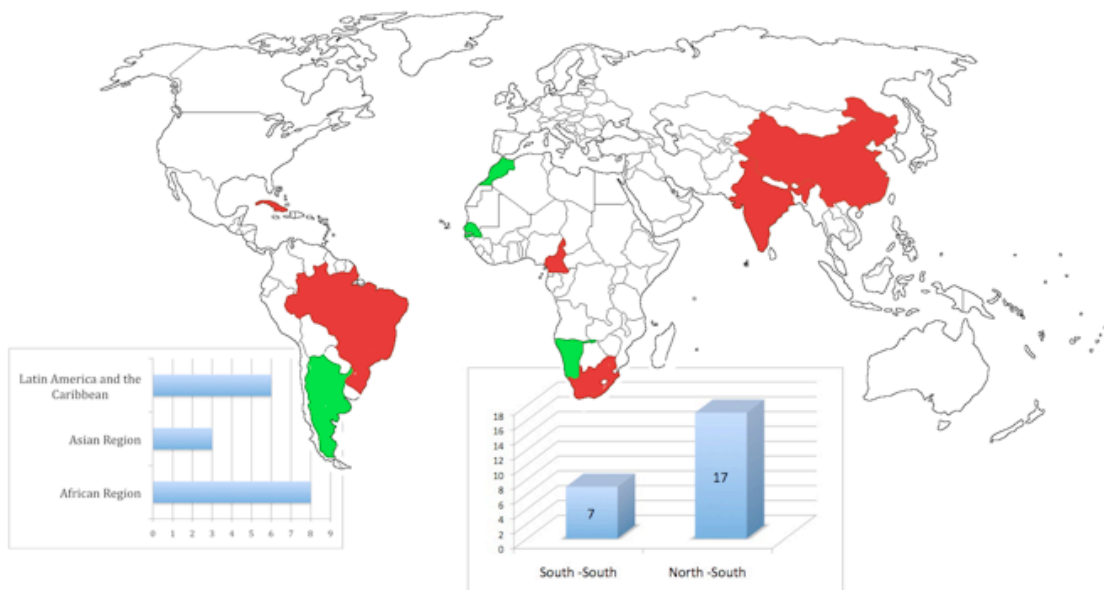


The Office of External Activities: A review

*A 28-year pathway of The Abdus Salam ICTP for the
progress of science in the emerging world*

A 6-year Report (2006-2011)



Foreword

The year 2010 was a significant date for the Abdus Salam International Centre for Theoretical Physics (ICTP). Firstly, that year was the 25 anniversary of the creation of the Office of External Activities (OEA), one of the major efforts of this Centre for sponsoring the progress of science in the emerging nations. Secondly, the ICTP started the Strategic Plan 2010-2014 ("*Science and Development for a Changing World*"). This forward-looking instrument for guiding the pathway that the ICTP is to follow in the near future intended to provide a vision and to identify clear goals, in order to move forward from the considerable and laudable achievements of the OEA during its first 28 years.

We have organized this report along this line of action, stressing the achievements of the OEA during its first quarter of a century. For this purpose we have drawn a series of 11 diagrams and charts with the most significant year, namely, 2010, the data for which is available in the OEA files. This compilation of data is intended to serve as a basis for subsequent appreciation of the progress in years 2010-2014, beginning with a complete set of data in a large set of tables for the years 2006-2011. The initial step taken in this Report uses the information received by the OEA, which is now complete and is fully incorporated in the present work. In the appendices we have provided the set of 51 tables including the new 2011 data.

To bring to the attention of the readers the extraordinary gathering of remarkable institutes, universities and centres of higher education and research with which the OEA has collaborated, we have introduced a set of over 60 illustrations. Since this report covers a period of almost three decades we have also insisted to introduce photographs of the key players that preceded the present administration of the OEA by Dr. George Thompson and collaborators.

To review the work of the OEA has been a singular privilege indeed, as well as a daunting challenge that in July 2010 the author gladly and eagerly undertook by the kind invitation of the ICTP Director Professor Fernando Quevedo. There was no precedent for such a task, in spite of the considerable amount of excellent and significant work that the OEA—a cornerstone of ICTP influence in the emerging countries—had done for over a quarter of a century. Our hope is that by making this detailed document available to the present and hopefully future funding agencies the growth of this singular branch of the Abdus Salam ICTP will continue to grow steadily.

In view of the considerable size of the OEA archives, it seemed reasonable to restrict our attention only to a brief and significant recent period for which the data was complete. But even though we have limited our attention to this 6-year period, nevertheless it brings to our attention the considerable world wide impact of the OEA: the Institutional Index lists 53 universities, besides many Research Centres, whereas the Country Index lists 107 different countries with

which this larger group of institutions that share with the Abdus Salam ICTP common efforts to encourage the academic progress of the emerging nations.

One final clarification for the readers: even though at first it looks inelegant, we have insisted in preserving the corresponding references to the original OEA files. Our experience has forced upon us to recognise the present and future value of returning to both the original files that are currently in the OEA Offices, as well as to those that are now displaced in "dead archives". Within the text a most discrete position has been reserved for this valuable OEA code numbers, namely at the end of the figure captions, before its credit. In addition, each table has been linked to the original source by quoting, once again, the OEA internal code number next to the table number. In view of the considerable bulk of information that preceded the present digital age, the hard copies of the original OEA files are a true and significant treasure trove for our funding agencies as well as for our institutional partners to delve into the wealth of information that constitutes this perennial and laudable effort to build the external collaborations of the ICTP.

We hope that this Report will help to fully appreciate the high priority that this Office has recently been granted within the well-focused ICTP Strategic Plan for the period 2010-2014.

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Adjunct to the OEA

Staff Associate ICTP

May 2013

Table of contents

Foreword	3
Table of Contents	5
The Head of the Office of External Activities	7
Acknowledgements	8
 INTRODUCTION	 9
 THE AFFILIATED CENTRE PROGRAMME	 11
The African Current Affiliated Centres	12
The Former Asian Affiliated Centres	17
A Current East European Affiliated Centre	21
The Current Latin American and Caribbean Affiliated Centre	22
PROJECTS	25
The Former African Projects	26
The Current African Projects	32
The Former Asian Projects	34
The Current Asian Projects	36
A Current European Project	41
The Former Latin American and Caribbean Projects	42
The Current Latin American and Caribbean Projects	43
 THE NETWORK PROGRAMME	 45
The Former African Networks	46
The Current African Networks	47
The Former Asian Networks	54
The Current Asian Networks	57
The Former Latin American and Caribbean Networks	59
The Current Latin American and Caribbean Networks	61
 VISITING SCHOLARS/CONSULTANTS	 65
 REGIONAL ENCOURAGEMENT	 67

SCIENTIFIC MEETINGS	69
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Appendices

Appendix 1: A brief history of the Office of External Activities	71
Appendix 2: Former and Current Affiliated Centres (2006-2011)	75
Appendix 3: Former and Current Projects (2006-2011)	81
Appendix 4: Former and Current Networks (2006-2011)	89
Appendix 5: Visiting Scientists (2006-2011)	103
Appendix 6: Scientific Meetings (2006-2011)	105

Indices

ACRONYMS AND ABBREVIATIONS	109
COUNTRY INDEX	113
INSTITUTIONAL INDEX	117
NAME INDEX	121
ABOUT THE AUTHOR	123

The Head of the OEA Office



The Office of External Activities (the OEA) was established in 1985 and is currently headed by Professor George Thompson. He was born in Australia and at present is research scientist of the High Energy, Cosmology and Astroparticle Physics Scientific Section. Dr. Thompson joined the OEA in 2005.

Acknowledgments

The present report has benefitted from the collaboration of many colleagues: First of all, we thank the ICTP Director Professor Fernando Quevedo for the privilege and challenge he granted the author in July 2010 to become associated with the OEA. Thanks are also due to Mrs. Dorotea Calligaro and Eleonora Crotta from the OEA Office, with their valuable experience, they have generously and continually given the author their precious advice and wise counselling in their special fields of expertise. More recently Ms. Vivian Zaccaria has joined the OEA.

Mr. Raffaele Corona and co-workers from the ICTP Multimedia Publications and Printing Services, with their characteristic selfless efficiency and proficiency in digital and related matters have generously contributed to improve considerably the production of the present work.

Mr. Johannes Grassberger provided invaluable help, so that the author could master the digital techniques necessary for producing the diagrams that summarise so efficiently the worldwide influence of the OEA.

Mrs. Anna Triolo, from the Public Information Office, kindly helped to select the appropriate illustrations for Appendix 1 from the ICTP Public Relations Office Archives.

Mr Alessandro Bulzani has offered valuable help in the retrieval of files from the Abdus Salam ICTP Archive Repository (Dead Archives) for several OEA files that have been confined there, due to the voluminous amount of data of the OEA office preceding the year 2007.

We thank the ICTP Archives for the illustrations in Appendix A, as well as for the use of the illustrations retrieved from the publication: ICTP and Africa. Compiled and edited by K. R. Sreenivasan (printed in Trieste by the ICTP Publications and Printing Services, 2007). In addition, Dr. Hugo Perez Rojas (Cuba) and Professor Stanislas Ouaro, President of the University of Ouaga II, in Gonsse, Burkina Faso are gratefully acknowledged for supplying valuable illustrations.

Even though I have received such generous collaboration from many colleagues at the ICTP, any remaining difficulties and misprints in the Review are entirely the responsibility of the author that will be subsequently eliminated.

Last, but certainly not at all least, thanks are due to the current Head of the OEA Office, Dr. George Thompson, for his continued relevant, critical, wise counselling and for multiple timely suggestions brought to our attention since the beginning of this work in July 2010.

Introduction

The Office of External Activities (the OEA) was established in 1985 and is currently headed by Professor George Thompson (cf., p. 7). For a brief history of the Office, prior to the present administration, we refer to Appendix 1, p. 71.

The objective of OEA is mainly to help the research and training activities of physicists and mathematicians living and working in developing countries. OEA provides assistance to scientists in their home countries. Such support complements the training and research provided to scientists from developing countries at the Abdus Salam ICTP. The OEA programmes provide funds for student grants, fellowships for young researchers, visits of research collaborators and other activities.

The OEA actions are aimed at providing a backup to individuals, groups or institutes in the developing countries to accelerate their promotion to an international level (North-South collaboration) and to stimulate networking of scientists in the developing regions to reach a critical mass of researchers (South-South collaboration).

The present administration of the ICTP has undertaken a Strategic Plan for the period 2010-2014 "Science and Development for a Changing World". In this document it is ratified that the ICTP has a dual mission: to pursue high quality research and to nurture science in the developing world. In order to achieve these goals, the ICTP intends to enhance substantially the role of OEA by a complementary set of activities:

- Affiliated Centres
- Projects
- Networks
- Visiting Scholars/Consultants
- Scientific Meetings

with a new major activity focusing on the creation of ICTP branch institutes.

The purpose of the present report is to assess what OEA has done over the last 5 years. The academic activities are illustrated with graphics and images. The emphasis has been placed on the turning point of the renewed efforts of the ICTP, which began in the year 2010. This has been illustrated in the diagrams, while the data for the period 2006-2011 has been reported in full in the appendices.

The Affiliated Centre Programme

An Affiliated Centre is an Institute or University Department of Physics or Mathematics that carries out a specific long-term research project on a definite subject with well-defined purposes. The Affiliated Centres have a regional character and are strongly supported by the local authorities and the hosting institute. The work corresponding to the period 2006-2011 can be consulted in Appendix 2. In some more detail in 2011 the OEA supported 7 Affiliated Centres with 5 of them in Africa.

The OEA has encouraged, with special emphasis, graduate schools, which in 2011 had an ongoing set of 23 Ph.D. (or Troisième Cycle) students with partial, or full support from the OEA funds. The OEA has sponsored other graduate school programmes in Africa. These activities include Master, or Diploma courses.

In Fig. 1 we show the distribution when the major effort of the OEA began to line up with the current ICTP Strategic Plan:

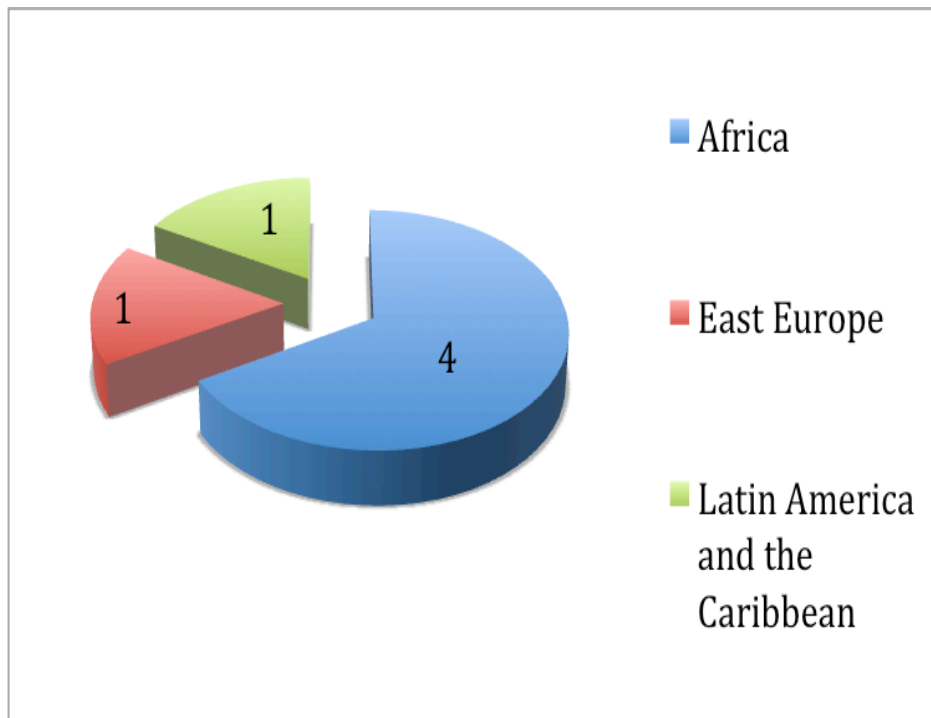


Fig. 1 Distribution of Affiliated Centres supported by the OEA. (The data refers to the year 2010.) The full data for the period 2006-2011 is shown in Appendix 2. Henceforth all the data in the diagrams refers to the year 2010. The data reported in the Appendices covers the period 2006-2011. Credit: the author archives.

THE AFRICAN AFFILIATED CENTRES

The Current Affiliated Centres

The Affiliated Centre located at L'Institut de Mathématiques et de Sciences Physiques (IMSP)

The University of Abomey-Calavi, Porto Novo, Benin is the host of this OEA collaboration. The IMSP is a centre for education and research in pure and applied mathematics, physical sciences and engineering (cf., Fig. 2).



Fig. 2 L'Institut de Mathématiques et de Sciences Physiques (IMSP), Porto Novo, Benin (AC-3). Credit: *ICTP and Africa*. Compiled and edited by K. R. Sreenivasan. Printed in Trieste by the ICTP Publications and Printing Services (2007), p. 13

IMSP is a focal point for Advanced Schools and conferences in the region. One striking example is represented by the biannual series of workshops in mathematical physics, the GIRAGA workshops. These events take place in alternative venues between IMSP and the University of Yaounde I (Cameroon). The abbreviation stands for the Inter-African Group of Research in Analysis, Geometry and Applications. Their activities have created a stimulating environment for African mathematicians to keep abreast with current international trends in mathematical research. [From: *IMSP Scientific Report, 2009-2010*.] The considerable growth of IMSP in their Graduate School, as well as in their successful flow of research publications has been summarized in Appendix 2.

The Affiliated Centre located at University Cheikh Anta Diop (UCAD)

This Affiliated Centre, at the UCAD University, Dakar, Senegal, is named after the Senegalese historian and anthropologist Cheikh Anta Diop. The Centre itself is at the UCAD Laboratory of Atoms and Lasers of the Physics Department. The OEA appointed them in 1992. The main vocation of the Dakar Affiliated Centre is to promote and to enhance teaching, training and research programmes in the field of lasers, atomic and molecular physics (LAM).

From the beginning their intention is to interact with similar centres in other African nations of that region, including amongst others Ghana, Sudan and the Ivory Coast. Through different academic activities the LAM Centre has developed strong partnerships with world organizations, such as SPIE (the International Society for Optical Engineering) and ICO. These affiliations clearly demonstrate that the visibility of the Dakar Centre has extended from a regional influence to the international Optics community (the International Commission for Optics). [From: *2000 and 2009-2010 Annual Reports*.]

