

THE AFRICAN LASER CENTRE: TRANSFORMING THE LASER COMMUNITY IN AFRICA

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The creation and utilization of science and technology in most African countries lag behind those on the other continents. This gap must be closed if the nations of Africa ever hope to join the ranks of the world's most economically competitive countries. Despite the high technological development of a few countries, such as South Africa, the vast majority of African countries are struggling in the high tech arena. Major impediments to economic prosperity in Africa are the following:

1. Extremely low, although in a number of cases increasing, government investments in mathematics, science, and technology
2. Severe shortage of qualified teachers in primary and secondary schools
3. Lack of adequate teaching and research infrastructure at all levels
4. Long history of brain drain from the continent
5. Isolation experienced by many researchers, even from peers in the same country
6. Limited information technology and Internet services
7. Lack of skilled laboratory technicians
8. Frequent power and water outages.

Among international initiatives in Africa, the African Laser Centre stands out and must be supported by the governments of the participating institutions. Its genesis is the result of two independent efforts. One driven by the National Laser Centre (NLC) of South Africa and the other by the Edward Bouchet – Abdus Salam Institute (EBASI), which is affiliated with the International Centre for Theoretical Physics (ICTP) in Trieste, Italy.

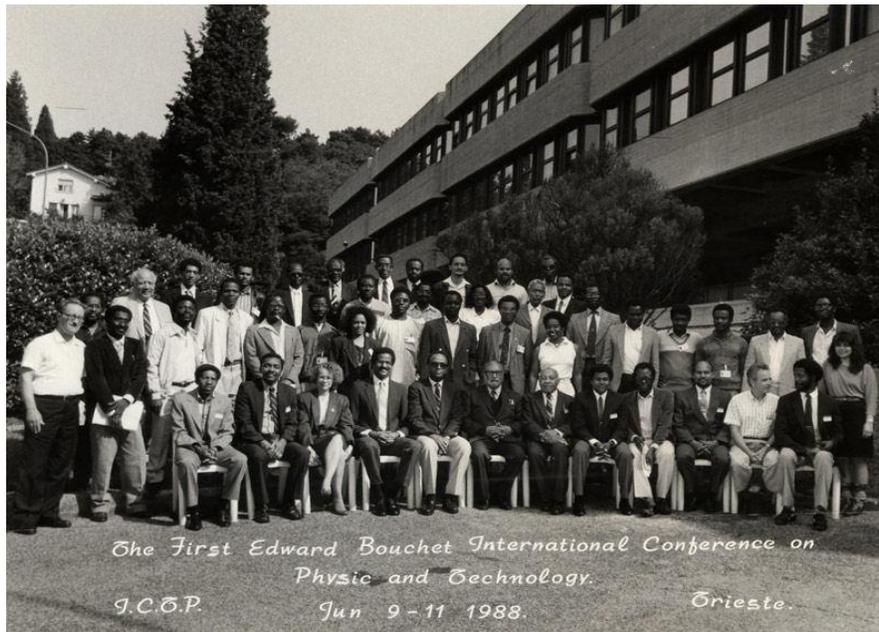
National Laser Centre of South Africa

Operated by South Africa's Council for Scientific and Industrial Research (CSIR), which is one of the leading science and technology organisations in Africa, the NLC provides a critical core of knowledge and expertise through the research, development and implementation of laser-based technologies. Among other advantages, this enables South African industries to improve their global competitiveness and expand their market share. The NLC's core competency areas include the following:

1. Laser materials processing
2. Laser physics and technology, including femtosecond and high energy picosecond lasers
3. Laser spectroscopy, including light detection and ranging (LIDAR), Raman spectroscopy, and laser-induced plasma spectroscopy
4. Biophotonics, including the development of diagnostic and therapeutic medical applications of lasers.

