being felt in the scientific community."* Two international conferences on 'South-South and South-North Cooperation in Sciences' have generated considerable interest and established South-South, and what is more important, South-North links. The second Conference in Beijing (China) in September 1987, was particularly successful. Held in a Third World country, it demonstrated the march of Third World science in the host country: the Chinese had fewer than 500 researchers in 1949 altogether — less than one per million of population. There are now 300,000 researchers in China and the country is approaching international norms, with a factor of 600 increase in 40 years. The participating developing countries thus had much to learn from China's example. The emphasis in the TWAS initiatives remains on South-South and South-North collaboration.

In the context of South-North relations, the Third World Network of Scientific Organizations has made an auspicious beginning with CIDA, the Canadian International Development Agency, pledging to *"consider a special request for support for the Network..."* The Italian Government has also promised a contribution of a quarter million dollars.

The formation of TWNSO — the scientific analogue of the Founding of the Group of 77 — deserves to be supported. Its membership stands at 80 today, and is drawn from 60 developing countries. The Network could act as a non-political group, both internally and externally, to espouse the cause of developing country science. The Ministers who participated in the three day meeting pledged to produce results at home, a development Salam did not expect so soon. It is a "bonus" outcome of the TWNSO meeting, he said.

The next meeting of the Network will be held in Colombia during October 1989. Should Dr. Perez be voted into power in Venezuela — he is a great supporter of science and has promised to raise the expenditures in scientific research to 2% of the GNP — a meeting of Latin American heads of state might concurrently take place in Colombia, giving Perez and Salam the chance to impress upon the distinguished gathering the importance of science in national, regional and global development.

Succinctly summing up the three day deliberations, the "Trieste Declaration", read out during the TWNSO conference, stated: *"Recognizing the fundamental importance of Science in socio-economic and cultural development and technological progress, and keeping in view the recommendations of the South Commission pertaining to the crucial role of Science in the Third World, as mankind approaches the 21st century, the members of the Third World Network of Scientific Organizations present at the meeting held in Trieste from 4 to 6 October 1988 resolve to work towards giving Science and Technology a position of highest priority in their own countries and to strengthen their collaboration with other countries of the South as well as the North."*

According to its statutes, the Network will be a *"non-governmental and non-profit-making organization."* The general objective of the Network has been defined as the promotion of *"South-South and South-North Cooperation in the development and application of Science and Technology in the Third World."* This could be achieved by (a) furthering the contribution of the South to global projects of science (such as Man and the Biosphere Programme of UNESCO and the International Geosphere Biosphere Programme of ICSU); (b) furthering the contribution of the South to areas of today's frontier science and technology which are most likely to have a strong impact on the economic and social development of the Third World (such as space science and technology, thermo-nuclear fusion, high technology and biotechnology); (c) South-South collaboration; (d) South-North collaboration; (e) encouraging Third World Governments to take appropriate political action to develop their scientific enterprise through self-reliance and proper allocation of resources. The Network will be headed by a President, four Vice-Presidents representing each of the African, Arab, Asian and Latin American regions, and a

Secretary General.

The first Meeting of the Network has elected the following officers for an interim period of one year:

President: Prof. Abdus Salam (Pakistan);

Vice Presidents: Prof. J.M. Aminu (Nigeria, African Region), Prof. B.A.R. Omar (Malaysia, Asian Region), Prof. M.L. Bouguerra (Tunisia, Arab Region), Prof. F. Del Rio (Mexico, Latin American & Caribbean Region);

Council Members: Prof. O.F. Bizri (Syria, Arab Region), Prof. A. Babale (Cameroon, African Region), Prof. Hu Qiheng (China, P.R., Asian Region), Prof. G.V. Taylor (Jamaica, Latin American & Caribbean Region), Prof. C. Ponnamperuma (Sri Lanka, Asian Region), Prof. L.K.H. Goma (Zambia, African Region);

Secretary General: Prof. M.H.A. Hassan (Sudan).