The high level of their Graduate School, as well as in their Research can be inferred from the corresponding table in Appendix 2. A total of 34 research papers were published in the period 1999-2006. The figure shows the UCAD library (cf., Fig. 3 and also "Networks"). [From: *Evaluation Report, 1999-2006, Annex 3*.]



Fig. 3 The Cheikh Anta Diop University (UCAD), Dakar, Senegal (AC-56). Credit: [http://en.wikipedia.org/wiki/File: BibliothèqueCheikhAntaDiop.JPG](http://en.wikipedia.org/wiki/File:BibliothèqueCheikhAntaDiop.JPG)

The Laser and Fiber Optics Centre (LAFOC)

This OEA collaboration is an Affiliated Centre located at the University of Cape Coast, Ghana. This University was established in 1962, whereas its affiliation with OEA dates back to 1992 (cf., Fig. 4). The training program became a reality due to another ICTP initiative, the TRIL Program (Training and Research in Italian Laboratories).



Fig. 4 Professor Gallieno Denardo the Head of OEA at the time of the inauguration of LAFOC (AC-57). Credit: ICTP and Africa. Compiled and edited by K. R. Sreenivasan. Printed in Trieste by the ICTP Publications and Printing Services (2007), p. 14

LAFOC does research in Optical Metrology, namely light scattering in fluids, optoelectronics and interferometry. Other areas are laser-induced fluorescence, and fiber optics for optical communications. [From: *Optics Development in Africa, a 2006 Report by P. K. Buah-Bassuah.*].

The Centre of Atomic, Molecular Physics and Quantum Optics (CEPAMOQ)

This Centre is Affiliated with the OEA. It is located at the University of Douala, Cameroon (cf., Fig. 5). Ever since the beginning of their collaboration with OEA, it has been evident that the CEPAMOQ Affiliated Centre is in a privileged position to help neighbouring countries at an academic level that includes both graduate-school training and in research.



Fig. 5 The University of Douala, Douala, Cameroon (AC-71). Credit: <http://www.cameroon-today.com/university-of-douala.html>

These collaborations have been implemented, for instance with Chad and the Central African Republic. The specific collaborations have encompassed the University of N'Djamena, the leading institution in Chad that was created in 1971 as the University of Chad, and was renamed to University of N'Djamena in 1994. The other outstanding example is the University of Bangui, a public university located in Bangui, Central African Republic. As of 2006, it is the only university in the Central African Republic. [From: *2006 Report 012/06/UD/FS/FS/CEPAMOQ.*]

The presence of external collaborators at the UCAD Affiliated Centre from neighbouring countries, including Congo, Gabon and Rwanda underlines their regional impact.

The Affiliated Centre at the Zewail City for Science and Technology (ZCST)

This new institution is an important partner that the OEA that was earlier in a different collaboration with the OEA. The Centre for Theoretical Physics (CTP, cf., Fig. 6) is now part of The Zewail City of Science and Technology: Egypt's National Project for scientific Renaissance. This initiative has received generous support from local sources. This is the most recent addition to the family of the Abdus Salam Affiliated Centres.



Fig. 6 The Zewail City of Science and Technology (AC 80). Credit: <https://www.zewailcity.edu.eg/the-city>

The concept of Zewail City of Science and Technology originated in 1999. Dr. Ahmed Zewail presented the idea and the road map for the Project on the occasion of Egypt's celebrations of Zewail's Nobel Prize in Chemistry (cf., Fig. 7).



Fig. 7 Inauguration of Zewail City by the Prime Minister and some members of the Cabinet on 1 November 2011. Credit: <https://www.zewailcity.edu.eg/the-city/city-overview>

As with the previous Project with Centre for Theoretical Physics (CTP) the current collaboration between the OEA focuses on the Graduate School and research projects.

THE ASIAN AFFILIATED CENTRES

The Former Affiliated Centres

The Department of Physics, Quaid-i-Azam University

The University was founded in Islamabad, Pakistan, only two years after the ICTP—in 1966—also with the support of Professor Abdus Salam (cf., Fig. 8). It sponsored research in mathematics and theoretical physics. Professor Riazuddin served as its first and founding director. He was one of Pakistan's leading scientists and himself a student of Abdus Salam. Since the 1960s until the present, the institute embarked on a major activity in the area of theoretical particle physics. It launched a strong experimental research program in a number of areas of physics, notably a consistent effort in Plasma Physics that included, amongst several research projects an early effort—in 2000—studying plasma focus as high intensity soft X-ray source.

The OEA has had a long supporting relation, first through a former Affiliated Centre, and currently as a Project (cf., Current Projects below).



Fig. 8 Quaid-i-Azam University Library, Pakistan. (AC-7).

Credit: http://commons.wikimedia.org/wiki/File:Quaid-i-Azam_University_Library.JPG

In the first year of this report—2006—the OEA funds were ear-marked in support of the Project "*Band structure calculations and crystal structure determination of $\text{CuBa}_2\text{Ca}_3\text{Cu}_4\text{O}_{12-y}$ superconductors*". During that year 2 MPhil students and 1 PhD student completed their theses. That work led during that year to 3 publications in peer-reviewed journals [Data from: *Evaluation Report of Dr. N. Ali Khan*, 7 August 2008].

Centre for Advanced Mathematical Sciences (CAMS), based at the American University of Beirut (AUB), Lebanon

The former Affiliated Centre CAMS was founded in 1999 through the efforts of an international group of scientists with the primary goal of becoming the premier center of excellence for research in the mathematical sciences in the Middle East. It was supported by the OEA during 2006. By creating opportunities for top-quality research and teaching, and by encouraging academic collaboration and interdisciplinary research at AUB and in the region, CAMS has served as flagship institute within AUB's academic plan to revitalize scholarship and research in the mathematical sciences (cf., Fig. 9).



Fig. 9 The reconstructed College Hall (AC-78). Credit: <http://en.wikipedia.org/wiki/File:Aubeirut174.jpg>

CAMS has a unique role to play as the leading regional institute for research in the mathematical sciences (From: *American University of Beirut - Center for Advanced Mathematical Sciences Official website*).

Department of Physics, Isfahan University of Technology

This former Affiliated Centre at Isfahan, Islamic Republic of Iran is part of an engineering university (the Isfahan University of Technology) that was established in 1977. Its relation with the OEA goes back to 2002 and it collaborated with the ICTP till 2008, which materialized into a number of fellowships for PhD students and young academic staff from neighboring countries. The OEA also contributed to upgrading local computer facilities (cf., Fig. 10).



Fig. 10 Main Administration Building, Isfahan University of Technology, Iran (AC-85).
Credit: <http://en.wikipedia.org/wiki/File:IutSpring.jpg>

The main focus of the collaboration centered on the area of computational condensed matter physics that included the structure of boron compounds at high pressure, as well as the interaction of electric fields with of rare earth materials [From: *Assignment letters 2002-2008*, *Proposal 2002* and *Evaluation Report 2003*].

HCM Institute of Physics Viet-Nam (IOP), based at Ho Chi Ming City

The former Affiliate Centre, the High Energy Physics Centre at the Ho Chi Minh Institute of Physics Viet-Nam was also associated firstly with the Vietnamese Academy of Science and Technology, and secondly with the Government of Vietnam. It received consistent support from the OEA from 2004 till 2006 for the project “Collaboration with the D_0 experiment at the Fermi National Accelerator Laboratory to develop experimental and phenomenological aspects in South Vietnam (cf., Figure 11).



Fig. 11 The Tevatron Collider at the Fermi National Accelerator Laboratory, Chicago, USA, the experimental facility where the Former Affiliated Center collaborated (AC-87). Credit: <http://en.wikipedia.org/wiki/Tevatron>

The official acceptance of the Vietnam High Energy Physics Group to the D_0 collaboration went back to the year 2001. This experimental facility had the distinction of being responsible for the discovery of the Top Quark in 1994. Subsequently, the accelerator was involved with the search of the Higgs particle, CP violation super-symmetric particles, dark matter and dark energy. For these reasons the OEA considered relevant its support for the growing group of young scientists from many universities of South Vietnam.

Some of the specific assignments included analyzing data to determine properties of the Top Quark. In addition, it is worth mentioning that these young Vietnamese scientists, with the OEA support were involved in measurements of the CP violating decays of the B system, including the Cabibbo–Kobayashi–Maskawa matrix elements. An important consequence of this effort is illustrated by the acceptance for PhD work of three young members of this group in universities such as Florida State University and Northern Illinois University. (From: *Application for Funds in its Fourth Year of Association with the OEA.*)

A CURRENT EAST EUROPEAN AFFILIATED CENTRE

The Pavel Sukhoi Gomel State Technical University (PSGSTU)

This is an Affiliated Centre located at Belarus (cf., Fig. 12). The University is one of the leading technical educational institutions in the Republic of Belarus. The Laboratory for Physical Studies (LPS) of this University has been carrying out high-level research projects in the field of High Energy Physics. Their research has been centred on the search for new physics scenarios that are needed to rationalise the new physics that is emerging from the new instrumentation that has been made available to the physics community at the Large Hadron Accelerator at CERN in Geneva, as well as at the International e^+e^- Linear Collider.

Having funds from different sources, including those of the OEA this Affiliated Centre has been supporting a Fellowship Programme for the benefit of scholars, not only for Belarus, but also for the region of Eastern Europe.

It provides training for the graduation of engineering personnel and higher scientific qualification personnel for such branches of industry, as mechanical engineering, metallurgy, power engineering, economy, radio-electronic engineering and information technologies.



Fig. 12 The Pavel Sukhoi Gomel State Technical University, Belarus (AC-88).

Credit Wikipedia: http://en.wikipedia.org/wiki/File:BLR_Gomel_Pavel_Sukhoi_State_Tech_Univ_1.jpg

THE CURRENT LATIN AMERICAN AND CARIBBEAN AFFILIATED CENTRES

The Instituto de Matemática y Ciencias Afines (IMCA)

This Affiliated Centre is located in Lima, Peru (cf., Fig. 13). In 1989 the Institute began a programme supporting the regional development in mathematics in Peru. Its funds came from the Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy. This programme was based for its scientific organization on the Instituto de Matematica Pura e Aplicada (IMPA), Rio de Janeiro until 1997.

Since that date IMCA took over regional development. This Institute belongs to the Universidad Nacional de Ingenieria (UNI), a polytechnic school that receives the best Peruvian students in sciences and engineering. The initial project was prepared by special request of Professor Abdus Salam who strongly encouraged the establishment high-level mathematical activities in Peru.

From the early support provided by the OEA, IMCA began to set up a library that was a focal point for the whole country. Besides its affiliation with the OEA, IMCA benefits from associated institutes and universities, such as Pontificia Universidad Catolica del Peru, Universidad Nacional de Ingenieria, Instituto de Matematica Pura e Aplicada (IMPA), Rio de Janeiro, Brazil, Centre International de Mathématiques Pures et Appliquées (CIMPA), Nice, France and Centre de Recerca Matematica, Barcelona, Spain. [From: *IMCA's website* <http://www.imca.edu.pe/sitio/>.]



Fig. 13 Instituto de Matemática y Ciencias Afines (IMCA), Lima, Peru (AC-70).
Credit: <http://www.imca.edu.pe/sitio/index.php>

Throughout its Affiliated Centres, the OEA has always encouraged graduate schools. The full data for the period 2007-2011 is shown in Appendix 2. The distribution of all the graduate students supported by the OEA in the initial year of 2010 is shown in Fig. 14:

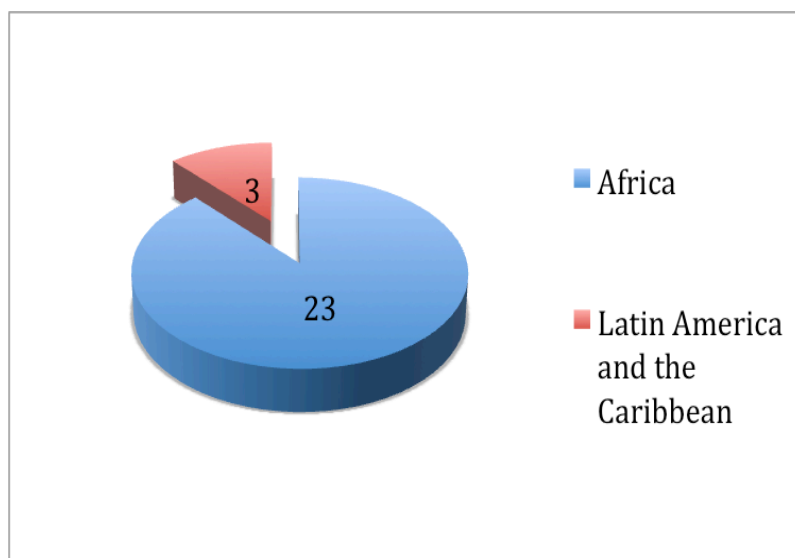


Fig. 14 In 2010, the typical year of our illustrations, the Office was supporting a group of 19 Ph.D. (or Troisième Cycle) students with partial, or full support. The OEA has sponsored other graduate school programmes in Africa and Latin America, including Master, or Diploma courses. The full data for the period 2006-2011 is shown in Appendix 2. Credit: the author archives.

Throughout all its Affiliated Centres the OEA has encouraged graduate schools. The distribution of all the graduate students supported by the OEA is shown in Fig. 15:

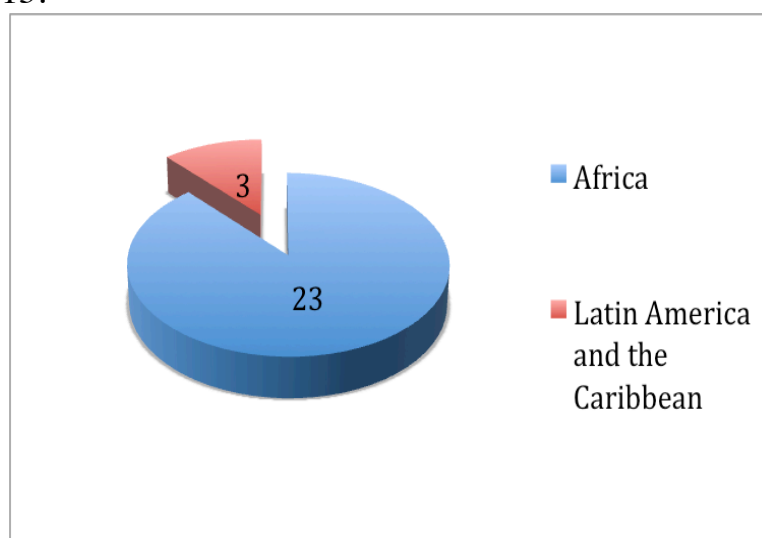


Fig. 15 In 2010 the Office was supporting a group of 19 PhD (or Troisième Cycle) students with partial, or with full support. The OEA has sponsored other graduate school programmes in Africa and Latin America, including Master, or Diploma courses. Credit: the author archives.

Projects

Given the lack of trained personnel in physics and mathematics at universities in some developing countries and the fact that many students from these countries who pursue their graduate studies in industrialized countries do not return to their countries of origin, the OEA supports specific PhD courses. OEA also supports several research projects that do not currently fit the category of Affiliated Centres.

There are 9 active projects, of which 3 are in Africa, 4 in Asia, 1 in Latin America and 1 in South-Eastern Europe. The areas of research covered are: Earth Sciences, Mathematical Sciences, Physical Sciences and Space Sciences. Post-doctoral fellows and graduate school students, mainly Ph.D. candidates with a strong representation from African nations, are implementing the research projects. The OEA is supporting 20 PhD students distributed amongst its 9 Projects. The Office is also supporting other graduate students amongst these projects.

At the beginning of the ICTP Strategic Plan 2010-2012 there were 12 active projects, whose distribution is shown in Fig. 16:

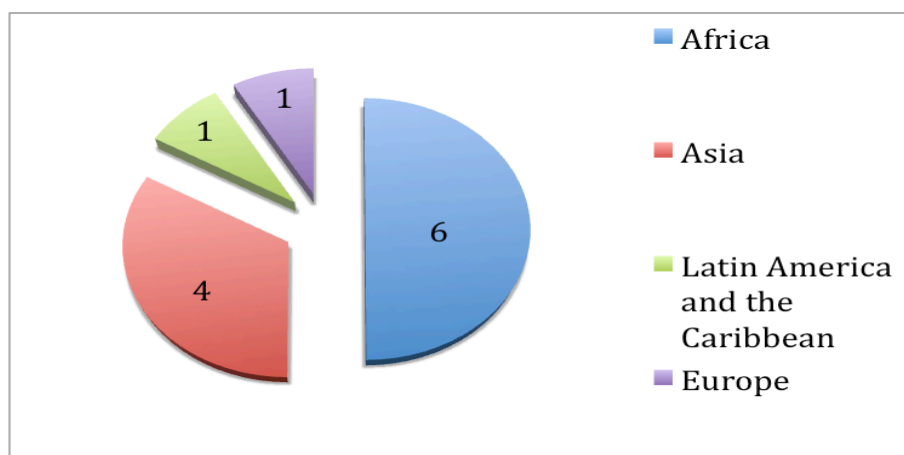


Fig. 16 Distribution of projects supported by the OEA in the year 2010. Credit: the author archives.

