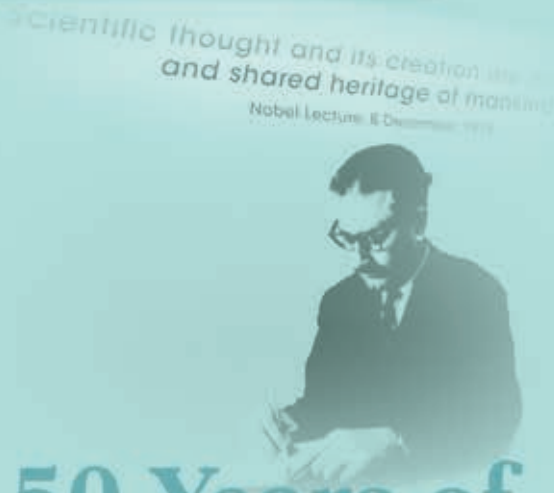

AS-ICTP: 50 Years of Science for the Future

– Views from Islamabad

Edited by:
I.E. Qureshi

Commission on Science and Technology for Sustainable Development in the South (COMSATS)

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Commission on Science and Technology for Sustainable Development in the South (COMSATS)

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50 Years of Science for the Future
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FOREWORD

The major part of this collage of articles is based on personal reminiscences of some very senior and some relatively younger Pakistani scientists living in Islamabad, who had been associated with ICTP at various stages of their careers in Physics and Mathematics. They got together in COMSATS Institute of Information Technology (CIIT), Islamabad campus, on 18th October 2014, at the invitation of COMSATS and ICTP-Pakistan Chapter to commemorate the 50th Anniversary of the Abdus Salam International Centre for Theoretical Physics (AS-ICTP). More than 100 participants comprising of ICTP Associates, CIIT faculty members, and Physics students of the university, were present on the occasion. Some of those attending the meeting were earlier invited by ICTP to participate in the mega event of its golden jubilee held in Trieste from 6th to 9th October 2014, but were unable to do so due to issues of travel arrangements. The ICTP alumni did not want to let this auspicious occasion slip away without any activity in Islamabad. COMSATS Headquarters took upon itself not only to hold a dignified ceremony, where some of the closest associates of Prof. Abdus Salam could pay their homage to ICTP and its founder, but also made the event more special by web-launching of the Urdu

translation of an ICTP publication entitled, 'One Hundred Reasons to be a Scientist'.

The publication of the proceedings was not envisaged initially. However, after the speeches were made and memorable pictures shared with the audience during the event, it was very clear that this gathering has a special significance. Hoping that a compilation of the memories and observations about ICTP made by the learned speakers would be a valuable addition to the existing records, essays and books about ICTP and its founder, it was decided to publish the views and impressions from the capital of Salam's homeland. In order to increase the utility of this publication, some additional data, pictures, historical documents and selected excerpts from other publications have been added for the benefit of readers.

The transcripts of all original articles were carefully edited by the Editorial Committee, and vetted by the authors, while published material has been reproduced after due authorization. The inclusion of a Preface by the incumbent Director ICTP, Prof. Fernando Quevedo, no doubt, has enhanced the value of the book. On behalf of COMSATS, it is my pleasure to thank the distinguished contributors of articles and all others who have provided support for this initiative. My special thanks are due to the Public Information Officer of ICTP, who provided invaluable support by sharing some historical pictures of scientific activities held in Trieste. It is sincerely hoped that the readers would find this collection of articles interesting and informative.

Dr. I. E. Qureshi
Executive Director COMSATS

PREFACE

In 2014, ICTP celebrated 50 years of a unique institution that over the years has become more and more relevant to the needs of our planet and its inhabitants, for science as a key component of our culture, science for development and as one of the most effective means of our survival: Science for the Future.

ICTP's founding fathers, particularly the Pakistani Nobel Laureate Abdus Salam and his visionary partner, the Italian physicist Paolo Budinich, had a dream more than 50 years ago, to create an institution that can bring scientific excellence to all corners of the world, to use the universal language of science to unite its people in a perfect example of what nowadays is called "science diplomacy" and to raise the awareness of the importance of science worldwide. They managed to turn this dream into a reality and it has been an honour for me during the past five years to contribute to keep this dream alive.

Our path in the last 50 years has not been an easy one. The Centre would not be here to celebrate its 50th anniversary without the generous and continuous support of the Government of Italy as well as the IAEA and UNESCO. It is in this way that ICTP has succeeded

to remain faithful to its mandate and to adapt itself to the changing world of science and technology.

By now many people and world leaders are aware of the importance of science for our future. At ICTP, we strongly believe that the most important components of the scientific endeavour are the scientists themselves. They need to be continuously educated and supported throughout their whole research career for the benefit of their countries and society in general. As such, ICTP is the prime scientific research institution of UNESCO.

ICTP's 50th Anniversary also marks the transition from my first to second mandates as Director of ICTP, and it is the perfect opportunity to summarize the developments of the past five years with a critical view on achievements and challenges. We are proud of the progress we have made in the past few years in response to the current scientific developments and demands from developing countries. We have initiated new ambitious programmes such as the opening of regional partner institutions worldwide; new research areas in quantitative life sciences and renewable energies; substantial developments in high performance computing; new educational programmes such as the joint ICTP/SISSA Ph.D. and master programmes and the joint ICTP/IAEA/University of Trieste master in medical physics. This concrete progress and expansion has been achieved without an increase in the budget of the institution and without sacrificing the commitment for excellence in all other ICTP programmes.

In addition to the initiatives mentioned above, ICTP plans to pursue three goals important to the institution's ongoing mission:

1. Gender Issues

ICTP will commence a concentrated effort to increase the

percentage of women at ICTP in all roles. Related projects would include improving outreach, making facilities more accommodating to women, encouraging networks among ICTP women, and increasing the number of women in leadership positions within ICTP and in the Scientific Council.

2. ICTP Ambassadors

This programme seeks to engage postdocs, professors on break, and retired professors from any institution in the world who would be willing to participate in ICTP activities in the developing world in order to share their knowledge and skills by, for instance, teaching classes or initiating research collaborations. Collaboration with other organizations such as universities could help to implement the programme and finance travel expenses associated with it. Potential involvement to cooperate with the International Astronomy Union and the Square Kilometer Array (SKA) in order to promote Astronomy studies in Africa will also be explored.

3. High-School and Undergraduate Teacher Training

An important part of ICTP's support of science in the developing world involves motivating young people who are interested in science, helping to keep them in the field by helping to outline a future for them. Training of teachers by working scientists – especially for high-school teachers, but also for teachers at the undergraduate level – can have a huge influence on students, with teachers transmitting the excitement and creativity of the world of science and attracting the brightest minds. Other ways of supporting science students include offering specialized summer schools and research opportunities to undergraduates, as well as providing e-learning and m-learning (learning apps for mobile devices) activities.

The next few years will mark a time of consolidation of these new initiatives for which a substantial increase in both the number of scientists working at ICTP and the corresponding infrastructures will be needed in order to reach the level required for the proper running of these activities. Extra sources of funding will be needed. This will be a major challenge for ICTP, one for which we hope to count on the continuing support of longtime sponsors as well as new partnerships.

Prof. Fernando Quevedo
Director ICTP

CHRONOLOGY OF KEY EVENTS IN THE HISTORY OF ICTP

1964: ICTP officially inaugurated with programmes in plasma, high energy and nuclear physics. ICTP's first main research group, headed by Professor Abdus Salam in collaboration with John Strathdee, is High Energy Physics.

1965: Federation Scheme is launched, with agreements signed between ICTP and scientific institutions in Central and Eastern Europe. Later, these agreements will be made with developing countries throughout the world. Also, Associateship Scheme is established.

1965: Research group in plasma physics, headed by Boris Kadomtsev, Marshall Rosenbluth and William Thompson, organized.

1966: First international course on theoretical nuclear physics takes place, directed by Amos de-Shalit and Claudio Villi. Jerzy Sawicki assembles research group in nuclear physics.

1967: Solid state physics added to research and training curriculum.

1968: Official opening of ICTP's Main Building in Miramare, just outside of Trieste, Italy.

1970: UNESCO joins IAEA as a full partner in the management of ICTP.

1977: ICTP establishes a solid state research section; eventually the section is renamed Condensed Matter and Statistical Physics.

1979: Professor Abdus Salam shares the Nobel Prize in physics with Professors Sheldon Glashow and Steven Weinberg for their work on the theoretical unification of electromagnetic and weak forces.

1982: The ICTP Prize is established. The first recipient is Professor Ganapathy Baskaran of the University of Madras, India, in 1983.

1983: Professor Abdus Salam, together with a distinguished group of scientists from developing countries, creates the Third World Academy of Sciences (renamed The World Academy of Sciences for the advancement of science in developing countries in 2012), a main forum for science in developing countries.

1983: The Training and Research in Italian Laboratories (TRIL) programme is established, allowing scientists from developing countries to spend extended periods at laboratories run by major Italian scientific institutions.

1985: ICTP's highly prestigious Dirac Medal is established. The first recipients are Professor Edward Witten, Institute for Advanced Study, Princeton, USA, and Professor Yakov Zeldovich, Space Research Institute, Moscow, Russian Federation.

1985: ICTP establishes its Office of External Activities (OEA).

1986: ICTP creates the Mathematics research section.

1990: Plasma Physics Research group is established.

1991: The Diploma Course is launched in High Energy Physics and Condensed Matter Physics. The programme grows over the years to include other disciplines.

1994: Establishment of Aeronomy and Radiopropagation Laboratory.

1995: Argentinean physicist Professor Miguel Virasoro, University of Rome "La Sapienza", is appointed director of ICTP.

1996: ICTP founder Professor Abdus Salam dies in Oxford, UK, aged 70.

1998: The Physics of Weather and Climate research section is established; in 2006 it changes its name to Earth System Physics to include Mechanics of Earthquakes and Tectonophysics.

2000: The ICO/ICTP Award is established for the field of optics. The first recipient is Professor Arbab Ali Khan from Quaid-i-Azam University in Islamabad, Pakistan.

2002: IAEA's Department of Technical Cooperation partners with ICTP's Office of External Activities to create the Sandwich Training Educational Programme (STEP).

2003: Indian-born US citizen Professor Katepalli R. Sreenivasan, University of Maryland, USA, is appointed director of ICTP.

2005: The Ramanujan Prize for Young Mathematicians is established. The first recipient is Professor Marcelo Viana, Instituto de Matemática Pura e Aplicada (IMPA), Brazil.

2009: Guatemalan physicist Professor Fernando Quevedo of the University of Cambridge, UK, is appointed director of ICTP.

2012: ICTP, together with the Universidade de São Paulo, Brazil, and the São Paulo Research Funding Agency, opens ICTP-SAIFR partner institution. Additional partner institutions will open in Mexico, Turkey, Rwanda, China, and other countries.

2014: ICTP launches new research area in Quantitative Life Sciences.

2014: ICTP inaugurates new, joint Master in Medical Physics programme with the University of Trieste.

2014: ICTP and SISSA inaugurate new Master in High Performance Computing programme.

2014: ICTP opens the Scientific Fabrication Laboratory (SciFabLab), the first of its kind in the region.

2014: ICTP celebrates its 50th anniversary with a four-day conference featuring political dignitaries, Nobel Laureates and top physicists.

HISTORICAL DATA ON ICTP PROGRAMMES

In 1964, ICTP had 154 visitors from 40 countries;
In 2014, 5670 from 142 countries.

Training activities:

In 1964, 1-2 seminars per year;
Now more than 60 training activities per year

Associate members:

4 members appointed in 1964;
408 active appointments in 2014;
Since the programme's inception in 1964, more than 2650 scientists from 100 developing countries have been selected as ICTP Associates.

Federation Agreements:

8 in 1964 with Eastern European countries;
87 in 2014 with developing countries all over the world.

TRIL:

37 fellows in 1983;
61 in 2014;
1300 TRIL fellows since 1983.

OEA:

1986: 60 meetings; 4 visiting scholars;
2014: 8 affiliated centres, 7 projects, 9 networks, 61 scientific meetings.

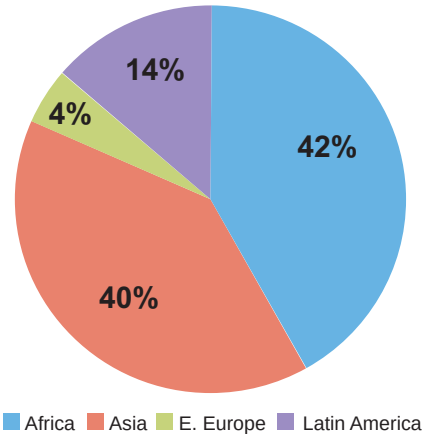
Postgraduate Diploma Students:

Since 1991, 720 completed diplomas.

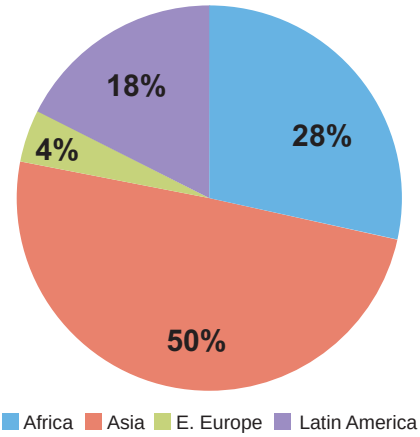
STEP Students:

Since 2003, 145 students have been enrolled.

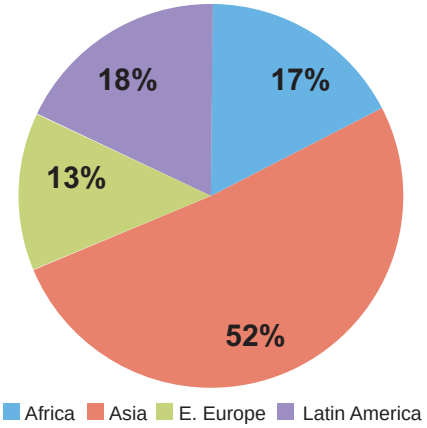
Regional Distribution of 720 ICTP Postgraduate Diploma Students (1991-2014)



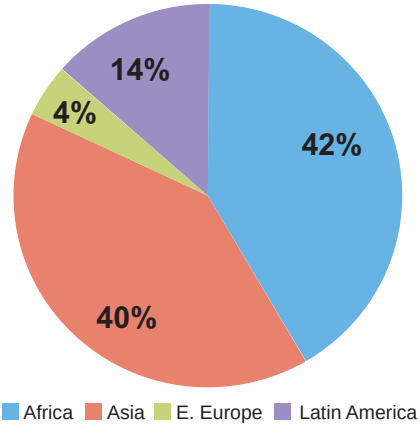
Regional Distribution of 2,650 ICTP Associate Members (1964-2014)



Regional Distribution of 1,300 ICTP TRIL Fellows (1983-2014)



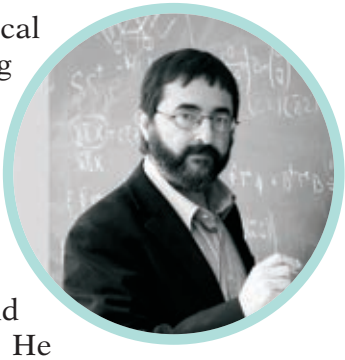
Regional Distribution of 145 ICTP STEP Fellows (2003-2014)



PROFILES OF ICTP DIRECTORS

Fernando Quevedo, Director of ICTP (2009 to Present)

Dr. Fernando Quevedo of Cambridge, a Guatemalan national, was appointed director of ICTP in October 2009.



Dr. Quevedo is a well-known theoretical particle physicist with wide-ranging research interests in string theory, phenomenology and cosmology. He was awarded the 1998 ICTP Prize in recognition of his important contributions to superstring theory.

He was born in 1956 in Costa Rica and obtained early education in Guatemala. He obtained his Ph.D. from the University of Texas at Austin in 1986 under the supervision of Nobel Laureate, Steven Weinberg. Following a string of research appointments at CERN, Switzerland, McGill University in Canada, Institut de Physique in Neuchatel, Switzerland, and the Los Alamos National Laboratory,

USA, as well as a brief term as professor of physics at the UNAM (Mexican National Autonomous University), Mexico, Dr. Quevedo joined the Department of Applied Mathematics and Theoretical Physics at the University of Cambridge, UK, in 1998, where he is currently Professor of Theoretical Physics and Fellow of Gonville and Caius College.

Katepalli Sreenivasan, Director of ICTP (2003 to 2009)

Educated in India, Australia and the Johns Hopkins University, Katepalli R. Sreenivasan taught at Yale for twenty-two years from 1979, as the Harold W. Cheel Professor of Mechanical Engineering from 1988, later holding joint appointments in the Departments of Physics, Applied Physics and Mathematics. Between 1987 and 1992, he was the Chair of the Mechanical Engineering Department and, in 1989, (the equivalent of) the Acting Dean of Engineering and Applied Science.

In 2002, desiring to learn how a public university works, he moved to the University of Maryland as Distinguished University Professor, Glenn L. Martin Professor of Engineering and Professor of Physics, and served for a year and a half as the Director of the Institute for Physical Science and Technology. He was then appointed as the Director of the International Centre for Theoretical Physics in Trieste, Italy.

Miguel Virasoro, Director of ICTP (1995 to 2002)

Miguel Virasoro was born in Buenos Aires, Argentina. After completing his doctorate in physics at the University of Buenos Aires, he worked at the Weizmann Institute of Science in Israel and at the Universities of Wisconsin and California in the United States as a post-doctoral fellow from 1967 to 1971. He became Professor at the University of Buenos Aires in 1971, and has held the position of Professor of Physics at the University of Rome since 1982. From 1974 to 1980, Professor Virasoro worked at Conicet in Argentina, the Institute for Advanced Study in Princeton, the Ecole Normale Superieure in Paris, and at CERN. Professor Virasoro has been honoured with many international awards. He has made fundamental contributions to statistical physics, field theory and complex systems.

Paolo Budinich, ICTP Co-founder and Deputy Director (1964 to 1978)

In October 1964, ICTP was officially inaugurated in Trieste with Salam as its first director, and Paolo Budinich, his main interlocutor in all the negotiations that led to ICTP's creation, as deputy director.

Budinich was also the main architect in the creation of many other scientific institutions in Trieste, including the International School for Advanced Studies (SISSA), the International Centre

for Genetic Engineering and Biotechnology (ICGEB), the Elettra Sincrotrone, and the Immaginario Scientifico.

Budinich was born in Lussingrande, on the island of Lussino (Losinj) and raised in Trieste. After studies in Pisa's Scuola Normale Superiore, and a long and adventurous military war period including service as a submarine officer. He started up high international standard physics in Trieste.

Abdus Salam, ICTP Co-founder and Director (1964 to 1993)

Abdus Salam was born in Jhang, Pakistan, in 1926. He was educated at Punjab University, Lahore, St. John's College, Cambridge, and Cavendish Laboratory, Cambridge where he obtained his Ph.D. in 1952. He then returned to Pakistan where he served as Professor at Government College, Lahore, and University of the Punjab. In 1957 he was appointed as Full Professor of Theoretical Physics at Imperial College and returned to England. He was Director of the International Centre for Theoretical Physics (ICTP), Trieste, Italy, from 1964 to December 1993.

He shared the 1979 Nobel Prize in physics with Glashow and Weinberg. Salam died in Oxford on 21 November 1996 after a long illness.

(Courtesy: Public Information Office, ICTP)

Glimpses of the 50th Anniversary Celebrations at AS-ICTP, Italy

Director ICTP, Fernando Quevedo, addressing the participants of the 50th Anniversary celebration (Source: ICTP Photo Archives)

Mario Giro, Under Secretary of State, Italian Ministry of Foreign Affairs, speaking to the august gathering at the ceremony (Source: ICTP Photo Archives)

The dignitaries at ICTP's 50th Anniversary event. From left, CERN Director-General, Rolf-Dieter Heuer; Elisa Quevedo; ICTP Director, Fernando Quevedo; Rwandan President, Paul Kagame; UNESCO Director-General, Irina Bokova; Prince El Hassan bin Talal of Jordan and his wife, Princess Sarvath; IAEA Director General, Yukiya Amano; TWAS Executive Director, Romain Murenzi; and Assistant Director General UNESCO, Flavia Schlegel (Source: ICTP Photo Archives)

ICTP staff on the campus after 50th Anniversary celebrations (Source: ICTP Photo Archives)

Director General UNESCO, Irina Bokova, and Director General IAEA, Yukiya Amano on the occasion of 50th Anniversary of ICTP (Source: ICTP Photo Archives)

Distinguished participants gathered around 50th Anniversary cake (Source: ICTP Photo Archives)

ICTP Dirac Medalists: (3rd from Left) Gabriele Veneziano; (3rd from Right) Ashoke Sen, and (2nd from Right) Andrew Strominger (Source: ICTP Photo Archives)

ICTP Prize (2013) given to Yasaman Farzan, Professor at Institute for Research in Fundamental Sciences, Iran, standing with D.G. UNESCO and Director ICTP (Source: ICTP Photo Archives)

ICTP IN THE WORDS OF SALAM

The pinnacle of Salam's advocacy for establishing ICTP was seen in his speech, entitled "Need for an International Centre for Theoretical Physics", at the General Conference of International Atomic Energy Agency (IAEA), Vienna, 1962. The strong case he built to convince the delegates of the Conference, in this regard, is evident from the following excerpts of his speech:

"The case for the Agency to support theoretical physics gets stronger when we consider this subject from the point of view of the emerging countries. First and foremost let us not forget that young scientists in the under-developed world feel the urge to meet the challenge of fundamental science as much as anyone else. Among the fundamental sciences, theoretical physics has a peculiar fascination for them.

(i) First, no costly apparatus is needed.

(ii) Second, in this field individual initiative – rather than collaborative effort – can still lead to a breakthrough. Almost invariably theoretical physics is the first science in smaller countries, which gets developed at the advanced level. History bears this out; this was the case in Japan with Yukawa and

Tomonaga; this was the case with India, in Brazil, Turkey, Lebanon and Argentina. No one can reverse this historical process of the order in which science grows in rich or poor soils. But in spite of the native ability, in spite of the ambitions of these scientists, they, in common with other scientists in their countries, suffer from one fatal disability – isolation. After an initial period of brilliant work at some active centre, they are faced with a cruel choice; either to leave their countries or to ossify and become scientific administrators. Unlike other scientists whose disabilities may include lack of costly equipment and apparatus, the theoretical physicist can be helped at a very small cost, by making frequent contacts possible, and by awarding him frequent visiting Fellowships to live for periods at active centres."

"Gentlemen, let us project to twenty years from now. The world is moving closer, economically, intellectually, scientifically. In twenty years, there will be international research centres not only for theoretical physics but for most fundamental sciences. The world trend is in this direction and nothing can stop it. It is possible for us in this Agency to take the initiative in forwarding this movement. I do hope very much we shall. With these words I commend to you the resolution in front of us –"

"Need for an International Centre for Theoretical Physics"
Ideals and Realities — Selected Essays, (Ed.) Lai, C. H.,
Copyright @ 1987, World Scientific Publishing Co.

Prof. Salam wrote after 22 years of the establishment of ICTP highlighting his vision of Science Transfer to the Third World as:

"The creation at Trieste of the International Centre for Theoretical Physics in the 1960s came about when some of us from the developing countries urged agencies of the United Nations, and in particular the

International Atomic Energy Agency (IAEA) and the United Nations Educational, Scientific, and Cultural Organization (UNESCO), to assist in ameliorating this situation regarding theoretical physics research. We were met with incomprehension even from some of the developed countries where physics flourishes."