In addition, three Standing Committees have been formed:

1. **Global Projects:** Chairman: Prof. C. Pavan (Brazil);
2. **Hazards:** Chairman: Prof. E.U. Emovon (Nigeria);
3. **Programmes:** Chairman: Prof. J.M. Aminu (Nigeria).

TWAS Awards 1987

The annual Prizes of the Third World Academy of Sciences for 1987 were presented to the recipients (Prof. Cesar Latter for physics, Prof. Mudambai Seshachalu Narasimhan for mathematics, Dr. Adolfo Martinez-Palomo for biology and Prof. Chuang-Tian Chen for Chemistry) on 3 October 1988 in the Lecture Hall of the ICTP.

One of the main objectives of the Third World Academy of Sciences is to accord recognition to high calibre scientific research undertaken by individual scientists from developing countries and to apply it for the benefit of human welfare and the development of the Third World.

In pursuance of the above objective, the Academy has been awarding prizes since 1985 to individual scientists from developing countries who, in the opinion of the Council of the Academy, have made outstanding contributions to the advancement of science. Consideration is given to proven achievements judged particularly from a national and international viewpoint.

Each award consists of a prize amounting to US$ 10,000 as well as a medal on which major contributions of the award winner are mentioned.

Four Awards in Basic Sciences are given each year in the fields of Biology, Chemistry, Mathematics and Physics.

Prof. Cesar Lattes addressing the audience in the Main Lecture Hall at ICTP.

Candidates for the awards must be nationals of developing countries and as a rule, working and living in those countries.

Members of the Third World Academy of Sciences are not eligible for such awards.

Nominations are made on special Nomination forms and should clearly state the contributions which the candidate has made towards the development of the particular field of science for which the awards would be given. The nomination should be accompanied by complete biodata, list of publications, and, if possible, examples of publications or other evidence which could be cited to prove the candidate's contributions.

Nominations for the awards are invited from all members of the Third World Academy of Sciences as well as from Science Academies, National Research Councils, Universities and Scientific Institutions in developing countries as well as from Scientific Institutions in advanced countries.

Nominations for each award are considered by a Committee of distinguished scientists appointed by the Council of the Academy.

The awards are presented on a special occasion during the Autumn of each year.

Physics: Prof. Cesar Lattes (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brazil), *"for his fundamental contributions to High Energy Physics and in particular for the discovery of natural and artificial mesons"*.

Prof. Cesar Mansueto Giulio Lattes, the second son of Italian emigrants, Giuseppe Lattes and Carolina Maroni Lattes, obtained his Bachelor's degree in Physics from the Universidade de São Paulo (USP) in 1943. In a distinguished career spanning almost 45 years, the academic positions held by Lattes have included: Assistant Professor of Theoretical and Mathematical Physics, USP 1944-1948; Professor of Physics, USP 1948-1949; Professor of Nuclear Physics, Universidade do Brazil (now Universidade do Rio de Janeiro) 1949 to date; Professor of Physics, Centro Brasileiro de Pesquisas Fisicas, 1949 to

date; Professor of Advanced Physics, USP 1960-1986 (partial retirement) November 1986; Professor of Physics, Universidade Estadual de Campinas, 1967-1986 (partial retirement November 1986); and Professor of Physics, Pontificia Universidade Catolica do Rio de Janeiro, 1964.

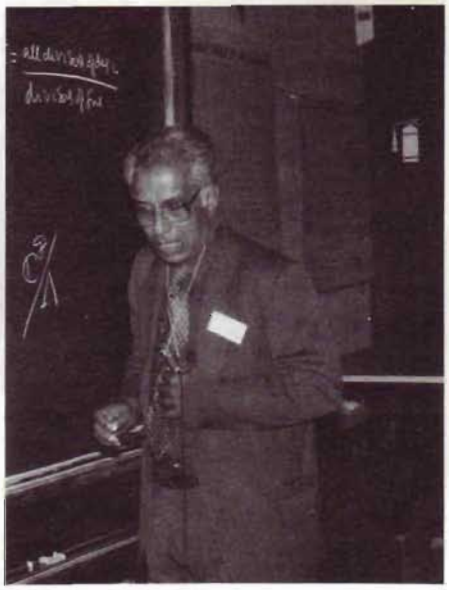
In the capacity of a researcher, he has served as: Research Associate, Bristol University 1946-1947; expert consultant, Radiation Laboratory, University of California, Berkeley, under contract with USNA Atomic Energy Comission 1948-1949; Associate Professor, University of Chicago, 1955-1956; Research Associate, University of Minnesota, School of Science and Engineering, 1957; and visiting scholar, Istituto di Geologia Nucleare, CNEN, Pisa Italy, 1964.