The areas of research covered are: Earth Sciences, Mathematical Sciences, Physical Sciences and Space Sciences. The majority of these projects are in Africa and Asia with a presence in East Europe and Latin America and the Caribbean. Post-doctoral fellows and graduate school students, mainly PhD candidates with a strong representation from African nations, are implementing the research.

The graduate student distribution for the period 2007-2011 can be consulted in Appendix 3. In detail, by regions the earlier work corresponding to 2010 is shown in Fig. 17:

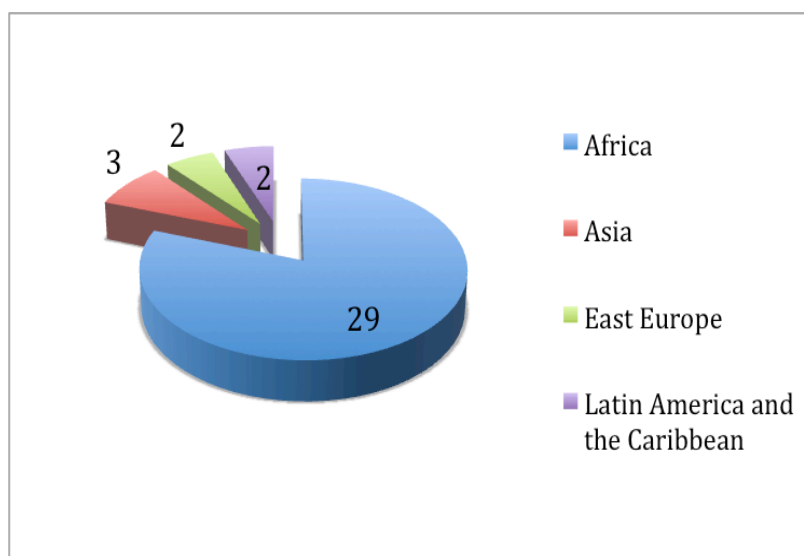


Fig. 17 The distribution of graduate students supported as part of the Projects Programme. Credit: the author archives.

THE AFRICAN PROJECTS

The Former African Projects

The PhD Program in Mathematics in Sub-Saharan Africa

This collaboration was based at the University of Nigeria at Nsukka, Nigeria, focusing on a Graduate School with a significant number of doctoral students from the region. It was formerly based at the University of Nigeria and currently it is based at the African University of Science and Technology (AUST) in Abuja, Nigeria, which has an excellent library (cf., Fig. 18).

The long collaboration with the OEA goes back to 1998. The mission of AUST is to advance knowledge and educate students in science, technology, and other areas of scholarship that will best serve the African continent in the 21st century. From its beginnings the intention was to establish 2 focal points in Sub-Saharan Africa for a PhD degree programme.



Fig. 18 The Sid Ahmed Baba Library, African University of Science and Technology (AUST) in Abuja, Nigeria (PRJ-01). Credit: <http://aust.edu.ng/library>

The PhD Programme in Mathematics and Applied Mathematics at the University of Pretoria, Pretoria, South Africa

In 1930 an earlier Technical College assumed the name of the University of Pretoria. An increase in student numbers necessitated the building of new facilities such as the Club Hall and Administration Building (cf., Figure 19) when the 7th faculty, the Medical Faculty, was established in 1943.



Fig.19 The Administration Building of the University of Pretoria. The former OEA Project was centered at the Mathematics Department (PRJ-02). Credit: [https://en.wikipedia.org/wiki/File:Die skip_University_of_pretoria.JPG](https://en.wikipedia.org/wiki/File:Die_skip_University_of_pretoria.JPG)

The association of the OEA with the mathematics activities of the University of Pretoria goes back to 2000. The related research of the corresponding Department was firstly on partial differential equations, their numerical analysis and mathematical modeling. Secondly, the departmental research also covered abstract analysis, topology and applications. Funding was provided for fellowships to students from Africa that was assigned amongst others to students from Cameroon, the Democratic Republic of Congo, Mozambique, Rwanda and South Africa.

West African Training School in Analysis and later in Algebra, Geometry and Algorithms (WATS), Saint Louis du Senegal

The West African Training School in Analysis and later in Algebra, Geometry and Algorithms (WATS), took place at Saint Louis du Senegal during the period 2002-2006. Typically, 18 students followed a 24-week training course during the summer months (August-September). These schools were coordinated from the University of Ouagadougou, Bourkina Faso, which was founded in 1974. It is located in the area of Dawn Van Noord in Ouagadougou.

The WATS Schools have taken place in the pleasant surroundings of Saint-Louis (cf., Figure 20), which is the capital of Senegal's Saint-Louis Region. It is located in the northwest of Senegal, near the mouth of the Senegal River, and 320 km north of Dakar, Senegal's capital city.



Fig. 20 A view of the city hosting of the WATS Schools (PRJ-06). Credit: https://en.wikipedia.org/wiki/Saint-Louis,_Senegal

Optics Training for Namibia based at the University of Namibia, Windhoek, Namibia

The University of Namibia (UNAM) is located in Windhoek. It was established in 1992, UNAM includes Faculties of Agriculture and Natural Resources, Economics & Management Sciences Education, Humanities and Social Sciences, Law, Medical & Health Science, and Science.



Fig. 21 The University of Namibia Main Campus at Windhoek (Prj 12). Credit: University of Namibia (PRJ-12). Official website <http://www.unam.na/>

The OEA collaboration with the Science Faculty goes back to the year 2004. In the time span covered in this review the collaboration took place in the year 2006. The focus of their research was on laser-induced fluorescence techniques for the health sector, as well as with some applications to ultraviolet stress on vegetation.

Project at the School of Physics and Applied Physics of the Al-Neelain University based at Khartoum, Sudan

Al-Neelain University is a public university located in Khartoum, Sudan. It was founded in 1993. It started as the Khartoum branch of the American University of Cairo. It has six faculties: Commerce and Political Science, Engineering, Law, Optometry and Visual Sciences, Science and Technology (cf., Fig 22).



Fig. 22 The Al-Neelain University based at Khartoum, Sudan (PRJ-28).
Credit: <http://www.anasudani.net/english-9.html>

During the period of the present review the OEA collaboration with this university as a Project was during the year 2007. (Earlier it had been an Affiliated Centre.)

The research of the School of Physics and Applied Physics was Materials Science with a view of promoting the area in the region that included Ethiopia, Yemen, Kenya and Uganda. Their academic staff had been trained in the UK, The Netherlands, China India and Sudan. The OEA collaboration was focused mainly on fellowships for MSc and PhD students.

Physics Beyond the Standard Model based at the Center for Theoretical Physics (CPT) based at the British University of Egypt

This Project goes back to 2002 and it is reviewed in Appendix 3 for the period 2006-2011, when it became an Affiliated Centre. Its scope was to provide Egypt and the region of the Middle East and Africa with a preeminent scientific institute that contributes to fundamental research in physics, astronomy and their interfaces. [*From the Proposal for ICTP Affiliated Centre for Theoretical Physics 2008.*]

The Centre for Theoretical Physics (CTP, cf., Fig. 23) is part of The Zewail City of Science and Technology (cf., Current Affiliated Centres).



Fig. 23 The British University in Egypt, the former venue for the CPT, now an OEA Affiliated Centre that is hosted at the Zewail City for Science and Technology (PRJ-30).

Credit: http://en.wikipedia.org/wiki/File:British_University_in_Egypt.jpg

Department of Physics, Addis Ababa University, Ethiopia

The Graduate School of the Department of Physics is located at the Addis Ababa University in Ethiopia receiving its current status in 1975 (cf., Fig. 24). The University was originally named University College of Addis Ababa It had been founded by the former Ethiopian emperor Haile Selassie I in 1962.

The OEA collaborated with this Graduate School from 2006 till 2009. This university had already developed a tradition in their Graduate School offering its first master's programs in 1979 and its first PhD programs in 1987.



Fig. 24 Addis Ababa University, Ethiopia (PRJ-31). Credit:

[http://en.wikipedia.org/wiki/File:Addis_Abeba_University_\(Sam_Effron\).jpg](http://en.wikipedia.org/wiki/File:Addis_Abeba_University_(Sam_Effron).jpg).

The Current African Projects

The International Chair in Mathematical Physics and Applications (ICMPA)

This OEA collaboration is based at the University of Abomey-Calavi (UAC) in Cotonou, Benin (cf., Fig. 25) which was formerly called the Université Nationale du Bénin. This institution is the largest and oldest university in Benin. It was established in 1970.



Fig. 25 University of Abomey-Calavi (UAC) at Cotonou in Bénin (PRJ-15). Credit: <http://safe-africa.net/Abomey.htm>

The ICMPA became the UNESCO Chair of Mathematical Physics and Applications in April 2006. Besides their Graduate School, ICMPA organizes an International School every two years providing a fruitful venue for mathematicians, mathematical and theoretical physicists for scientists from the African continent. The collaboration with the OEA goes back to 2005.

The PhD Programme in Mathematics

This current Project is based at the Institute of Mathematical Sciences in Accra, Ghana. The Institute of Mathematical Sciences is a centre for the development and training of young mathematicians towards postgraduate study. Its Graduate School has students on Sandwich PhD and MSc/MPhil programmes. The participating universities in Ghana are:

The University of Ghana at Legon, the Kwame Nkrumah University of Science and Technology (KNUST) at Kumasi (cf., Fig. 26) and the University of Cape Coast. This Project also organizes regional conferences, workshops and colleges in order to promote the mathematical sciences in the region.



Fig. 26 The main entrance of the KNUST, Kumasi, Ghana. In the foreground we can appreciate the statue of the first president of the Republic of Ghana, who was also the founder of this university (PRJ-22). Credit: http://en.wikipedia.org/wiki/Kwame_Nkrumah_University_of_Science_and_Technology

The Regional Postgraduate Diploma in Mathematics

This Project is based at the University of Botswana in Gaborone, Botswana (cf., Fig. 27). The mission of the University of Botswana is to improve economic and social conditions for the Nation while advancing itself as a distinctively African university with a regional and international outlook. The OEA has been collaborating with the Graduate School both with at the PhD and MSc Levels.



Fig. 27 Regional Postgraduate Diploma in Mathematics based at the University of Botswana in Gaborone, Botswana (PRJ-23). Credit Wikipedia: http://en.wikipedia.org/wiki/University_of_Botswana.

THE ASIAN PROJECTS

The Former Asian Projects

Ghulam Ishaq Khan (GIK) Institute of Engineering Sciences and Technology at Topi, Pakistan

The GIK Institute is named after former President of Pakistan Ghulam Ishaq Khan. The foundation of the Institute goes back to 1993 (cf., Fig. 28). It is situated beside the river Indus in the mountains of Tarbela and Gadoon-Amazai, in the Khyber-Pakhtunkhwa near the town of Topi.



Fig. 28 GIK Institute Main Entrance (PRJ-16). Credit: http://en.wikipedia.org/wiki/Ghulam_Ishaq_Khan_Institute_of_Engineering_Sciences_and_Technology

The OEA collaboration with the GIK Institute covered the period 2005 till 2007. The Faculty of Engineering Sciences with which the OEA collaborated covered multi-disciplinary engineering topics using Mathematics, Physics, Computer Science and Engineering, especially the physical sciences overlapped some of the modern fields of engineering such as: lasers, semiconductors and superconducting devices.

The OEA focused on collaborating with their Graduate School that offers MSc and PhD degree programs in applied mathematics and applied physics.

Mechanics and Mathematics Department, National University of Uzbekistan (NUU) at Tashkent

The National University of Uzbekistan has 13 schools. The university was founded in 1918 as Turkestan People's University, with 1,200 students (cf., Fig. 29). In 1920 it was reorganized as Turkestan State University, and in July 1923 it was renamed the First Central Asian State University, a name it retained through the end of the 1950s. With the independence of Uzbekistan it became the National University of Uzbekistan.



Fig. 29 The National University of Uzbekistan Campus (PRJ-24).

Credit: http://en.wikipedia.org/wiki/File:Tashkent_State_University_1977.jpg

The OEA collaboration with the National University of Uzbekistan covered the period 2003 till 2009. The main orientation of the collaboration centred on their Graduate School, especially a Master's Degree programme.

THE CURRENT ASIAN PROJECTS

The Salam Chair

This Project is based in Lahore, Pakistan that initiated in 2000. The Federal Government of Pakistan had established the Salam Chair in Physics at Government College University, Lahore in 1999. It was named after the Nobel Laureate of Pakistan, Professor Abdus Salam (cf., Fig. 30).



Fig. 30 GCU Tower, Government College University, Lahore, established in 1864 (PRJ-05). Credit: http://en.wikipedia.org/wiki/Government_College_University.

The OEA has been collaborating with its Graduate School, both in its PhD and MPhil programmes. This project, directed by Dr. G. Murtaza distinguishes itself for its research publications and the successful Graduate School; some of its successes are summarized in the Appendix 3.

The OEA has been a significant source of support for the Salam Chair that, in addition, has been pursuing various research projects with the Pakistan Science Foundation and the Pakistan Atomic Energy Commission. This emphasis in research, especially in the area of plasma physics, has provided a favourable environment for their high-level Graduate School that the OEA has singled out as a valuable Project. [From: *Salam Chair in Physics GC University Lahore Summary Progress Report (March 2000-February 2007)*.]

The Project Fellowships

The Project Fellowships at a Former Affiliated Centre (cf. Section on the Affiliated Centres) is based at Islamabad, Pakistan. This project is based at the Department of Physics at the Quaid-i-Azam University. QAU was established in 1967 and assumed its present name in 1976. Since its foundation it has been contributing to the rapid advancement of Pakistan in areas of its relevance (cf., Fig. 31).



Fig 31 Quaid-i-Azam University Entrance (PRJ-27). Credit: http://en.wikipedia.org/wiki/Quaid-i-Azam_University

They specialize in a significant condensed matter problem, namely superconductivity that was discovered by Nobel Laureate Kamerlingh Onnes in 1911, in metallic mercury below 4 K (-269.15°C). The same phenomenon is possible at considerably higher temperatures with a potential technological implication. Nobel Laureates Karl Muller and Johannes Bednorz discovered high-temperature superconductors (HTS) in 1986 at the International Business Machines Corporation, IBM. Since its beginnings in 2009 the Project Fellowships focuses on the mechanism for high temperature superconductors (HTS).

The mechanism for superconductivity is known at the lower temperatures. John Bardeen, Leon Cooper and J. Robert Schrieffer pointed it out in their seminal contribution, which was also highlighted by another Nobel Prize. In this case the flow of electrons cannot be resolved into individual electrons, but instead consists of many pairs of bound electrons, the so-called Cooper pairs. These pairs are formed when an electron moving through the material distorts

the surrounding crystal lattice, which in turn attracts another electron and forms a bound pair that is capable to flow without resistance, the normal conductivity properties become truly “super”.

However, in the case of HTS the favourable flow of electrons has a different origin, which is where the QAU researchers have been publishing their work in peer-reviewed journals with the OEA support. In HTS the Cooper pairs are formed close to a magnetic transition allowing the quantum phenomenon of spin-density waves that lead to the superconductivity. The investigation of the mechanism that drives the QAU researchers is regarded as one of the experimentally accessible methods just shedding light on the transport properties of HTS. This Project has not only enhanced research activities, but provides a useful tool to understand the mysterious mechanisms underlying HTS. [From: *QAU Report to OEA, November 24, 2009.*]

Theoretical Astrophysics

This is an OEA Project based at the Ulugh Beg Astronomical Institute, Tashkent, Uzbekistan (cf., Fig 32). The Institute is named after a Timurid ruler (1394, 1449), as well as an astronomer, mathematician and sultan A series of research topics include low-frequency (LF) signals in ionosphere for anticipating tectonic phenomena. Collaboration with Stanford University has provided them with instrumentation capable of approaching the study of very LF electromagnetic phenomena in ionosphere and the magnetosphere. (Very LF refers to radio frequencies in the range of wavelengths from 10 to 100 kilometres).



Fig. 32 Observatory of Ulugh Beg (PRJ-29). Credit: <http://dome.mit.edu/handle/1721.3/51749?show=full>.