EBASI

Inspired by Physics Nobel Laureate, Abdus Salam, EBASI was established to foster science and technology collaborations between researchers in Africa and African-American researchers in the United States. Initially, the founders named it the Edward A. Bouchet Institute in honor of the first African American to receive a Ph.D. in any field, which happened to be physics. Bouchet (1852-1918) earned the degree in 1876 from Yale University. After Salam passed in 1996, the organization honored him by adding his name. The first organizational meeting of the Bouchet Institute occurred during June 9-11, 1988, at ICTP. Fig. 1 displays a group photo of the participants at that inaugural meeting, which was jointly funded by ICTP and the U.S. National Science Foundation. Over the years, EBASI has



**Figure 1. Participants at the Inaugural Meeting of the Edward A. Bouchet Institute
US Organizers, Lynette and Joseph Johnson Seated 3rd and 5th from left
and Nobel Laureate Abdus Salam Seated 6th from left
ICTP, Trieste, Italy June 1988**

sponsored the following international conferences:

- 1988: Trieste, Italy
- 1990: Accra, Ghana
- 1998: Gaborone, Botswana
- 2001: Cotonou, Benin
- 2003: Tunis, Tunisia
- 2007: Cape Town, South Africa.

Genesis of the ALC

The National Laser Centre inherited a large inventory of laser equipment from the termination of a uranium enrichment programme in which South Africa collaborated with France. After the dissolution of that programme, the NLC launched a laser equipment loan programme, called the Rental Pool Programme, for researchers and educators at South Africa's higher education institutions. This programme also continues to offer technical support and university access to the NLC's laser equipment. Fig. 2 shows two research participants in the loan program, as featured on the CSIR Website. The programme was so successful that the government decided to explore instituting a more continental dimension to the programme so that laser users throughout Africa could borrow the equipment.

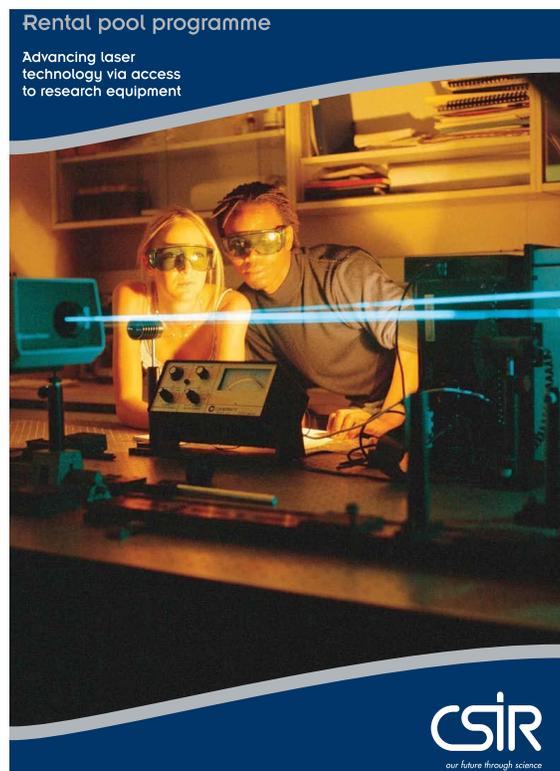


Figure 2. Two Participants in the NLC-operated Rental Pool Programme¹

At the same time EBASI held its Fourth International Conference during August 6-10, 2001 in Benin. At a meeting of the EBASI Council during that conference, Sekazi Mtingwa proposed that EBASI establish a committee to start working with African governments to bring a synchrotron light source to the continent. A synchrotron light source is an electron accelerator that produces the world's brightest beams of X-rays that can be used in a broad range of disciplines, including physics, chemistry, materials science, biology, and palaeontology. The importance of that proposal is easily gleaned

¹ http://www.csir.co.za/lasers/brochures&fact_sheets/RPP_brochure.pdf

from Fig. 3, which shows the locations of the various synchrotron light sources in the world. With the construction of recent light sources in Brazil and Australia, Africa becomes the only habitable continent in the world without such a facility. From the EBASI discussions, the participants decided that, instead of going straight for a synchrotron light source, which could cost on the order of one billion U.S. dollars, the committee should work with researchers and governments on the African continent to improve the infrastructure and expertise needed to empower laser research and training. Such expertise already exists widely across the continent, but due to a lack of adequate



Figure 3. Locations of Synchrotron Light Sources²

financial support, many researchers find themselves struggling to enhance, or even maintain, their research and training programmes.