"Over the 22 years that the Centre has existed now, it has shifted from emphasis on pure physics towards basic disciplines on the interface of pure and applied physics – disciplines like physics of materials and microprocessors, physics of energy, physics of fusion, physics of reactors, physics of solar and other non-conventional energy, geophysics, space physics, biophysics, neurophysics, laser physics, physics of oceans and deserts, and systems analysis – this, in addition to the staples of high energy physics, quantum gravity, cosmology, atomic and nuclear physics and mathematics."

"In its humble way, the Centre has enhanced the subject of physics in general, and physics communities in developing countries in particular."

"Science Transfer to the Third World",
Solutions for a Troubled World (1987)
(Courtesy: Earthview Press)

ICTP remained an important component of Prof. Salam's remarks at international fora on Science and Technology. In the notes prepared for the 1988 meetings of the South Commission, he highlighted ICTP as the proponent of South-South collaboration.

"South-South collaboration of scientists takes place automatically at International Centres, for example, at the International Centre for Theoretical Physics, where, during the last 25 years, there have been 23,000 visits of developing country physicists who have met and have had the opportunity to collaborate with each other. (Even for the larger

countries like India and China, scientists from different parts of the country hardly meet except in the international locations). What is urgently needed is provision of funds for carrying on this collaboration after the physicists have left the Centre for their countries."

"International Modalities for the Growth and Utilization of Science and Technology", Notes on Science, Technology and Science Education in the Development of the South (Dec. 1989)
(Courtesy: TWAS)

Of special significance with regard to the role of ICTP for aiding scientists from developing countries are in his remarks made in a 1992 publication issued by The World Academy of Science (TWAS).

"I believe that one of the best anti-brain-drain devices is that pioneered by the IAEA-UNESCO-run ICTP in Trieste, the Associateship scheme, whereby distinguished scientists working and living in DC's (developing countries) have a guarantee of spending 6-12 weeks at the Center at times of their own choosing, three times during a period of six years. Their fares and living expenses are met by ICTP. No salaries are paid. Over 400 physicists working in the Third World are at present ICTP Associates. After more than 25,000 visits made over the last 28 years by research physicists from the Third World, there has not been a single case of brain-drain from among the Associates and Fellows who have come to work at this prestigious Center…"

Science and Technology: Challenge for the South (1992)
(Courtesy: TWAS)

A book published by AS-ICTP on its 40th anniversary included an article based on the previous interviews of Prof. Salam, in which the concept of ICTP was elaborated:

"But as a physicist, I was completely isolated. It was very difficult to get the journals and keep in touch with my subject. I had to leave my country to remain a physicist. Now, it is the lack of this contact with others that is the biggest curse of being a scientist in a developing country. You simply do not have the funds, the opportunities, which those from richer countries enjoy as a matter of course. There are not the communities of people thinking and working in the same fields. This is what we have tried to cure by bringing people together at the International Centre for Theoretical Physics which I founded in Trieste in 1964. The Centre provides the possibility for scientists to remain in their own country for the bulk of the time, but come to the Centre to carry out research for three months or so. They meet people working in the same subject, learn new ideas and can return to their own country charged with a mission to change the image of science and technology in their own country."

"Science and Scientists in Developing Countries",
One Hundred Reasons to be a Scientist, 2nd Edition (2005)
(Courtesy: ICTP)

ICTP: A Personal Perspective

Fayyazuddin
National Distinguished Professor
National Centre for Physics, Islamabad, Pakistan

After doing Ph.D. from Cambridge University and a brief visit to Princeton, USA, Abdus Salam returned to his Alma mater, Government College Lahore, as a Professor of Mathematics and Head of the Mathematics Department, Punjab University Lahore, Pakistan, in 1951. In early 1954, he left for Cambridge to take up the position of lecturer in physics. In 1957, he moved to Imperial College of Science and Technology, London, as a professor at the young age of 30. During his Ph.D., he had done seminal work in quantum electrodynamics (QED); he solved the outstanding problem of overlapping divergences in QED.

Mid fifties was an exciting period in high energy and particle physics. In a rapidly developing field, it is not easy to work in isolation in weak academic and intellectual environment. This was the main reason of Salam's return to England.

In physics, theories are formulated in the form of differential equations. With the advent of quantum mechanics, matrices and non-Abelian groups made inroads in the structure of theoretical physics. The symmetries, in particular non-Abelian gauge

Seminar on High Energy and Particle Physics in ICTP auditorium (1965). Left to Right (First Row): Fayyazuddin, S. Razmi, and J. A. Strathdee; (Second Row): H. Harari in conversation with Munir Rashid (1965)

symmetries, played an important role in this development. Salam and his group at Imperial College London made outstanding contributions in this transition in particle physics.

This would not have been possible if he had not moved from Lahore to England. In this way, he contributed to advancement of knowledge which is 'a common heritage of whole humankind'. We in Pakistan should be proud of his contributions. The intrinsic value of knowledge to human civilization is an important factor to broaden our vision. At the back of his mind, he felt that in order to develop a viable research group in a developing country, one has to devise a mechanism to overcome scientific isolation.

As a member of Pakistan delegation to International Atomic Energy Agency (IAEA), he articulated the proposal of the establishment of International Centre for Theoretical Physics (ICTP) to start with,

where people working in developing countries could come for short visits to keep pace with the development of knowledge as Associate Members. Also the Centre would arrange short courses and workshops in various fields for the graduate students and faculty from developing countries.

The idea was opposed by some developed countries and also by India, which was represented by Dr. Homi J. Bhabha. With Salam's fantastic self-confidence, power of articulation and with strong support from Italy, he was able to get approval of the establishment of International Centre for Theoretical Physics with the sponsorship of IAEA.

ICTP started functioning in 1964 in a temporary location in Piazza Oberdan, Trieste. My first visit to ICTP was for four months (March - June) in 1965. It was an exciting time in particle physics. The main event was a two-month seminar on high energy physics and elementary particles (May – June). It was a privilege and inspiring to hear the lectures and talks by Julian Schwinger, Sidney Coleman, Sheldon Glashow, Murray Gell-Mann, Salam (to name a few), who were at the frontiers of Particle Physics. The atmosphere at

Mrs. Fayyazuddin and her son during a reception at a ship in Trieste harbour with H. Shayb from Palestine (1965)

Pakistani Physicists at ICTP cafeteria
(L to R): 1. Dr. Riazuddin, 5. Dr. Sarwar Razmi, 7. Dr. Fayyazuddin

the Centre gave the feeling that physics has no boundaries. Irrespective of nationality and faith, people were freely interacting with each other.

In 1966, my brother, Riazuddin, joined the newly established Islamabad University (Now Quaid-i-Azam University) as the founding Director of its Institute of Physics. The atmosphere at the Institute was conducive for research and marked by openness. The faculty had a vision and outlook that was not confined to physics alone, but was much wider in scope. The academic standard was strengthened by distinguished visiting faculty from abroad whom Riazuddin was able to invite for short visits using generous grants from Ford Foundation. This programme, supplemented by short term visits of the faculty and students to ICTP, was essential for creating international linkage. This linkage is of utmost importance to avoid inbreeding – a real problem in a country where there is only a single institute of its kind. ICTP has played a key role in this respect.

My second memorable visit to ICTP, together with Riazuddin was in 1968. In 1968, ICTP moved to its new building in Miramare. The symposium on Contemporary Physics in June 1968, was addressed by a Galaxy of Physicists: Hans A. Bethe, Francis Crick, Paul A. M. Dirac, Werner Heisenberg and Eugene P. Wigner. It was exciting to

12th Regional Conference on Mathematical Physics at NCP (2006)

listen to persons whose contributions have significantly modified the structure of physics.

In the 20th century, two conceptual revolutions – *Theory of Relativity* associated with Einstein, and *Quantum Mechanics* – took place. The transition to Quantum Mechanics, in the words of Freeman Dyson, was "more profound. It changed our way of thinking not only in Physics, but also in Chemistry, Biology and Philosophy". To see and listen to two of the founders of Quantum Mechanics, Heisenberg and Dirac, was an awe-inspiring experience. I distinctly remember, the session which Dirac was presiding. He introduced Heisenberg by saying, "We were of same age, Heisenberg succeeded where I failed".

The book titled, 'Theory of Weak Interactions in Particle Physics', which turned into a classic text and became standard reference for later generations of physicists in 1970s, authored by R. E. Marshak, Riazuddin and C. P. Ryan, was put in the final form in 1968, when the three authors were together at ICTP in Trieste. The collaboration of

12th Regional Conference on Mathematical Physics at NCP, Islamabad (2006).
(L to R): Dr. Riazuddin, Dr. G. t'Hooft and Dr. F. Hussain

the three authors of different nationalities, belonging to different faiths shows that knowledge is a common heritage of whole mankind.

I spent the summer of 1972 at ICTP. Riazuddin and I attended the conference on the history and foundations of quantum mechanics together with a conference banquet in honor of Dirac's 70th birthday. Both Eugene Wigner and John Wheeler, who had been hawks in favor of nuclear armament, were also speakers at the conference. There was strong feeling for nuclear disarmament among students of Trieste University. They wanted to protest against the presence of Wigner and Wheeler. Hendrick Casimir who was presiding over the session handled the situation tactfully, allowed the students to express their feelings and then gave the opportunity to Wigner and Wheeler to reply. After that the session continued without any ugly incident. Our first two students, Masud Ahmad and Ahmed Ali did their Post-Doctoral studies at ICTP in the early 70's.

ICTP fostered the Regional conferences on various branches of physics by co-sponsoring these meetings. The series of conferences was initiated by Iranian, Pakistani and Turkish physicists after a meeting at ICTP in 1986. The region originally comprised Iran, Turkey and Pakistan, and was expanded to encompass West Asian

countries, including India and Bangladesh.

The regional conference on Mathematical Physics in Tehran in 2004 was a success where the participants from the region took an active part.

12th Regional Conference on Mathematical Physics at NCP, Islamabad (2006)
(L to R): Dr. Riazuddin, Dr. Ashok Sen and Dr. Fayyazuddin

The 12th regional conference of the series on "Mathematical Physics" was organized by National Centre for Physics, and co-sponsored by Abdus Salam ICTP, which was held at Quaid-i-Azam University Campus in 2006. There were 163 participants and the event covered broad range of topics. A large contingent of colleagues from India and Iran participated in the conference.

In its 50 years of existence, ICTP has admirably fulfilled the mission for which ICTP was envisaged. It has expanded its activity to encompass broad areas of physics and some other fields.

Role of ICTP in Shaping my Research Career

N.M. Butt
Preston Professor of Nano Science & Technology and Chairman, Preston Institute of Nano Science & Technology (PINSAT). Preston University, Islamabad, Pakistan

My First Visit to ICTP: Participation in 10 Week "Winter College on Condensed Matter Physics" (October-December 1967)

My association with the International Centre for Theoretical Physics (ICTP) in Trieste was a great stepping stone in shaping my career as a scientist at the beginning of my research career. In 1965 at the University of Birmingham, U.K. as a Common Wealth Scholar I did my Ph.D. in Physics in the area of Experimental Nuclear/Solid State Physics using Mossbauer gamma-rays to study the inelastic scattering from single crystals of LiF. This Ph.D. work was well appreciated for its novelty and for the experimental verification in 1963 of the theory of phonon scattering from crystals developed in 1923 by the famous Swedish Physicist, Ivar Waller, some 40 years earlier than its experimental verification by D. A. O'Connor and me published in Physics Letters, 7, 233, 1963. This important research paper has been cited in several books as well as in research journals and is being cited even now, some 50 years after its publication. Professor Waller invited me to Sweden for seminars on this novel research. Soon after my Ph.D., the Pakistan Atomic Energy

Commission (PAEC) arranged my one year Post-doc, at the Nuclear Research Centre, Karlsruhe, Germany, in the field of neutron diffraction and scattering at the Research Reactor (FR-2). This Post-doc was arranged with a view that research reactor that was being installed at the Pakistan Institute of Nuclear Science and Technology (PINSTECH) would be used for Neutron Diffraction and Scattering work. After completing my Post-doc of about one year, I returned to Pakistan in 1966 and was posted as Senior Scientific Officer at PINSTECH in Islamabad, the capital city of Pakistan. PINSTECH at the time was being built at about 20 km from Islamabad at Nilore as a major R&D centre of PAEC. The site of PINSTECH had been chosen by Dr. I.H. Usmani, the then Chairman PAEC and Professor Salam, who was the Adviser to the President of Pakistan, Mr. Ayub Khan.

Immediately after joining PINSTECH in October 1966, I initiated a research group on Neutron Diffraction for research at the newly

[Right] Rented Building of ICTP: Piazza Oberdan, Trieste (1967)

started 5 MW swimming pool type research reactor, constructed by American Machine and Foundry (AMF), USA, under the Eisenhower's "Atom for Peace Program". This reactor is being operated successfully at enhanced power of 10 MW (enhanced in 1995) and is actively used for research on neutron diffraction and scattering from materials.

The ICTP was founded in 1964 at Trieste, Italy, by Professor Salam, who was also its Founding Director. In its first implementation phase, the scientific activities were initiated in three areas of Physics; namely High Energy Physics, Low Energy Nuclear Physics and Condensed Matter Physics. The coordinator for the Condensed Matter Physics was Professor Stig Lundqvist of Sweden. He was supported by the famous solid state physicists, Professor John M. Ziman, FRS, and Professor Norman H. March. The first activity in the area of Condensed Matter Physics was the organization of a 10-week long 'Winter College on Solid State Physics', where about 70 selected young scientists mostly from developing countries were to be lectured by eminent physicists from the world over. I was lucky to be selected as a participant in this course organized by ICTP in October 1967 at the first temporary building of ICTP in Piazza Oberdan in the city centre of Trieste.

Prof. J. Ziman introducing Winter College on Solid State Physics (Oct-Dec. 1967) Piazza Oberdan, Trieste

Dr. N.M. Butt (in circle) attending Winter College on Solid State Physics (Oct.-Dec. 1967) Piazza Oberdan, Trieste

In this Winter College on Solid State Physics in ICTP, eminent scientists like John M. Ziman, Alan Liddiard, Norman H. March, G. Caglioti and the future Nobel Laureates like Bertram N. Brockhouse and Pierre-Gilles de Gennes gave us the lectures. Brockhouse was awarded Nobel Prize in 1994 for pioneering contributions to the development of neutron scattering techniques for studies of condensed matter, while P-G de Gennes was awarded Nobel Prize in 1991 for discovering that methods developed for studying order phenomena in simple systems can be generalized to more complex forms of matter, in particular to liquid crystals and polymers. The interaction with these famous physicists during this course inspired me to continue with my research career for the rest of my life. During this course, I had very useful contacts

1. Dr. N.M. Butt and 2. Prof. V. Sayakanit (Thailand) at Piazza Oberdan, Trieste, 1967

with young scientists from many countries, particularly those from Europe. One particular example is of Erio Tosatti, currently Professor at International School for Advanced Studies (SISSA), Trieste, who was interim Director of ICTP after the retirement of Professor Salam, and my fellow course mate of Winter College (1967). We have been in touch for nearly 50 years now.

(L to R): Prof. Erio Tosatti and Dr. N. M. Butt (Trieste - May 2007)

The Social Life at ICTP

Apart from the excellent academic environment provided by ICTP, the social life there was equally exciting. Scientists with different national and cultural backgrounds were living in harmony, and were very helpful, cooperative and tolerant during open discussions. ICTP provided a platform that promoted international brotherhood.

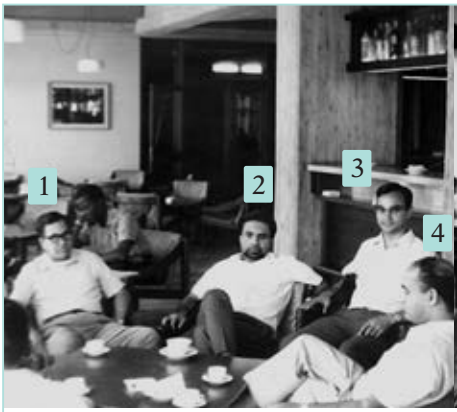
The frequent meetings in the cafeteria of ICTP at lunch time and the availability of tea/coffee throughout the day encouraged academic discussions at the coffee table.

The provision of table tennis provided a refreshing time after day-long hard work. I often relaxed by playing table tennis in late evening, often at midnight with a fellow Bulgarian scientist.

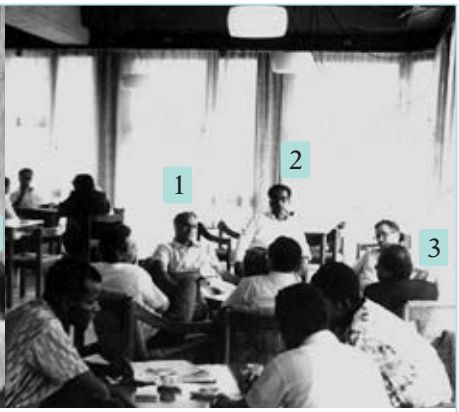
Glimpses of ICTP Cafeteria at Lunchtime (1970)

The library facilities were available 24 hours, which had a variety of research journals and books.

In short, life at ICTP was vibrant, both in terms of academic learning and social interaction.



1. Dr. Riazuddin, 2. Dr. Munir A. Rashid, 3. Dr. N.M. Butt, 4. Dr. Sarwar Razmi



1. Dr. Sarwar Razmi, 2. Dr. Haroon Rashid, 3. Dr. Arif uz Zaman

Six-week Research Visit at the Reactor Centre, KTH, Stockholm, Sweden

At the end of the course, and on recommendation of Professor Salam through a letter written to Professor Erik Larsson (a physicist in the area of neutron scattering from liquids at the Royal Institute of Technology (KTH)), I was able to gain experimental research experience in Neutron Scattering for six weeks at the Reactor Centre at KTH, Stockholm. This gave me a chance to enhance my research-related interaction with the Swedish scientists like Ulf Dahlborg, Göran Grimvall, and Ivar Waller (a famous theoretical physicist and a Member of the Nobel Committee for Physics (1945-1972)). Waller's theory of 1923 of phonon peaks under the Bragg Diffraction peaks in an x-ray diffraction experiment, I had verified experimentally in Mossbauer Gamma-ray diffraction in 1963, 40 years after his theory. He invited me for seminars at Uppsala University and Nuclear Research Reactor at Studsvik, Sweden. Although very senior to me in age and acclaimed theoretical solid state physicist, he became a fast friend because of my research work which helped verify his theory. We continued our scientific interactions for several years and had face-to-face discussions during my visits to ICTP as an Associate.

Prof. E. Wigner (Nobel Laureate) and Dr. N.M. Butt at ICTP (1970)

Selection as Associate and Senior Associate ICTP (1970-1989)

In addition, all these occasions at ICTP helped me in making contacts with very senior scientists from advanced countries like Prof. E. Wigner, Nobel Laureate and one of the important scientists of Manhattan Project. I also benefitted from fellow young scientists

1970 ICTP Miramare
First Row (L to R): 1. Goran Grimvall, 3. Francis Kofi Anpenyin Allotey, 6. Stig Lundqvist, 7. Ivar Waller

belonging to developed countries, as well as other eminent scientists from the developing world. I took serious interest in availing the benefits from the scientific activities organized at ICTP. In 1970, I was again selected for a course on solid state physics, after which I was selected as Associate of ICTP for the next 5 years (1970-75). This gave me the opportunity to make three short visits to ICTP for research and for attending advanced courses in solid state physics. As an experimental physicist, I made a proposal to ICTP to allow me to have short visits to the University of Oxford for collaborative experimental work with Professor B.T.M. Willis and Professor Anthony K. Cheetham, FRS, in the field of x-ray and neutron diffraction, who were doing research at the Research Reactors at Atomic Energy Research Establishment (AERE), Harwell, the famous nuclear laboratories of U.K. I was granted the opportunity to carry out collaborative experiments with these scientists that allowed me to publish my research work in reputed journals. The joint publications were well cited in the later years. Further, I carried out collaborative work as an experimentalist with a

theoretical condensed matter physicist, Dr. G. Solt from Hungary, as a result of my consultation with him during our visits to ICTP. Our collaboration led to two important joint publications that were well cited in the later years. This was indeed very useful for sharing knowledge at the international level.

Prof. G. Solt with his family at ICTP (1970)

I got an extension of another five years (1975-80) as an Associate, and later as Senior Associate for further six years, during which I was able to conduct collaborative research with European physicists and publish research papers. These visits at ICTP kept me active in research as a young scientist belonging to a developing country – an outcome directly in line with the objectives for which ICTP was established in 1964. After my short visits researching at ICTP, I would return to my regular job in Pakistan full of enthusiasm to carry on research even under very difficult conditions. This experience proved instrumental as in the later years of my career I was able to train and guide the younger scientists in Pakistan.

Invited Seminars in European and Scandinavian Countries

During this period (1970s and 1980s) due to the contacts made with European scientists, I was invited to give seminars in several European countries, like Poland, Finland, Denmark, Germany, France, Norway, Austria, and Yugoslavia at the time. Professor Stig

Lundqvist, Adviser to Professor Salam on Condensed Matter Physics, arranged my seminar at the University of Göteborg, Sweden. He became a supporting senior friend for later activities at ICTP. He invited me to participate in the celebration of the 25th Anniversary of ICTP in 1989, during which I gave a seminar as a part of the activities related to solid state physics.

My Invited Participation in the Silver Jubilee Celebration of ICTP (1989)

As ICTP was established in 1964 by Salam, its Silver Jubilee was celebrated in October/November 1989 with inspiring scientific activities for three weeks in the form of seminars, lectures by Nobel Laureates and other eminent scientists, mainly in the areas of Elementary Particle Physics, Mathematics, Nuclear Physics, Plasma Physics and Condensed Matter Physics.

Some 200 scientists took part in the celebrations, including 6 Nobel Laureates, one of them being Steven Weinberg, the co-winner of Nobel Prize with Prof. Salam in 1979. I was fortunate to be the only physicist invited from Pakistan by Professor Lundqvist.

This participation is one of the most memorable events of my scientific career. Apart from the rich experience of listening to lectures and discussions of eminent scientists for three weeks, the most emotional and proud moments for me as a Pakistani were those of the inauguration and closing days of the Silver Jubilee ceremonies. On the inauguration day, one noticeable thing was the participation of Mr. Giulio Andreotti, the then Prime Minister of Italy as usually the Prime Minister does not take part in a technical conference; and the other thing was the 10-minute long technical presentation of the Nobel Laureate Professor Samuel C. C. Ting, who specially flew from CERN (Geneva) to announce the famous results of the experiment performed a week earlier at CERN that

verified the theoretical predictions of Professor Salam. Professor Ting flew back to CERN soon after the inauguration. Such was the importance and respect given to the scientific eminence of Salam.

The other moment of pride for me as a Pakistani was on the closing day of the Silver Jubilee celebrations. Professor Robert Schrieffer, the 1972 Nobel Prize winner for superconductivity, was acting as a compère, while Professor Salam and a couple of other eminent scientists were sitting on the stage as distinguished participants. The moment of pride was when Professor Schrieffer bowed towards Professor Salam sitting and said, "Professor Salam our hats off to you, you have created ICTP not only as a centre of Physics but as the world-centre of science as a whole", and then he announced that they (ICTP) wanted to dedicate a poem to Professor Salam on the occasion and that poem was presented by Professor Frederick Reines, who received the Nobel Prize in 1995.