His theoretical scientific work has mainly related to statistical thermodynamics at high temperature plus high density and the abundance of nuclei in the universe (in association with G.V. Wataghin), and classical theory charged point particles with dipole moment (under Frenkel condition) with W.C. Schutzer and M. Shonberg as collaborators.

His non-theoretical scientific work has been fairly exhaustive and included many important research undertakings such as: Calibration of concentrated Ilford Research Emulsion (produced by Mr. C. Waller 1964); A study of Alfa-radioactivity of rare earths, unsuccessful search for element 61 (1946 Bristol); A nuclear emulsion method for the determination of energy and momentum of fast neutrons in cosmic rays, with G. Occhialini (1946 Bristol); Detection of negative pions produced by 380 MeV Alfa-particles on fixed target, with Eugene Garder (1948 Berkeley); Detection of positive and negative pions photoproduced by Bremstrahlung of 300 MeV electrons accelerated in the radiation laboratory electron synchrotron: for Edwin McMillan (January 1949 Berkeley); Unsuccessful search for the electronic decay of the positive pion, with L. Anderson (1956 Chicago), and the study of the angular correlation in the decay of π^+ into μ^+, with P.S. Freier (1957 Minneapolis).

Prof. Lattes was the ad-hoc coordinator of the Brazilian part of the Brazil-Japan collaboration on study of cosmic rays and high energy interactions: morphology and study of multiple production of hadrons. Started in São Paulo University 1962 and joined by CBPF 1964, by UFF around 1983, and FUFMT in 1988, also joined by Soviet and Polish groups of Pamir collaboration in 1981.

Mathematics: Prof. Mudambai Seshachalu Narasimhan (Tata Institute of Fundamental Research, Bombay, India), *"for his fundamental contributions to mathematics in the areas of algebraic geometry, differential geometry, representation theory of semi-simple groups and partial differential equations".*



Prof. Mudambai Seshachalu Narasimhan lecturing after receiving the Prize.

Narasimhan lecturing after receiving the Prize.

Born on June 7 1932, Prof. Narasimhan joined the Tata Institute of Fundamental Research (TIFR) in 1953 as a research student and did his thesis in anlysis under the supervision of Professor K. Chandrasekharan. His post-doctoral work was carried out in Paris for a two-year period with Professor Laurent Schwartz. At present he is a senior Professor of Mathematics at the Tata Institute of Fundamental Research.

His contributions to mathematics are in the fields of algebraic geometry, differential topology, representation theory of lie groups and partial differential equations.

In algebraic geometry the major contribution (over the past 20 years) has been the development of the theory of moduli of algebraic vector bundles, starting with the basic theorem on the identity of stable and unitary bundles on algebraic curves.

Results in differential geometry include the theorem on the existence of universal connections which have been extensively used by mathematicians and physicists.

The Langlands conjecture on the concrete realization of the discrete series representations was solved in the Hermitian symmetric case for most weights. A characterisation of real analytic functions via an elliptic differential operator with analytic coefficients was given. This contains as a special case well known analytic regularity theorems.