On the other hand, extremely low frequency (ELF) is a term used to describe electromagnetic radiation (radio waves) with frequencies from 3 to 300 Hz corresponding to wavelengths from 100,000 to 1000 kilometres. This collaboration has allowed The Theoretical Astrophysics Project to set up an ELF/VLF radio receiver that can monitor signals above the atmospheric noise

floor, a fundamental capability for analysis in electromagnetic phenomena in the ionosphere and in the magnetosphere. [*From the 2008 Evaluation Report.*]

The Theoretical Astrophysics Project is also oriented towards research in astronomy and astrophysics, including galaxy formation, gravitational lenses and gravitational models. Some emphasis has also been put on the role of magnetized gravitational objects. There are a number of significant publications in these fields in the specialized literature.

The ICTP Fellows at the Centre for Space Physics (CSP)

This Project is based in Kolkata, India (cf., Fig. 33).



Fig. 33 Indian Centre for Space Physics, Kolkata in India is a Government Aided Autonomous Institute (PRJ-32). Credit Official website: <http://csp.res.in/ICSP-WEB/publicoutreach.html>

In instrumentation they are responsible for the development of payloads for an Indo-Russian satellite with an X-Ray Laboratory for testing and evaluating such payloads. CSP is an upcoming space research centre located in the Eastern part of India, the only one of its kind. It was established in 1999 and has been recognized, amongst others, by the University of Calcutta and the prestigious Indian Space Research Organization (ISRO).

Their Graduate School currently has many PhD students (one of which, from Nepal, has been funded by the OEA since 2008 until his graduation, cf., Appendix 3). They have programmes in astrobiology, astrochemistry and satellite payload making significant contributions that are of vital relevance for ISRO in Moon exploration. India is now a leading nation in space research with the success of the Chandrayan 1 mission that was launched by ISRO in October 2008, and operated until August 2009. [Partially from the *CSP Report to OEA of 22 May 2006*.]

The location of CSP is ideal for collaborating with other emerging nations, such as: Bangladesh, Bhutan, Myanmar, Nepal (with the successful collaboration mentioned above) and Thailand. Graduate students from this region have joined CSP with fellowships from OEA. One special research project has led to better understanding of emission from galactic centres due to the presence of black holes. [From: *2011 Evaluation Report*.]

A CURRENT EUROPEAN PROJECT

The Southeast European Network in Mathematics and Theoretical Physics (SEENET-MTP)

This Project is based at the Department of Physics, Faculty of Science and Mathematics, University of Nis in Serbia. Their research includes cosmology, string and field theory. It has been active in the exchange visits of researchers and students (cf., Fig. 34).

The String and Cosmology Group is a most active field of cooperation that has been stimulated by the OEA Project. These efforts have encouraged progress in Particle Physics, Quantum Field Theory and Mathematical Physics. The Project has aimed at establishing a self-sustained Balkan Research and Training Network in Physics and Mathematics [*From the Project and Budget Proposal for the year 2011.*]

The OEA contribution towards the activities of SEENET-MTP is used for exchange of visits and short-term grants. Collaborations with neighbouring countries in the South-East European Region, such as Bulgaria, and Bosnia-Herzegovina have taken place. [*From: Evaluation Report, March 3, 2011.*]



Fig. 34 University of Nis in Serbia was founded in 1965 (PRJ-09).
Credit: http://en.wikipedia.org/wiki/University_of_Niš.

THE LATIN AMERICAN AND CARIBBEAN PROJECTS

The Former Projects

The Project Latin American Centre of Physics (Centro Latino Americano de Fisica, CLAF)

The long association of the CLAF with the OEA has evolved through a series of fruitful changes. Originally it began as a Former Associated Centre. Then it became a Former Project, as we shall review it in this section. (Subsequently, we shall find CLAF again in its present association with the OEA as a Network.) It was founded two years before the Abdus Salam ICTP itself (cf., Fig. 35).



Fig. 35 The Mario de Almeida Pavilion is the venue of the CLAF offices. This Centre was founded on 26 March 1962, in a joint meeting between UNESCO and the Brazilian Government, in Rio de Janeiro, with the participation of 20 Latin American countries (PRJ-07).

Credit: http://www.claffisica.org/index.php?r=site/sobre_claf

Since then it has been a robust promoter of South-South Cooperation for a long time a partner of the OEA. An early Cooperative PhD Programme has been maintained to the present. In this Project the origin of the students was from a wide range of countries, including Argentina (Centro Atómico, Bariloche, Argentina), Brazil (at the Centro Brasileiro de Pesquisas Físicas), Cuba and Paraguay Bolivia, Mexico, Peru and Uruguay (Universidad de la República de Montevideo).

The Current Projects

The Diploma Programme

This OEA collaboration is based at the Instituto Balseiro, Bariloche, Argentina (cf., Fig. 36). The Institute was founded in 1955 but was named in honour of physicist Dr. José Antonio Balseiro in 1962. Dr. Balseiro (1919 – 1962) was director of the physics department of the Facultad de Ciencias Exactas y Naturales of the Universidad de Buenos Aires. The Institute admits students who have completed two years of university studies (either in Physics or Engineering) and have implemented a careful admission procedure since 1958. The collaboration with the OEA involves a Diploma Programme, leading to a Master Degree. The Diploma/Master Programme started in the year 2003 as a one-year programme. From the year 2006 it became a full Diploma/Master Programme with two possible orientations “Particles and Field Theory”, including astrophysics, cosmology field theories and string theory.

The second orientation is in “Condensed Matter”, which includes strongly correlated electrons, superconductivity, semiconductors, low dimensional systems and magnetism [From: *Report on the Evolution of the Diploma/Master Programme, Bariloche, October 25, 2006.*]



Fig. 36 Instituto Balseiro, Bariloche, Argentina (PRJ-18). Credit: http://en.wikipedia.org/wiki/Balseiro_Institute

The Network Programme

A Network is a system of research groups in an entire region, or among different regions, that pursue a common scientific project over an extended period. The OEA supports networks because they are an efficient approach to overcoming the problem of isolation and counteracting the brain drain, emphasising South-South collaboration and the sharing of expertise and facilities. At present the OEA supports 11 networks in mathematical and physical sciences that will be reviewed below.

But the area of influence of the Networks is much wider since, for instance, in Africa they have a continental coverage. The related research is leading to 39 doctoral theses spread over the above-mentioned three regions, as well as by 19 other graduate school students. The present situation should be compared with the initial effort at the beginning of the implementation of the 4-Year ICTP Strategic Plan, which is illustrated in Fig. 37:

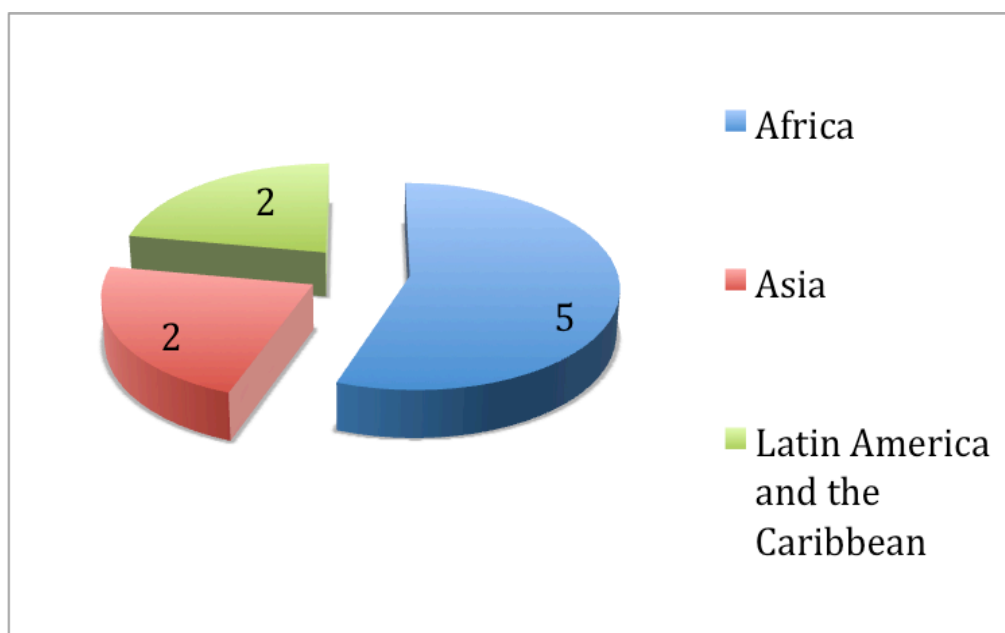


Fig. 37 Distribution of Networks supported by the OEA.

Once again, the OEA is building up the achievements during its first 25 years, as demonstrated in 2010, when the graduate schools that the OEA supported led to 39 doctoral theses spread over the above-mentioned three regions, as well as by 19 other graduate school students. These previous successes are shown in Fig. 38:

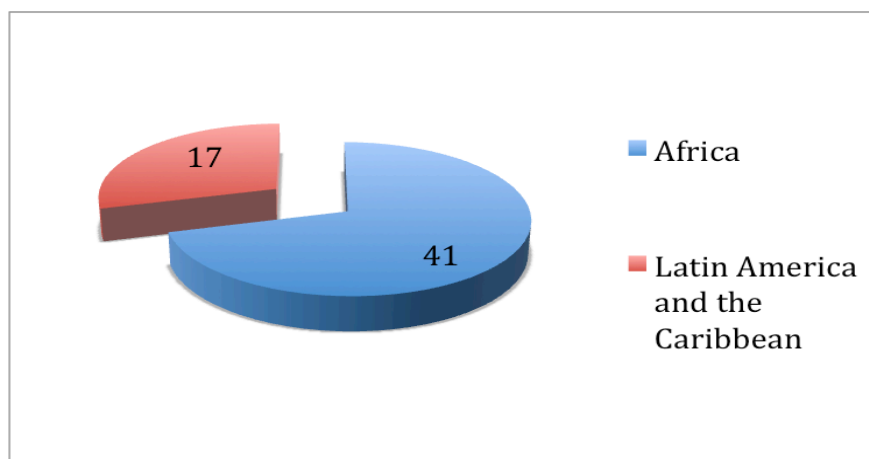


Fig. 38 The distribution of graduate students supported as part of the Network Programme. Credit: the author archives.

THE AFRICAN NETWORKS

The Former African Networks

Network on High Energy Physics and Quantum Groups

This Network is based at the University Mohammed V, Rabat and Ibn Tofali at Kenitra, Morocco. This university was founded in 1957 and inaugurated in Rabat in 1959 by late King Mohammed V.



Fig. 39 (a) University Library, (b) Faculty of Science, (c) Scientific Institute. (NET-62).

Credit: University Mohammed V website <http://www.um5a.ac.ma/index.php/en/typography-5/university-history>

The OEA collaboration with this High Energy Group contributed towards activities such as conference organization, as well as encouraging visiting scientists to the Network node.

The Current African Networks

The African Lasers, Atomic, Molecular and Optical Science Network (LAM)

This Network has continental influence. It is based at the University of Cheikh Anta Diop in Dakar, Senegal (cf., Fig. 40).



Fig. 40 Cheikh Anta Diop University campus, with its Main Library shown at the Centre (NET-27). Credit: http://en.wikipedia.org/wiki/Cheikh_Anta_Diop_University

We have already met this prestigious French West African University in the Section of Affiliated Centre Programmes (cf., Affiliated Centres). The Network itself was launched in Dakar in 1991 during the First International Workshop on the physics and Modern Applications of Lasers (held in Dakar, Senegal).

From its beginnings this Network defined its objectives firstly, to develop amongst its members exchange programmes in research and teaching in the fields of laser physics and secondly, to organize scientific meetings, including schools, conferences and workshops. [From: *Report for 1995-1996.*]

The North African Group for Earthquakes and Tsunamis (NAGET)

This Network is based in Algeria. NAGET started its activities, once again, in 2011. Its main node is at the Centre of Research of Astronomy, Astrophysics and Geophysics (CRAAG), Algeria, cf., Figure, counting amongst its many disciplines Astronomy where the Algiers Observatory is located. It was founded as a Network in 2000 (cf., Fig. 41).

The renewed efforts of this significant Network are strongly motivated by the unprecedented range of seismic activity in the region of North Africa. Hence the Network has focused the attention of scientists and local communities on geo-hazards. Since the 1990s large earthquakes have caused severe damage and loss of life in the region, including Algeria itself, Morocco and Egypt. [From: *NAGET Annual Report 2011*.]



Fig. 41 The Algiers Observatory was built in the late nineteenth century (NET-40). Credit: http://en.wikipedia.org/wiki/Algiers_Observatory.

The African Network on Lasers, Atomic and Medical Physics

Tunisia is the host nation of this Network. It has widespread influence in both North Africa and Sub-Saharan Africa, namely the specific countries involved are: influencing Algeria, Burkina Faso, Cameroon, Republic of Central Africa, Chad, Tunisia and Senegal. Its main node is located at the Laboratoire de Spectroscopie Atomique Moléculaire et Applications (LSAMA) in the Faculté des Sciences de Tunis, Université Tunis El Manar, Tunis (cf., Fig. 42).



Fig. 42 Faculty of Mathematical, Physical and Natural Sciences of Tunis. The Tunis El Manar University (UTM) is a university located in Tunis, Tunisia. It was founded in 2000. It is organized in 11 Faculties (NET-45). Credit: The University official website <http://www.utm.rnu.tn/documents/presentation/annuaire/utm.jpg>

The network aims to continue the common research activities developed since 2001, especially aiming to strengthen South-South collaborations. Their project aims to study theoretical and experimental approaches to structural interactions, dynamics and kinetics of reactions of molecules with plasma, keeping in mind environmental applications, and the life sciences, including medical physics. [From: *Proposal for the 2012 Renewal of Network Project.*]

It is also remarkable the interaction of this network with one of the OEA affiliated centres: the CEPAMOQ. It has been training researchers from sub-Saharan Africa providing an excellent example of South-South cooperation that the OEA has been striving to implement. The Network has played an important role in the progress and direction of research, especially through the PhD programme.

The Partial Differential Equations, Modelling and Control

This Network is based in Burkina Faso. Its main node is in Burkina Faso at the University of Ouagadougou, which was founded in 1974 (cf. Fig 43). It is

located in the area of Zogona in Ouagadougou, Burkina Faso. From its beginnings it enjoyed administrative assistance from the University of Saint Louis in Senegal, the University of Nouakchott in Mauritania and the Gaston Berger University at Ouagadougou in Burkina Faso. (From: *Professor Hamidou Toure's Report of the 2006 Academic Activities*).



Fig. 43 University of Ouagadougou (Net 47). Credit: Courtesy of Professor Stanislas Ouaro, President of the University of Ouaga II, in Gonse, Burkina Faso

The fruitful relation with the Abdus Salam ICTP goes back to May 1999. It has been influencing researchers gathered from the Sub-Saharan region in the area of Mathematics, namely Ivory Coast, Mauritania, Senegal and Burkina Faso itself. The network came into being in order to promote a sub-regional critical mass of active mathematics researchers in the fields of Partial Differential Equations and Modelling and Control. It maintains good links with the international scientific community, maintaining a doctoral programme in Applied Mathematics with the additional intention of building research capacity in the regional universities.

The network has contributed to avoid to some extent the problem of the brain drain. It has maintained an active academic programme of international events that in recent years have included schools and workshops. Since 2003 the Network has maintained an International Conference on Mathematics and Applications to Development Problems in Sahel every three years. The major aim of the organizers has been to give an opportunity for mathematicians in the Network and in the African Region to present the result of their research. [From: *Network's 2009 Activity Report*.]

The African Network in Geometry and Algebra Applied to Development (RAGAAD)

This Network was founded in 2003. It has representatives in the following countries: Algeria, Benin, Burkina Faso, Cameroon, Congo, Ivory Coast, Guinea, Mali, Mauritania, Morocco, Niger, Senegal and Tunisia. The network is based at the University of Yaounde 1 at the Department of Mathematics, Faculty of Sciences in Yaounde, Cameroon (cf., Fig 44).

This university was built with the help of France and opened in 1962. In 1993 there was a university reform splitting the original institution into two (Université de Yaounde I and Université de Yaoundé II) following the university branch-model of the University of Paris.



Fig. 44 University of Yaounde 1 at the Department of Mathematics, Faculty of Sciences (NET-59).
Credit: <http://www.panoramio.com/photo/83191035>

This Network has made significant impact on the Sub-Saharan region, especially in its Least-Developed Countries with the collaboration of the University of Rennes. Two successful Graduate Schools have been maintained by the network: firstly at Niamey, Niger and, secondly, at Dakar, Senegal.