The poem described the eminence of Salam as a scientist par-excellence as

Poem Dedicated to Prof. Salam

N.97.bmm.
Received from
ICTP, TRIESTE
12/2/96

Grand Unification

A tribute to Abdus Salam

I,V *From out of the East there came a man*
who thought to divine the cosmic plan
To unify the hearts of man
And make whole, concepts deep and grand.

II *From out of the West came Nobility*
To grace the deep insight, the unity
Arising from diversity.

III *From out of the East there came such a man*
Whose heart and mind did mostly nobly span
Man's highest hopes and dreams and plans
Transcendent with love and humility.

IV *From out of the depths of the human soul*
Came this man so well crafted for his role
Came this man who would make
That which is fragmented whole.

Fred Reines
Fred Reines
3 November 1989

Ref: 25 yr. Ceremony ICTP – 1989

well as a man of great integrity, humility, who was earnestly respected by the international community.

Both these days of inauguration and closing left a lasting effect on my life. I authored a newspaper articles, titled "The Nobel Man", published in the daily "The News" (Islamabad edition, on 11 January 1998) to highlight the honour given to Professor Salam in a ceremony held at ICTP on the occasion of his first death anniversary (in January 1998). During the ceremony the Centre's name was changed to "Abdus Salam International Centre for Theoretical Physics" (AS-ICTP). Salam died in January 1997 in Oxford, England and was buried in Jhang, Pakistan.

My last meeting with Prof. Salam at his residence in Oxford (December 1993)

I cannot forget the greatness, humility and straight forwardness of Professor Salam, which I myself am a witness. In 1974, when I was on a short visit to ICTP as Associate, I went to meet Professor Salam in his office in the morning for some discussion and to also pay him my regards. At that time, he used to divide his time for managing his

duties towards Imperial College London and ICTP. Somehow on that day the meeting was not smooth and Professor Salam was somewhat harsh in his remarks. After a few minutes of the meeting, I returned to my work as usual. In the afternoon, I received a note from Professor Salam that at the same time expressed his regret for being hard and his confidence in me as one of the leaders of Pakistan physics who was to shoulder higher responsibilities. This shows his greatness and caring attitude towards his younger colleagues. It is about 40 years now, when this incident took place, but I have great reverence for Professor Salam for this note to me. May God bless him for his nobility.

Personal Note from Dr. Abdus Salam


My dear Butt,

I am sorry if I was a little hard to day but you are one of the leaders of Pakistan physics & we would all like you to shoulder higher responsibilities. So please treat my remarks as تربیت. May Allah forgive me for any harsh remarks,

Sincerely
Abdus Salam

My dear Butt,

I am sorry if I was a little harsh today but you are one of the leaders of Pakistan Physics and we would all like you to shoulder higher responsibilities. So please treat my remarks as "Tarbiat" (guidance). May Allah forgive me for my harsh remarks,

Sincerely
Abdus Salam

Benefits to Younger Generation of Pakistani Scientists

Due to my active research, I was selected for a tenure of 6 years as a Senior Associate of ICTP. This further added to my enthusiasm to carry on research and also enabled me to establish research groups

at home (Pakistan), involving my younger colleague scientists and training them for research at my institute.

The association with ICTP as Associate and Senior Associate enabled me to contribute to R&D in Pakistan. Without these opportunities provided by ICTP, I could not have attained my position as a respectable scientist at home and abroad. The honours of being awarded D.Sc. degree by the University of Birmingham, UK; International Khwarizmi Prize by Iran; Fellowship of the Islamic Academy of Sciences, Jordan; winning of Research contracts of IAEA, and being deputed as Technical Assistance Expert to the UN Mission in Chile, etc., were all because of the rich experience I gained during my scientific visits to ICTP.

In this way, I had about 20 years long association with ICTP. This enabled me to visit various countries in Europe and give seminars in several countries of different continents. These contacts helped me in the successful execution and management of the research programmes in my home country, which is in line with one of the visions of Prof. Salam for establishing the ICTP. It helped me to attain a good research standing; and winning academic and national and international awards. My career earned me high positions at national level; I served as the Chairman of Pakistan Science Foundation (PSF); Director General of the premier nuclear institute of Pakistan, the PINSTECH; Chairman of National Commission on Nano Science and Technology (NCNST) of the Ministry of Science and Technology, Government of Pakistan; and hold the title of Scientist Emeritus of PAEC. All these achievements were made while keeping my permanent service in Pakistan throughout my professional career.

As a supporter of ICTP, I established 'ICTP - Pakistan Chapter' in Islamabad in 2002 as its Founding President (2002-2003) to promote the importance of ICTP in Pakistan.

Dr. N.M. Butt, Founding President of ICTP - Pakistan Chapter addressing the gathering at the inauguration of the Chapter in Islamabad (2002)

Plaque Unveiling Ceremony of 'ICTP - Pakistan Chapter' 2002 (L to R): Mr. Parvez Butt, Chairman PAEC; Dr. Hameed A. Khan; Dr. N.M. Butt (Founding President); Dr. I.E. Qureshi, and Dr. Ishfaq Ahmad (Former Chairman PAEC)

My all-time Gratitude to AS-ICTP

The AS-ICTP has been instrumental in enabling me to serve my country to the best of my abilities, as it has been instrumental in strengthening of the culture of science in many developing countries across the world. From the platform of ICTP, the vision of Professor Salam to prevent brain-drain and strengthen science in developing countries through various programmes is being considerably fulfilled.

I am extremely grateful to the senior scientists of ICTP of my time, like Professor Salam, Professor Paulo Budini, Professor Stig Lundqvist, Professor Norman H. March, Professor John M. Ziman, and the administrative staff of ICTP, for their encouragement, support and help during my visits to ICTP. May God take this centre to greater and greater heights for the promotion of science in the developing countries in the years to come.

(L to R) Mr. Hamende (former Senior Administrative Officer of ICTP in 1970s), Dr. N. M. Butt and Mr. Ehsan Masood (Nature, London) – Trieste, 2007

Lasting Legacy of Salam – AS-ICTP

Ghulam Murtaza
Visiting Professor
Quaid-i-Azam University, Islamabad, Pakistan

First of all I would like to thank the organizers for inviting me to the 50th anniversary celebrations of Abdus Salam International Centre for Theoretical Physics (AS-ICTP) at COMSATS Institute of Information Technology (CIIT), Islamabad. ICTP itself held the celebrations a few days back; unfortunately I missed that due to visa problems.

I fondly cherish the pleasant memory of my association with the Centre spread over a period of almost 49 years, starting from 1965 when I first attended the high energy physics conference in May/June 1965. That meeting was held in the Centre's old building in Piazza Oberdan, Trieste downtown. I was a student at Imperial College London at that time. Since then I have visited the Centre for about 18 times. ICTP is like a second home to me.

Let us first have a few facts about the Centre for the benefit of our young audience. AS-ICTP was set up in 1964 to provide scientists from the Third World with opportunities to conduct research and to study new developments in physics and mathematics. The scope of activities has since been widened to include applied and related fields of science.

Abdus Salam receives a plaque from a group of scientists, including M.H.A. Hassan, Ghulam Murtaza, and M.H. Saffouri, ICTP, Trieste, 24 June 1983 (Source ICTP Photo Archives).

Each year about 6,000 scientists visit ICTP. And since its establishment in 1964, more than 116,000 scientists from 184 different countries have visited the Centre, of which 20% were women scientists.

ICTP is funded largely by the Italian government and it operates under a joint administrative framework established by the UNESCO and the IAEA.

The various scientific areas of ICTP activities are:

- Physics: Condensed Matter, Solid State Physics and Materials Science, Computational Methods, Atomic and Molecular Physics, Laser Spectroscopy, Semiconductor Physics and Technology.

Conference on Physics for Development and Symposium on the State of Physics and Mathematics in Africa: ICTP, Trieste, 8-16 October 1984. Daniel Afedzi Akyeampong, Hendrik B.G. Casimir, Julian Chela-Flores, Joseph S.G. Jackson, Yen Kheng Lim, Mambillikalathil G.K. Menon, Virulh Sa-Yakanit and Ghulam Murtaza are among the group. (Source: ICTP Photo Archives)

- Physics and Energy: Plasma Physics and Fusion, Non-Conventional Energy Sources, Applied Nuclear Physics.
- Physics and Technology: Optical Physics and Lasers, Communication Physics and Technology, Optical Fibers, Microprocessors and Informatics, Synchrotron Radiation Applications.
- Earth and Environmental Sciences: Geophysics and Siesmology, Oceanograpy, Physics of the Atmosphere and Aeronomy, Meteorology and Climatology, Soil Physics, Environmental Control, Mathematical Ecology, Modeling of Environmental Systems.
- Physics of the Living State: Biophysics, Medical Physics, Neurophysics.
- Miscellaneous: Instrumentation for Nuclear and Sub-nuclear

Physics, Topics at the Interface with Chemistry, Engineering, Biology, etc.

The Abdus Salam International Centre for Theoretical Physics (AS-ICTP) has the following major programmes:

- Office of External Activities (OEA);
- Associate & Federation Schemes;
- Training and Research in Italian Laboratories (TRIL);
- ICTP Diploma Programme;
- ICTP/SISSA Joint Master's Degree Programme;
- ICTP Awards;
- Cooperation with TWAS;
- Library & Donation Programme;
- Scientific Computing Section.

Equally important, ICTP created a nurturing environment for the development of a constellation of institutions in and around Trieste, each of which is dedicated to the promotion of Science and Technology in the developing world. These institutions include:

- The World Academy of Sciences (TWAS);
- Third World Network of Scientific Organizations (TWNSO);
- Third World Organization for Women in Science (TWOWS);
- Inter-Academy Panel: the global network of science academies;
- International Centre for Genetic Engineering and Biotechnology (ICGEB);
- International Centre for Science and High Technology (ICS);
- International School for Advanced Studies (SISSA), and
- Elettra Synchrotron Light Laboratory.

Official opening of the Third World Academy of Sciences (TWAS); Abdus Salam welcomes J. Perez de Cuellar, Secretary General of the United Nations (ICTP, Trieste, 5 July 1985). (Source ICTP Photo Archives).

Indeed the city of Trieste has become a 'Science City'. This institutional constellation has come to be known as the "Trieste System". The Italian government's willingness to generously support each of Trieste's scientific enterprises reflects the government's own vision and willingness to turn Abdus Salam's vision into reality.

The Centre was established in 1964 and Salam became its Director. For the first four years, the Centre was temporarily housed in a rented building in Piazza Oberdan located in the City Center of Trieste. Eventually, the Centre shifted to its new premises which is situated in a beautiful environment of Miramare on the outskirts of Trieste. To mark the memorable occasion, Salam organized an International Conference, titled Contemporary Physics. The Conference encompassed the whole spectrum of Physics. More than

300 people participated in this month-long Conference, out of which many were from the Third World. I was fortunate to be one of them. Imagine a scientist from the Third World, who usually remains isolated from the mainstream of knowledge, spending a month in an environment where the most renowned scientists of the century are present – the legendary personalities whose stories one reads in books and magazines – and listens to their lectures and talks to them. Something special about the event was that apart from the usual sessions during the day, special lectures were organized in the evenings, for which the following six most notable scientists of the century were invited: Werner Karl Heisenberg, Paul Adrien Maurice Dirac, Hans Albrecht Bethe, Eugene Paul Wigner, Oskar Benjamin Klein, and Lev Davidovich Landau (Landau could not attend himself on account of illness, however one of his famous companions,

Dirac Medal 1985 to Yakov Zeldovich and Dirac Medal 1986 to Alexander Polyakov: award ceremony, ICTP, Trieste, 15 November 1986; A. Polyakov, Abdus Salam, Prince Carlo della Torre e Tasso, Y. Zeldovich and P. Budinich (1986). (Source ICTP Photo Archives).

Evgeny Mikhailovich Lifshitz, attended on his behalf). These grand old masters were the personalities that had played a major role in shaping the frontiers of 20th century Physics. Hence, one may title this evening lecture programs as 'The story of Physics as told by its Discoverers', during which these people also narrated the incidents, circumstances and background that they went through during their journey of inspired moments of creativity. How Salam conducted these lectures is out of the ordinary. One evening it was Heisenberg's turn to tell his story. Prof. Dirac was also present. Both of them were Nobel Laureates. Remember, Salam was not yet a member of this elite club. Being the host of the event, Salam went onto the stage and after narrating an ancient story of the King of Persia whose wise vizir instead of presenting the beverages to the visiting imperial guest gave it to his own King to offer it to the guest himself by stating that it only befits a King to present to another, he announced, "I hereby invite Professor Dirac to come and introduce Heisenberg. It only befits a Nobel Laureate to introduce another."

The environment of the Conference was extraordinary. One felt like living a dream. So many stars of the world of physics were around. Such a stimulating and inspiring environment was surely a once-in-a-lifetime experience. Only Salam's genius could perform such a task.

Another exciting incident which I experienced at ICTP was when the Physics Nobel Prize of 1979 was announced. I was fortunate enough to be there in Trieste at the time. With the breaking of the news of Salam sharing the Nobel Prize, a wave of excitement and joy reverberated all over. The city of Trieste was especially thrilled with the news. The radio and television programs eulogized Salam and the Centre. Similarly, the newspapers of the following morning discussed Salam and Pakistan. The common people of Trieste celebrated Salam's achievement with such zeal and enthusiasm as if he was one of their own. Salam of Pakistan was talked about in the

streets and boulevards of the city. All of a sudden, Pakistan became a respectable country. And the Pakistani scientists at the Centre in Trieste were imagined to be the Nobel Laureates of the future. Surely Pakistan could not find a better ambassador than Salam.


To Professor
Abdus Salam
With heartfelt congratulations for the well-deserved recognition of your work
Your Staff
Trieste 15-October 1979

Certificate of Appreciation presented to Prof. Salam by ICTP staff (1979)

Salam who was in London at the time, arrived in Trieste after a couple of days. The entire staff of the Centre and the scientists present there came out of the building and gathered at the entrance to receive Salam. As soon as the staff car stopped at the gate, I stepped forward, opened the car door and shook hands with Salam the Nobel Laureate. A grand reception was arranged the same evening. Salam was the centre of attention. One by one, people were coming forward and expressing their sentiments. When it was my turn, my heart and mind were in a strange state. Being an old student of Salam, I couldn't muster courage to be informal with him. But that day, unlike the usual, I went ahead and hugged Salam and, congratulating him, I said:

"Sir, you have created history, you are the first from the Muslim

The Abdus Salam Memorial Meeting held at ICTP, Trieste, Nov.19-22, 1997 (Rexhep Meidani, speaker) (Source: ICTP Photo Archives)

The Abdus Salam Memorial Meeting held at ICTP, Trieste, Nov.19-22, 1997. Participants and staff who had been present at "Piazza Oberdan", (L-R): M. Martinis, R. Ramachandran, M. Fasanella, L. Masperi, A. Maduemezia, M. Baghdadi, D. Gatta, A. Hamende, K.T. Shah, M. Lewis, G. Ghirardi, I. Radatti, R. Delbourgo, D. Buranello, L. Fonda, L. Bertocchi, G. Mack, M. Zingarelli, D. Akyeampong, G. Murtaza, J. Boyce, J. Ziman, J. Niederle, E. Tosatti (Source: ICTP Photo Archives).

World to have received this honour (i.e. Nobel Prize in Science)." And Salam kept saying "*In Sha Allah*, *In Sha Allah* (If Allah wills)".

Before concluding, I would like to recall that on the occasion of Salam's first death anniversary in 1997, a grand memorial meeting was organized, during which Physics lectures were delivered for two-and-a-half days while one full day was dedicated to remembering Salam by his friends, students, colleagues, collaborators, admirers and other international dignitaries. Prof. Salam's family was also invited. On that occasion, the Director of the Centre announced that, as per decision of the Italian government, the Centre would now be known as Abdus Salam International Centre for Theoretical Physics. It is remarkable how much Italians loved Salam and owned him. The Centre has preserved all Salam's documents, prizes, awards, souvenirs, personal collections books,

A Glimpse of Salam Memorial Room at ICTP
(Photo Courtesy: Dr. I.E. Qureshi - 2008)

his chair and smoke pipe (*huqqa*) in a room called 'Salam Memorial Room', which is located in the Centre's library.

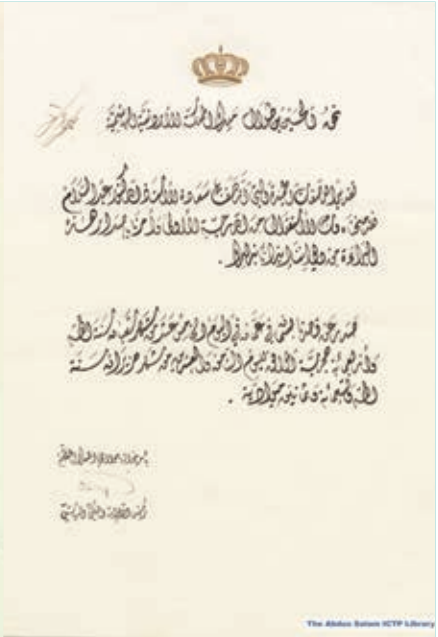
In the end, I would say: The Centre has played a very crucial role in the lives of many of us in the developing world. The Centre is indeed the secret of our intellectual survival. I hope and pray that the Centre will continue to serve the cause of science of the Third World in the future.

A ROYAL MEDAL
FOR THE YEAR 1978 HAS BEEN AWARDED BY
HER MAJESTY THE QUEEN
ON THE RECOMMENDATION OF
THE COUNCIL OF THE ROYAL SOCIETY
TO
PROFESSOR ABDUS SALAM
FRS
IN RECOGNITION OF HIS OUTSTANDING CONTRIBUTIONS TO THE PHYSICS OF ELEMENTARY PARTICLES WITH ESPECIAL REFERENCE TO THE UNIFICATION OF THE ELECTROMAGNETIC AND WEAK INTERACTIONS

PRESIDENT
SECRETARIES

THE ROYAL SOCIETY
LONDON
St Andrew's Day 1978

Certificate: Royal Medal, The Royal Society, London, UK (1978)



Certificate: Doctor of Science Honoris Causa, Yarmouk University, Irbid, Jordan (1980)

Certificate: Foreign Member of the Russian Academy of Creative Endeavours, Moscow, Russia (1991)

Commemorative postage stamp issued by the Government of Pakistan in 1998, to honour the services of Salam as part of its "Scientists of Pakistan" series

My Association with the AS-ICTP

Abdullah Sadiq
Dean, Faculty of Basic and Applied Sciences
Air University, Islamabad, Pakistan

The following is a brief description of my long and fruitful association with the International Centre for Theoretical Physics (ICTP) at Trieste, Italy, renamed in 1997 as the Abdus Salam ICTP (AS-ICTP).

First Visit: I first heard of ICTP a few years after my return from the United States, in early 1971. It was in 1975 when I first visited the Centre on the recommendation of Dr. N. M. Butt, then my senior colleague at the Pakistan Institute of Nuclear Science and Technology (PINSTECH), Islamabad. This was soon after some major aircraft hijackings had taken place. As I was going out of the terminal of the Leonardo da Vinci Airport in Rome on my first visit to AS-ICTP, a young security guard pointing at the box of computer cards in my hand nervously asked me in his typical Italian accent as to what it was. Without even waiting for me to complete my reply he said, 'Go, don't know Arabic, don't know Arabic' and hurriedly let me go through the gate.

After a rather long drive, the airport bus dropped me at the Trieste railway station. After booking a room in a nearby Hotel Roma, I

College on Computational Physics : ICTP, Trieste, 17 May - 11 June 1993
(Source: ICTP Photo Archives)

decided to go to the Centre. By then I had learnt that in Italian 'Centre' was 'Centro' pronounced as 'chentro; and 'where' was 'dove' pronounced as 'though way'. Thinking of ICTP as the only 'Centre' in town, I asked some people 'dove centro?'. I was directed to take a bus and in a minute or two found myself in the Trieste city centre. After some trial-and-error, I finally managed to reach the Centre in Miramare that was a few kilometers in the opposite direction.

Lying at the lush-green foothills overlooking the shimmering blue water of the Adriatic Ocean, visiting the Centre was like a love at first sight. It is no surprise that some soldier of the Roman army after climbing down from the plateau overlooking the Adriatic ocean and seeing this enchanting view might have exclaimed, 'mira mare' (look at the sea), just as some Mughal prince is said to have exclaimed 'wah' (wow) as his entourage passed by what has since then become the city of Wah, some 20 kilometers west of Islamabad.

After hours of intense study in the library of the Centre or

ICTP Prize for 1987 in honour of Nikolaj N. Bogolyubov given to A. Sadiq (Centre): ceremony held at ICTP, Trieste, 7 August 1987. Also in the picture are (Left) Paolo Fusaroli (Rector of the University of Trieste, 1981-1990) and (right) Hassan R. Dalafi (Programme and Liaison Officer, ICTP). (Source: ICTP Photo Archives)

concentrated work at one of its computer terminals, it used to be most relaxing to have a leisurely stroll in the peaceful and quite Mira Mare Park adjacent to the Centre or to sit on a stone bench in it overlooking the Gulf of Trieste. From there one could have a clear view of the city of Trieste with the parts of the then Yugoslavia in the background towards the East and the shoreline of Grado and Sistiana beaches towards the West.

Facilities and Opportunities: The International Centre provided, as it still does, excellent facilities and rich opportunities for research work to visitors from less developed countries. Its excellent library was well stocked with the latest issues of major journals of physics and mathematics along with their backdated issues. Its extensive book collection contained, besides technical tomes, many important books on the history of science along with biographies and

ICTP Prize for 1987 in honour of Nikolaj N. Bogolyubov to A. Sadiq - Ceremony held at ICTP, Trieste, 7 August 1987; A. Sadiq receiving the prize from N.N. Bogolyubov. (Source: ICTP Photo Archives)

autobiographies of leading scientists. It had ample quiet seating places where one could study and work without any disturbance. For people like me doing extensive computations, the computer facilities of the Centre were more than adequate and the person who was its in-charge, A. Nobile, was very competent, friendly and helpful.

The Centre was managed in a most efficient manner. People responsible for looking after the needs and requirements of short-term visitors, especially Dr. Amende , who was in charge of the Center's administration, and his small team of competent and efficient secretaries (including the two librarians Maria and her associate Mariocha) were competent, efficient and welcoming. Most of the skeleton staff at the Centre used to do multitasking. Besides handling the incoming and outgoing mail of the staff and the large number of visitors, the 2-3 person team in the mail room used to print, sort, staple and mail the large number of Centre's reports all over the world. Some of them even performed the duties of drivers for the Director and important visitors. The lone guard living in a small cabin in the parking lot also worked as the gardener of the numerous flower pots watering and pruning them and cutting long surrounding hedges. This was in addition to his round the clock duty

as the guard, opening the gate of the Centre for visitors long after working hours and over the weekends. Evidently, he also served as a house keeper at the Director's residence above his cottage. The result was that visitors did not have to worry about any mundane issues like housing, post and their travel arrangements. They had all the time at their disposal to concentrate on their study and research.