Upon returning to the U.S., as Chair of the EBASI Committee to Promote Laser-Based Science and Technology in Africa, Mtingwa sent many emails to researchers in Africa, informing them of the new EBASI initiative. Hardus Greyling, an executive at the NLC, received one such email and shared it with Philemon Mjwara, then Manager of the NLC and presently Director-General of South Africa's Department of Science and Technology (DST). The NLC and EBASI decided to join forces and work together to shore up laser research and training in Africa.

As a first step, the NLC sponsored a workshop in Pretoria, South Africa during 2001. In attendance were laser experts, governmental officials, and other interested partners from Africa, the U.S., and Europe. To carry out the objectives derived from that first ALC Workshop, the participants established two Task Teams as follows:

- Task Team 1: Convened by Paul Buah-Bassuah of the Laser and Fibre Optics Centre (LAFOC) at the University of Cape Coast, Ghana, and Sekazi Mtingwa of MIT and North Carolina A&T State University. This

² Source: <http://www.lightsources.org/cms>

team led the writing of the *ALC Strategy and Business Plan*.

- Task Team 2: Convened by Giovanni Hearne of the University of the Witwatersrand (currently at the University of Johannesburg) and Hubertus von Bergmann of the Laser Research Institute at the University of Stellenbosch. This team performed exhaustive equipment audits of laser research and training facilities in a number of African countries, and even the island of Réunion.

Based upon the audits' findings, Task Team 1 produced the *Strategy and Business Plan* with important inputs from a number of people, mostly the following:

South Africa

- Philemon Mjwara (Centre Manager of the NLC)
- Darrell Comins (University of the Witwatersrand)
- Hardus Greyling (NLC)
- Danie de Lange (Attorney)
- Malik Maaza (University of the Witwatersrand, currently at iThemba LABS)
- Max Michaelis (University of Natal)
- Narendra Viranna (De Beers)

Senegal

- Amadou Wagué (Université Cheikh Anta Diop de Dakar and President of the ICTP-sponsored African Laser Atomic Molecular and Optical Sciences Network, more widely known as the LAM Network)

Egypt

- Yehia Badr (Director of NILES, the National Institute of Laser Enhanced Sciences, at Cairo University)

Sweden

- Sune Svanberg (Director of the Lund Laser Centre at Lund University)

France

- Pierre Chavel (General Secretary of the International Commission for Optics)

Italy

- Gallieno Denardo (Head of the Office of External Activities for ICTP, deceased)

Henry Tromp (NLC) and Anthon Botha, a private consultant with TechnoScene (Pty) Ltd, South Africa, performed final drafting of the document, which was completed in November 2002 with the title, *A Strategy and Business Plan for an African Laser Centre*.

Subsequent to the writing of that document, the official Launching Ceremony of the ALC occurred on November 6, 2003, in Johannesburg, South Africa during the Ministerial Segment of the New Partnership for Africa's Development (NEPAD) Conference on

Science and Technology for Development. NEPAD declared the ALC to be one of its Centres of Excellence. Figs. 4-10 show some of the activities on the days of and after the ALC Launching Ceremony. Photo identifications are found at the end of this document.



Figure 4. Laser Show during the NEPAD Launching Ceremony of the ALC Johannesburg, November 2003



Figure 5. Group Photo of ALC Founders Attending Launching Ceremony, Johannesburg, November 2003



Figure 6. (left-to-right) Sekazi Mtingwa and Sibusiso Sibisi, President and CEO of the CSIR, at ALC Launching Ceremony Johannesburg, November 2003



Figure 7. Group Photo of ALC Founders Attending Business Meeting Pretoria, November 2003



Figure 8. (left-to-right) Hardus Greyling and Henry Tromp during a Tea Break at ALC Business Meeting Pretoria, November 2003



Figure 9. ALC Founders Visiting the University of the Witwatersrand Johannesburg, November 2003



Figure 10. ALC Founders Visiting the Laboratory of Malik Maaza at Wits Johannesburg, November 2003