The Nano African Network Initiative (Nano-Afnet)

This collaboration with the OEA is based in South Africa (of continental influence). NanoAfNet has continental coverage. Its foundation originated in the ICS-UNIDO North-South Dialogue workshop held in Trieste-Italy in 2005. It was created the same year. It is coordinated from the iThemba Laboratory for Accelerator-Based Sciences, which is a group of multi-disciplinary research laboratories administered by the National Research Foundation, Somerset West (part of the City of Cape Town metropolitan municipality), and South Africa.

It is based at two sites in the Western Cape and Gauteng. The coordination of the Network is at iThemba LABS (Laboratory for Accelerator Based Sciences), a multidisciplinary facility aiming to become the leading African organisation for research, training and expertise in accelerator based science and technologies.

The objectives of the National Research Foundation (NRF) overlap considerably with those of the Abdus Salam ICTP: to support and promote research through funding, human capacity development and the provision of the necessary research facilities, in order to facilitate the creation of knowledge, innovation and development in fields of the natural sciences, and technology, including indigenous knowledge systems (cf., Fig 45).



Fig. 45 iThemba LABS (laboratory for accelerator based sciences), a multidisciplinary facility aiming to become the leading African organisation for research, training and expertise in accelerator based science and technologies (NET-63). Credit: Official Site: <http://www.tlabs.ac.za/>

The African Network for Solar Energy (ANSOLE)

ANSOLE provides an indication of the growth of the OEA Networks. ANSOLE is based at the Johannes Kepler University, Linz, Austria (cf., Fig 46). It joined the ICTP System in 2011. ANSOLE aims to foster research activities in the field of solar energy among African scientists working in and out of Africa. For this reason countries in which there are already representatives are from four continents (From: *ANSOLE's Scientific and General Report 2012*):

- **In Africa:** Algeria, Benin, Burkina Faso, Burundi, Cameroon, Chad, Côte d'Ivoire (Ivory Coast), Djibouti, Cameroon, Congo-Brazzaville, Congo Kinshasa, Egypt, Ethiopia, Ghana, Kenya, Mali, Malawi, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, South Africa, South Sudan, Sudan, Tanzania, Togo, Tunisia Uganda, Zambia and Zimbabwe.
- **In America:** Canada and USA.
- **In Asia:** China, P. R., India, Jordan.
- **In Europe:** Austria, Belgium, Britain, Estonia, France, Germany, Greece, Ireland, Italy, Netherlands, Russian Federation, Sweden and Turkey.

The list is in the process of being extended. The network hopes to facilitate the exchange of ideas between students and scientists involved in solar energy research, formulate joint project proposals, put out joint publications, organize workshops and implement a graduate programme on solar energy.



Fig. 46 The Main Library of the Johannes Kepler University, Linz, Austria (NET-73). Credit: http://en.wikipedia.org/wiki/Johannes_Kepler_University_of_Linz

THE ASIAN NETWORKS

The Former Asian Networks

Asian African Association for Plasma Training based at the Department of Physics, University of Malaya, Kuala Lumpur, Malaysia

The Asian African Association for Plasma Training was based at the Department of Physics, University of Malaya, Kuala Lumpur, Malaysia (cf., Figure 47).



Fig. 47 Rimba Ilmu building, University of Malaya at Kuala Lumpur (NET-AC-2 AAAPT).
Credit: http://en.wikipedia.org/wiki/University_of_Malaya

This University has its roots back in the 19th century basically to cover the life sciences, especially medicine. But soon after courses were devoted to pure science studies, including Physics. The foundation of the University of Malaya was in 1949 in Singapore was under the merger of the earlier colleges of medicine. Ten years later, the university was divided into two autonomous campuses, one in Singapore and the other in Kuala Lumpur, the venue where the collaboration of the OEA took place over the three-year period 2005-2007.

The Metals and Alloys Network

This Network was based at the Department of Physics, University of Dhaka, Bangladesh. The University itself is the oldest university in modern Bangladesh, established in 1921 (cf., Figure 48). The university's distinguished alumni include Satyendra Nath Bose (pioneer of Bose-Einstein statistics), and Sir Kariamanickam Srinivasa Krishnan (co-discoverer of the Raman effect).



Fig. 48 A statue on the Bangladesh Liberation War, located at the centre of Dhaka University Campus (NET-24). Credit: http://en.wikipedia.org/wiki/University_of_Dhaka.

The OEA collaborated with this Physics Department during the period 2006-2009. The Department has a research programme in Condensed Matter Physics that include problems such as properties of ceramics and nano-materials. The OEA collaboration encouraged their Graduate School.

Seismic Microzoning of South-East Asian Cities

The Seismic Microzoning of South-East Asian Cities by Realistic Modelling of Earthquake Ground Motion based at the Centre for Mathematical Modelling and Computer Simulation (CSIR) was based at the city of Bangalore, India. The CSIR is involved in developing modelling approaches for the study of the structure and evolution of complex systems. It was established in 1988 in the Belur Campus of the National Aerospace Laboratories (NAL), Bengaluru, India.



Fig. 49 Belur Campus of the National Aerospace Laboratories (NAL), Bengaluru (NET-65). Credit: <http://gazeintotwilight.blogspot.it/2010/09/national-aerospace-laboratories.html>

The OEA - CSIR collaboration took place from 2006 till 2008. [From: http://en.wikipedia.org/wiki/CSIR_Centre_for_Mathematical_Modelling_and_Computer_Simulation].

The Bangkok-Beijing-Shanghai Network in High Energy Physics

This Network was based at Fudan University in Shanghai, P. R. China influencing South East Asia, whose large graduate school comprises 134 sub-disciplines that are authorized to confer PhD degrees, 201 Master degree programs. Its foundation goes back to 1917. Besides the Popular Republic of China the influence extends to South East Asia and Pakistan (cf., Fig. 50). The activities of collaboration between the OEA and this Network go back to 2007.

The scientific focus is on fundamental physics, including cosmology and high-energy physics. During its first year scientists from Fudan University collaborated with Chulalongkorn University, the oldest university under the Thai modern educational system, founded in 1917. The Network benefitted the Graduate-School programme in Shanghai. [Based on: *2007 Scientific Report*.]



Fig. 50 Fudan University historic gate. The two Chinese characters Fu and Dan, literally mean "(heavenly light shines) day after day", were chosen by a distinguished educator in modern Chinese history, Father Ma Xiangbo S. J. from the Confucian Classics (NET-67). Credit: <http://en.wikipedia.org/wiki/File:Fudan000.jpg>

The Current Asian Networks

The Relativistic Astrophysics, Cosmology and Gravitation

This Network based in Pakistan at the National University of Sciences and Technology (NUST), at the Rawalpindi Campus. This Network has adopted the acronym BIPTUN, from the initial of the countries themselves Bangladesh, India, Pakistan, Turkey and Uzbekistan (cf., Fig. 51):



Fig. 51 NUST Pakistan Navy Engineering College (PNEC). The campus is home to the Computer Aided Designing and Manufacturing Centre and the Professional Development Centre. The university is co-educational offering undergraduate and postgraduate degrees leading to PhD in the fields of engineering, information technology, medical sciences, and management science (NET-53).

Credit: <http://en.wikipedia.org/wiki/File:PNEC.jpg>

Their research activity has centred on the effects of the electromagnetic field on special objects of some relevance in astrophysics and cosmology, such as “gravastars” (objects hypothesized in astrophysics as an alternative to the black hole theory), wormholes (hypothetical topological feature of space-time that would be, fundamentally, a “short-cut” through space-time), black holes in a brane-world (this is an extended mathematical concept that appears in string theory and related theories). [Based on: *2008 Scientific Report*.]

South East Asia Consortium for Condensed Matter Physics

The South East Asia Consortium for Condensed Matter is a Network that has been in collaboration with the OEA since 2009. It is based at the Physics Department of Tribhuvan University, Katmandu, Nepal (cf., Fig. 52).



Fig. 52 The Tribhuvan University Administrative Building ((NET-56).

Credit: http://en.wikipedia.org/wiki/Tribhuvan_University

The University began its activities in 1959. The OEA main objective has been to stimulate their Graduate School, both at the PhD as well as at the MSc levels. Currently this University is making a major effort in this direction with an enrolment at the post-graduate level of over 2000 students.

THE LATIN AMERICAN AND CARIBBEAN NETWORKS

The Former Latin American and Caribbean Networks

Seismic microzoning of Latin American Cities (SMLAC)

The SMLAC Network was based at the Centro Nacional de Investigaciones Sismológicas, Havana, Cuba. The collaboration with the OEA covered the period from 2003 till 2008. The implication of the important meetings during the collaboration between SMLAC and the OEA was the construction of regional models of the structure of the crust-upper mantle in Costa Rica.

In addition, several synthetic seismograms were calculated for cities in the region, including Kingston (Jamaica), Lima (Peru), San Jose (Costa Rica) and Barquisimeto (R. B. Venezuela). These cities were chosen since they cover a broad spectrum of seismic hazard levels (cf., Figure 53)



Fig. 53 Location shown in red font for cities in Latin America and the Caribbean where researchers from SMLAC calculated synthetic seismograms with the support of the OEA (NET-58). Credit: The author archives.

Latin-American Network on Slow Dynamics of Complex Systems

The Latin-American Network on Slow Dynamics of Complex Systems was based at the Henri Poincare Chair of Complex Systems and Superconductivity Laboratory, Physics Faculty, University of Havana, Cuba (cf., Figure 54).

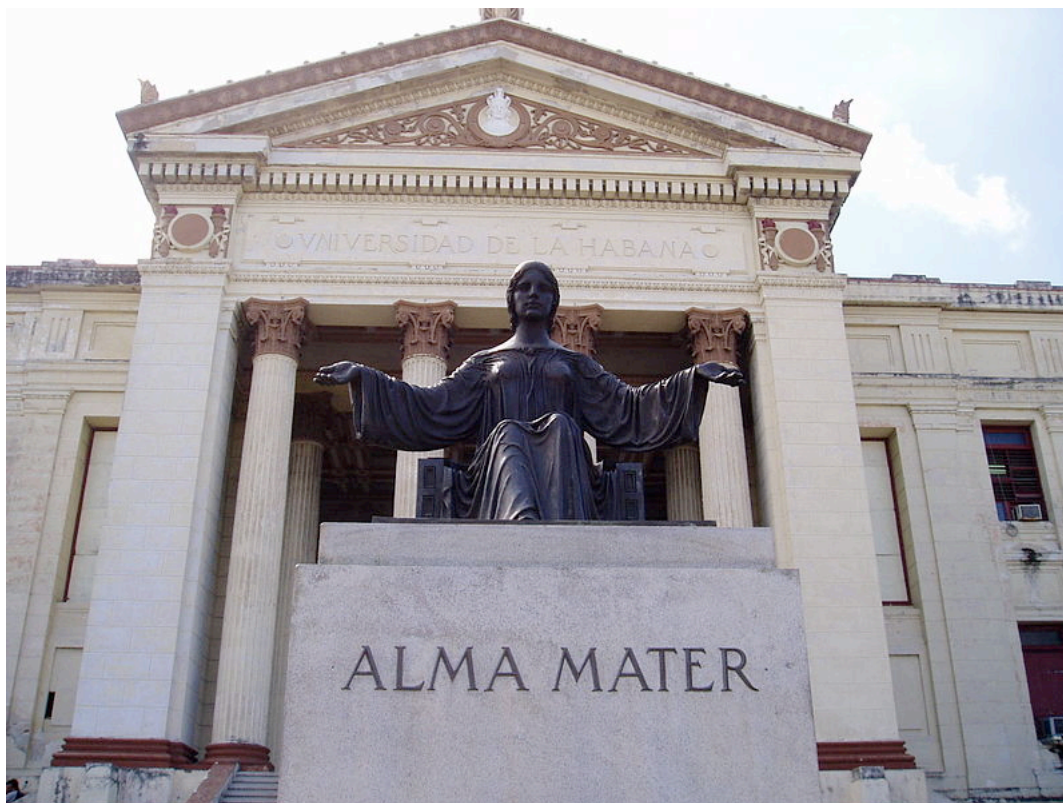


Fig. 54 Entrance of the University of Havana (NET-61). Credit:
http://commons.wikimedia.org/wiki/File:Universidad_de_la_habana_fachada.JPG

Its influence covered Argentina and Brazil. The University of Havana is made up of faculties and research centers in different fields like economics, sciences, social science and humanities. The collaboration of the OEA with the Network focused on theoretical studies of the statistical physics of non-equilibrium processes.

The Current Latin American and Caribbean Networks

The Caribbean Network of Quantum Mechanics, Particles and Fields

This Network is based in Cuba. It began its association with the ICTP in 1998. It has been responsible for a large number of publications and its influence has gone beyond its national boundaries. This network enjoys a fruitful collaboration with Mexican and Brazilian academic centres (cf., Fig. 55):



Fig. 55 Aerial view of the University of São Paulo, Brazil that has taken part in the Network collaboration (NET-35). Credit: http://en.wikipedia.org/wiki/University_of_São_Paulo

The groups forming this Network are focused on four areas of expertise:

Firstly, electronic and optical properties of molecular and semiconductor nanosystems arising from a collaboration between the Centre of Applications and Nuclear Development (CEDEAN) and the Faculty of Chemistry of Havana University, Cuba.

Secondly, astroparticle physics and cosmology coordinated at Instituto de Cibernetica, Matematica y Fisica (ICIMAF), Havana, Cuba (cf., Fig. 56) with a collaboration extending from Universidad Autonoma de Mexico to the University of Porto Alegre in Brazil.



Fig. 56 The ICIMAF building where the Departments of Mathematics and Theoretical Physics are located (NET-35). Courtesy of Professor Hugo Perez Rojas

Thirdly, external fields in quantum field theory. This node of the Network is coordinated once again from ICIMAF and its collaborations extend to Centro Brasileiro de Pesquisas Físicas (CBPF) and University of Sao Paulo, Brazil.

Finally, quantum field theory and its applications in high energy physics and condensed matter physics, coordinated from ICIMAF and extensive collaborations ranging from Universities of Sao Paulo and Para, both in Brazil; Pontificia Universidad Catolica de Chile, Santiago and Universidad Catolica del Norte, Antofagasta, Chile.

Centro Latinoamericano de Fisica (CLAF)

We found earlier this Centre as one of the Former Projects that was based in Brazil at Centro Brasileiro de Pesquisas Físicas (CBPF), Rio de Janeiro. Its influence is continental. It has a long history stimulating various countries of that region. Its long-standing relation with the OEA began as a Former Project (cf., the corresponding entry and illustration, p. 42).

In subsequent years the Graduate Schools of the Latin America and the Caribbean Region proceeded along the same lines producing a large number of scholars that graduated at the PhD level due to this fruitful Network. The areas that were stimulated in 2011 included astroparticle physics, statistical mechanics, nano-materials, general relativity and medical physics. [From: *40 Years of CLAF, A Faheem Hussein monograph, 2002; Report of Luis Masperi, 1999*].

The Latin American Network of Ferroelectric Materials

This Network is based in Cuba with its main node at the University of Havana, but with fruitful exchanges with Brazilian institutes (cf. Fig. 57).



Fig. 57 The University of La Havana, where the Latin American Network of Ferroelectric Materials has its main node (NET-43). Credit: Ismael Clark Arxer, UNESCO Science Report 2010

Since its inception in 2000 with 7 member institutions the Network has doubled in size. It has consistently contributed to linking the national community in ferroelectric materials with other countries in Latin America. In recent activities a special effort has been made in the relevant area of the wider use of experimental techniques, including scanning and transmission electron microscopy observations (SEM and TEM), dynamic re-crystallization (DRX) and extended X-ray absorption fine structure (EXAFS).

Visiting Scholars/Consultants

This programme promotes collaboration between scientists working in institutions in the developing countries and leading scientists throughout the world. The Visiting Scholar/Consultant is required to make at least two research visits over three years, each lasting at least a month. The Visiting Scholar/Consultant carries out joint research with his counterpart and lectures students in his or her field of expertise. This is another effective way to counteract the isolation of scientists and to allow them to maintain contacts and collaborate with leading experts from other countries.

There are currently 21 active Visiting Scholars: the African region has 9, Asia has 4, while Latin America and the Caribbean have 8. The total number of grants awarded during 2011 is 8. In detail the programme of Visiting Scholars is being implemented in 2011 by a system of 21 grants that are distributed in the following areas: Earth, Life, Mathematical and Physical Sciences. In Africa this programme has benefited Benin, Ghana, Liberia, Morocco, Nigeria, Senegal and Zimbabwe, while in Asia the countries that have profited from these grants are Indonesia and Nepal. Finally, in Latin America and the Caribbean the countries involved in the programme are: Argentina, Brazil, Cuba and Peru.