The intellectual environment at the Centre was, as it must be even more so now, most conducive for research. In addition to the relatively young visitors from all over the world, there were senior physicists from developed countries. Such regular senior visitors in my field of condensed matter physics were Norman March, Robin Stinchcombe both of Oxford University, and Paul Butcher, University of Warwick, UK, Stig Lundqvist from Chalmers

Stig Lundqvist receiving the special Dirac Medal from Abdus Salam. On the left, Anders Sjöberg, President of Chalmers University of Technology (Source: ICTP Photo Archives)

(L to R): 1. Abdullah Sadiq, 2. John Ziman, FRS (Director Science Policy Group, UK) , 4. Allan Cook, FRS (Cambridge University) (Picture: 1987)

University, Sweden. Later on they were joined by Erio Tosatti and Mario Tossi of Italy and Yu Lu of the Chinese Academy of Sciences. There were also other senior visitors, such as Bob Schrieffer, Michael Wortis, Michael J. Morasvscik and Raza Ali Tahir-Kheli from the United States, von Klitzing from Germany and P. G. de Gennes from France. The talks at the topical summer workshops, lectures by these senior visitors, the in-house senior scientists and by invited luminaries, such as Paul Dirac, Rudolf Peierls and von Klitzing, and seminars by the young visiting scientists provided lots of thought-provoking new ideas for one to work on. Once while on a stroll with Peierls, in response to my question about his life story, he suggested that I should read his autobiography, titled 'The Bird of Passage: Recollections of a Physicist', that had recently been published. Needless to say that this book was already available in the library of the Centre and I thoroughly enjoyed reading it.

In case the Centre did not have in-house facilities or expertise in the field of specialization of a visiting scholar, it generously provided funds for visiting a place of his or her active research interest. I recall visiting Oxford University, perhaps during my very first visit, to carry out my more extensive computations on its supercomputer. During a subsequent visit to the Centre, I visited Professor P. G. de Gennes of

Abdullah Sadiq during ICTP Prize Ceremony (1987) (Source: ICTP Photo Archives)

College de France to finalize my work on long-chain polymers that was inspired by his talks given on the 'Frontiers of Physics and Contemporary Needs', at the Nathiagali International Summer College, Pakistan.

Professor Abdus Salam: Any mention of ICTP would not be complete without referring to Professor Abdus Salam, the Founding Director of the Centre and its moving spirit. He was always there during summer, living in a small house overlooking the Centre. While he usually met visiting scholars during receptions he hosted for them, he made special efforts to meet Pakistani visitors by calling them over to his office. On such occasions, he would strive to learn about the state of science and education in Pakistan and would urge them to help improve it. This was specially the case after the resolution of National Assembly of Pakistan regarding the Ahmadi community in the early 70's. Earlier, as Science Advisor to the Government of Pakistan, especially during the Ayub era, he had played a key role in the establishment of major educational and scientific institutions

Abdus Salam and Nikolaj N. Bogolubov during the ICTP Prize 1987 Ceremony (Source: ICTP Photo Archives)

and organizations of the country. These include the then Islamabad University, now Quaid-i-Azam University, and the Pakistan Atomic Energy Commission. Though greatly disillusioned on his dissociation from the educational and scientific scene of the country after that resolution, he continued to provide all possible help to the Pakistani scientific community.

Once, while working alone on a computer terminal in the entrance lobby of the ICTP building long after the usual working hours or over a weekend, I heard someone dragging his feet as he walked into the building. Looking back, I noticed that it was Professor Salam walking towards the elevator on his way to his office. This was the early stages of his illness that eventually proved fatal. Soon after that, it became clear that it would not be possible for him to continue to lead the Centre for very long. As expected, people had started talking about life at the Centre after Salam.

A few years later, I met a former class fellow from Peshawar University at the Centre. He was then a physics teacher in a college, in a small remote town, and was a part of a group comprising physics teachers from Pakistan, who were invited to the Centre that summer. Thinking that others at the Centre might think of this as a

special favor to Pakistan, I went to discuss with Salam my concerns of possible backlash against Pakistanis after he relinquished his responsibilities at the Centre. His response was curt and blunt saying that let people say whatever they want I will try to help Pakistanis so long as I am here.

Four winners of the ICTP Prize : ICTP, Trieste, 16 July 1999; L-R : S. Wadia, A. Sen, G. Baskaran and A. Sadiq (Source: ICTP Photo Archives)

Earlier, he had introduced me to Professor Antonio Marussi of the University of Trieste, a leading expert in earth sciences and a regular visitor to Pakistan, to discuss the possibility of establishing mineral and water resources centers in Pakistan. This idea unfortunately could not be realized due to petty squabble among concerned professionals back home.

How ICTP helped me stay active in physics: The Centre has been a breath of fresh air for scientists from developing countries and particularly for me. As I mentioned in my acceptance speech on the occasion of receiving the ICTP Prize and Gold Medal, I had given up doing physics research after completing my Ph.D. from the United States in January 1971. This was in part due to the profound influence on me of the anti-Vietnam moment in the States and the student's uprisings all over the word during the mid to late sixties. Then there were major floods that devastated large parts of former East Pakistan just before my return, the national elections soon

thereafter leading to the army action in the former East Pakistan and the emergence of Bangladesh. As a result, in addition to teaching some courses at the then Islamabad now Quaid-i-Azam University and organizing the PINSTECH library, I was mostly preoccupied with and engaged in more 'socially relevant work', including adult education after office hours in a Rawalpindi slum. In 1974, when PINSTECH hosted a major conference on solid state physics, which among others was attended by John Ziman then at Bristol University, UK, I decided to return back to physics research, the field in which I was trained. I started working on a problem with the available rudimentary scientific literature and computational resources and refined this work further during my visits to ICTP as its Associate Member. My work at ICTP helped me successfully compete for the coveted von Humboldt scholarship in 1982. My work as a Humboldt fellow in collaboration with Kurt Binder, then at Juelich, Germany in turn led to my nomination for the ICTP Prize and Gold Medal, which was awarded to me by Nikolaj N. Bogolubov in whose honor it is named.

After some time, I became a senior Associate Member of the Centre. In the late eighties, I was also offered staff associate membership that entailed my joining the Centre on full time basis. At that time, I was deeply involved in the planning of what is now the Ghulam Ishaq Khan Institute of Engineering Science and Technology (GIKI), Topi, Pakistan. It was a difficult decision to make but eventually I decided to decline the ICTP offer. In return ICTP very kindly gave me a blank check for visiting the Centre at any time I wanted. Because of my long and fruitful associations with ICTP, I consider Trieste as a home away from home.

"Salam's Centre" and What it Meant to Me

Asghar Qadir
Department of Physics, School of Natural Sciences
National University of Sciences & Technology
Islamabad, Pakistan

The International Centre for Theoretical Physics (ICTP) was proposed by Prof. Abdus Salam as early as 1960, and its motivation was eloquently elaborated in his speech in 1962 at the General Conference of IAEA in Vienna. His argument was that scientists in the Third World suffered from academic isolation, leaving them with only two options: either die academically or leave the country. His suggestion was that there should be some place where they could gather and interact with the top scientists in the field, and then return home to disseminate the knowledge they had acquired. This way the underdeveloped countries could genuinely become developing countries. Of course, he was not arguing for setting up an institution for technology-transfer, which would have been more in line with what everyone had been promoting. His point was that the countries should develop the scientific base and technology would come automatically. When he made his proposal the scientists of the developed countries responded that "the Third World does not need jet planes, it needs donkey carts". Notice that it was not ox-carts or bullock carts, leave alone horse carts, it was donkey carts. In the teeth of that opposition, he persisted with his arguments to convince the keepers of scientific development to agree to his suggestion.

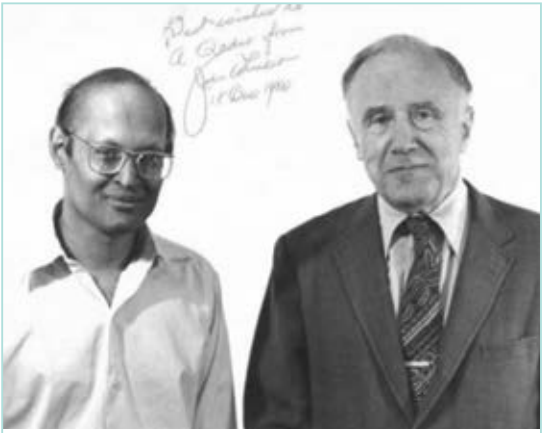
Finally, to demonstrate that nothing could be achieved, a petty amount was sanctioned to start the Centre. Presumably, their idea was that while appearing to agree, they would have torpedoed the proposal in such a way that it could never be raised again.

They had not anticipated that the brilliant scientist may also be an equally brilliant manager. Despite the low budget provided, Salam conceived of a way to generate the required funds. He put the Centre up for auction. He would place it where he was offered the best support for it. He had hoped that Pakistan would put up a reasonable bid and he could place it in Pakistan, and help develop Pakistan most of all. That did not happen. He went around to various countries trying to convince them to host the Centre and promising the great benefits that would accrue from it. He was fortunate enough to find a receptive ear in Budinich, himself an excellent mathematical physicist and very influential in his home town of Trieste. The city of Trieste offered to provide a building and give some amount for support. Then Salam took his proposals to various possible donor countries to get more support for the programmes. The Centre was started in 1964 with Salam as Director and Budinich as Co-Director. With Salam's tireless efforts funds kept on getting arranged and new programmes kept on being started. However much he achieved for it, he never rested on his laurels but kept on striving for more. The Centre went on from one financial crisis to another, yet always expanding in its programmes, its faculty, its staff, its activities and its holdings. The Centre that was expected to be stillborn not only survived but thrived. Nor were the promises misplaced. When Salam died the tradespeople of the City of Trieste insisted that the Centre be officially named the "Abdus Salam International Centre for Theoretical Physics" — Salam's centre!

Many people have many stories to tell of what role the centre played in their lives. I will tell you mine. I returned to Pakistan immediately after completing my Ph.D. in 'Relativity' in 1971 at the age of 24 and

a half. There was only one other relativist, who had obtained his Ph.D. under the same supervisor that I had, Roger Penrose. He had come from the University of Karachi and then gone to Libya. As such, at that age I faced the isolation that Salam had talked of that he faced at a very young age. I was fortunate enough to join the University of Islamabad (now Quadi-i-Azam University), which had many ex-students of Salam, one of whom (Muneer Rashid) arranged for me to visit ICTP in 1972 to attend a course on 'Complex Analysis'. There I got all the benefits that Salam had told the International Atomic Energy Agency (IAEA) about, breaking isolation by meeting top scientists from around the world, getting an opportunity to do some research and to learn new subjects in great depth, as well as learning to think for myself. I did not have an opportunity to go for a postdoctoral fellowship but my association with ICTP served the same purpose. The world was open for me to get what I wanted. I went again in 1975 for a course on Systems Analysis and was fortunate enough to also attend the first Marcel Grossmann Meeting on Recent Developments in General Relativity, which was held at

First Marcel Grossmann meeting on general relativity, ICTP, Trieste, and Istituto di Fisica Teorica, University of Trieste, 7-12 July 1975
(Source: ICTP Photo Archives)



An autographed picture of John Archibald Wheeler with a young Asghar Qadir (1980)

ICTP. That gave me egress to the world community of relativists. I had earlier been familiar with the London community and had some contact with those in Cambridge, but had later lost touch while I was in Pakistan. It was this that allowed me to actually start my career as a relativist.

In the process, I kept on getting the opportunity to learn new subjects by attending courses on all sorts of subjects at the ICTP. This allowed me to grow not only as a physicist and a mathematician but as a scientist. I had always been interested in many other fields and had done some work in Economics and on the History and Philosophy of Science. I got a chance to attend a course on Mathematical Economics in 1978, interact with the international community of economists, and meet many scientists with views on the Philosophy of Science. Both the contacts and the courses served me in good stead for further development of my career.

Salam was a missionary for Science, with the missionary zeal for proselytizing. He could be extremely convincing and once he had got "his claws in" he could be ruthless about his demands on what one had to do. He did that to me. He started early in my contact with him and said that we had to do more to ensure that people from Pakistan could benefit from the ICTP. If we did not, we would find ourselves cut off as well. When he pushed on it, I said "You do not realize how difficult it is to work in Pakistan and get anything done there." His response was typically Salam: "Do you think it was easy to get this

The Abdus Salam Memorial Meeting held at ICTP, Trieste, Nov.19-22, 1997; (L to R) Saeed A. Durrani, Asghar Qadir (speaking) and Imran Saadi. (Source: ICTP Photo Archives)

Centre? Do you think it is easy to run it? Where do you think the money comes from?" I felt so small. Never again did I try giving that type of excuse to him — nor to anybody else — nor even to myself. Thereafter, I decided there would be no excuses. There is either success or failure, and failure was not an option. For the rest of my life, I have been infected by the same zeal. I am not so effective in influencing others but the zeal is there.

One of the many indirect benefits achieved by the ICTP has been that scientists from antagonistic countries meet each other and learn to see the other countries with friendly eyes. It negates the demonizing that the media and leadership of each country engage in. As such, it is very powerful force for engendering world peace. This aspect of ICTP has been remarked on by many scientists from India and Pakistan (and other countries).

The overwhelming success of the ICTP has led to establishment of

Prof. Asghar Qadir alogwith Prof. Riazuddin, the founder Director of NCP, on the terrace of the Main Building (Leonardo Da Vinci) of AS-ICTP, Trieste (August 2012)

various centres being developed in Third World countries. In Pakistan, among others, it led to the International Nathiagali Summer Colleges in Physics and Contemporary Needs, and setting up National Centre for Physics in Pakistan, which was headed by my close friend and renowned Pakistani physicist, Prof. Riazuddin, as its founder Director. It has led to much greater efforts to take the Third World scientists to first World countries, who then go back to develop science and technology in their home countries. The impact gets multiplied down the generations and has led to an exponential increase in scientific activity around the World. Since the word salaam means 'peace' in Arabic, I had said that the literal meaning of Salam's name is 'servant of peace' and I felt that it could have been a more apt addition to the centre's name. In that sense, ICTP — Salam's centre — should be dubbed "the house of peace". To me it has been the means of my survival and development as a scientist, a house of wisdom and a house of peace. Long may it flourish and grow.

50 Years of AS-ICTP – Some Reminiscences

M. Zafar Iqbal
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Introduction

It is amazing to notice how fast does time go – it is hard to believe that AS-ICTP, which started off as ICTP back in 1964, has already completed half a century, leapfrogging from the 20th to the 21st Century. But then again, haven't I myself grown from a young man of 27 years, when I made my first ever visit to this outstanding international institution in 1976, to an over 66 year old, greying, balding and aging man, already retired from his primary institution of employment (the Quaid-i-Azam University) after close to 40 years of active service. Hard to believe all this, isn't it?

Interaction with Prof. Salam

As far as I remember, it was at the ICTP in 1976 where I had my first ever face to face meeting with the great Professor Abdus Salam, to whom the AS-ICTP now deservedly owes its first two initials. I was there to participate in the Winter College on Condensed Matter Physics among many other Pakistani scientists from the universities and research organizations, like PINSTECH. Yes, I remember how

he used to make sure he gave audience to every single visiting scientist in country-wise and region-wise group meetings, in the meeting room next door to his office, to ensure he had first-hand view of the problems of research in their respective developing or under-developed – truer to the open spirited terminology of those times – countries. These groups spanned nationals from as far as Indonesia and other developing countries in the far-east to the Spanish and Portuguese speaking scientists from Latin America, through the Arabic, Swahili and French speaking ones, among others, from the African continent. Every one of us knew that he was more familiar than most of us with the painful experience of sustaining oneself in research, an essential element of academic life, while struggling not to succumb to the isolation syndrome, largely prevalent among scientists in the Third World – the very *raison d'etre* that drove him to his dedicated struggle for and ultimate achievement of the target of creating ICTP, to break this isolation. He would, nevertheless, delve deeply into updating his knowledge of the current state of the direly needed state patronage and financial input, or lack thereof, that the development of Science and Technology warranted in these countries, through such meetings with the younger scientists from the Third World. He made it a point to advise and, at times, even admonish these visiting scientists to spare time and energy to struggle to persuade and, if need be, push their respective governments back home to increase the share of their GDPs spent on education and research to something like 3 percent, through collective action, besides their own academic pursuits. In the one-on-one meetings with him, for which he generously devoted his time, particularly for scientists of Pakistani origin, I believe - although those from other countries were also never disappointed, if they wanted to meet him in his office – this admonishing trait of his took on a particularly stronger turn. I must admit I was perplexed once or twice during such meetings, in which he would start off the conversation by asking what I was doing (back at my institution) and I would start describing my own research

interests and he appeared to lose interest and interrupted to inquire what was I doing on the 'development of science' front, a subject far more dear to him than somebody's own research. It took me more than one meeting with him on subsequent ICTP visits to realize what he really meant whenever he nonplussed me with the innocent, simple question "what are you doing (back home)?"

ICTP and Experimental Physicists

Although there was a majority of experimental physicists among us at that College, we got to realize that somehow, given the term 'theoretical physics' in the name of ICTP, it was (wrongly, in our opinion) interpreted to bar the experimentalists from activities such as the annual summer workshops in theoretical condensed matter physics at the Centre. We also realized that the possibilities of involvement of such visiting scientists in the experimental research facilities (outside the Centre) in Italy and possibly in the rest of Europe, using the usual financial support from the Centre, were rather limited, if not non-existent. On bringing these points up in discussions with Prof. Salam, we were referred to the Deputy Director of ICTP, Prof. Paolo Budini (Budinich, later in his life) for possible concrete action. These rounds of discussions not only with Dr. Budini, but also with other leading scientists then available at the Centre, including Prof. John Ziman, head of the Condensed Matter Physics (CMP) Committee of the ICTP and Prof. G. Chiarotti, Prof. F. Bassani and Prof. A. Frova, among lecturers at the College from the University of Rome La Sapienza, finally led to the following changes favourable to the experimentalists:

i. Summer Workshops in Theoretical Condensed Matter Physics were opened to interested and qualified experimentalists.
ii. The Italian Labs Program was expanded and strengthened to enable far more experimental physicists and Materials Scientists visiting the Centre to benefit.

I felt particularly gratified that these efforts on our part and the openness of the ICTP administration bore fruit in bringing about these changes with important future consequences for the experimental scientists, who suffered not only from the isolation, in common with the theorists, but also from the limitations of severe financial constraints of the developing countries in pursuing their research goals.

Link as ICTP Associate

Later on, I was awarded the Associateship of the ICTP for two consecutive terms of 6 years each, under which my last visit to the Centre took place in 1990, when the first Iraq war was going on, I clearly recall. Many things changed at the ICTP during those years, including the establishment of the accelerator lab, Elettra, a major lab facility up on the hill above Barcola, an indispensable bus stop for change of buses to the Trieste town centre, where most visitors to ICTP often bumped into one another, either while shopping for grocery etc or dining out over the weekends. A laboratory in High Temperature Superconductivity (HTS) was set up at the Adriatico Building soon after the landmark discovery of 1986, under the leadership of an Italian physicist, Dr. Matacotta, where I also had the opportunity to work during a summer visit.

Contacts at and through ICTP

My meeting and interaction with Erio Tosatti, Michele Parrinello, Roberto Car – the latter two now famous for their pioneering 1985 paper "Unified Approach for Molecular Dynamics and Density-Functional Theory", the basis of the celebrated Car-Parrinello Method – Prof. Mario Tosi, well known for his seminal theoretical work on liquids and the very humble, gentleman physicist, Prof. Franco Bassani, responsible for grooming generations of the finest Italian researchers in Theoretical Condensed Matter Physics, some

Symposium on Frontiers in Condensed Matter Physics, ICTP, Trieste (Italy), 11-13 August 1990, held in Honour of Prof. Stig Lundqvist's 65th Birthday

Some of the well-known distinguished visitors, including the Nobel Laureates, and permanent members of the ICTP (e.g., Erio Tosatti, 2nd from right in the seated row) can be easily recognized. The author can be seen second from left in the row sitting on the floor of the Adriatico Building Terrace

of the outstanding Italian theorists in Condensed Matter Physics, whose association I fondly cherish, would not be possible without my link with the ICTP. Similarly, getting to meet and know the highly esteemed scientists like Prof. Stig Lundqvist, the famed Swedish theorist and head of the CMP committee of ICTP after John Ziman, and meeting the Nobelists Prof. J. R. Schrieffer and P. W. Anderson from the US are among some of the memorable highlights of my visits to the ICTP. One of the most engaging lecturers I have ever had the occasion to listen to, was one of the early pioneers of the field of superconductivity in the pre-HTS era, Prof. B. T. Matthias, from the University of California, La Jolla, California, USA. I often found myself reproducing his impressive remark on having a thorough command over the periodic table of elements: "I do not accept anyone as a solid state physicist, if he/she does not remember the

Symposium on Frontiers in Condensed Matter Physics, ICTP, Trieste (Italy), 11-13 August 1990, held in Honour of Prof. Stig Lundqvist's 65th Birthday

(L to R): H. Rohrer, P.W. Anderson, Abdus Salam (Director, ICTP), Stig Lundqvist, Paolo Budinich (Deputy Director, ICTP) and J. Robert Schrieffer

periodic table by heart!", before my students whom I lectured on solid state physics later in my life. His command over the subject and inimitable style of delivery, I found simply riveting. Listening to talks by luminaries like the Nobelist, Prof. Heinrich Rohrer, one of the inventors of the scanning tunneling microscope, Prof. Klaus von Klitzing and Horst Stoermer, the German and German/American, Nobel prize winners for the Integral and Fractional Quantum Hall Effect, respectively, at the ICTP has been among abiding joyful experiences of my life. Meeting the Russian physicist of repute, Prof. Vitaly Ginzburg (of the Ginzburg-Landau Theory of superconductivity repute), soon after the discovery of the high temperature superconductivity and having a convivial chat with him in the ICTP bar is an equally stimulating memory of my visits to ICTP. Prof. N. H. March and Prof. Paul Butcher from the UK were also among the prominent condensed matter physicists I came to know well through meetings at the ICTP. No less exciting have been the

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Salam and Lundqvist on the Adriatico Terrace
The two neckties casually hanging around his neck were presents to Prof. Lundqvist from some of the speakers and his ex-students present on the occasion. Prof. Salam already needed the support of a stick for comfortable walking, as seen in this picture.

many acquaintances and friendships fostered through informal meetings and chats with any number of visiting scientists from the Latin American countries, Asia and the Middle East. Those who stand out among these are the very amiable Prof. Ganapathy Baskaran from the Institute of Mathematical Sciences in Madras (now Chennai), India, Prof. Mehmet Tomak, of the Middle East Technical University, Ankara, Turkey, Prof. Laila H. Abu Hassan of the University of Jordan, Amman, and some others from Brazil and Argentine.

Exposure to New Ideas

Apart from benefitting from the interaction with so many scientists from both the industrially developed world and the third world in the melting pot that ICTP has been and will continue to be, exposure to numerous new ideas and branches of physics has been of great value to my growth as a professional physicist and a teacher of physics. Example of such a hitherto unfamiliar idea for me was the interesting field of soliton physics within the framework of non-linear phenomena, which has wide ranging applications in the real world, involving mostly non-linear interactions. My exposure to this novel idea came through a lecture series I happened to have attended at the ICTP during my first visit. Later, this interest resulted in the publication of two research papers in Physical Review B in conjunction with two colleagues at my home university, at least one of whom had a similar exposure to the field through one of his summer stays at the ICTP.