Biology: (Centro de Investigacion y de Estudios Avanzados del IPN, Mexico D.F., Mexico), *"for his fundamental contributions to the knowledge of the cell biology of cancer cells and parasites".*

Dr. Adolfo Martinez-Palomo was trained as a physician in Mexico. He carried out his postgraduate studies in Canada, where he found the first experimental suggestion that the heart is not only an efficient pump, but also an endocrine organ. He then moved to France where he made observations now considered classical on the abnormalities of the surface of cancer cells, with the use of the electron microscope. Back in Mexico he initiated, with the tools of modern cell biology, a far-reaching study on one of the most important parasitic diseases of man, amebiasis. His first contribution in this field was the demonstration of biological differences between pathogenic and non pathogenic amebas, a discovery of importance for understanding the epidemiology of the infection. Afterwards, he turned his attention to elucidate the cellular bases of the destructive effect of the parasite on mammalian tissues, using in vitro and in vivo models. The investigation gradually broadened in scope to include aspects of the pathology, immunology and control of the infection, summarized

in two books that represent the first modern and comprehensive monographs on amebiasis. He has attracted several eminent investigators and obtained support to create the Mexican Program for the Study of Parasite Diseases, which represent one of the best examples that first rate research on diseases of the poor can be done in the Third World. His individual achievements are best framed within the accomplishment of this group, in constant search for academic excellence through active international scientific cooperation.

As President of the Mexican Academy of Sciences, he renewed the collaboration between the National Academy of Sciences and its Mexican counterpart. He is an active member of the Council of the Latin American Academy of Sciences and of the International Commission on Health Research, an independent initiative based at Harvard University that seeks new solutions to the pressing health needs of developing countries. His more recent responsibility is the formulation of the program on science and technology for health for the next administration of the Mexican government.

His current academic interests include the biology of amebiasis and giardiasis, the structure and function of epithelial membranes, and new developments in immunoelectronmicroscopy.

Chemistry: Prof. Chuang-Tian Chen (Fujian Institute of Research on the Structure of Matter, Fuzhou, Fujian, China), *"for his outstanding contribution to the development of new nonlinear to the development of new nonlinear optical materials, the formulation of a quantum chemical theory that guides the search for such materials and the discovery of β barium borate and lithium triborate".*

Prof. Chuang-Tian Chen was born in Ningbo, Zhejiang, China, on April 1, 1937. He obtained a B.S. degree in theoretical solid-state physics from Beijing University in 1962. He was hired as a research assistant at the East China (later changed to Fujian) Institute of Research on the Structure of Matter, an institute of the Chinese Academy of Sciences in Fuzhou, Fujian, founded and directed by Prof. Jiaxi Lu. He rose to the rank of full professor in 1986 and became Deputy Director in charge of research in 1988. He did research at Stanford University during the academic year 1985-86 and has been a frequent visitor to major U.S. and European research institutes since then. His work in new non-linear optical materials and contributions to the national economy have been recognized and appreciated by both the provincial and national governments. He was named and received by the Premier of China on March 12, 1987, as one of nine outstanding contributors in the nation.

He was initially reluctant about his assignment to Fujian Institute of Research, which was then famous in China for its structural chemistry research but not known for its physics and materials science research. Several of his professors convinced him he could study electrooptic and nonlinear optic properties at this institute as high quality, large crystals of $NH_4H_2PO_4$, KH_2PO_4 (KDP), and KD_2PO_4 were produced there for scientific and technological applications in China. Indeed, he studied proton NMR spectra of KDP crystals and, with some helpful suggestions from Prof. Lu, succeeded in explaining the paradoxical spectral behavior in terms of the proton location in the hydrogen bonds. He then started a structural chemical investigation into the origin and mechanism of nonlinear optical properties of inorganic oxides. Unfortunately, this study was soon interrupted by the Cultural Revolution of 1965-1973. During that period he grew single crystals from melts and measured their optical and dielectric properties.

He resumed his theoretical study of structure-property relationships in nonlinear optical materials following the Cultural Revolution. Very soon he formulated the anion group theory, a quantum chemical theory that describes and predicts the nonlinear optical behavior of inorganic solids based on the functional, oxygen-containing anion group. Consider for example, $BaTiO_3$, a well known and well characterized material. The anion group theory ascribes the second harmonic effect into microscopic and macroscopic parts. The microscopic part arises from each deformed TiO_6 octahedron, which can be computed quantum-chemically by perturbation theory practically without any adjustable parameters. The macroscopic effect is then a linear superposition of the microscopic second harmonic tensors. This way, the second harmonic coefficients of $BaTiO_3$ were computed and agree satisfactorily with experimental data. Similar agreements have also been obtained for other perovskites and tungsten bronzes. This initial success immediately attracted the attention of Prof. Lu, who has since provided constant encouragement, support and advice to the search for new materials.