The present situation should be compared with the initial effort at the beginning of the implementation of the 4-Year ICTP Strategic Plan, which is illustrated in Fig. 58.

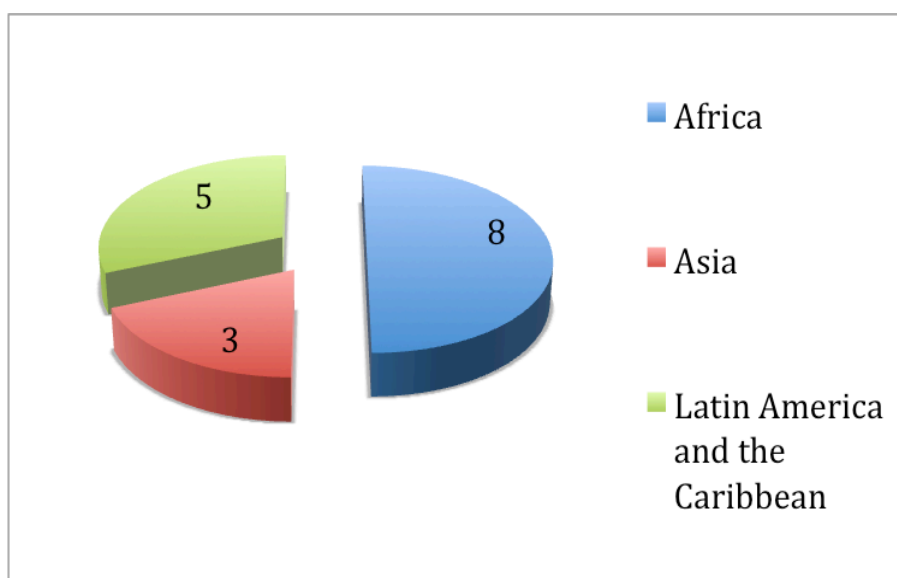


Fig. 58 Distribution of Visiting Scholars supported by the OEA. Credit: the author archives.

The Visiting Scholar/Consultant is required to make firstly at least two research visits over three years, each lasting at least a month, and secondly to carry out joint research with his counterpart and lectures students in his or her

field of expertise. This is another effective way to counteract the isolation of scientists and to allow them to maintain contacts and collaborate with leading experts from other countries.

Regional encouragement

We would like to emphasize two aspects of the regional encouragement of OEA: South-South and North-South cooperation. The active programme of Visiting Scholars for the emerging countries that we are supporting are, in a good proportion, scientists from the South itself—a fact that we are pleased to highlight.

In Fig. 59 we show the world distribution of South-South cooperation:

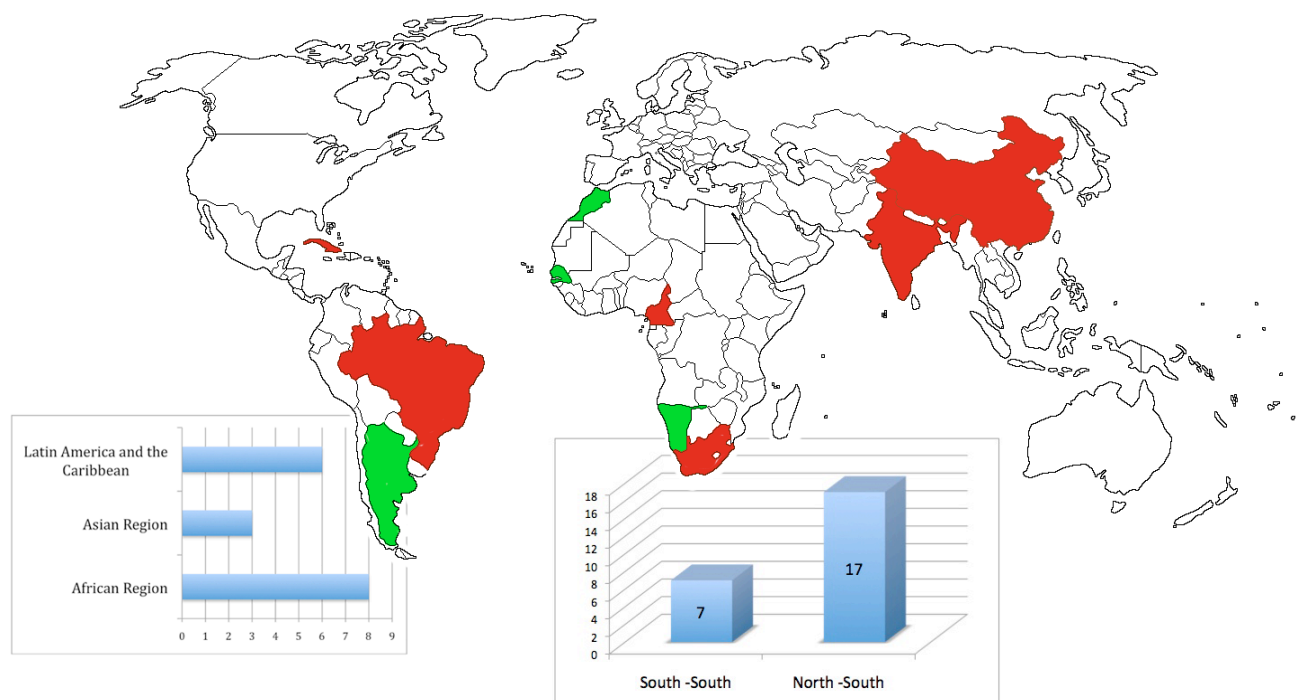


Fig. 59 Worldwide distribution of South-South cooperation supported by the OEA. Credit: the author archives.

Data is written as host country—country of origin of the Visiting Scientist. Firstly, in the African Region we sponsored the following South-South collaborations, Morocco-Brazil, Namibia-South Africa, Namibia-India, Senegal-Cameroon. Secondly in Latin America and the Caribbean three collaborations took place: one between Argentina-P. R. China and two between Brazil-Cuba (2).

Colour code: Nation of origin of the Visiting Scholar (red), host country (green).

The insets: (centre) comparison of the regional cooperation that has encouraged by the OEA; (left) relative distribution of the regional collaborations that have been encouraged by the OEA.

Regional collaborations by countries: In the African Region there were the following 8 collaborations: Benin-Canada, Benin-USA, Egypt-USA, Ghana-Netherlands, Ghana-Sweden, Ghana-UK, Madagascar-France and Malawi-USA. Secondly, in Asia we supported cooperation between Indonesia-Australia, Nepal-Denmark and Uzbekistan-Germany. In Latin America and the Caribbean 6 collaborations took place: Argentina-Spain, Brazil-France, Brazil-UK, Cuba-Belgium, Perú-Denmark, Republica Bolivariana de Venezuela-Belgium.

For the year 2011 these programmes included 5 South-South cooperation agreements. The scientists from Europe, North America and Oceania are distributed among 11 nations (Australia, Austria, Belgium, Canada, Denmark, France, Italy, Poland, Spain, United Kingdom and the United States). The OEA

has been supporting 2 South-South cooperation agreements in the African Region between Morocco and Brazil and between India and Nigeria.

On the other hand, the OEA has 16 North-South cooperation agreements. Those in African Region were 7 collaborations: Benin-Canada, Benin-USA, Ghana-UK, Ghana-USA, Liberia-Canada, Senegal-USA, and Zimbabwe-Austria.

The Visiting Scholars/Consultants awarded in 2011 are 8 of which 2 are South-South cooperation agreements between Nigeria/India and between Nepal/Malaysia. The other awards concern the African Region North South cooperation between: Benin/USA, Liberia/Canada, Senegal/USA and Zimbabwe/Austria.

Besides, at the end of the first 25 years of activities the OEA supported 17 North-South cooperation agreements that were distributed, as shown in Fig. 60.

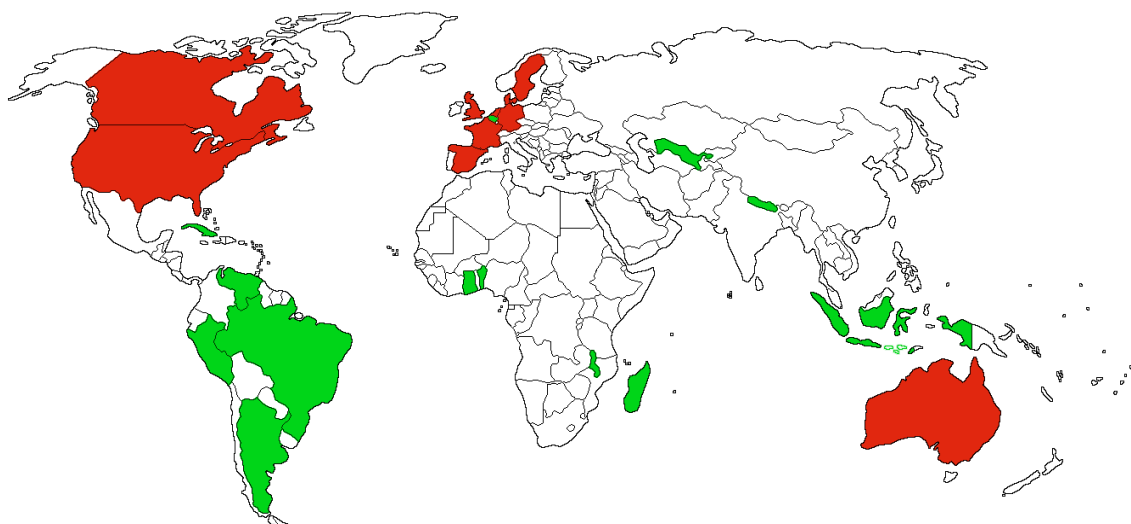


Fig. 60 Worldwide distribution of North (red)-South (green) cooperation supported by the OEA in the year 2010. Credit: the author archives.

In the African Region the following 8 collaborations took place: Benin-Canada, Benin-USA, Egypt-USA, Ghana-Netherlands, Ghana-Sweden, Ghana-UK, Madagascar-France and Malawi-USA.

In Asia the OEA supported cooperation between Indonesia-Australia, Nepal-Denmark and Uzbekistan-Germany.

In Latin America and the Caribbean 6 collaborations took place: Argentina-Spain, Brazil-France, Brazil-UK, Cuba-Belgium, Perú-Denmark, Republica Bolivariana de Venezuela-Belgium.

Scientific Meetings

The OEA encourages the organization of international and regional scientific meetings in developing countries by offering financial assistance to the organizers of conferences, workshops, and schools.

The present situation should be compared with the initial effort at the beginning of the implementation of the 4-Year ICTP Strategic Plan, which is illustrated in Fig. 61:

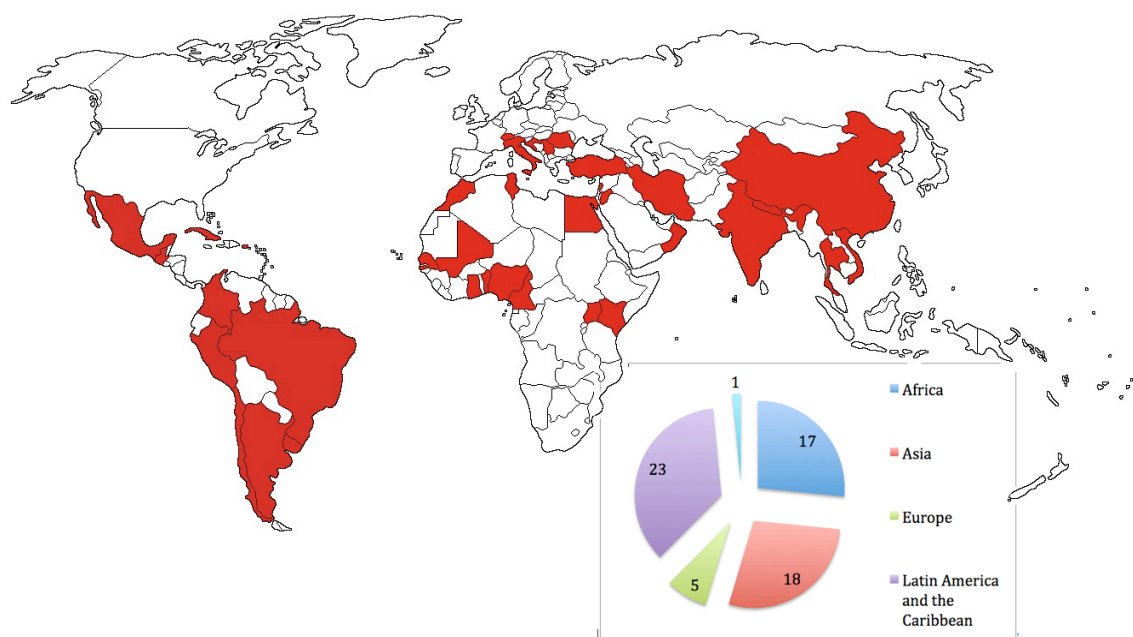


Fig. 61 Worldwide distribution of grants supported by the OEA for scientific meetings. Credit: the author archives.

Inset: Distribution of grants for scientific meetings supported by the OEA:

The 17 nations of the African Region were: Benin (2), Cameroon (2), Egypt (2), Ghana (2), Kenya, Mali, Morocco (3), Nigeria, Senegal, Tunisia and Uganda.

In Asia 18 grants were assigned: India (2), Islamic Republic of Iran (3), Jordan, Lebanon, Nepal, Oman, People's Republic of China, Thailand, Turkey (3) and Vietnam (4).

In Europe 5 grants were assigned: Bulgaria, Croatia, Italy, Serbia, and Switzerland.

In Latin America and the Caribbean 23 events were supported: Argentina (5), Brazil (6), Chile (5), Colombia, Cuba, Guatemala, Mexico (2), Peru and Uruguay. Finally, in North America a single event was sponsored in United States of America (Puerto Rico).

In 2011 the OEA has distributed 67 grants in five areas of knowledge: climate, education, mathematical sciences, physical sciences and space sciences. The grants assigned to the meetings in the African Region have been 20: Benin (2), Cameroon (2), Egypt, Ethiopia, Ghana (2), Madagascar, Morocco (5), Nigeria, Rwanda, Senegal, South Africa (2) and Tunisia. Meetings held in Asia received 26 grants: Armenia, Cambodia, Georgia (2), India (4), Indonesia (2), Islamic Republic of Iran, Jordan (2), Malaysia (2), Nepal (2), Pakistan, Philippines, People's Republic of China, Singapore, Sultanate of Oman,

Thailand and Vietnam (3). OEA assigned 4 grants for meetings that were held in Europe: Bosnia & Herzegovina, Bulgaria, France and Serbia. In Latin America and the Caribbean 17 events were supported: Argentina (4), Bolivia, Brazil (2), Chile, Colombia (3), Cuba (2), El Salvador (2), Honduras and Mexico.

APPENDIX 1: A BRIEF HISTORY OF THE OEA

(From its foundation in 1986 until 2004, when its current director, Dr. George Thompson, was appointed).

Professor Jan S. Nilsson (1932-2010)

The Office became operational in 1986 under its Founding Director, Professor Nilsson (cf., Fig. 62).



Fig. 62 Professor Jan S. Nilsson. Courtesy of The ICTP Photo Archives

Dr. Nilsson was an associate fellow of the Academy of Sciences for the Developing World, as well as president of the International Union of Pure and Applied Physics (IUPAP). One of Sweden's leading physicists, Nilsson was a professor of mathematical physics at Chalmers University of Technology, the dean of the Faculty of Mathematics at the University of Gothenburg, and for six years rector at the same university.

Professor Gallieno Denardo (1935-2007)

Professor Denardo was Head of the OEA in the period 1988-2003 (cf., Fig. 63).



Fig. 63 Professor Gallieno Denardo during his period at the OEA from 1988 till 2003. Courtesy of The ICTP Photo Archives

Professor Denardo was associated with ICTP since the Centre's inception. He served as head of the Office of External Activities for 10 years as well as a consultant of the Office after his retirement up until he passed away in the year 2007. From July 2002 to October 2003, he was appointed Acting Administrative Director. In 2005 the SPIE Educator Award recognized Professor Denardo for his outstanding contribution to training in optics hundreds of postdoctoral students and professors, mainly from developing countries, by organizing international schools and colleges at the ICTP for 20 years.

He was instrumental in establishing and running all ICTP activities on optics and lasers, including the Laboratory and the ICO/ICTP Award. Since 2008, the Award is called "ICO/ICTP Gallieno Denardo Award" to honour the memory of Gallieno Denardo, as a recognition of the coordination of the optics activities at ICTP for more than twenty years.

Professor Faheem Hussein (1942-2009)

The Head of the OEA from 1997 until 2004 was Professor Hussein (cf., Fig. 64).