Concluding Remarks

All in all, it is fair to say that the AS-ICTP has faithfully served its original purpose, as conceived by its founder, Prof. Abdus Salam, insofar as it has successfully bolstered a large number of scientists from the third world in sustaining their research activities at their home institutions, after being fired up by interaction with their peers from the developed world, leading quite a few of them to otherwise unreachable heights in their respective fields of study. My only regret is that during the last decade or so, I came to learn through my e-mail communications with Prof. Sreenivasan, the first Director after Prof. Salam passed away, and his junior colleagues that sadly the Senior Associate position (mostly opted for by the third world scientists close to their retirement) to maintain their scientific link with AS-ICTP had been limited to theorists only. To me it appeared like the story of experimentalists going back full circle, since our

original massive struggle of the 1970s. Prof. Sreenivasan, who is an experimental physicist himself, was very sympathetic to the idea, but somehow could not manage to reverse this decision of the relevant committee in spite of our sustained dialogue on the subject. In the event, of course, he completed his tenure at the AS-ICTP and I superannuated beyond the age limit of 65 years for that position and everybody lives happily ever after. Meanwhile, I learnt at the same ceremonial meeting of the Pakistan Chapter of the AS-ICTP from some junior colleagues that they have been accepted as senior associates in spite of being experimentalists – I am glad to learn that, if indeed it heralds a change in rules, not just representing a few individual cases, where, apparently, the rules may have been relaxed.

Glimpses of the ICTP 50th Anniversary Ceremony held at CIIT, Pakistan

Prof. Dr. Fayyazuddin, National Distinguished Professor, National Centre for Physics, Islamabad, Pakistan

Dr. N.M. Butt, Chairman, Preston Institute of Nano Science & Technology (PINSAT), Preston University, Islamabad, Pakistan

Prof. Dr. G. Murtaza, Visiting Professor,
Quaid-i-Azam University, Islamabad, Pakistan

Dr. Abdullah Sadiq, Dean, Faculty of Basic and Applied Sciences,
Air University, Islamabad, Pakistan

Prof. Dr. Asghar Qadir, Professor, Department of Physics, School of Natural Sciences, National University of Sciences & Technology, Islamabad, Pakistan

Prof. Dr. Saleem Asghar, Eminent Professor, Department of Mathematics, COMSATS Institute of Information Technology (CIIT), Islamabad, Pakistan

Prof. Dr. M. Aslam Baig, Distinguished National Professor, National Centre for Physics, Islamabad, Pakistan

Dr. Hamid Saleem, Professor, Institute of Space Technology, Islamabad, Pakistan

Dr. Arshad Saleem Bhatti, Dean Faculty of Sciences (Dept. of Physics)
COMSATS Institute of Information Technology (CIIT), Islamabad, Pakistan

Dr. Kashif Sabeeh, Associate Professor, Department of Physics,
Quaid-i-Azam University, Islamabad, Pakistan

Dr. Jamila Bashir Butt, Assistant Professor, Department of Physics, COMSATS Institute of Information Technology, Islamabad, Pakistan

Dr. I.E. Qureshi, Executive Director COMSATS, Islamabad, Pakistan

Eminent Speakers, Participants and Guests of the event

Some participants of the ceremony

The Way I Saw ICTP and Prof. Abdus Salam

M. Aslam Baig
Distinguished National Professor
National Centre for Physics, Islamabad, Pakistan

We are celebrating the 50th anniversary of The Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, commonly known as AS-ICTP. We all know that it was established way back in the early sixties by Prof. Abdus Salam, the only Nobel Laureate from Pakistan, and an icon of pride for the Nation. This Centre is located near a beautiful castle, Miramare, on the coast of Mediterranean about ten kilometers from Trieste, a small town on the border between Italy and former Yugoslavia. This Centre is an emblem of science education that has been playing a vital role for the career-building of a number of researchers from the developing countries, and I am one of them. It was Prof. Salam's vision to provide a platform for the scientists working in the developing countries, where they can interact with eminent scientists and subject specialists from the developed countries. In my opinion, he has been very successful in delivering his ambitious message to the world, and breaking the isolation of the scientists working in the developing countries. I have had a very long association with ICTP and Prof. Salam spread over a period of about twenty years, and will try to cherish my unforgettable memories here.

Prof. Abdus Salam, Nobel Laureate, Founder and Director of the ICTP

Prof. Salam was not only popular in Pakistan but he was also famous world over for his revolutionary achievements in the field of Particle Physics. In Pakistan, he held key positions in the country as an Advisor to the President of Pakistan. Subsequently, he became Professor of Theoretical Physics at Imperial College, London. I never got a chance to meet him in Pakistan while he was serving at the Government College Lahore, but I heard a lot about his achievements and reputation in the scientific world. In 1975, I was doing my M.Phil at the Karachi University, where I saw an advertisement about the 'International Winter College on Atomic, Molecular and Laser Physics' organized by ICTP. I was doing research in the field of Molecular Spectroscopy under the supervision of Dr. M. Rafi and Dr. M. Aslam Khan, and we had managed to get our first paper accepted in the Journal of Atomic and Molecular Physics in UK. Dr. Rafi encouraged me to apply for attending this college, which I did without any hope of acceptance. After a couple of months, I received an invitation letter along with some literature about ICTP, a small booklet containing some commonly used words of Italian language and information about the winter climate of Trieste. This was the happiest moment of my life as I was to go to Italy, interact with the top scientists in my field of research and above all, have my dream come true for meeting Prof. Abdus Salam.

It is a long story how I got the 'No Objection Certificate' (NOC) from the Ministry of Education, Government of Pakistan, and completed

other unnecessary formalities to go to Italy, but the day I entered ICTP, all my strenuous efforts were over. I was very well looked after by the local staff for Housing, Finance and Travel, etc. It was a completely new world for me where I experienced cold weather, cultural varieties, different eating habits, and, above all, a platform reflecting a galaxy of Nobel Laureates, renowned scientists and young researchers in the quest of knowledge. How can I forget the lectures by these towering personalities who had done miracles in science to built the subject of Physics. It is indeed a different feeling when you dream of seeing persons who have written innovative research papers and books, and here you are talking to them face-to-face.

One day, I received a message during the proceedings of the college that Prof. Salam will meet all the Pakistani participants. I was overjoyed to have my very first meeting with Prof. Salam. I found him a very composed and reserved person who spoke very little but was eager to listen to his fellow countrymen. He started asking us, one by one, the aim of our visit to ICTP and our current research activities. On my turn, I explained my motives of visiting ICTP and also told him about the research paper on molecular structure that we got published in Journal of Physics. B: Atomic and Molecular Physics, a reputed journal published by Institute of Physics, UK. Prof. Salam appreciated my work which gave me a lot of confidence and encouragement. During this meeting, I realized that Prof. Salam was very focused and targeted on the subject. He was very comfortable and deeply interactive with those who talked on the specific issues of science but he always avoided to interact with those who just wanted to meet him for pleasure. Before meeting him, I had an impression in my mind that 'he is a Pakistani and will behave like a usual Pakistani'. But after meeting him, this impression was over in a fraction of a second. After interacting with Prof. Salam, I soon found out that he is a man of great vision, full of ambitions and a God-gifted super human, and above all was worried about science in

Winter College on Lasers, Atomic and Molecular Physics : ICTP, Trieste, 21 January-22 March 1985; Group photo with Prof. Salam (Source: ICTP Photo Archives)

the Muslim World, and particularly in Pakistan.

During my three-month stay at ICTP, I met Prof. Salam a number of times. For lunch, there was a table reserved for him at the corner of the cafeteria where he used to dine with the College lecturers; however, to meet him one had to get an appointment from his office. One day, I got a message that Prof. Salam wants to have a meeting with me. I was frightened that I might have done something odd, but when I went to his office I got a very kind welcome. He wanted to know about my future plans and if I had any desire to visit any laboratory around. I was not at all prepared for such an unexpected generous offer. In those days, I was following the research papers of the group of Prof. Stig Lundqvist in Sweden, Prof. M. Ginter from Maryland, USA, and Prof. Jones from National Research Council of Canada (NRCC). I told Prof. Salam about my interest in visiting Sweden to do some experimental work in my field of research. To my surprise, one day I got all the arrangements made by the ICTP

authorities – a return air ticket, financial support for two-week stay and an acceptance letter from Prof. Lundqvist. This sympathetic act and good will gesture of Prof. Salam changed my earlier impression about his stiff attitude, and after that I felt more comfortable talking to him. After spending two weeks in Sweden, I came back to ICTP, and went to Prof. Salam to thank and brief him about my visit. My stay in Sweden was not as successful as I had been expecting but I learned some good experimental techniques to generate short lived molecular hydrides. During this meeting, Prof. Salam inquired about my plans for Ph.D. I replied in positive provided I get some financial support. Prof. Salam made another offer, which I think was only due to my luck. He asked me to contact different institutions and gave me the permission to write his name as a reference. I immediately wrote to different institutions and also mentioned that I am a "Guest Scientist" at ICTP. Actually, we were provided some ICTP letter heads for correspondence with the words "Guest Scientist" printed on them. In response, I got offers from well reputed Professors, such as Prof. Bates from Belfast, Prof. Innes from Binghamton, Prof. Jones from Canada and Prof. Garton from Imperial College London. I cannot express how fortunate I was feeling to have so many options for my future prospects. I showed these letters to Prof. Salam and in response he just asked my impression about Imperial College. Deep inside, I also wanted to join Imperial College because Dr. Aslam Khan did some experimental work at Imperial College London that made a good impression on Prof. Garton that was reflected in his acceptance letter. Thus, I decided to join Imperial College with a wishful thinking to have sustainable contacts with Prof. Salam. The day I was leaving for London, my brother, Abdul Sattar, gave me fifty thousand rupees so that I could spend the first few months comfortably. In those days, it was officially allowed to carry only 34 US$ while travelling abroad. However, the day I arrived at Imperial College London, I was given a cheque to cover my travel expenses and an advance of one-month scholarship.

Winter College on Atomic and Molecular Physics, 9 March to 3 April 1987, Trieste, Italy (Source: ICTP Photo Archives)

My first three months at Imperial College London were the most crucial in paving the way for my future career. I worked very hard, from early mornings till late nights and even during the weekends. Prof. Garton used to visit the College on the weekends to check his mail but I think he was also monitoring the activities and involvements of his research students in scientific and academic activities. I was assigned a job to calibrate a three-meter vacuum spectrograph, for which I was using three light sources to generate sharp spectral lines of iron and CO. Here I would like to mention that my experience of working in the Spectroscopy Laboratory at Karachi University proved to be very useful. One day, I showed the spectrum of iron to Prof. Garton and also told him the wavelengths of a sharp triplet. Prof. Garton looked at me and asked how I knew those wavelengths by heart. I told him that we had been using these sharp lines as reference wavelengths to calibrate the absorption spectra of other free radicals. Prof. Garton was impressed and directed me to set up a laboratory at the Synchrotron Radiation Facility of Bonn University, Germany, to do high-resolution

absorption spectroscopic studies of atoms. During my stay at Imperial College, I also met Prof. Dr. Connerade, a very energetic and dynamic young faculty member who was on holidays in France when I joined the College. On his return he visited the laboratory where I had been working and started discussing the future program although it was our first meeting. I am sure he was well briefed by Prof. Garton. He was very friendly and invited me to visit his family a number of times and soon we became family friends. I was more comfortable talking to Dr. Connerade than to Prof. Garton, as the later spoke in an accent of ancient English that was hard for me to understand. Eventually, I was registered as a Ph.D. student under the supervision of Dr. Connerade. Before joining Imperial College, I had five published research papers to my credit, and Prof. Garton acknowledged it by saying, 'just get involved in research work and forget about the other formalities'. It was again a matter of luck and prayers of my parents that I was appointed as a Research Assistant at Imperial College London but was also permitted to work at Bonn University, Germany, with an additional incentive of Foreign Service Allowance; which was admissible for the British Forces working in Germany. I think Prof. Salam was constantly monitoring my activities at Imperial College, and subsequently, at Bonn University. During this period, I visited ICTP almost every year, and kept my contacts alive with Prof. Salam.

Let me quote an incidence about Prof. Salam's mind-set. One day a Pakistani was visiting London, he came to me and showed his desire to see Prof. Salam. I told him that he was a busy person and had hardly any time for such meetings, but he still insisted to meet Prof. Salam. I called his secretary and luckily I got a message that Prof. Salam has given us an appointment. When we entered his office, Prof. Salam asked about the purpose of our meeting. The man said he just wanted to pay Salam (salutations) to him. Prof. Salam repeated his question, but the man gave the same reply. On this, Prof. Salam shook his hand and said, '*Salam ho gia, bus; Aap Ja Saktay*

Winter College on Atomic and Molecular Physics: Photon Assisted Collision in Atoms and Molecules, 30 January to 24 February 1989, Trieste, Italy (Source: ICTP Photo Archives)

hain' (meaning, I accept your salutation and you may go now). The man was surprised over the unexpected response of Prof. Salam. I told him later that Prof. Salam did not like formalities, and loved to see those who came with some specific scientific objective and focused research programmes.

Prof. Salam's love for Pakistan was beyond any doubt. I would like to share another occasion when some scientists from Pakistan visited him at ICTP. During the discussion, Prof. Salam asked a senior scientist about his mission there. He replied nothing specific except: "*Kuch daikh dakh kar kuch kar kra lain gay*" (meaning: I would look around and manage to do something). On these remarks, Prof. Salam got furious and said, "*Aik third class scientist aik third world country say aa kar yeh jawab day raha hay*" (meaning: a third class scientist from a Third World country is answering in this vague manner). He further remarked, "What a waste..... you should not

have been selected, rather someone else might have benefited from this institution". All this shows how much concerned Prof. Salam was about the development of science in Pakistan and to respond to the needs of Pakistani researchers in a befitting manner.

In 1979, Nobel Prize was announced for Prof. Salam and I went from Bonn University, Germany, to participate in the celebration at the Imperial College London. I congratulated Prof. Salam and told him that I had completed my Ph.D and also won the Alexander von Humboldt Foundation Fellowship (the most prestigious German Fellowship) to continue working at Bonn University under the collaborative venture between the Bonn University and the Imperial College. He encouraged me to keep working with dedication and commitment to pave the way for other Pakistanis to benefit from this facility in Germany. We did a lot of work on the inner shell excitation; double excitation and autoionization in atoms and molecules; and published a number of papers in scientific journals of international repute. One day, I took the absorption spectrum of Xenon at the highest resolution spectrograph that we commissioned at the Bonn Synchrotron Radiation Facility and showed it to Prof. Wolfgang Paul, Director of the Physikalisches Institute, Bonn University, who later got Nobel Prize for developing Paul Trap. He was so fascinated by the spectrum that he asked me for its bigger picture that he later hanged in his office. With pride, he used to tell the visitors that was the spectrum taken by our researcher at the Bonn synchrotron radiation facility, which was a matter of great honor for me.

In 1985, Prof. Salam advised me to return to Pakistan and to establish a laboratory on experimental Physics. It was more than ten years of my stay in Europe and I was gaining a good reputation among the Atomic Physics community, but for me Prof. Salam's suggestion was an order to be obeyed. I asked Prof. Salam about how to proceed. His reply was, "just relax and wait". In the meantime, he wrote letters of recommendation to the Vice Chancellors of different

universities in Pakistan highlighting my credentials and achievements. I realized it when I received many job offers: viz., Professorship from Prof. Tahir Hussain, Vice Chancellor, Azad Jammu and Kashmir University; Associate Professorship at the Baluchistan University; Assistant Professorship at Karachi University; and Assistant Professorship at the Quaid-i-Azam University (QAU), Islamabad. An interesting offer was from the Vice-Chancellor, QAU, Prof. Shaikh Imtiaz Ali, who offered the position of Assistant Professor at the maximum of Basic Pay Scale-18, with an indication that this is the maximum he could offer at the time but also promised that he would be advertising the post of Associate Professor in Physics soon. Indeed, he fulfilled his promise and sent me the advertisement before my departure from Germany. What a man of commitment he was; I respect him a lot. I showed these letters to Prof. Salam, who suggested that I should join QAU. Prof. Salam remarked that QAU would be an ideal place for me to work as it was dominated by Theoretical Physicists at that time and it would be an achievement to establish a high grade experimental facility there. At the same time, my selection as an Associate of ICTP helped me further to keep visiting Europe and my research group in Germany.

I joined QAU, Islamabad, in 1986 and immediately started to work on establishing the Atomic, Molecular and Laser Physics laboratory at the Department of Physics, Quaid-i-Azam University, Islamabad. I would like to mention Prof. Denardo who was incharge of the Office of the External Activities at ICTP, with whom I had very cordial friendship. He helped me a lot at the initial stages to set up the Laser Spectroscopy facility at QAU. Although I was yet unknown within the Pakistani science community, the supporting letter from Prof. Salam very soon made me high-flying to the authorities in the scientific and academic circles in Pakistan. Here, I would also like to mention the valuable financial support by Dr. Ishfaq Ahmad, the then Member (Technical), Pakistan Atomic Energy Commission

(PAEC) to procure baseline equipment for the Laser Spectroscopy laboratory. Dr. Ishfaq Ahmad later became the Chairman PAEC, and continued his support for the up-gradation of this facility at QAU for the benefit of postgraduate researchers. In addition, I was supported through Dr. Nisar Ahmed, Head Applied Physics Division at the Pakistan Institute of Nuclear Science and Technology (PINSTECH) to purchase the first Laser for my laboratory. This valued financial help, together with support from Pakistan Science Foundation, University Grants Commission (now known as Higher Education Commission - HEC) and other R&D organizations, enabled me to establish the facility to perform research work that gained international recognition. The major addition of equipment in the Laboratory was made during the tenure of Dr. Atta-ur-Rahman (the then Chairman HEC) under the programme "Strengthening and up-gradation of laboratories in Pakistani universities" as well as indigenous Ph.D programme. I benefitted a lot from these initiative of Higher Education Commission (HEC) of Pakistan.

Prof. Salam continuously followed my scientific activities and research progress in Pakistan. Once he asked me about my feeling after returning to Pakistan, and if I were satisfied by the achievements in this country. My answer was "certainly" and "no regrets". I was so lucky to have started my scientific career as a participant in the 'Winter College on Atomic, Molecular and Laser Physics' at ICTP. Later, I was invited at ICTP to deliver series of lectures at the 'Winter College on Quantum Optics' (3 - 21 March 1997), 'Winter College on Spectroscopy and Applications' (8 - 26 March 1999), and Winter College on Spectroscopy and Applications (19 February – 2 March 2001). Based on my substantial research contributions, I was awarded the 1987 Gold Medal (Physics) by the Pakistan Academy of Sciences (PAS). Later, I was awarded with prestigious Civil Awards namely, *Tamgha-i-Imtiaz* (Science) in 1993 by Mr. Ghulam Ishaq Khan, President of Pakistan; *Sitara-i-Imtiaz* (Science) in 1999 by Mr. Muhammad Rafiq Tarer, President of

Pakistan; and *Hilal-i-Imtiaz* (Science) in 2009 by Mr. Asif Ali Zardari, President of Pakistan.

The laboratory I established at QAU is now well-known internationally and we have made significant contributions in measuring the highly excited Rydberg levels of atoms; measurements of the photoionization cross sections from the excited states of atoms; laser isotope enrichment of lithium-6; laser-induced breakdown spectroscopy for the elemental composition analysis. From this laboratory, about thirty (30) students earned their Ph.D. and about seventy (70) M.Phil degrees, and the work in this laboratory still continues with the same zeal and output. It was Prof. Salam's desire to have a world class Laboratory in Pakistan and I have tried to come up to his expectations. It is up to the scientific community of Pakistan to judge whether Prof. Salam's decision to establish a laboratory at QAU in Pakistan was in the direction to reflect his love for this country.

I owe a lot to ICTP and Prof. Salam, in particular for what I have achieved from visits to this prestigious institution established by the Pakistani Nobel Laureate. Interestingly, Prof. Salam wanted to appoint working scientists as Chairmen of the Pakistan Science Foundation, University Grants Commission, and Vice-Chancellors of different universities in the country. He was always encouraging us to write in the newspapers for public awareness and make efforts to enhance the budget for education, at least to a level of 5% of the GDP.

My last meeting with Prof. Salam was in 1994-95 at ICTP. Prof. Denardo, Head of the External Activities at ICTP told me that Prof. Salam was enquiring about me. I immediately rushed to his office for an appointment. To my surprise, Prof. Salam immediately let me in. I was shocked to see his physical condition, he was leaning on a chair and could barely speak as he was suffering from the

Parkinson's disease. He offered me a cup of coffee which I accepted. Even in this condition, he started enquiring about the status of science and research in Pakistan as he was always worried about it. He touched upon almost every field, including political situation, working environment, education, science and technology. During the meeting, he had difficulties to join his words due to his bad health. For me it was very painful to see Prof. Salam in this state. After an hour-long meeting, I asked for his permission to leave but he signaled me to remain seated. I tried to beg his permission a couple of times after that but his response was the same. Normally, Prof. Salam would not give a visitor more than five minutes. After a couple of hours, he asked his attendant to help him stand. With his help he walked up to the door then he just hugged me, and again started talking about the status of science in Pakistan. I could feel his tears pouring on my clothes, which made me emotional too, as even I could not stop mine. His last words of advice to me were, "Science of Pakistan is now in your hands". Here, he meant the relatively young generation. I left his office with my eyes full of tears and sympathies for the shattered man who ruled the scientific world for decades and was then helpless but still full of affections and love for his beloved country, Pakistan.

It was the core objective of Prof. Dr. Abdus Salam to break the isolation of scientists in the Third World Countries, especially the scientists from Pakistan, from those working in the developed countries. Development of conducive academic environment and scientific culture in Pakistan was his top priority. In my opinion, the best way to pay tributes to Prof. Abdus Salam is to establish a high grade research Centre in Pakistan which is restriction-free and open to all, like ICTP, and where foreign scientists can come freely and our researchers can have direct interaction with them. The National Centre for Physics (NCP) is a very good platform to fulfill this purpose provided it follows the footsteps of AS-ICTP. The scientific community of Pakistan is very committed and the nation

on the whole is very vibrant. Given the right direction and a suitable platform, it can flourish and excel fast. Only this way, the dream of Prof. Salam can come true.

AS-ICTP as Seen by a Mathematician

Saleem Asghar
Eminent Professor, Department of Mathematics
COMSATS Institute of Information Technology
Islamabad, Pakistan

It was 1974 when I first heard that some of our friends from Pakistan Atomic Energy Commission (PAEC) were travelling to Trieste, Italy, to attend a course at International Centre for Theoretical Physics (ICTP). At that time, I was registered as a Ph.D. student at the department of mathematics, Quaid-i-Azam University – the then Islamabad University. I was familiar with the Centre, being a student of Prof. Muneer Rashid who was a Theoretical Physicists of great caliber. Prof. Rashid had a close association with Prof. Abdus Salam, as he had been his Ph.D. student at Imperial College, London. I thus became greatly enthusiastic about ICTP, which is now Abdus Salam International Centre for Theoretical Physics (AS-ICTP).

At that time, travelling abroad was considered to be a great opportunity both socially and academically, particularly to international centers like AS-ICTP. It was more so for the graduates like me undertaking doctoral studies in Pakistani universities. In those days, Ph.D. graduates were mostly from England, America and Germany, etc. I may mention that I was the third person to complete Ph.D. from Pakistan in Mathematics and perhaps the sixth in any field in the entire country. After graduating in 1975, I always

desired to visit AS-ICTP. All through those years, I had the feeling of deprivation in the sense of not being able to attend a university in the First World.