Buoyed by this success and in collaboration with several colleagues from the Fujian Institute of Research, Prof. Chen expanded the scope of his investigation to iodates and nitrites. The lone-pair electron of the IO_3^- anion enhances the second harmonic generation. The NO_2^- group is the first example of a planar functional unit and its nonlinearity is enhanced by the conjugated π orbitals perpendicular to the NO_2^- units. Based on these results on lone-pair electron and π orbitals, a set of structural criteria was derived as guidelines for the search for and development of new crystals.

Subsequently, the borate series was discovered including both lithium triborate (LiB_3O_5) and a low temperature form of barium borate (BaB_2O_4). The successful developments of these crystals are the culmination of unwavering support and collaboration of colleagues from the Fujian Institute of Research and from the Fujian Institute of Research and contributions from other research institutes of the Chinese Academy of Sciences and worldwide. Both borates are transparent deep into the UV region: BaB_2O_4 (BBO) is transparent to 189 nm and LiB_3O_5 (LBO) to 180 nm. Both have high optical damage thresholds and are usually homogeneous and practically non-deliquescent. BBO and LBO are complementary: BBO is currently the only crystal that can generate the 5th harmonics (212 nm) of the 1.06 μm output of a YAG:Nd laser whereas LBO has very large acceptance angle and can be non-critically phase-matched. Hence these two crystals are already internationally acclaimed and with good

prospects of broad applications in laser science and technology. Development of other UV transparent, nonlinear optical crystals of the borate series is continuing.

First History of Science Prize of the TWAS

The Third World Academy of Sciences has set up an Award of US$ 10,000 for the best research essay highlighting the pre-20th Century scientific achievements of a Third World scientist, whose work had not previously been recognized.

The essay is to indicate the impact of the scientist's contributions on his/her community, and to establish its influence on modern scientific thought.

The essays submitted for this competition, open to scholars from the South as well as the North, are carefully judged by an International Committee of experts on the History of Science appointed by the Council of the Academy.

The 1987 TWAS History of Science Prize was awarded to Prof. David A. King (Johann Wolfgang Goethe-University, Frankfurt, W. Germany) has been honoured *"for his essay entitled* "Shams Al-Din Al-Khalili and the Culmination of the Islamic Science of Astronomical Timekeeping", *and in particular for bringing to light the highly impressive astronomical tables compiled in Damascus in the 14th Century and used there until the 19th Century and used there until the 19th Century for timekeeping".*

David A. King is Professor of History of Science and Director of the Institute for the History of Science at Frankfurt University, a position which he has held since 1985.

Born in England (1941), he studied mathematics at Cambridge University and education at Oxford University (1960-64); his first appointment was with the Sudan Government Ministry of Education (1964-67). Thereafter he did his graduate work in Islamic Studies and History of Science at Yale University (1968-72), specializing in the history of Islamic science. Then he directed the Smithsonian Institution Project in Medieval Islamic Astronomy at the American Research Center in Egypt (1972-79) and was Associate and Full Professor of Near Eastern Languages and Literatures at New York University (1979-85).

Professor King has worked extensively on medieval scientific manuscripts in libraries all over Europe, the Near East, India and Central Asia, and has recently published a three-volume catalogue of over 2,500 Arabic, Persian and Turkish scientific manuscripts preserved in the Egyptian National Library in Cairo. His early research focussed on technical achievements of the Muslim astronomers (hence his interest in Al-Khalili), but he has also worked extensively on popular folk astronomy, and particularly on the interplay of science and religion on medieval Islamic society.