Fig. 64 Professor Faheem Hussein, who headed the OEA in the period 1997 till 2004. Courtesy of The ICTP Photo Archives

Professor Hussein was a theoretical physicist born in what is now Pakistan. He attended Chelsea College, The University of London, England where he completed a BSc (hons.) in physics in 1963. He went on to an MSc in physics from Imperial College, The University of London, England under Abdus Salam. Finally, in 1966 he obtained a PhD in Theoretical physics under the supervision of Professor Paul T. Matthews.

He collaborated with the ICTP in many other functions since the Centre's foundation. He officially joined ICTP in 1990, though he had been a regular visitor to the institute since its inception. A former Associate and a member of the High Energy Physics group, Professor Hussein also coordinated ICTP's Diploma Programme and headed the OEA. He was always a strong and vocal advocate for the promotion of science in developing countries.

APPENDIX 2: Affiliated Centres (2006-2011)

In the tables below we list those students that were supported with ICTP funds. Research papers are listed as published or submitted. Those submitted in one year are most probably part of those that are accepted in the following year.

2A. Former Affiliated Centres

Table 1. (AC-7) Fellowships at Islamabad, Pakistan (later on, in the year 2009, this Affiliated Centre became Project 27)

Year	Ph.D	MPhil	Obtained (PhD)	Obtained (MPhil)	Research Papers	
					Published	Submitted
2006	1	—	—	—	3	—

Table 2. (AC-78) Centre for Advanced Mathematical Sciences (CAMS) based at the American University of Beirut, Lebanon

Year	Support for training, fellowships and field work	Other activities	
		Conference organization	Travel support
2006	—	—	6 visitors supported

Table 3. (AC-85) Department of Physics, Isfahan University of Technology at Isfahan, Iran

Year	PhD	MPhil	Travel support	Research Papers	
				Published	Submitted
2006-2008	—	—	11 physicists from less developed Iranian universities	3	5

Table 4. (AC-87) HCM Institute of Physics Viet-Nam (IOP) at Ho Chi Ming City.

Year	PhD	MPhil	Travel support	Research (Information not available for the published papers, but the Vietnamese scientists at FermiLab participated in their experiments)	
				Published	Submitted
2006	3	5	For Vietnamese scientists to visit FermiLab	—	—

2B. Current Affiliated Centres

Table 5. The Centre of Atomic, Molecular Physics and Quantum Optics (CEPAMOQ), The University of Douala, Douala, Cameroon

Year	Fellowships		Obtained (PhD)	Gender	Research papers	
	PhD	MSc			Published	Submitted
2006	4	11	1		10	9
2007	1	9	2	—	10	6
2008	2	9	1	—	13	1
2009	7	—	1	—	9	7
2010	10	—	2	—	6	6
2011	7	—	6	—	6	1

Table 6. Pavel Sukhoi State Technical University of Gomel (PSGSTU), Gomel, Belarus

Year	Fellowships		Obtained (Ph.D)	Research papers	
	PhD	MSc		Published	Submitted
2006	5	—	—	2	—
2007	5	—	3	4	1
2008	4	—	2	6	2
2009	5	—	2	4	1
2010	4	—	2	6	2
2011	2	—	—	5	2

Table 7. (AC-3) L'Institut de Mathématiques et de Sciences Physiques (IMSP), Porto Novo, Benin

Year	Fellowships		Obtained (PhD)	Research papers	
	PhD	MSc (Memoire DEA)		Published	Submitted
2006	8	4	3	9	7
2007	15	5	—	—	9
2008	11	—	3	7	2
2009	11	—	2	4	—
2010	11	—	2	5	4
2011	12	14	5	19	4

Table 8. (AC-70) Instituto de Matematica y Ciencias Afines (IMCA), Lima, Peru

Because of the type of courses that are followed (2 types of Master programme) and the split of the academic year the numbers below refer to an average over students. The first PhD student from the institute was awarded in 2006. Three students received their Master degrees in that year. (Their academic activity (publications) is mainly implemented by means of a substantial number of book publications.)

Year	Fellowships		Obtained		Research papers	
	PhD	MSc	PhD	MSc	Published	Books
2006	—	—	—	—	3	6
2007	5	14	1	3	—	—
2008	4	11	1	1	—	—
2009	4	15	—	1	2	—
2010	3	15	1	2	—	—
2011	3	14	—	5	—	—

Table 9. (AC-56) Department of Physics, Cheikh Anta Diop University (UCAD), Dakar, Senegal

Year	Fellowships		PhD (obtained)	Research papers	
	PhD	MSc		Published	Submitted
2006	6	—	—	6	—
2007	9	—	—	1	—
2008	10	—	—	2	—
2009	8	—	—	1	—
2010	4	—	—	2	2
2011	4	—	—	4	2

Table 10. (AC-57) Laser and Fiber Optics Centre (LAFOC), The University of Cape Coast, Ghana

Here, while the number of fellowships appears small, roughly half of the ICTP funds are spent on equipment that benefits all the students.

Year	Fellowships		Obtained		Gender	Research papers	
	PhD	MSc	PhD	MSc		Published	Submitted
2006	3	6		3		—	4
2007	5	4	—	1	2 F	2	—
2008	4	3	—	2	2 F	3	—
2009	1	4	—	—	—	—	—
2010	3	4	—	—	1 F	—	—
2011	1	4	—	—	1 F	—	—

Table 11. (AC-80) The Affiliated Centre at the Zewail City for Science and Technology (ZCST)

The Project Physics Beyond the Standard Model based at the Center for Theoretical Physics (CPT). was promoted to an Affiliated Centre in 2011.

Year	Fellowships		Obtained		Research papers	
	PhD	MSc	PhD	MSc	Published	Submitted
2011	—	3	—	—	13	7

APPENDIX 3: Projects (2006-2011)

3A. Former Projects

Table 12. (PRJ-01) PhD Program in Mathematics in Sub-Saharan Africa, Nigeria

Year	Ph. D	Obtained (PhD)	Research Papers	
			Published	Submitted
2006	5	1	9	3
2007	6	1	3	9
2008	7	—	11	6
2009	7	2	4	—

Table 13. (PRJ-02) The PhD Programme in Mathematics and Applied Mathematics at the University of Pretoria, South Africa

Year	PhD	MPhil	Obtained (PhD)	Obtained (MPhil)	Research Papers	
					Published	Submitted
2006	5	—	—	—	3	2

Table 14. (PRJ-06) West African Training School in Analysis and later in Algebra, Geometry and Algorithms (WATS), Saint Louis du Senegal. (Subsequently it becomes Net 47.)

Year	Support for training, fellowships and field work	Other activities	
		Conference organization	Travel support
2006	Towards 18 students for 24 weeks training	WATS	Towards 18 students

Table 15. (PRJ-07) CLAF, Brazil (previously AC 28 and currently a Network)

Year	PhD	MPhil	Obtained (PhD)	Obtained (MPhil)	Research Papers	
					Published	Submitted
2006	10	—	3	—	2	1

Table 16. (PRJ-12) Optics Training for Namibia, University of Namibia at Windhoek

Year	PhD	MSc	Obtained (PhD)	Obtained (MSc)	Research Papers	
					Published	Submitted
2006	1	1	—	—	—	—

Table 17. (PRJ-16) Ghulam Ishaq Khan Institute of Engineering Sciences and Technology, Topi, Pakistan

Year	Ph.D	Obtained (PhD)	Research Papers	
			Published	Submitted
2006-2007	2	—	5	—

Table 18. (PRJ-24) Mechanics and Mathematics Department, National University of Uzbekistan at Tashkent

Year	MSc and other group members	Obtained (MSc)	Research Papers	
			Published	Submitted
2006	1	1	15	—
2007	6	—	—	2
2008	7	—	—	—
2009	9	—	1	—

Table 19. (PRJ-28) Project at the School of Physics and Applied Physics of the Al-Neelain University based at Khartoum, Sudan

Year	PhD	MSc	Obtained (PhD)	Obtained (MSc)	Research Papers	
					Published	Submitted
2006	2	5	—	—	—	—

Table 20. (PRJ-30) Physics Beyond the Standard Model based at the Centre for Theoretical Physics (CPT) based at the British University of Egypt

Year	PhD	Obtained (PhD)	Research Papers	
			Published	Submitted
		—		
2006	6		6	3
2007	8	—	13	—
2008	5	—	8	6
2009	6	—	—	—
2010	3	—	18	5

In 2011 the Project became an Affiliated Centre.

Table 21. (PRJ-31) Department of Physics, Addis Ababa University, Ethiopia

Year	PhD	Obtained (PhD)	Research Papers	
			Published	Submitted
2006	1	—	2	—
2007	1	—	—	—
2008	1	—	—	—
2009	1	1	1	1

3B. Current Projects

Table 22. (PRJ-05) The Salam Chair based at Lahore, Pakistan

Year	PhD	MPhil	Obtained (PhD)	Obtained (MPhil)	Gender	Research Papers	
						Published	Submitted
2006	3		1	2		14	-
2007	3	—	—	4	2F	21	4
2008	3	—	1	—	2F	16	—
2009	3	3	1	—	1F	8	—
2010	3	2	—	3	1F	7	—
2011	3	3		1	2F	10	—

The Chair has on average some 12 students in total, the majority are PhD students and some are MPhil students. The OEA has funded 3 PhD Fellowships every year since 2006.

Table 23. (PRJ- 09) The Southeast European Network in Mathematics and Theoretical Physics SEENET-MTP at Nis, Serbia

Year	PhD	MSc	Obtained (PhD)	Obtained (MSc)	Gender	Research Papers	
						Published	Submitted
2007	—	—	—	—	—	—	—
2008	—	—	—	—	—	—	—
2009	3	—	—	—	1F	—	—
2010	3	2	—	—	—	—	—
2011	3	2	—	—	1F	10	2

Table 24. (PRJ-15) The International Chair in Mathematical Physics and Applications based at Cotonou, Bénin, ICMIPA

Year	PhD	MSc	Obtained (PhD)	Obtained (MSc)	Research Papers	
					Published	Submitted (or in press)
2006	4	—	—	—	9	2
2007	14	—	4	—	16	13
2008	4	—	—	—	—	—
2009	5	—	2	—	13	3
2010	4	—	—	—	11	2
2011	1	9	1	9	10	6

The research has also been communicated in several book chapters. It has also been recorded in numerous internal reports and preprints.

Table 25. (PRJ-18) Diploma Programme based at Bariloche, Argentina

Year	MSc	Obtained (MSc)	Research Papers	
			Published	Submitted
2006	4	—	—	—
2007	3	1	—	—
2008	4	3	—	—
2009	5	1	—	—
2010	2	2	—	—
2011	3	—	—	—

Table 26. (PRJ-22) PhD Programme in Mathematics based at Accra, Ghana

Year	Ph.D	MSc	Obtained (PhD)	Obtained (MPhil)	Research Papers	
					Published	Submitted
2006	11	20	3	—	—	—
2007	8	11	1	4	4	1
2008	7	8	4	—	6	3
2009	9	13	1	2	—	—
2010	6	8	1	14	—	—
2011	3	8	4	8	—	—

Table 27. (PRJ-23) Regional Postgraduate Diploma in Mathematics based at Gaborone, Botswana

Year	Ph.D	MSc	Obtained (PhD)	Obtained (MSc)	Research Papers	
					Published	Submitted
2006	1	2	—	—	—	—
2007	1	2	1	1	1	—
2008	2	1	—	—	—	—
2009	1	1	1	—	—	—
2010	—	2	—	—	—	—
2011	1	1	—	—	—	—

Table 28. (PRJ-27) Fellowships at Former Affiliated Centre, based at Islamabad, Pakistan

Year	Ph.D/MSc	Obtained (PhD)	Research Papers	
			Published	Submitted
2009	1 MSc	1	5	—
2010	1 MSc	—	1	—
2011	—	—	—	—

Table 29. (PRJ-29) Theoretical Astrophysics based at the Uleg Beg Astronomical Institute, Tashkent, Uzbekistan

Year	PhD	Obtained (PhD)	Gender	Research Papers	
				Published	Submitted
2007	—	—	—	7	8
2008	—	—	—	15	9
2009	3	3	—	15	—
2010	2	2	1F	20	1
2011	6	2	—	18	2

Table 30. (PRJ-32) ICTP Fellows at the Centre for Space Physics (CSP) based in Kolkata, India

Year	PhD	Obtained (PhD)	Research Papers	
			Published	Submitted
2007		—	—	—
2008	1	—	—	—
2009	1	—	—	—
2010	1	1	—	—
2011	1	—	1	1

APPENDIX 4: Networks (2006-2011)

4A. Former Networks

Table 31. (NET-AC-2-AAAPT) Asian African Association for Plasma Training based at the Department of Physics, University of Malaya, Kuala Lumpur

Year	Support for training, fellowships and field work	Other activities (Travel Support)	Publications	
			Published	Submitted
2006-2007	1 for a Nepalese student	1 visitor from I.R. Iran to visit the Technological University of Singapore	—	—

Table 32. (NET-24) Metals and Alloys, based at the Department of Physics, University of Dhaka, Bangladesh

Year	Support for training, fellowships and field work	Other activities (Travel Support)	Publications	
			Published	Submitted
2006-2009	2 for Nepalese students 6 MPhil theses completed 2 PhD theses completed 4 PhD students working on their theses in 2007	1 visitor from I.R. Iran to visit the Technological University of Singapore	12	—

Table 33. (NET-58) Seismic microzoning of Latin American Cities (SMLAC), based in Havana, Cuba

Year	Support for training, fellowships and field work	Other activities (Travel Support)	Publications	
			Published	Submitted
2006	Meetings in Caracas, Trieste, Kingston and Havana	4 participants of the Caracas Meeting 2 participants in the Kingston Meeting 2 participants in the Havana Meeting	—	—
2007	1 Meeting in Jamaica. 1 Meeting in R.B. Venezuela (participants from Cuba, Costa Rica and Peru).	1 Cuban scientist for each of the two meetings.	1	—
2008	1 Meeting in R.B. Venezuela..	1 Jamaican scientist (female). 1 Cuban scientist.	—	—

Table 34. (NET-61) Latin-American Network on Slow Dynamics of Complex Systems based at the Henri Poincare Chair of Complex Systems, University of Havana, Cuba influencing Argentina and Brazil

Year	Support for training, fellowships and field work	Other activities		Publications	
		Conference organization	Travel Support	Published	Submitted
2006	Support for Cuban and Brazilian activities	—	Exchange of visits of scientists belonging to the network	—	—
2009	—	—	1 Cuban to Argentina. 1 Cuban to Brazil. 1 Brazilian to Cuba. 2 Brazilians to Argentina. 4 Argentinians to Brazil.	16 were reported for the period 2007-2008	—

Table 35. (NET-62) Network on High Energy Physics and Quantum Groups based at the University Mohammed V, Rabat and Ibn Tofali University at Kenitra, Morocco

Year	Promotion of Science	Research Papers	
		Published	Submitted
2006	11th High Energy and Mathematical Physics Workshop Purchase of Computers Exchange visit	1	—

Table 36. (NET-65) Network on Seismic Microzoning of South-East Asian Cities by Realistic Modelling of Earthquake Ground Motion based at CSIR Centre for Mathematical Modelling and Computer Simulation, Bangalore, India

Year	Promotion of Science	Research Papers	
		Published	Submitted
2006	Organization of Meeting on Seismic Hazard in Asia	—	—
2007	—	—	—
2008	1 Workshop on Seismic Hazards in Asia (co-sponsored by the Director's Office of ICTP) 2 travel grants for scientists	—	—

Table 37. (NET-67) Bangkok-Beijing-Shanghai Network in High Energy Physics and Cosmology, based Sanghai, P. R. China influencing South East Asia

Year	Support for training, fellowships and field work	Other activities		Publications	
		Conference organization	Travel Support	Published	Submitted
2007	—	1 postgraduate course on cosmology in Thailand.	1 Chinese scientist to Thailand. 1 Thai scientist to P.R. China.	2	—
2008	—	—	—	—	—
2009	—	—	—	—	—
2010	—	1 Advanced School. 1 Workshop.	1 Chinese scientist to Thailand. 3 Thai scientists to P.R. China.	—	—

4B. Current Networks

Table 38. (NET-27) African Lasers, Atomic, Molecular, Optical Science Network (LAM), based at Dakar, Senegal with continental influence

Year	Support for training, fellowships and field work	Other activities	
		Conference organization	Travel support
2006		8th International Workshop, Cape Coast, Ghana Topical Meeting of International Commission in Optics (ICO)	For participation in 2 meetings in South Africa
2007	3 (Mauritania). 2 (Mali). 1 (Senegal).	• 1 meeting in Algiers. • Support for an Affiliated Centre (Cameroon).	• 1 for promoting the Network. • 1 for an Egyptian to attend a conference in Algiers.
2008	• 4 PhDs (1 Mauritania, 3, Senegal). • 1 sandwich (Dakar/Mali).	• 1 meeting in Douala, Cameroon. • 1 meeting in Dakar, Senegal. • 1 regional African meeting (ICT).	• 3 for the Network coordination. • 2 students from Senegal sent to Nigeria and Kenya.
2009	• 2 students (Mauritania), • 4 students (Senegal), • 1 research grant to a female student in Algiers.	• 3 workshops. • Contributed as a Founding Member to the African Laser Centre (ALC). • Launching of the African Physical Society.	• 1 student from the University of Bamako (Mali) sent to Senegal. • 3 students from Senegal sent to Ghana.
2010	• 2 students (Mauritania). • 5 students (Senegal). • 1 PhD. sandwich student at the universities CAD of Dakar and Bamako, in Mali.	• 1 International Conference on Optical Science and Applications for Sustainable Development. • 1 workshop (LAM 9). • 1 Training Course on Mass Spectrometry in Nutrition.	• A programme of exchange of scientific visits. • Financial support to the ETOP • Meeting in Tunisia (US\$ 1,000). • Support of a Moroccan Research Fellow to attend a meeting in Tunisia.
2011	• Continued the student support of 2010.	• LAM/IAEA African Regional training Course on Mass Spectrometry. • Multispectral Imaging Spectroscopy in nutrition (Bamako, Mali).	• The LAM President participated in the ICO Congress in Puebla, Mexico, and in the ICTP Winter College.