The breakthrough came in 1985, when I was invited to AS-ICTP to attend a workshop on applied mathematics. It was a short stay of around a month. The real turning point came in 1986 when I was offered a position of visiting mathematician at the Centre. Until that time, during the preceding about ten years, I had only three publications and that too from my Ph.D. thesis. It was during my stay in Trieste that I published one paper as single author in a very prestigious journal, 'The Journal of the Acoustical Society of America'.

It was not all about the publication of a paper but the confidence and self-assurance that I got during my stay and the ability to conduct research on my own. Sometimes, it happens that some opportunities enable you to explore yourself and realize your strengths and weaknesses. Likewise, the appointment at the Centre helped me to break my academic isolation, interact with my peers, and avail the best library facilities; just what Prof. Salam envisioned when he established ICTP. My sincere gratitude is due to the great scientist of Pakistan and the AS-ICTP. The AS-ICTP is truly a place where the Third-World scientists get to know each other and develop into future academic leaders not only in their own countries but also the world over. The confidence and the right academic and research attitude that ICTP imparted in me changed my career altogether. Later on, I was awarded Associateship of the AS-ICTP, DAAD fellowship in Germany and Fulbright fellowship in the United States. At home, I was awarded civil awards of *Tamgha-e-Imtiaz (T.I.)* and *Sitara-e-Imtiaz (S.I.)* by the Government of Pakistan. If I had not had that opportunity, I would not have been able to achieve any of this and what I passed on to the next generation. Now I am in a position to feel satisfied and take pride that more than 70 students

have completed Ph.D., either with me or with my Ph.D. students.

This narrative is not about me and my personal achievements, but is a way of paying tribute to the concept and vision of Prof. Salam that led to the creation of AS-ICTP. I attribute my achievements to my honorable and highly respected teachers, Prof. Dr. M.A Rashid, and Professor Abdus Salam; the AS-ICTP; and Prof. Asghar Qadir for encouraging me to continue with my research. I am also grateful to the Rector of CIIT for his visionary leadership in providing me a platform to deliver what little I gained during all these years starting from my visit to the AS-ICTP uptill these late years of my life.

In the end, I would like to add that I look back at the thirty years since I first visited AS-ICTP with a sense of pride and gratitude.

The author with his students from the Department of Mathematics, COMSATS Institute of Information Technology (CIIT), Islamabad (2015)

Role of AS-ICTP in Development of Science and Technology in Pakistan during the last 50 Years

Hamid Saleem
Professor, Department of Space Science
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It is a matter of great pleasure for the scientists of developing countries that Abdus Salam International Centre for Theoretical Physics (AS-ICTP), Trieste, Italy, has completed its 50 years successfully. Director of the Centre, Prof. Fernando Quevedo, invited many scientists from Pakistan to participate in the 50th Anniversary Conference. The AS-ICTP has played an important role in the promotion of science and technology in developing countries with the assistance from developed nations. I attended many plasma colleges, workshops, conferences as Participant, Senior Associate and Speaker in ICTP and noticed that many of the scientists, who were participating in plasma related activities from different parts of the world, wanted to open similar centres in their own countries.

The ICTP has played a vital role in my research career. I met many reputed scientists of the world during my visits to ICTP and it was a matter of great pleasure for me to meet with the people whose books I had been reading in Pakistan. I learnt a lot from the lectures delivered in different plasma colleges, workshops and conferences by the brilliant scientists and experts of the field. My first visit to ICTP was in 1984 and during that time I realized that it was very

hard for me to understand the lectures because my basic concepts of physics were very weak. I was a student of mathematics and physics was a new subject for me. But I appreciate the culture of ICTP where young researchers and students can interact with the well-known scientists, including Nobel Laureates very frankly and can learn as much as they want. It is true that science has no boundaries. I was very happy when I was first time appointed as a Senior Associate of ICTP in 2001 and it is still continued. Later on, I was invited as Speaker in many plasma colleges and workshops, which were mainly organized by Prof. S.M. Mahajan of USA, Z. Yoshida of Japan and P.K. Shukla of Germany.

The ICTP provided me an opportunity to establish research collaborations with many scientists and groups in different parts of the world. In 1995, during a visit to ICTP Prof. Yoshida introduced me to Prof. T. Sato of Japan and it was a great experience for me to work in National Institute for Fusion Science (NIFS), Toki, Japan as a Post-doctoral Fellow (1996-1998) of the Japan Society for the Promotion of Science (JSPS). Through ICTP, I succeeded in establishing collaborations with Centre for Plasma Astrophysics (CPA), K-Leuven University, Belgium, Tokyo University, Japan, University of Texas at Austin, USA and some other research groups.

I sincerely appreciate the efforts of Dr. Imtinan Elahi Qureshi, Dr. Arshad Saleem Bhatti and the support of COMSATS Institute of Information Technology (CIIT) to celebrate the 50th Anniversary of the Abdus Salam International Centre for Theoretical Physics (AS-ICTP). As everyone knows, Pakistanis feel pride when they visit ICTP because this centre came into existence by the vision and efforts of great Abdus Salam, a Pakistani Nobel Laureate in Physics.

A large number of Pakistani scientists have benefited from AS-ICTP including our teachers, colleagues as well as students during the last 50 years. The AS-ICTP has played a very positive role in the

development of research groups in Pakistan, particularly in the areas of mathematical and theoretical sciences. Many experimentalists have also benefited from AS-ICTP because this centre provides assistance to them for training in Italian laboratories. It also provides financial support to its Associates to visit other universities and institutes of the world to conduct high quality research in their relevant fields.

I must acknowledge the role of ICTP in supporting my research and providing assistance to me for developing strong and active groups of researchers at PINSTECH and National Centre for Physics (NCP) in the field of plasma physics. I know several senior Pakistani scientists who did the same. We came to learn about ICTP through our seniors who had been visiting this centre from time-to-time and guiding the research of younger colleagues and students in Pakistan.

Professor Abdus Salam wanted to establish a centre like AS-ICTP in Pakistan, but it could not happen at that time. So it was established in Italy and about 90 percent budget of the Centre comes from the Italian Government while the rest comes from UNESCO and IAEA. Indeed, Italian nation has the right to be proud of their contribution in the progress of science and technology in developing countries.

The students of Professor Salam and senior scientists of Pakistan tried very hard to establish a similar centre in Pakistan and fortunately they succeeded. As a result, the National Centre for Physics (NCP) came into existence formally in 2004. Particularly, the contributions of Dr. Ishfaq Ahmad and Dr. Riazuddin are commendable in establishing this centre. I served for six years as Director General of NCP. It is indeed a matter of pride for me that NCP has been continuously progressing during the past many years. Its progress can be judged by the fact that NCP published 262 research papers in international journals in 2013 and it has collaborations with many international universities and institutes. I

hope the young researchers will continue working with zeal and spirit. The collaboration of NCP with CERN is supported by Pakistan Atomic Energy Commission (PAEC). The first MoU between NCP and ICTP was signed by late Prof. Riazuddin. It has been extended three times during my tenure and I am grateful to the Directors of ICTP, Prof. Fernando Quevedo and Prof. Katepalli R. Sreenivassan in this regard.

38th International Nathiagali Summer College on Physics and Contemporary Needs (2013); Chairman PAEC, Dr. Ansar Parvez giving away shield to a young participant. 1. Prof. F. Quevedo, 2. Dr. B. Suleman and 3. Dr. Hamid Saleem can be seen on Podium

In 2010, I was invited to ICTP to attend the meeting "ICTP after 45: Science and Development for a Changing World" (8-10 November). The ICTP has contributed to fostering scientific research in developing countries throughout the world, and is increasingly looking outward, planning to expand its role further by opening affiliated centres in different parts of the world. This was announced in the opening speech of Prof. Fernando Quevedo in this activity. That invitation led to a personal meeting with him in which I

proposed to affiliate NCP with ICTP and he kindly agreed. He suggested that I should work with Dr. Joseph Niemela, Senior Researcher and Head of Applied Physics, to accomplish this task. Fortunately, Dr. Niemela has a very friendly nature and is a dynamic person. He was very helpful and cooperative. We both worked together to strengthen the links between NCP and ICTP.

Director General NCP, Dr. Hamid Saleem, giving a souvenir to Dr. Joseph Niemela, Head Applied Physics Division, ICTP (2014)

I had initiated a series of scientific activities with the title "International Scientific Spring (ISS)" after joining NCP as Director General in 2008. More than 300 young researchers and many foreign speakers participated in these activities regularly every year since 2009. I had been directing these activities myself for the first few years. Since 2012, both myself and Dr. Niemela have been directing these activities and now it has become a joint activity of ICTP and NCP. The AS-ICTP supports many other scientific activities in Pakistan, including Nathiagali Summer College (which is a well-known activity and has been regularly held since 1974 with the support of PAEC).

The AS-ICTP has started organizing regional activities in developing countries for the benefit of a large number of scientists and researchers of the regions, in addition to its regular activities at ICTP, Trieste. On my request, the AS-ICTP agreed to arrange its regional activities in Pakistan also and I am very grateful to Prof.

Quevedo for supporting Dr. Niemela and myself to arrange such activities in Pakistan. The first such activity was the "First ICTP-NCP International College on Plasma Physics", 11-15 November 2013, which was held in NCP and was directed by Dr. S.M. Mahajan (Professor in Texas University at Austin, USA), Dr. Z. Yoshida (Professor in Tokyo University, Japan), Dr. Niemela (Italy) and H. Saleem (Pakistan). Both Prof. Mahajan and Prof. Yoshida have been directing the Plasma College at AS-ICTP, Trieste, Italy since long. The second regional activity of ICTP "School on LHC Physics" was held in Nov. 2014 and was directed by Hafeez Hoorani (NCP) and J. Ellis (CERN).

Now I take this opportunity to bring to your notice a suggestion given to me by Dr. J. Niemela who is very supportive to NCP. Then I shall present a proposal which can be materialized only through the support of science community of Pakistan.

D.G. NCP, Dr. Hamid Saleem, presenting a souvenir shield to Executive Director TWAS, Dr. Romain Murenzi (2014)

Firstly, Dr. Niemela of ICTP has suggested to me that a consortium of universities should be formed to promote collaboration with AS-ICTP, involving Higher Education Commission (HEC) of Pakistan. In this regard, I discussed some plans with the Chairman HEC, Dr. Mukhtar Ahmad, in the presence of Dr. Niemela, during International Scientific Spring 2013. But after my retirement in June 2014, I could not continue efforts in this direction.

Secondly, I want to submit a proposal for your consideration based on my experience. I think very strongly that the HEC or Pakistan Academy of Sciences (PAS) or Pakistan Science Foundation (PSF) should establish a research centre on the pattern of AS-ICTP in Pakistan. Such a centre can achieve its goals only if a free and open atmosphere is provided to the local and foreign scientists for interaction with international science community. The success of ICTP lies in its spirit to work for scientific development for the benefit of mankind. It has a very free and inspiring atmosphere for young researchers and students. I like to point out that science has its own culture which is beyond all prejudices of nationalities and religions.

The development of science and technology requires a culture of respect for new ideas and independent thinking. We need to establish a centre in Pakistan that should have an open and free atmosphere similar to ICTP for the training of young enthusiastic researchers. Such a centre will play a pivotal role in promoting science and technology in the country with the collaboration of international scientists. This centre should have affiliation with ICTP and should be focused on high-quality research in modern sciences. Apart from its affiliation with ICTP, the centre should work in collaboration with other internationally reputed universities and institutes. In this institute, the senior retired scientists and experts will continue contributing to the projects of national development throughout their lives in collaboration with young researchers and

students of different universities. In the beginning such a centre should be established in Islamabad under a Board of Governors which must consist of the scientists of international repute. Later a chain of such centres should be opened in different regions of the country. If such a centre or institute is established in the country, it will play a pivotal role in the promotion of science and technology in the country which will also be fruitful for the industrial and economic development.

D.G. NCP, Dr. Hamid Saleem and Executive Director TWAS, Dr. Romain Murenzi, with officials of NCP and COMSATS (2014)

My Scientific and Academic Growth as an Experimental Physicist: Inspirations from ICTP

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To be associated with the Abdus Salam International Centre for Theoretical Physics (AS-ICTP) is a dream for almost every scientist from the developing countries. The first international visit that I made was a visit to ICTP in 1989, just when I was starting my research and academic career at the Department of Physics, University of the Punjab, Lahore. The visit was made for my participation in the second workshop on 'New High Temperature Superconductors', held in March - April 1989. It was a unique experience as the lectures were complemented with laboratory work at ICTP. At that time, ICTP was doing an experiment to develop its own facilities for the experimentalists from the developing countries. Later, they remodeled and introduced the concept of affiliated laboratories for the Third World scientists. This visit proved to be a great inspiration for me to pursue research as a career. I not only got a chance to meet some other renowned scientists in the condensed matter physics, like Prof. S. Koch, Prof. E. H. Dohler, Prof. E. Tosatti, Prof. Andrea Frova, and Prof. G. Scoles, but I also got the honor of meeting Prof. Salam twice during that visit. I found him very worried for the state of science in Pakistan. He was particularly concerned about the experimental

The author (circled) among the group of participants of the Experimental Workshop on High Temperature Superconductors 30 March - 14 April 1989, ICTP, Trieste, Italy (Source: ICTP Photo Archives)

science and encouraged me to play a part in development of experimental science in Pakistan. The visits to ICTP helped me to decide about my broader field of research, i.e., condensed matter physics (CMP). The contacts made during these visits were also helpful for me as later for my Ph.D. admission in Cambridge University, the reference letters were written by Prof. Dr. Mujahid Kamran, Prof. Dr. Shaukat Ali and Prof. Dr. Naveed Akhter Malik, the first two were regular visitors of ICTP. Since then, I have visited the Centre many times after completing my Ph.D. from the University of Cambridge, Cambridge, UK. During my first visit, I also dreamed of giving a talk in the main auditorium of the Centre, which was fulfilled in 1994 when I contributed a student talk, as I came from Cambridge to participate in one of the activities. ICTP has played a big role in my professional growth. In 1997, I received a two-year ICTP – TRIL Award, which I availed at the University of Rome, La Sapienza, where I worked on the optical properties of self-assembled InAs quantum dots, with Prof. Andrea Frova and Prof. Mario Capizzi. This was one of the hot topics at that time.

The author in a group photo of the participants of AIP Industrial Physics Forum 2012: Capacity Building for Industrial Physics in Developing and Emerging Economies, ICTP, Trieste, 16-19 April 2012 (Source: ICTP Photo Archives)

Incidentally, during these two years, ICTP also supported one of my students from the University of the Punjab to work with me for six months in Rome. I became a Regular Associate of the Centre in 1997. Both programs gave me opportunity to introduce younger crop of scientists from Pakistan. During that period, ICTP introduced a scheme for Regular Associates and allocated funds for at least three young scientists to accompany them on their visits to ICTP. Later ICTP changed the latter component of Regular Associates scheme to Junior Associates scheme. I am very pleased to mention that out of four students that visited ICTP due to my regular association with ICTP, three have completed their Ph.Ds from USA, Italy and South Korea. I believe very strongly that ICTP had a big contribution in developing their careers as well. Even one of those three, Dr. Fakhar ul Inam, also joined the Condensed Matter Physics group of ICTP as a post-doctorate fellow. I am very glad for these young men.

Since ICTP has broadened its horizons by offering research

The author participated in the Second Workshop on Distributed Laboratory Instrumentation Systems: ICTP, Trieste, 20 October - 14 November 2003 (Source: ICTP Photo Archives)

opportunities to experimentalists, through its Laboratory Affiliation scheme introduced in mid 90s. I must admit, I personally benefited a lot. Initially, ICTP wanted to set up its own laboratories but then decided to affiliate selected Italian laboratories and interested European laboratories for ICTP visitors. This actually resulted in more participation from both sides, i.e., visitors and laboratories. Once I visited the University of Wuerzburg, Germany, and University of Illinois at Urbana Champaign, to do my experiments. Not only this, I managed to establish academic links of ICTP with my home institution, COMSATS Institute of Information Technology (CIIT), Islamabad, as an affiliated institution of AS-ICTP. The Department of Physics at CIIT is an affiliate institute of the AS-ICTP under its Associate and Affiliation scheme. In this program, three scientists/faculty members of age under 45 can visit ICTP every year with one way airfare and living expenses funded by ICTP. So far, at least 6-7 scientists of CIIT have visited ICTP. In addition, the Institute also signed an MoA with the Training and Research in Italian Laboratories (TRIL) Office during 2004 - 2007 for its faculty

and graduate students to work in the Italian laboratories. Four people made extended visits of the Italian labs during this period. As a result, two Ph.D students of CIIT visited Advanced Technology and Nano Science (TASC) laboratories for their research work, and two faculty members visited ICTP as affiliates. Every year one or two faculty members visit ICTP to participate in different ICTP programmes. During last ten years, we have also benefitted from ICTP's other programmes like Sandwich Training Educational Programme (STEP), Office of External Affairs (OEA) for sandwich visits, and for inviting speakers from developing countries to deliver talks in conferences arranged by CIIT. ICTP has been instrumental for CIIT to develop relations with various laboratories in Trieste, TASC and Elettra Synchrotron Light Source to name a few. These laboratories have become hosts for us to perform various kinds of experiments, particularly using synchrotron radiation source. Since I also cannot leave my institution for long periods, I make short visits to ICTP to continue experimental work at TASC and other laboratories in the surroundings of ICTP. I would like to get involved with the theorists of ICTP, as in Pakistan we really do not have many theorists, especially in condensed matter physics. I would also like to contribute in organizing activities at ICTP and outside, particularly in Pakistan. I have already organized two international meetings in 2006, for which ICTP's external office also contributed towards CIIT-ISESCO International School on 'Surfaces, Thin Films, Nanostructures', Lahore. Pakistan (Oct. 27 - Nov. 02, 2006); and CIIT-ISESCO International Conference on 'Nanoscience and Nanotechnology', Islamabad. Pakistan (Nov. 03–05, 2006). These meetings were quite successful. Being a Senior Associate will give me more leverage to contribute towards the spreading of science and related awareness in Pakistan. This will also give me ample opportunity to introduce fresher crop of emerging scientists from Pakistan to the international platform of AS-ICTP.

Personal Recollections of ICTP and Recommendations for Students

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We have this image of a scientist: a lonely figure, toiling away in a laboratory or in his office trying to uncover the deepest secrets of nature. In rare cases this image is true. Generally, interaction among scientists is essential for science to flourish.

Realizing this, very early in his career, Prof. Salam dedicated his life to finding ways for scientists from the developing world to interact with those from the developed world. For this purpose, to reduce the isolation of scientists in the developing countries, he set up ICTP. It has been very successful in meeting this goal.

As an Associate of ICTP, I have had the privilege to participate in the activities of and visit ICTP on several occasions. This has allowed me to spend extended periods of time, mostly the whole summer, engaged in research work there.

ICTP has a strong Condensed Matter programme with the focus on theoretical aspects of strongly correlated electronic systems. As a result, ICTP has been able to attract distinguished condensed matter theorists as short- and long-term visitors. In this regard, Professor

Boris Altshuler from Columbia University, USA, comes to mind who is a regular visitor and a distinguished physicist. He is usually there in the summers, and plays a pivotal role in ongoing condensed matter activities. It is always a pleasure to interact with him and benefit from his vast experience and knowledge.

Conferences and workshops organized in ICTP are of the highest standard. In the following paragraphs, I shall mention a few conferences and workshops that I have been a part of and why they have been special.

In 2008, ICTP was able to gather the most distinguished physicists working on graphene physics for a week. This activity was 'Graphene Week 2008'. After its success, Graphene Week has become an annual event, even though the venue is usually not ICTP these days. Attending the Graphene Week was personally very inspiring for me and left a huge impact on my own research. In this conference, both Andre Geim and Kostya Novoselov, who had not yet won the Nobel Prize for their synthesis of and experiments on graphene were present. They won the Nobel Prize in 2010. The talks were a wonderful mix of theory and experiment. A memorable moment in the conference was when it was announced during the conference that Geim had won the Euro Physics Prize for that year, one of the highest European Physics prizes.

Another memorable series of workshops was held in the summer of 2010. These were on the Principles and Design of Strongly Correlated Electronic Systems, an area that covers a broad range of topics on the frontier areas of Physics. The principal organizers, Piers Coleman and Andy Schofield, did a remarkable job of selecting the topics and speakers, which gave a detailed overview of the field, as well as the open questions in the field. An interesting feature of this conference was an updated blog that was maintained by Piers throughout the conference. A very useful aspect of this conference

was the blackboard sessions in the evening where some of the open questions in the field were discussed at the blackboard. These sessions brought out a lot of physics as simple models and examples had to be constructed to explain deep concepts in a short time on the blackboard.

Another conference that highlighted some of the most important themes in condensed matter physics was held in 2012. It was titled, "Innovations in Strongly Correlated Electronic Systems". It provided the opportunity to all the participants to discuss and understand how strong correlations lead to different kinds of orders in Condensed Matter systems. A wonderful aspect of this workshop was its scope. It covered High-Tc superconductivity, topological phases of matter, as well as localization physics and glassiness. There was much to gain from it and I have very fond memories of the discussions with the participants of this activity.

In the same year, I was a part of another activity held in late August, mostly focused on a condensed matter related topic of current interest. This was the Conference on 'Majorana Fermions'. One of the highlights was a talk by Leo Kouwenhoven related to his experiments on the experimental realization of Majoranas in quantum nanowires. Even though the results were somewhat controversial at that time, they were the closest to an experimental realization. Another highlight was the colloquium by Carlo Beenakker (University of Leiden, Netherlands). Carlo is well known in the physics community as a brilliant researcher and speaker. In his talk, he was able to explain very clearly what Majorana Fermions are and how they can appear in superconductors. The packed audience in the main auditorium in ICTP comprised a large number of students and non-specialists who came away with a clear perspective on Majorana Fermions. I also found talk of Sankar Das Sarma (University of Maryland, USA) on Majorana Fermions in hybrid semiconductor structures very stimulating. His group had

Some participants of ICTP Workshop on Majorana fermions, non-abelian statistics and topological quantum information processing, Trieste, Italy (20-24 August 2012) (Source: ICTP Photo Archives)

come up with one of the first proposals for detecting Majoranas, and his talk highlighted it and the current status of the field.

In 2013, a Conference on 'Geometrical Aspects of Quantum States in Condensed Matter' was held. This is one of the most important themes in condensed matter physics. The highlight of this Conference was a talk by Subir Sachdev from Harvard. He is one of the most eminent condensed matter theorists. In fact, he delivered the Salam lecture series at ICTP in 2014. His talk was on quantum criticality in two-dimensions. He was able to present in a very clear manner the link between quantum criticality in 2D and High-Tc superconductivity. Another very interesting and stimulating talk was on non-Fermi liquid fixed points by Shamit Kachru. This is a very challenging topic and is of great importance in condensed matter physics, as a host of non-Fermi liquids have been discovered but a theoretical model explaining their behavior remains elusive. Ashwin Vishwanath's talk on topological phases in interacting phases was another highlight in this conference for me. He has an amazing ability to present even the most difficult and deep concepts in simple,

Dirac Medal 2012 to F.D.M. Haldane, C.L. Kane and S. Zhang: Award Ceremony, ICTP, Trieste, 4 July 2013; F.D.M. Haldane Speaking and View of Main Lecture Hall. (Source: ICTP Photo Archives)

clear language. There were three talks by the Dirac medal winners C. L. Kane, S. C. Zhang, and D. Haldane, which also stand out for their clarity and depth.