His publications include some sixty articles, many reprinted in two volumes entitled *Islamic Mathematical Astronomy and Islamic Astronomical Instruments* (London 1986-87). These contain, for example, the first history of astronomy in Egypt and Syria, and descriptions of various astronomical tables for finding the direction of Mecca (*qibla*), regulating the times of prayer, and predicting the visibility of the lunar crescent. Also in book form are a history of astronomy in Yemen (1983) and a history of astronomical timekeeping in the Islamic world (to appear); he also co-edited a volume of studies in honour of his former teacher, Professor E.S. Kennedy of the American Professor E.S. Kennedy of the American University of Beirut (New York, 1986). He is currently preparing a book on the sacred direction in Islam and a history of astronomy in the Maghrib.

India: Work on Superconductors Ignored Abroad

by courtesy of
SUNS,
Special United Nations Service,
October 1988

New Delhi, Oct 3 - When high temperature superconductors were first reported in early 1987, no theoretical mechanism was known which could explain the phenomenon. Yet two Indian physicists, S.N. Ekbote and A.V. Narlikar of the National Physical Laboratory, New Delhi, had as early as 1980 not only predicted the possibility model based on magnetic interactions to explain the occurrence, but reports of the magnetic interaction model of high temperature superconductors now being put forward by several western researchers and appearing in scientific journals in recent months totally ignore the Indian work. The articles on the subject neither acknowledge nor mention the work of the Indian scientists in this frontier area, says a report in *Science Reporter*, the journal of the Council of Scientific and Industrial Research (CSIR).

The model proposed by S.N. Ekbote and A.V. Narlikar was based on a series of conduction electron spin resonance (CESR) and spin-wave resonance-experiments carried out on several superconducting materials in the superconducting state. Later, in a book on superconductivity and superconducting materials published in 1983, these two physicists had even predicted the possibility of high temperature superconductors, the first of which were not reported till 1987.

At the time it was first proposed in 1980, the magnetic interaction model of Ekbote and Narlikar did not find much support from physicists as it was claimed that the existing BCS theory (named after three scientists who developed the theory) could explain developed the theory) could explain superconductivity better. But the coming of the high-temperature superconductors changed all that, for according to the BCS theory superconductivity was impossible at temperatures a few degrees above absolute zero (minus 273 degrees Celsius).

The new ceramic superconductors show superconducting properties up to 100 degrees above absolute zero or more, temperatures too high to be accounted for by the BCS theory.

Today most researchers in the field, including Nobel Laureate P.W. Anderson, believe there is indeed some sort of magnetic interaction involved in

high-temperature superconductivity, just as predicted by the Indian physicists years ago.

Activities at ICTP October 1988

Title: FOURTH SUMMER COLLEGE IN BIOPHYSICS (12 September - 7 October 1988).

Organizers: Professors H. Farach (University of South Carolina, Columbia, USA), S. Mascarenhas (Universidade de São Paulo, São Carlos, Brazil), F. Quadrifoglio (University of Udine, Italy) and G.C. Ghirardi (University of Trieste and ICTP, Trieste, Italy).

Lectures: Description of the biological system: mitochondria. Introduction to the quantum theory of reaction rates. Bioenergetics and thermodynamics. Electron transfer in photosynthetic centers. Photochemical electron transfer in biological and model systems. Modelling of electron transfer reactions in biology. Bioenergetics in bacteria, photoposphorilation and charge separation. Energy transduction in plant photosynthesis. Photosystems I, II: electron transfer in oxygenic photosynthesis. Biochemistry and electron microscopy of antenna proteins in photosynthesis. Introduction to ESR techniques. The photosystem I reaction centre of oxygenic photosynthetic organisms: general presentation of electron transfer reactions. Recombination reactions inside the primary radical pair of photosystem I reaction centre: magnetic field effects. Electron transfer reactions involving the secondary electron acceptor of photosystem I: identification as a Quinone molecule. Protein-engine including the electron tunneling in biology and solitons in bacteriorhodopsin. Role of Ubiquinone in electron transfer and dynamics of membrane diffusion. Structure and function of metalloproteins from the electron transfer chain of sulphate reducing bacteria. Crystallographic structural studies of light energy and electron transfer systems. Theoretical issues in photosynthetic electron transfer. Electron transfer in simple and complex metallo-proteins. Crystallographic studies of Heme clusters in cytochrome: structural approach of electron transfer. Molecular electronics. The Mössbauer effect. Fundamental issues of reaction dynamics: a view from electron transfer. Rates in bacterial reaction centres.