Table 39. (NET-35) Caribbean Network of Quantum Mechanics, Particles and Fields, based in Cuba

Year	Ph.D/Troisieme Cycle	MSc	Research Papers	
			Published	Submitted
2006	7 (1 approved)	7 (1 approved)	9	9
2007	2	2	12	3
2008	—	—	8	5
2009	4	4	—	—
2010	4	1	15	3
2011	4	3	13	2

In addition, there has been support for post-doctoral fellows. There were also several events organized, or with participation of Network members.

Table 40. (NET-37) CLAF (Centro Latinoamericano de Fisica) based in Brazil with continental influence especially Brazil, Cuba, Mexico and Peru

Year	Ph.D/Troisieme Cycle	PhD (approved)	Research Papers	
			Published	Submitted
2007	9 PhDs: 2 Cubans in Brazil. 3 Cubans in Mexico. 1 Bolivian in Brazil. 1 Colombian in Mexico. 2 Peruvians in Mexico.	—	2	—
2008	5 PhDs: 1 Peruvian in Mexico (female). 1 Peruvian in Mexico. 1 Colombian in Mexico. 2 Cubans in Mexico.	—	3	—
2009	3 PhDs: 1 Cuban in Mexico. 1 Colombian in Brazil. 1 Cuban in Brazil.	—	—	—
2010	11 PhDs: 1 Peruvian in Mexico. 1 Colombian in Mexico. 1 Cuban in Mexico (completed the degree). 1 Cuban in Cuba (female). 7 others.	—	3	1
2011	5 PhDs (Cuba). 3 PhDs (Brazil). 2 PhDs (Mexico).	2	7	3

Table 41. (NET-40) North African Group for Earthquakes and Tsunamis (NAGET) based in Algeria, starting once again in 2011, influencing Egypt, Libya, Morocco, Sudan and Tunisia

Year	Support for training, fellowships and field work	Other activities	
		Conference organization	Travel support
2007	A scientist from Maulay Ismail University in Morocco did some field work in Egypt at the National Reserch Institiute for Astronomy and Geophysics	—	2 Visiting Scientists form Egypt to Morocco
2011	—	—	—

Table 42. (NET-43) Latin American Network of Ferroelectric Materials based in Cuba influencing Colombia and Brazil

Year	Science promotion	Other activities		Publications	
		Conference organization	Travel Support	Published	Submitted
2006	2 PhD approved	Applications of Piezoelectric Ceramics Vibrational Spectroscopy in Molecules and Crystalline Solids	1 Mexican to Cuba 2 Cubans to Mexico 1 Brazilian scientist in Mexico	15	3
2007	5 students	• Course on electron paramagnetic resonance. • Course on crystal growth and polarized light microscopy	• 1 lecturer at the EPR course. • The head of the Network visited the University of Puebla, Mexico.	13	1
2008	2 Mexican students 1 Colombian student	• Course on piezoelectricity and piezoelectric materials	1 Mexican lecturer (F) 6 students: from Mexico (3), Colombia and Brazil (2).	15	6
2009	1 Cuban to Mexico 1 Cuban to Colombia 2 Mexicans and 1 Brazilian for the TF course	• Course on ferroelectric materials. • Course on thin films.	• The head of the Network visited the University of Guadalajara for research activities. • 1 Mexican lecturer. • 1 Brazilian lecturer.	7	10
2010	2 PhD students planning their theses	• Course on impedance spectroscopy	• For 2 graduate students • Travel grants for 2 scientists	11 (and 2 chapters in books).	5
2011	2 PhD students planning their theses	• First Meeting of Young Network Researchers (at ICIMAF, Cuba)	• Travelling support for 2 PhD Cuban students and Network scientists to visit Brazil.	9 (and 5 additional ones in proceedings)	4

Table 43. (NET-45) African Network on Lasers, Atomic and Medical Physics in Tunisia influencing Algeria, Burkina Faso, Cameroon, Central African Republic, Chad, Tunisia and Senegal

Year	Other activities		Publications	
	Support for training, fellowships and field work	Events (organized)	Published	Submitted
2007	2 PhD students (Tunisia and Morocco) 1 postdoc; 1 sandwich course	3	2	4
2008	3 PhD students (including 1 from Algeria, female) Travel grants for 2 scientists	4 Workshops 2 Advanced Schools	8	3
2009	4 PhD students (including 1 Senegal, 1 Republic of Central Africa, 1 Tchad (female) 1 Algeria (female))	4 Workshops	1	1
2010	7 PhD students (including 3 females)	Workshops in Education for Trainers	1	1
2011	7 PhD students: Burkina Faso (1); Cameroon (2) Central African Republic (1); Senegal (1)	Alop International Workshop (Tunis)	1	1

Table 44. (NET-47)Partial Differential Equations, Modelling and Control, based in Burkina Faso influencing Senegal and Mauritania

Year	Support for training, fellowships at PhD level	Support for training, fellowships at MSc (Memoire DEA) level	Conference organization	Publications	
				Published	Submitted
2006	1 Thèse d'Etat 1 PhD	2 MSc	2nd Conf. on Mathematical Applications to Development Problems in Sahel	5	4
2007	7 PhD (defenses) 1 Thèse d'Etat (defense)	6 MSc (defenses)	• 1 Workshop of mathematical modelling • 1 Training School • 1 African Conf. on Applied Mathematics • 1 Conf. in honor of C. Lobry	7	6
2008	2 PhDs (defenses)	1 M.Sc (defense)	• PDE and nonlinear analysis	16	7
2009	6 PhD (defenses) including 1 female	2 MSc (defenses)	—	15	13
2010	4 PhD (defenses)	7 MSc (defenses)	• 1 International School of models of epidemiology • 1 Colloquium on Informatics	15	15
2011	4 PhD	—	• Workshop of Mathematical Models and Data Processing of Water and Sound • Workshop on Control of Systems and Modelling (Senegal)	Not available	Not available

Table 45. (NET-53) Relativistic Astrophysics, Cosmology and Gravitation, originally based in Pakistan but now divides into two nodes at: 1. Bangladesh, India and Uzbekistan (BIU) and 2. Pakistan and Turkey (PT)

Year	Support for training, fellowships and field work	Other activities		Publications	
		Conference organization	Travel Support	Published	Submitted
2007	1 Pakistani scientist to Turkey. 1 Uzbekistani scientist to India	—	—	—	—
2008	3 Uzbekistan scientists to India	—	—	—	4
2009	—	—	—	—	—
2010	1 Uzbekistani scientist to India 1 Indian scientist to Turkey. 1 Pakistani scientist to Turkey	—	—	—	—
2011	Exchange of researchers visits within the Network	—	—	—	—

Table 46. (NET-56) South East Asia Consortium for Condensed Matter Physics based in Nepal influencing Bangladesh and India

Year	Support for training, fellowships and field work PhD/MSc	Other activities	
		Conference organization	Travel support
2009	1 PhD 3 MSc	4	—
2011	1 PhD 3 MSc	—	—

Table 47. (NET-59) African Network in Geometry and Algebra Applied to Development (RAGAAD), based in Cameroon influencing Benin, Burkina Faso, Congo, Republic of (Congo-Brazzaville), Mali, Mauritania, Niger, Senegal and Tunisia

Year	Fellowships	Support for training and field work		Publications	
		Conference organization	Travel Support	Published	Submitted (or preprints)
2006	4 PhD	3 meetings in Cameroon, Congo and South Africa	3 scientists to travel: Niger to France Guinea to ICTP Congo-Brazzaville to Senegal	29	—
2007	4 PhD	• WATS 1 (West African Training School).	2 students for a colloquium.	24	—
2008	10 PhD 4 MSc	• WATS 2 • A Workshop in Nigeria. • Conf. on African cryptology.	• 9 student travel grants. • 5 other travel grants.	20	—
2009	8 PhD 4 MSc (2 PhD defenses)	• WATS 3 • School on algebraic topics and cryptology.	• 4 scientists for local academic supervision • 5 student travel grants.	4	—
2010	12 PhD (3 PhD defenses) 4 MSc	• WATS 4 • School of cryptology in Cameroon. • A Workshop in Nigeria. • Ecole CIMP-UNESCO-MICNN Theorie de Nombres e Algorithmiques (in Bamako, Mali)	• For 4 doctoral students in Niamey, Niger, and for doctoral and master students from sub-Saharan countries. • For scientists from Senegal and Tunisia to travel to Cameroon.	—	—
2011	6 PhD (2 PhD defenses)	• Atelier de Combinatoire • African Cryptology at UCAD, Dakar, Senegal	• For 2 scientists from Burkina Faso to visit the University of Aix Marseilles 2, and for doctoral students from Niamey, Dakar and Yaounde.	13	2

Table 48. (NET-63) Nano African Network Initiative (Nano-Afnet), based in South Africa with continental influence

Year	Support for training, fellowships and field work	Other activities		Publications	
		Conference organization	Travel Support	Published	Submitted
2006-2007	9 PhD 6 MSc	4 events	—	14	3
2008	1 PhD 4 MSc 30 graduate school trainees, including 6 females	9 conferences	• 15 Visiting Scientists. • 14 travel grants for scientists.	14	1
2009	1 PhD 33 graduate school trainees, including 12 females	—	14 Visiting Scientists. 13 travel grants for scientists.	67	—
2012	—	—	—	—	—

Table 49. (NET-73) African Network for Solar Energy, based in the Johannes Kepler University, Linz, Austria with continental influence

Year	Support for training, fellowships and field work	Other activities		Publications	
		Conference organization	Travel Support	Published	Submitted
2011	5 PhD students: • From Univ. Tebessa, Algeria to the University of Linz • From Univ. Ngaoundere, Cameroon to Univ. Dakar, Senegal • From Univ. Dakar to Univ. El Jadida, Morocco • From Univ. Univ. Yaounde I to Hassan II Univ. of Mohammedia, Morocco • 1 PhD completed by a student from Ethiopia	ANSOLE Days 2012 (University of Yaounde I, Cameroon)	2 ANSOLE students to the University of Linz	3	—

APPENDIX 5:**Table 50. Visiting Scholars/Consultants (2006-2011): the data refers to new assignments.**

COUNTRY	2006	2007	2008	2009	2010	2011
Argentina	—	—	1	1	—	—
Benin	3	—	—	1	—	1
Brazil	—	2	—	—	2	—
Cuba	—	1	—	1	—	1
Egypt	—	1	—	—	—	—
Ethiopia	1	—	—	—	—	—
Ghana	2	2	—	2	1	—
India	—	1	—	—	—	—
Indonesia	—	1	—	—	1	—
Iran (I.R.)	1	—	—	—	—	—
Liberia	—	—	—	—	—	1
Madagascar	—	—	—	1	—	—
Malawi	1	—	—	1	—	—
Morocco	—	1	—	1	—	—
Namibia	—	2	—	—	—	—
Nepal	—	—	—	—	—	2
Nigeria	—	—	—	—	—	1
Peru	—	—	—	1	—	—
Senegal	—	—	—	—	1	1
Sudan	1	—	—	—	—	—
Thailand	—	1	—	—	—	—
Turkey	1	1	—	—	—	—
Uzbekistan	—	1	—	—	—	—
Zimbabwe	—	—	—	—	—	1
TOTAL	10	13	1	9	5	8

APPENDIX 6:**Table 51. Scientific Meetings (2006-2011)**

COUNTRY	2006	2007	2008	2009	2010	2011
Algeria	3	—	—	1	—	—
Argentina	6	4	6	10	5	4
Armenia	—	—	1	—	—	1
Australia	—	1	—	—	—	—
Azerbaijan	1	—	2	—	—	—
Bangladesh	—	1	1	—	—	—
Belarus	1	—	—	—	—	—
Benin	—	2	2	—	2	2
Bolivia	2	1	—	—	—	1
Bosnia & Herzegovina	—	—	1	—	—	1
Brazil	6	3	2	5	6	2
Bulgaria	1	1	2	1	1	1
Burkina Faso	—	—	—	1	—	—
Cambodia	—	—	—	1	—	1
Cameroon	1	1	3	2	1	2
Chad	1	—	—	—	—	—
Chile	1	—	2	2	5	1
China, P. R.	2	1	—	1	1	1
Colombia	—	4	1	1	1	3
Congo-Brazzaville	—	—	1	—	—	—
Côte d'Ivoire	—	1	—	—	—	—
Croatia	1	1	—	—	1	—
Cuba	3	1	2	—	1	2
Egypt	5	3	6	2	2	1
El Salvador	—	—	1	—	—	2
Ethiopia	—	—	1	1	—	1
France	1	—	1	—	—	1
Germany	1	—	—	—	—	—
Ghana	3	3	2	2	2	2

COUNTRY	2006	2007	2008	2009	2010	2011
Georgia	—	—	1	—	—	2
Guatemala	—	—	—	1	1	—
Honduras	—	—	—	—	—	1
India	8	3	4	5	2	4
Indonesia	—	5	1	2	—	2
Iran (I.R.)	3	2	3	3	3	1
Italy	—	—	—	2	1	—
Jordan	1	—	1	—	1	2
Kenya	—	1	—	—	1	—
Laos	1	—	—	—	—	—
Lebanon	—	—	—	—	1	—
Macedonia	—	—	—	1	—	—
Madagascar	—	—	1	—	—	1
Malaysia	1	1	1	2	—	2
Mali	—	—	—	—	1	—
Mexico	4	3	—	1	2	1
Mongolia	—	1	1	—	—	—
Morocco	3	2	1	2	3	5
Namibia	1	—	—	—	—	—
Nepal	—	—	—	2	1	2
Nicaragua	—	1	—	—	—	—
Niger	—	1	—	—	—	—
Nigeria	2	2	1	1	1	1
Pakistan	4	3	1	2	—	1
Peru	1	—	1	—	1	—
Philippines	—	2	—	—	—	1
Puerto Rico	—	—	—	—	1	—
Romania	1	—	—	1	—	—
Sudan	—	2	—	—	—	—
Russian Fed.	—	—	1	—	—	—
Rwanda	—	—	—	—	—	1
Senegal	—	2	—	2	1	1
Serbia	1	1	1	—	1	1
Singapore	—	—	—	1	—	1

COUNTRY	2006	2007	2008	2009	2010	2011
South Africa	—	3	1	—	—	2
Sri Lanka	1—	—	—	—	—	—
Sudan	—	2	—	—	—	—
Sultanate of Oman	—	—	—	1	1	1
Switzerland	—	1	—	—	1	—
Tanzania	—	2	1	1	—	—
Thailand	—	2	—	1	1	1
Trinidad & Tobago	—	1	1	—	—	—
Tunisia	1	1	1	1	1	1
Turkey	—	2	1	1	3	—
Uganda	2	—	1	—	1	—
Ukraine	—	1	—	2	—	—
Uruguay	—	1	2	1	1	—
Uzbekistan	—	1	—	2	—	—
Venezuela (R. B.)	1	—	—	—	—	—
Vietnam	5	2	3	4	4	3
Zambia	—	—	1	—	—	—
TOTAL	80	77	65	72	63	67