A memorable occasion was the Dirac Medal ceremony held in ICTP in 2013. C. L. Kane, S. C. Zhang and D. Haldane won the Dirac medal in 2012 for their seminal work on topological insulators. A ceremony was held to honour them. It was especially memorable for me because I have worked on topological insulators, and have followed their work closely like many others. As a part of the ceremony, the winners gave talks on their work and lessons about life learned along the way. These were very informative and inspirational. Since I had been working in the same area, it had personal relevance.

Up till now, I have tried to list some of my fond memories of scientific activities that I was involved in. Now I would like to focus on the future role that I believe ICTP can play in the growth and development of young researchers and students. In other words, I

would like to address how ICTP can benefit the students and faculty in Pakistan. Therefore, it is mainly directed at younger colleagues and students.

In this regard, the following ICTP programmes are worth-mentioning:

- ICTP makes available on its website videos of conferences and lectures that are held there. If one is not physically present there, it is still possible to benefit from these resources. I encourage students to make use of it. From personal experience, I can say that I encourage my students to watch the video lectures and the feedback from them is always very positive. When one of my students is selected in the ICTP Diploma programme, I encourage him/her to go through the video lectures of the Diploma courses from the preceding years, during the summer before leaving for ICTP. They have found this practice very useful as this gives them a head start when they begin formal Diploma courses at ICTP.
- One can also apply to attend various workshops and conferences that may be of interest. If accepted either as a speaker or a participant, travel and lodging is usually provided by ICTP. This gives us the opportunity to present our work to an international audience, as well as to personally interact with others.
- As a Regular Associate of ICTP, I have found the Associate scheme extremely useful. It provides an opportunity for extended stay in ICTP. One can carry out research there with few distractions. The library and the Internet facilities are excellent. Another great advantage is that one can time the visit when one or more activities in an area of interest are taking place. I can speak from personal experience that I have benefited greatly from these activities as mentioned above.

  To make the most of the Associate scheme, if possible, one should try to establish collaboration with some of the permanent

The Author Participated in the Advanced Workshop on Non-equilibrium Bosons from Driven Condensates to Non-linear Optics, ICTP, Trieste, 19-23 August 2013 (Source: ICTP Photo Archives)

scientists there. I have been fortunate to do that with Dr. Markus Mueller, who is a permanent staff scientist at ICTP. This happened as a result of the Sandwich Training Educational Programme (STEP) that I have mentioned below. This kind of collaboration is very useful as a research project can be moved forward quickly in an extended stay provided by the Associate Scheme.

Furthermore, ICTP usually arranges a common office space for the Associates. This allows greater interaction among the Associates. I can count several Associates whom I have known as friends and collaborators.

- For students who have done M.Sc. and M.Phil., the Diploma programme is very attractive. The purpose of this programme is to bridge the gap in standards between the M.Sc./M.Phil. students in the developing and developed world. It is a one-year programme with rigorous courses as well as research work. Several students who obtained their M.Phil. degree under my supervision have gone on to join this programme. Admission to this programme is done on highly competitive basis but students

who have a good academic record and strong recommendations have a good chance of getting in. I would encourage students with a strong academic background to apply for this programme. Most of the students who obtain their ICTP diplomas go on to get admissions in some of the best Ph.D. programs in the USA and Western Europe.

- Another programme that my Ph.D. students have found extremely useful is the STEP. This programme is open to Ph.D. students who are enrolled full time in the Ph.D. programme. To be selected, the Ph.D. supervisor has to write a joint research proposal with a co-supervisor from ICTP. Once accepted, the Ph.D. student can visit and work with the co-supervisor in ICTP. In this way, the Ph.D. student gets an international exposure even though he/she is enrolled in the Ph.D. programme in the home country. In my experience, this is an extremely useful programme. I try to encourage my students to benefit from it.

These were some of the ideas that I wanted to share with students of physics based on my personal interaction with ICTP.

The Author Participated in the Summer School on Quantum Many-body Physics of Ultra-cold Atoms and Molecules: ICTP, Trieste, 2 - 13 July 2012 (Source: ICTP Photo Archives)

My ICTP Experience

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I did Diploma in High Energy Physics from Abdus Salam International Centre for Theoretical Physics (ICTP) in the year 2000-2001. If I remember correctly I arrived at ICTP on 23rd August 2000. The surroundings were very beautiful and the language was unfamiliar to me. There was one familiar face from Pakistan, my senior from University of Punjab, Shahida Dar. She helped me a lot in different matters on several occasions. Everybody at ICTP was also very helping and kind. I arrived earlier than usual time for diploma students. I was accommodated in Galileo Guest House.

The Secretary for diploma students, Concetta Mosca, was very much helpful. We got coupons for meals and stationery. So there were no worries about cooking. There were people from different countries (and continents) in my class.

Of course I do not have such a good memory as to remember names of all of the students of my class. There were two other diploma programs going on in ICTP: namely Diploma in Condensed Matter Physics and Mathematics. I had good relations with these class fellows during diploma and I met many of them later during my

A visit to CLEO detector in Cornell with Ph.D. class fellows of the author from Syracuse University. Two of them, Nabil Menaa and Radia Sia (From left to right), are also ex-ICTP diploma students.

Ph.D. at USA. By looking at names of my batch mates I could remember their faces, most of them. There were 5 students from Algeria, 3 from Vietnam, 3 from Egypt, 2 from Nepal, 2 from Iran, 2 from Turkey and 2 from Cameroon.

The ICTP course work filled up the gap between M.Sc. education from Pakistan and Ph.D. education from USA. Taking similar courses at USA became easy. I was already familiar with concepts needed in Particle Physics. I had completed M.Sc. in Physics from University of the Punjab, Lahore, Pakistan prior to attending the Diploma. The diploma program had two subjects that I had already studied in Pakistan, namely Relativistic Quantum Mechanics and Introduction to Particle Physics. All other courses including Quantum Electrodynamics (QED); Lie Groups & Lie Algebras (LL); General Relativity (GR); The Standard Model (SM); Quantum Field Theory (QFT); and SUSY Field Theory (SFT) were new to me. The

The author with one of her class fellows from ICTP, Adeola Adeleke Adeluyi during APS-2004 in Florida, USA

courses were very compact and we had to work hard to get good grades. I remember sitting together with one of my class fellows, Radja Boughezal from Algeria, to do the homework. From that time the people in ICTP library know us and they have been cooperative where ever we needed them. I can say without a doubt that these courses were equivalent to M.Phil. courses offered in Pakistani Universities. There were two semesters of course work and in the summer we also had to make a dissertation. For dissertation, I worked with Professor Antonio Masiero on "Determination of α and γ in Unitarity Triangle". This work consisted of a review of work done on determination of the angles of unitarity triangle. During this work I read many articles related to unitarity triangle. Another class fellow of mine, Radia Sia, was also doing similar work, i.e. determination of angle beta in unitarity triangle. So we used to sit together and find material related to our work. We used to discuss them with each other and then with Prof. A. Masiero. We were also selected for Ph.D. at Syracuse University, so we tried to finish our dissertation and be in time for the Ph.D. course to start at Syracuse by first week of August. So we practically had only two months to do the dissertation but we managed it.

In addition to these details of my course work and studies, I should mention about other things going on in my life. In the start I shared room with my senior Shahida Dar (who has now completed her Ph.D. from Delaware in Theoretical Particle Physics). Later, I moved to Sistiana with Christiana Winter who was working at ICTP during

During Sheldon Fest in 2005: The author with Nasra Sultana, another Pakistani ICTP-diploma holder

Dr. Jamila Bashir Butt with Shahida Dar during visit to Syracuse University, USA (2002)

that time and she was also landlady of my other senior Mansoora Shamim (Ph.D. in Experimental Particle Physics from Kansas University). Sistiana was a small village up in the mountains. I had to take bus from downtown Trieste to reach Sistiana. During the semester I kept on looking for path that could connect route of bus 44 to rout of bus 36. The bus 36 connected ICTP to Trieste. I was pretty successful in this exploration, by the end of my stay at ICTP I had found the way, which went up from Galileo Guest house to train station Miramare and then up to the village of Prosecco.

The location of ICTP is very beautiful, on one side we can see Adriatic Sea and on the other side we have hills. I saw the ocean for the first time. I had read about it in books but experiencing it and seeing it with my own eyes was a totally different experience. The view coming down from mountains gave a scene of Adriatic Sea which cannot be explained in words. I had found almost all walking paths between ICTP and Adriatic Sea whether they went from Miramare Park or from the main road. I remember all fruit trees which I could see on the roads and mountain paths, and in ICTP; cherry, plum, walnut, and fig trees. I also saw those trees which had

The author at Syracuse University with (L to R) Sadia Khalil and Nasra Sultana, both ex-ICTP diploma students.

only flowers on them and no leaf when the winter ended. I had seen such trees only in Pakistani movies and I thought that they did not exist in reality. But they were real. However, the trees act like this only in cold areas not in a warm area of Lahore from where I came. I also saw icicles for the first time (which looked like a sharply formed cone of ice) on the shade of the Sisitiana house.

ICTP also gave us an opportunity to learn Italian. Our Italian language teacher was Paula Altarelli wife of a famous particle Physicist. I was very happy to learn the language as without knowing Italian, communication was very hard within the city. Most of my class fellows knew French as second language and some knew Spanish so understanding Italian was easy for them, but students from sub-continent had English as second language that did not

seem very much useful here. Learning Italian also made me understand English better. I could see many words having root in Latin language (Latin is root/mother of Spanish, Italian and French language). It helped me later as well when I had to stay in France during my postdoc at CERN. I was able to learn and understand French easily. I had visited a couple of other cities with my friends, one of them is most famous, Venice, that was 2.5 hour by train from Trieste.

So ICTP helped me not only in education but also other aspects of my life. I was also able to secure finance to go for Ph.D. in USA. We had many facilities at ICTP, which we really missed later in life like meal coupons, free post, free stationery and, of course, free care by everyone. There was one thing for which we had to worry ourselves, it was halal food and halal ingredients other than that everything was perfect.

Now when I have gone through tough part of my life, I look back and find how much ICTP has contributed in my life. ICTP worked like a bridge between my state in year 2000 and current state. Today Jamila has a mind of a Ph.D., experience of different countries, languages and people. ICTP brings people from developing countries that I would have liked to meet, but I could not attend any event at ICTP while I was doing Ph.D. in USA. But when I joined National Centre for Physics in Pakistan and I applied for a conference and summer school related to Particle Physics, I was promptly selected. I again got a warm welcome.

I also feel that all this became possible because of the vision of one person, Dr. Abdus Salam. If he had not thought of ICTP, how could I and many other students have benefitted from it?

I am thankful to ICTP for being such a nice host as well as to Dr. Abdus Salam for making this Centre.

The ICTP and Beyond

I.E. Qureshi
Executive Director COMSATS
Islamabad, Pakistan

Prologue

The campus of the International Centre for Theoretical Physics (ICTP) is located on the slopes of an inconspicuous hillock on the shores of Adriatic Sea at the outskirts of historical city of Trieste, Italy. If one drives by its collection of nondescript buildings on the coastal highway, Strada Costiera, not much would be visible to indicate that this venue is the birth place of a revolutionary movement in science, which played a significant role in awakening the dormant tradition of scientific research in the newly independent countries of the world, politically categorized at one time as the 'Third-World countries'. Why this nonchalant neighborhood and not a bubbling metropolis of the ancient cities of culture and science in Egypt, Iraq or Pakistan?; that is a question which in itself provides a clue to the prevailing socio-economic world order at the inception of ICTP in early 1960s. Fifty years on, the scientific and economic landscape has changed considerably, but unfortunately the circumstances of the majority of countries in Asia, Africa and Latin America have not. From the very outset, with pitiful ignorance of the intellectual currents that shaped the Western

ascendance leading up to the colonization of much of the known and unknown parts of the globe, the leaders of the new nations, either suffered from acute inferiority complex or delusional belief in prospects of instant prosperity. The changing times were not reflected in the changing mindsets, resulting in the vicious circle of conflict, instability and poverty in much of the so-called Third World, also identified as the 'South'. A voice, at that time, rose from the East with richness of thought imbibed from the West, and clarity of purpose, engendered by personal experience and knowledge of history, which proclaimed that the mankind can be divided simply in two categories; those who have mastered science and technology, and the rest who have not. He noted that the former rule the others politically and economically, as was the case in the past, and that is what would happen at all times in future also. Looking for an egalitarian world, one should look no farther than building S&T capacity in the countries of the South. That was the recipe of one man, Prof. Abdus Salam, who not only distinguished himself as a scientific supremo, but also as one who practiced what he preached. He was no arm-chair philosopher, criticizing weaknesses and prescribing remedies for the benefit of others; he had the courage and conviction to put himself in the field and become an agent of change. The ICTP that Salam established is an epitome of his vision and drive. The Centre was rightly named after him as the Abdus Salam ICTP (AS-ICTP) a year after he passed away

To meet Prof. Abdus Salam in his office was one of the delights of visiting ICTP. The author posing with an ailing but joyous Salam (Picture: Feb. 1992)

in 1996, for his name alone can aptly describe what ICTP is all about. The spirit of ICTP is ever stronger today and its role is widening with every passing year.

ICTP on the Move

An international centre for the benefit of scientists of developing countries, located in the middle of Europe, was a unique undertaking by any standards. What was more astonishing was the declaration of its founder Director that the Centre will be home to research groups tackling scientific problems at the frontiers of knowledge. That was not an easy sell, at a time when it was considered more realistic for the West to 'transfer' the know-how of basic technologies to the hapless communities of technical workers in poor countries, as an aid for their economic development.

Sharing office space with other visitors is a norm in ICTP. The author with Prof. Pervez Hoodbhoy in their common office in the Main Building (Picture: August 2000)

Salam believed in 'transfer of science' and not 'transfer of technology'; preferably the 'transfer' of self-confidence and spirit of enquiry that leads to the emergence of new technologies. 'Theoretical Physics' was a good starting point and ICTP campus was meant to be the waterhole where scientific minds from the East and the West would interact and jointly partake in the scientific work of highest standards. By his own personal scientific achievements, he had already established that given the opportunities, anyone from

The group of Pakistanis that happen to be at the Centre at a given time keep in touch with one another. The Pakistani Head of ICTP Diploma Programme, (1) Prof. Fahim Hussain (deceased 2009) is seen with (2) the author and (3) Dr. Mujahid Kamran, presently Vice Chancellor Punjab University among other visitors (Picture: June 1999).

a developing country having talent and ambition, can achieve excellence in science. Thus, he personally inspired his close associates, students and visitors, who then inspired their colleagues and students, and so on. The scientific bug emanating from Trieste travelled far and wide, and changed the lives of hundreds of thousands.

ICTP did not stick to its scope dictated by its name for too long. When circumstances permitted, experimental facilities were added on site in selected areas, such as microprocessors and lasers, while schemes were launched to accommodate young experimental science aspirants from developing countries in Italian laboratories under the scheme of 'Training and Research in Italian Laboratories' (TRIL). With the advent of Internet and Information Technology (IT)

taking centre stage in the world, ICTP entered the field of information dissemination and education through World Wide Web. Programmes such as 'Radiopropagation Laboratory' and 'Open Source Software' were started to support scientists in resource constrained regions. Within the scope of Theoretical Physics, the earliest focus on Particle Physics was gradually expanded to core areas of Condensed Matter Physics and Plasma Physics. While ICTP expanded its scope of activities and ventured into fields far from conventional physics disciplines, Salam too allowed himself to be attracted by fundamental questions in Biology, attempting to see if physics theories can provide answers to perplexing phenomena taking place at molecular level in biological systems. Currently, the computational biology is a thriving field getting considerable attention of researchers at ICTP under the theme of quantitative life sciences. The emerging environmental threats owing to climate

Using ICTP stay as an opportunity of scientific cooperation with Italian universities is often quite feasible. The author in the University of Rome in front of Enrico Fermi's lab equipment (Picture: August 1999)

change and natural calamities in the form of earthquakes, tsunamis and hurricanes all fall under the areas of interest of ICTP's resident and visiting scientists from across the world. The early ventures into small-scale experimental facilities have been presently consolidated into a resident research group of Applied Physics. ICTP also distinguished itself as a place where emerging inter-disciplinary science topics are boldly explored in seminars and workshops, many of which bear the credentials of 'first time' in the world. Gradually, the honour of the Centre to host renowned scientists has turned into the honour of reputed scientists to visit the Centre. The Nobel Prize won by Salam no doubt added to the status and the prestige of the Centre, where other Nobel Laureates would gladly visit and lecture, when invited.

Personal Recollections of ICTP

The ICTP entered the lives of all tiers of scientists from the developing countries; from the seniors who participated in the earliest activities of the Centre, to the young doctoral graduates, to the students who attended diploma courses. I came to know about ICTP during my M. Phil. studies at Quaid-i-Azam University (formerly Islamabad University) in early 1970s. Almost all our teachers at the Institute of Physics were close to Salam; in fact they were affectionately called 'Salam boys' in Pakistan. It was natural that the word 'ICTP' would prop up during lectures also. However, it was not until 1984, when I had completed my Ph.D. in U.K and joined Pakistan Atomic Energy Commission (PAEC), that I first visited the Centre. The occasion was a workshop on 'Nuclear Model Computer Codes' held in collaboration with the International Atomic Energy Agency (IAEA). I fitted the bill for a typical visitor of ICTP; recently completing Ph.D. in Europe, coming back to home country, not finding other people in the same specialization of research, facing lack of required facilities (IBM computers in my case), and all set to be frustrated. The three weeks at ICTP gave me

Partnership with University of Bologna and PINSTECH blossomed because of ICTP visits. The author with members of research group of Prof. Giorgio Giacomelli (deceased 2014), not seen in the picture (Picture: July 1999)

the confidence that I can stay in Pakistan and still do the research of my choice. My peers in the theory group of Nuclear Physics Division in Pakistan Institute of Nuclear Science and Technology (PINSTECH), especially the Head of the Group, Dr. Abdullah Sadiq, were also frequent visitors of ICTP. I kept going to Trieste on special occasions, as well as routinely as a Regular Associate (1994-2001). In line with the tradition, I encouraged my juniors to go to ICTP and helped some to be placed in the Italian laboratories under the TRIL programme. In this way, my own cycle of ICTP interactivity, comprising of being nudged towards ICTP by mentors, boosting my own research studies through intensive work during spells of ICTP stay; and, then helping a number of other scientific workers at PINSTECH to visit the scientific shrine of Trieste, was completed.

An additional role that I played to serve the cause of ICTP was in my capacity as the elected President ICTP-Pakistan Chapter, during 2003-2004 following the completion of the tenure of Dr. N.M. Butt. This Chapter has been performing the function of dissemination of ICTP-related information to Pakistani universities and institutions,

Inaugural Ceremony of ICTP-Pakistan Chapter held at COMSATS Secretariat, Islamabad. The author is seen in the picture at the podium (Picture: May 2002)

and extending guidance in connection with their visits to the Centre by those who travel abroad for the first time in their lives. An important activity during my tenure as President of the Chapter was a series of lectures by relevant eminent Pakistani scientists, elucidating the history and scientific background of the research areas in which Nobel Prizes had been awarded.

How did I find life in ICTP during the period that I have been going there on visits spanning three weeks to three months at a time? In one word it can be described as 'surreal'. You would be doing the bare minimum to keep yourself alive (and reasonably healthy, even if losing considerable weight), and spend all your time in whatever you are supposed to do by way of academic and research work. For the former you would be provided a modest allowance, and for the later you found the top-class library, computing facilities, and work places. With all the 'Third-World problems' of bureaucracy and erratic services gone, the family concerns left behind, and job-

Scientific researchers often become science managers. The author lead a delegations of COMSATS Institute of Information Technology (CIIT) to ICTP for a meeting with Director, Fernendo Quevedo to discuss avenues of academic cooperation between the two institutions. Also seen in the picture is the Rector CIIT, Dr. S.M. Junaid Zaidi and his colleagues Dr. Arshad Saleem Bhatti and Dr. Raheel Qamar. (Picture: February 2012)

related chores suspended, a visitor to ICTP felt the exhilarating experience of being left alone with himself and his scientific thoughts. By looking around and finding a crowd of unpretentious intellectuals, casually dressed, and deeply immersed in their studies, one could not but have an 'out-of-world' feeling of sublime existence. As human nature goes, there would be occasions of grumbling also; mainly on issues of limited office space and standard 'cuisine' offered by cafeteria, reminding us of a hospital ward (that was naturally the biased opinion of curry lovers). Speaking of hospitals, it is a fact that the scrupulous cleaning of all work areas with strong antiseptics often leaves the scents of high sanitation all around ICTP. The strict regimen of 'work, work and work' would be punctuated by visits to coffee shop, where social interactions, especially with compatriots, took place. That was the only place where people talked casually and laughed, with quite a few still discussing their scientific problems. A fair mix of the young and old, men and women some with outstanding scientific achievements, some budding geniuses, all mingled up and constituted one homogeneous group of science enthusiasts. Any fun? Of course there was plenty, for the people who considered their work as fun. The highest level of

'recreation' would be a stroll on the cobbled path at the nearby beach. The ICTP life was surely an extraordinary experience.

ICTP without Borders

The indefatigable founder Director of ICTP was not a man to be content with what was achieved in Trieste. He was a citizen of the world, travelling all over places, engaging intelligentia, advising statesmen and lecturing academics. As the Executive Director of the Commission on Science and Technology for the Sustainable Development in the South (COMSATS), when I travelled to different developing countries I found Salam's footprint practically everywhere. As narrated by Prof. M. H. A. Hassan, former Executive Director of The World Academy of Sciences (TWAS), during his Skype address on the occasion of the 20th Anniversary of COMSATS celebrated in Islamabad in Oct. 2014, Salam wanted the ICTP model to be replicated in different regions in Asia, Africa and Latin America. He personally visited different countries in these regions and helped create national research centres in Physics, as well as in Mathematics. His special attachment and concern for his native country, Pakistan, helped the creation of institutions like Pakistan Institute of Nuclear Science and Technology (PINSTECH), Space and Upper Atmosphere Research Commission (SUPARCO), and Karachi Nuclear Power Plant (KANUPP). Following the advice of Salam, his illustrious student, Prof. Riazuddin and the then Chairman Pakistan Atomic Energy Commission, Dr. Ishfaq Ahmad, later established the National Centre for Physics (NCP) in Pakistan, which is operating on ICTP's pattern.