The was attended by 89 lecturers and participants (70 from developing countries).

Title: COURSE ON OCEAN WAVES AND TIDES (26 September - 28 October 1988).

Organizers: Professors L. Cavaleri (Istituto per lo studio della dinamica delle grandi masse del Consiglio Nazionale delle Ricerche, Venice, Italy), A.H. Cook FRS (Cavendish Laboratory, University of Cambridge, UK) and G.J. Komen (Koninklijk Nederlands Meteorologisch Instituut, De Bilt, Netherlands), with the sponsorship of the Italian Direzione Generale per la Cooperazione allo Sviluppo and the Cooperazione allo Sviluppo and the World Meteorological Organization.

Lectures: Hydrodynamics. Tidal analysis. Dynamics of ocean waves. Boundary layer models and wind field reconstruction. Measuring ocean waves. Numerical ocean wave modelling. Storm surge modelling. Wind and wave observation from space. Nonlinear effects. Manual wave forecasting techniques and operational applications. 3-D models and water quality. Recent work with the 3-G WAM model. Air-sea interaction. Wave climatology.

The was attended by 105 lecturers and participants (75 from developing countries).

Title: MINI-SYMPOSIUM IN NONLINEAR SYSTEMS (31 October - 2 November 1988).

Organizers: Professors S. Lundqvist (Chalmers University of Technology, Gothenburg, Sweden), H.A. Cerdeira (UNICAMP, Campinas, Brazil), G. Casati (Centro A. Volta, Como, Italy) and B.A. Huberman (Xerox Palo Alto Research Center, USA).

Lectures: Relevance of classical chaos in quantum mechanics. Quantization of homoclinic motion. Quantum chaos and dissipation. Level statistics in disordered small metallic samples. The ecology of computation. Recycling strange attractors. Boundary layer induced turbulence. Characterisation of loss of memory in dynamical systems using multifractals. Dissipation on granular superconductors. Applications of dynamical zeta functions.

The was attended by 10 lecturers and

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participants.

Future Activities at ICTP

1988	
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 International Workshop on Computational Condensed Matter Physics: "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 Disorder 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
Mini-workshop on "Strongly Correlated Electron Systems"	19 June - 21 July
Research Workshop in Condensed Matter, Atomic and Molecular Physics	19 June - 29 September
Interface between Quantum Field Theory and Condensed Matter Physics (Anniversary Adriatico Research Conference)	20 - 23 June
Conference on Supermembranes	26 - 30 June
Summer School in High Energy Physics and Cosmology	26 June - 18 August
Quasicrystals (Anniversary Adriatico Research Conference)	4 - 7 July
Workshop on Superstrings	12 - 14 July
Strongly Correlated Electron Systems (Anniversary Adriatico Research Conference)	18 - 21 July
Symposium on Highlights in Condensed Matter Physics	1 - 3 August
Workshop on Phenomenology in High Energy Physics and Cosmology	16 - 18 August
Topical Meeting on Variational Problems in Analysis	28 August - 8 September
Computations in Physics and Physics in Computation (Anniversary Adriatico Research Conference)	5 - 8 September
Adriatico Working Party on Condensed Matter Properties of Neutron Stars	11 - 29 September
Workshop on Nonconventional Energy Sources	11 - 29 September
Workshop on Interaction between Physics and Architecture in Environment Conscious Design	25 - 29 September
Fifth College on Microprocessors: Technology and Applications in Physics	2 - 27 October
Workshop on Soil Physics Workshop on Soil Physics	9 - 27 October 9 - 27 October
College on Differential Geometry	30 October - 1 December
25th Anniversary Conference on "Frontiers in Physics, High Technology and Mathematics" *(strictly by invitation only)*	31 October - 3 November
Workshop on Telematics	6 - 24 November
Workshop on "Atmospheric Radiation and Cloud Physics"	27 November -15 December

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

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