Salam not only wanted Pakistan to enhance its S&T capacity, but also wished it to have a leadership role for the promotion of scientific cooperation among developing countries. He mooted the idea of creating a Commission on Science and Technology at the highest level of Heads of State/Government of the countries in the South, so

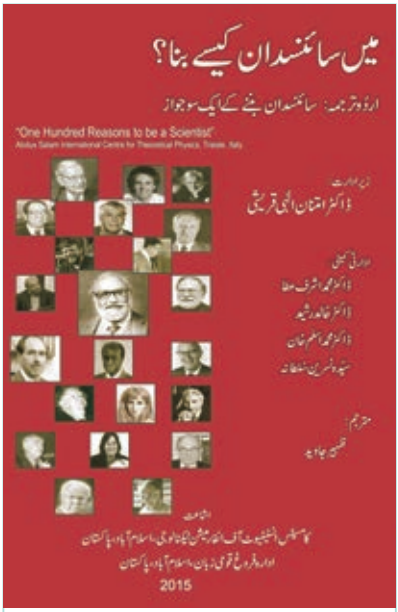
as to get maximum political patronage for South-South cooperation in S&T areas that are most relevant to socio-economic development. Knowing too well that 'high-level' forums usually limit themselves to issuing policy statements or declaration of support in principle, he directed his close associate, Prof. Hassan, to plan the linking of a network of scientific institutions with the international body that he envisaged. The formation of COMSATS was eventually announced by the then Prime Minister of Pakistan, Ms. Benazir Bhutto (Late), on 5th October 1994, in Islamabad during its Foundation Meeting. On that occasion 30 countries signed a Joint Statement to endorse the proposal, 14 of which became Members by signing the 'International Agreement to Establish COMSATS'. Later on, after further deliberations several other countries became Members. It may be a coincidence that the establishment of ICTP was announced 30 years earlier, exactly on the same date. However, it is not a coincidence that COMSATS was the embodiment of a larger plan of action going beyond ICTP and creating world-class research centres in selected disciplines, which could become homes to the best minds of the world. That could not happen, because the plan was too ambitious and the Third-World leaders were not visionary enough to grasp its game-changing nature. A relatively softer option of accrediting several outstanding R&D organizations, to be designated as COMSATS' Centres of Excellence, turned out to be a feasible option at that time. The role of TWAS in identifying such centres was crucial. Elaborate application forms were created to document the strengths of prospective centres, and teams of senior scientists were sent to observe available infrastructures on ground. Currently, 20 such Centres make up the COMSATS' Network of International S&T Centres of Excellence. The Heads of these organizations meet every year to exchange information about their research activities and discuss avenues of collaboration. Some of these centres owe their genesis to Salam's determined persuasions, such as National Mathematical Centre (NMC) in Nigeria; International Centre for Physics (CIF) in Colombia; and

International Centre for Environmental and Nuclear Sciences (ICENS) in Jamaica. In the last 20 years, COMSATS has made its mark as one of the important international players in South-South cooperation in science and technology.

The location of ICTP and The World Academy of Sciences (formerly the Third-World Academy of Science – TWAS) in Italy is also no coincidence. The first President of the Academy was none other than Salam himself, who conceived and implemented the idea of having a joint forum of science academies in the developing countries. Along with the Third-World Network of Scientific Organizations (TWNSO), the scientific elite and managers of S&T in the bulk of the Third-World, all came under the ambit of Trieste-based coordination offices. Apart from hosting ICTP and TWAS, Trieste is now known world-wide as a "City of Science", home to such prestigious centres as International Centre for Genetic Engineering and Biotechnology (ICGEB); International School for Advanced Studies (SISSA); International Centre for Science and High Technology (ICS); and Elettra synchrotron facility within the first Technology Park of Italy, etc.

Tributes to ICTP

By way of paying tributes to ICTP, COMSATS Headquarters and COMSATS Institute of Information Technology (CIIT) undertook a project of translating in Urdu the ICTP publication, entitled: 'One Hundred Reasons to be a Scientist'. The translation of this book was launched through COMSATS' website on the occasion of 50th anniversary celebrations of ICTP, held in Islamabad, Pakistan. The book, originally published in English, appeared in print in 2004. It was translated into Italian, Chinese, Portuguese, Marathi, but no Urdu version was attempted, understandably because of the herculean task of finding appropriate terminology from Urdu language to reflect the enormously condensed and highly advanced



Title cover of the book 'One Hundred Reasons to be a Scientists' (Urdu Version)

topics covered by some of the most prominent living scientists, in disciplines ranging from engineering, chemistry, physics, biology, to computer science, mathematics, and economics. The challenging task was eventually completed in time to be publically announced on October 18, 2014, the day when the 50th Anniversary of ICTP was celebrated in Islamabad.

During the course of translating this collection of highly inspiring articles, based on personal reflections of scientists and engineers who left indelible imprints on modern science and technology, it was fascinating to note that in some cases, the part played by ICTP in their lives came up with rich tributes to the Centre or to Salam himself. The nuclear physicist, James W. Cronin, who shared Physics Nobel Prize of 1980 for the discovery of CP violation, made the observation:

> *"The International Centre for Theoretical Physics is an institution which tries to help overcome the enormous disparities in the access to pure science. I shall never forget the statement of the former Director of the ICTP, Miguel Virasoro:*
>
> *"...the opportunity to participate in pure science is a basic human right!""*

Renowned field theorist, Freeman J. Dyson, stated:

> *"I write this piece in honor of my friend and hero Abdus Salam, founder and moving spirit of the International Centre for Theoretical Physics. Salam was great as a scientist, greater as an organizer, greatest as the voice of conscience speaking for the advancement of science among the poorer two thirds of the mankind".*

One of the pioneers of the String Theory, and Lucasian Professor of Mathematics in University of Cambridge, England, Michael B. Green, mentioned:

> *"Until 1984, I had given only one five minute talk on string theory at a small ICTP workshop. Subsequently, I was inundated by invitations to talk at international conferences and workshops. I was particularly grateful to Abdus Salam who took a strong interest in the subject and gave me the opportunity of organizing an annual spring school in string theory at ICTP between 1986 and 1990".*

The highly respected academician of Russian Academy of Sciences and Director of Landau Institute for Theoretical Physics in Moscow, Prof. Isaak M. Khalatnikov, recounted memories of his first visit to ICTP on the occasion of the opening of ICTP's new building in 1968, in these words:

> *"Here is the list of theorists who took part in this undoubtedly historical conference: academician Fock and later on elected academicians V.L. Ginsburg, A.A. Abrikosov, E.M. Lifshitz, L.D. Faddeev, E.S. Fradkin and myself. ……. I think that*

such a strong delegation of soviet physicists-theorists had never visited the West before".

Further elaborating his association with ICTP, he wrote:

> *"I was lucky to participate in numerous conferences devoted to the most relevant problems of contemporary theoretical physics, to be a Director of schools on physics of condensed matter and to be a member of Centre's Scientific Council. Taking part in the Centre's activities is an important and a special part of my scientific biography".*

Princeton University's Moffett Professor of Biology, who pioneered the field of Biological Complexity and Ecology, Simon A. Levin, mentioned in his article entitled, 'I Love a Puzzle':

> *"In 1982, I made my first visit to ICTP in Trieste, joining with Tom Hallam to organize the first course in mathematical ecology. That added an important new dimension to what I was doing – the chance to share what I knew with people from every imaginable nation, and to learn from them about the unique environmental problems of their countries".*

Keith Moffat of Trinity College, Cambridge, talking about his seminal work on the study of thin films of viscous liquid spread uniformly on the surface of a horizontal cylinder in rotation about its axis, acknowledged that:

> *"This problem first came to my attention through a lecture given by V. Pukhnachev at an ICTP Summer School of fluid dynamics in 1974 (a school that contributed to the modern acceptance of Fluid*

Dynamics as a legitimate and reputable branch of theoretical physics!".

The Brazilian Mathematician, Jacob Palis, who was the elected President of TWAS from 2006 to 2012, in his article on 'The joy of being a Scientist', expressed his views about ICTP as:

> *"...a symbol for the young talented people of how joyful it is to be a scientist. It was built as and continues to be a dream-place for the scientists of the whole world without divides, inclusive of the least developed countries from all continents"*.

Conclusions

The centerpiece of the philosophy that forms the basis of the establishment of ICTP is the belief that scientific capacity is indispensable for socio-economic progress. It requires long-term national commitment to create necessary infrastructure for scientific research. This research effort must be considered a collective responsibility and common heritage of mankind, irrespective of cultural and economic differences among its practitioners. The ultimate purpose of these endeavors should be to achieve equitable and inclusive development for all human beings leading towards an egalitarian world, with different societies enjoying equally good quality of life in a sustainable way. Organizations like ICTP, TWAS and COMSATS having common objectives and shared founding fathers can play a leading role in the historical progress of mankind's march towards fully understanding laws of nature, and framing its own inviolable universal laws based on social justice, peaceful coexistence, and equal rights.

ABOUT THE AUTHORS

Prof. Dr. Fayyazuddin

Prof. Dr. Fayyazuddin is a Research Consultant and National Distinguished Professor at the National Centre for Physics (NCP), Pakistan. He holds a Ph.D (Theoretical Physics), from Imperial College London. His research interests include different areas of Theoretical Particle Physics, in particular, Gauge Theories, Chiral Symmetry, Heavy Quarks, Spin Symmetry and Phenomenology of Particle Interactions.

Over the years, he has performed important academic assignments at Quaid-i-Azam University, Pakistan; King Abdul Aziz University, Saudi Arabia; Ummal Qura University, Saudi Arabia; and King Saud University, Saudi Arabia. Dr. Fayyazuddin is elected Fellow of the Third World Academy of Sciences and Pakistan Academy of Sciences and is a Member of the American Physical Society. He has also been Senior Associate, and Associate Member of AS-ICTP, Italy.

Dr. Fayyazuddin has been conferred several national and international awards, including 'D. Dwyer Bhawani Dass Gold Medal' by Government College Lahore, Pakistan; Gold Medal by the Pakistan Academy of Sciences for outstanding research work in Physical Sciences; and 16th Khwarizmi International Award (2003). He was conferred the second highest national civil award, *Hilal-i-Imtiaz* by Government of Pakistan in 2000. Dr. Fayyazuddin is co-author of three books.

Dr. N. M. Butt

Dr. N. M. Butt is presently Scientist Emeritus of Pakistan Atomic Energy Commission (PAEC) and Chairman, Preston Institute of Nano Science & Technology (PINSAT), Islamabad, Pakistan. He did his Ph.D. in Nuclear/Solid State Physics in 1965, and was awarded D.Sc. (Physics) in 1993 by the University of Birmingham, U.K. His research interests include: Crystal Diffraction studies using Mossbauer gamma-rays; Neutron Diffraction and Scattering from Solids; Research Reactor Utilization; Correlation of Micro-Macro properties of crystalline materials and Nanotechnology. His papers have been extensively cited, including some that have been cited over a period of more than four decades.

In past, he has held important positions in various Pakistani institutions including: Director General, Pakistan Institute of Nuclear Science and Technology (PINSTECH); Chairman, Pakistan Science Foundation; and Chairman, National Commission on Nano Science and Technology. He is one of the pioneers of Nanotechnology in Pakistan. Dr. Butt is a Fellow of the Pakistan Academy of Sciences and the Islamic Academy of Sciences. He is the First Joint Winner of International Khwarizmi International Award

(KIA), Iran (1995). He is on the Editorial Boards of several journals at home and abroad. He was awarded the national civil award, *Sitara-i-Imtiaz*, by the President of Pakistan for his services in science.

Dr. Butt has a long association with ICTP, Trieste, since its early years. He has been affiliated with the Centre as Associate and Senior Associate from 1970 to 1989.

Prof. Dr. Ghulam Murtaza

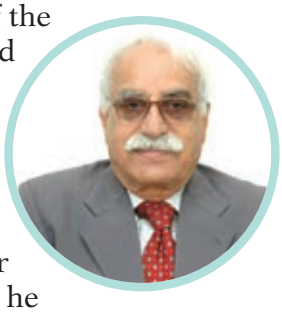
Prof. Dr. Ghulam Murtaza obtained his DIC & Ph.D. in Theoretical Physics from Imperial College, London, and has more than 53 years of university teaching and research experience at Quaid-i-Azam University, Islamabad, and as Distinguished National Professor, Government College University (GCU), Lahore (as holder of Salam Chair in Physics). First he worked in the field of Elementary Particle Physics and later changed over to Plasma Physics. He has published 298 research papers in various international journals of repute. He has supervised 64 M.Phil. dissertations and 31 Ph.D. theses.

He pioneered the important subject of Modern Plasma Physics and Controlled Thermonuclear Fusion in Pakistan (in 1975) and established Plasma Physics Groups at QAU, Islamabad and GCU, Lahore, Pakistan.

He also helped to set up Plasma Technology Laboratory at Centre for Advanced Studies in Physics (CASP), GCU, Lahore, wherein a 3kJ Plasma Focus device and a Surface Coating facility are operational.

Dr. Abdullah Sadiq

Dr. Abdullah Sadiq is Professor of Physics and Dean of the Department of Physics of the Air University of the Pakistan Air Force (PAF). He is also a renowned educationist of Pakistan with specialization in nuclear physics, solid-state physics, and computer simulation.



Dr. Abdullah Sadiq joined the Pakistan Atomic Energy Commission (PAEC) in late 1962 after his M.Sc. from Peshawar University, where he also briefly taught at its Physics Department. He did his Ph.D. in condensed matter theory from the University of Illinois at Urbana-Champaign, USA. During his stay at the PAEC's premier Institute, PINSTECH, from 1971 till 1992, he served as Head of its Theoretical Physics Group and Scientific Information Division. During this time he regularly visited the International Centre for Theoretical Physics as its Associate, Senior Associate and Staff Associate member, and also worked at the Nuclear Research Center at Juelich, Germany, as an Alexander von Humboldt Fellow. During the late 1980s, he got associated with the Ghulam Ishaq Khan Institute of Engineering Sciences and Technology, Pakistan, as a founding member of its parent body, the Society for the Promotion of Engineering Sciences and Technology in Pakistan (SOPREST), helping to establish this prestigious Institute and serving as its founding Dean and eventually as its Rector. The Center for Nuclear Studies (CNS) of PAEC was renamed as the Pakistan Institute of Engineering and Applied Sciences or PIEAS when he was its Director General, and given degree-awarding status in 2000 when he was also appointed as its Rector.

For his contributions to physics research he was awarded Pakistan's Civil Award, *Sitara-e-Imtiaz*. He was also awarded the ICTP Prize

and Gold Medal. He received the former in the honour of Nikolay Bogolyubov, in the fields of Mathematics and Solid State Physics in 1987 for his contributions to Statistical Physics.

Prof. Dr. Asghar Qadir

Prof. Dr. Asghar Qadir is a Professor of Physics at National University of Sciences and Technology (NUST), Pakistan, and holds a Ph.D from London University (UK). He specializes in Astrophysics, Cosmology and Relativity. In past, he has held various posts in Quaid-i-Azam University (QAU), Pakistan; Ghulam Ishaq Khan Institute of Engineering Sciences and Technology, Pakistan; King Fahd University of Petroleum and Minerals, Saudi Arabia.

Prof. Qadir has been awarded a number of awards, some of which include, Al Khwarizmi First Prize for Mathematics; Pakistan Academy of Sciences Gold Medal; *Sitara-i-Imtiaz* of Pakistan; and ISESCO Award for Mathematics. In 2004, he was also nominated as a 'Distinguished National Professor' by the Higher Education Commission of Pakistan.

Prof. Dr. Muhammad Zafar Iqbal

Prof. Dr. Muhammad Zafar Iqbal is currently serving as Advisor and Professor at COMSATS Institute of Information Technology, Islamabad. He holds a Ph.D. in Experimental Solid State Physics from University of Manchester (U.K) and M.Phil. in Theoretical Physics from Quaid-i-Azam University, Pakistan. His expertise in physics includes Experimental Solid State Physics

(Semiconductor Physics/Electronics). He has served as Acting Vice-Chancellor, Dean, Faculty (School) of Natural Sciences and Chairman, Department of Physics at Quaid-i-Azam University.

Dr. Iqbal is recipient of President's Award for Pride of Performance (1998); *Sitara-i-Imtiaz* (2004); First prize for publications in International Journals by Scientists, Ministry of Education (1988); and Open Gold Medal for Research Contributions in Physics by Pakistan Academy of Sciences (1993). He has over 120 research publications to his credit and has supervised a number of M.Phil. and Ph.D. students.

Prof. Dr. M. Aslam Baig

Prof. Dr. M. Aslam Baig is currently associated with the National Centre for Physics (NCP), Quaid-i-Azam University, Pakistan. With a Ph.D. from Imperial College London (UK), he specializes in the field of Atomic and Laser Physics. Dr. Baig has had an affiliation of more than ten years with Imperial College London and Bonn University, Germany. He established a laboratory at the Bonn Synchrotron Radiation Facility and instituted the Atomic and Laser Physics Laboratory at Quaid-i-Azam University. Dr. Baig has, inter alia, been the ICTP Associate and Senior Associate, Italy; ICS Associate of the United Nations Industrial Development Organization, Italy; Fulbright Fellow at the University of Virginia, Charlottesville, USA; and the founding 'Director Science' of the SESAME Project being established at Amman, Jordan.

To his credit are the supervision of 30 Ph.D. and 70 M. Phil. students; more than 250 research papers published in international refereed journals. He has participated and contributed in more than 120

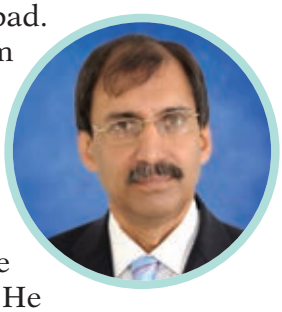
international conferences. The distinctions and awards Dr. Baig holds include: Gold-Medal by the Pakistan Academy of Sciences; Z.A. Hashmi Gold Medal (2012) by the Pakistan Science Foundation; and civil awards of Pakistan, *Tamgha-i-Imtiaz*, *Sitara-i-Imtiaz*, and *Hilal-i-Imtiaz*. In recognition of his contributions in the field of Atomic and Laser Physics the Higher Education Commission, Pakistan, designated him as "Distinguished National Professor" in 2006.

Prof. Dr. Saleem Asghar

Prof. Dr. Saleem Asghar is currently the Professor of Mathematics at COMSATS Institute of Information Technology (CIIT), Islamabad. He has been affiliated with CIIT for the last ten years. He holds a Ph.D. in Mathematics from Quaid-i-Azam University, Islamabad, Pakistan. Dr. Asghar has previously been associated with Quaid-i-Azam University, Islamabad, and CIIT Abbottabad Campus. He is also the lifetime Distinguished National Professor of Higher Education Commission (HEC) of Pakistan. He has supervised over 90 theses of Ph.D. and M.Phil. students and has over three hundred publications in international journals to his credit.

Dr. Asghar is recipient of two Civil Awards of Pakistan, the prestigious *Sitara–i-Imtiaz*, and *Tamga-i-Imtiaz*. Apart from his membership of national institutions, he has been associated with ICTP as Visiting Mathematician, and Associate Member; with University of Rhode Island, Kingston, USA, as Fulbright Fellow; with the University of Stuttgart, Germany as DAAD Fellow; and the University of Illinois at Urbana-Champaign as Visiting Scholar.

Dr. Hamid Saleem



Dr. Hamid Saleem is Professor at the Department of Space Science, Institute of Space Technology (IST), Islamabad. He is a plasma physicist with a Ph.D. from Quaid-i-Azam University, Islamabad, Pakistan. As a scientific administrator he has served in important positions: Director General, National Centre for Physics (NCP), Pakistan, Deputy Chief Scientist, PINSTECH. He has established active research groups in the field of plasma physics in PINSTECH and NCP. He has also worked at National Centre for Fusion Science (NIFS), Toki, Japan, as a Post-doctoral fellow of the Japan Society for the Promotion of Science (1996-1998). He is Senior Associate of Abdus Salam-International Centre for Theoretical Physics (AS-ICTP), Trieste, Italy since 2001, and has visited AS-ICTP many times as a participant, Senior Associate and Speaker. He has been doing collaborative research through short-term visits with the Centre for Plasma Astrophysics of K-Leuven University, Belgium, Tokyo University, Japan; and Texas University at Austin, USA.

He is recipient of several distinguished prizes and awards, including the 'Dr. M. Raziuddin Siddiqi Prize for Young Scientists under 40 for Physics' by Pakistan Academy of Sciences (1993); Gold Medal of the 'PINSTECH Performance Award' (2001); Gold Medal by Pakistan Academy of Sciences (2004); *'Tamgha-i-Imtiaz'* by the Government of Pakistan (2004); and Pride of Performance. He has over 120 publications in International Journals.

Dr. Arshad Saleem Bhatti

Dr. Arshad S. Bhatti is the Dean Faculty of Science, at COMSATS Institute of Information Technology (CIIT). He holds a Ph.D. in Micro and Optoelectronics from the University of Cambridge, Cambridge, UK. He was a Fulbright visiting scholar at the University of Illinois at Urbana-Champaign, USA. He is also a Senior Associate of the Abdus Salam International Centre for Theoretical Physics, Trieste, Italy.

Dr. Bhatti has vast experience of working in semiconductor low-dimensional structures for device applications. His interests include popularization of science and use of science for society. He was conferred *Tamgha-i-Imtiaz* in 2012 by the President of Pakistan. He is also COMSATS' Science Ambassador in the field of Physics.

Dr. Kashif Sabeeh

Dr. Kashif Sabeeh is a Tenured Associate Professor in the Department of Physics, Quaid-i-Azam University, Islamabad, Pakistan. He is a condensed matter theorist specializing in electronic properties and electronic transport in low-dimensional condensed matter systems, especially Dirac materials such as graphene, silicene and topological insulators. He has a Ph.D. in Physics from Stevens Institute of Technology, USA.

Dr. Sabeeh is a Regular Associate of the International Center of Theoretical Physics (ICTP) in Trieste, Italy, and a member of the American Physical Society. He is a member of the Board of Studies of Pakistan Institute of Engineering and Applied Sciences (PIEAS), Air University and Government College University (GCU), Lahore, Pakistan. He has a number of publications to his credit on electronic properties in low-dimensional systems. He has also been supervising a number of M.Phil. and Ph.D. students.

Dr. Jamila Bashir Butt

Dr. Jamila Bashir Butt is currently serving as Assistant Professor at COMSATS Institute of Information Technology (CIIT), Pakistan. She holds a diploma in Particle Physics from Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, and a Ph.D. in Experimental Particle Physics from Syracuse University, USA. Dr. Jamila has been teaching in universities of Pakistan and USA, and has assisted many students for their research work for M.S. and M.Phil. programmes.

Previously, she has worked as Senior Scientific Officer at National Centre for Physics (NCP), Pakistan; Post-Doctoral Fellow at University of Nebraska-Lincoln Nebraska (posted at CERN, Switzerland); Post-Doctoral Fellow at National Centre for Physics, Pakistan; and Research Assistant in High Energy Physics at Syracuse University, USA. She has a number of publications to her credit and has participated in several national and international conferences.

Dr. Imtinan Elahi Qureshi

Dr. Imtinan Elahi Qureshi is currently the Executive Director of the Pakistan based international organization, COMSATS. He holds a Ph.D. (1979) in Physics from the University of Surrey (Guildford, U.K.). He has served in Pakistan Atomic Energy Commission as research scientist and scientific administrator for more than 25 years (1980 – 2005). His specialization includes atomic, nuclear and particle physics. In the areas of exotic atoms, elastic scattering of hadrons, heavy ion reactions, radon dosimetry and non-accelerator high-energy physics, he has over 100 publications.

During the period July 2005 to August 2008, he was posted as Minister (Technical) in the Permanent Mission of Pakistan to the United Nations in Geneva, where he represented Pakistan as a member of delegation in the meetings of Conference on Disarmament, Biological and Toxin Weapons Convention, and United Nations Economic and Social Council's Commission on Science and Technology for Development.

As a research scientist and Head of Radiation Physics Division, Pakistan Institute of Nuclear Science and Technology (PINSTECH), Dr. Qureshi has traveled widely and established research collaborations in basic sciences in different institutions in Europe, China and Latin America. He has been a regular Associate of the International Centre for Theoretical Physics during the period 1995-99. Dr. Qureshi holds the titles of Adjunct Professor of Physics at COMSATS Institute of Information Technology (CIIT) and COMSATS Science Ambassador Emeritus. He is a recipient of PINSTECH Performance Award (1996) and Pakistan Government's Civil Award, *Tamgha-i-Imtiaz* (2004).

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