Organization of the ALC

With the assistance of Attorney Danie de Lange, the founders incorporated the ALC as a nonprofit organization under South African laws and constituted it as a virtual centre based at the NLC in Pretoria. Philemon Mjwara, then Centre Manager of the NLC, became the first Chair of the ALC Board of Directors; followed by Thulani Dlamini, who succeeded Mjwara and served as both Centre Manager of the NLC and Chair of the ALC during 2006-2008. He is currently the Manager for R&D at Sasol Technology in Johannesburg. Now, the ALC is led by Ndumiso Cingo, who succeeded Dlamini as Centre Manager of the NLC and Chair of the ALC Board. The current ALC Board of Directors consists of the following persons:

- Ndumiso Cingo, Chair (National Laser Centre, South Africa)
- El-Hachemi Amara (Centre de Développement des Technologies Avancées, Algeria)
- Zohra Ben Lakhdar (Tunis el Manar University, Tunisia)
- Hubertus von Bergmann (University of Stellenbosch, South Africa)
- Paul Buah-Bassuah (University of Cape Coast, Ghana)
- Adeniyi Fasasi (Obafemi Awolowo University, Nigeria)
- Jean-Marie Ndjaka (University of Yaoundé I, Cameroon)
- Malik Maaza (iThemba LABS, South Africa)
- Tom Otiti (Makerere University, Uganda)
- Mantoa Sekota (National University of Lesotho)
- Shyam Singh (University of Namibia)
- Mourad Zghal (Sup'Com University of Carthage, Tunisia)

- Sekazi Mtingwa, Diaspora Representative to the Americas (MIT, USA)
- James Uhomoibhi, Diaspora Representative to Europe (University of Ulster, UK)
- Amadou Wagué (Ex-officio LAM Network Representative, Senegal).

In order to work in tandem to improve laser research and training in Africa, the ALC established a Memorandum of Understanding with the LAM Network, a previously existing ICTP-sponsored network of laser users that is under the leadership of Ahmadou Wagué.

Since its establishment, the day-to-day affairs of the ALC have been managed successively by Henry Tromp, Aboubaker Beye (Université Cheikh Anta Diop de Dakar, Senegal) and currently Paul Motalane (NLC).

From the beginning of the ALC until its November 2011 Board meeting, there were two types of membership, and membership was restricted to institutions. Persons engaged in research and training from those institutions were considered participants. Fig. 11 shows the countries with ALC member institutions as of November 2011.

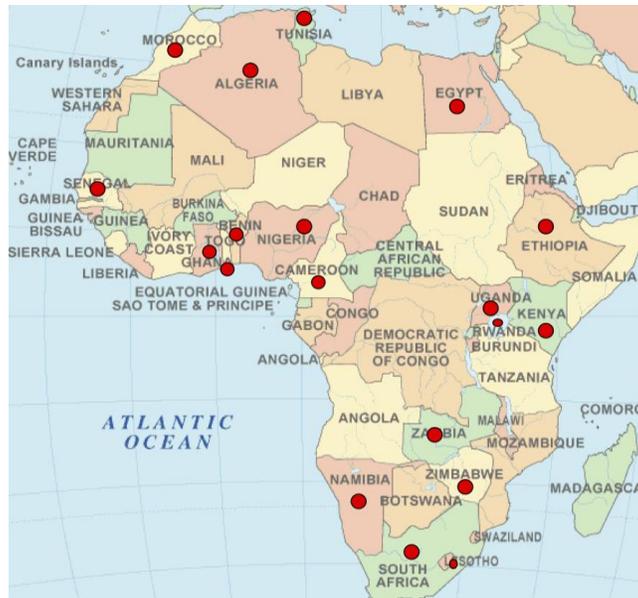


Figure 11. Countries with ALC Member Institutions³

The ALC has operated as a virtual hub, with the two types of memberships serving as nodes. The higher level nodes form the core and are designated as User Facilities, and the lower level nodes consist of all the other member institutions. Based upon the previously mentioned audits of the ALC Establishment Task Team 2, the User Facilities

³ Taken from the ALC Management Report to the Board of Directors Meeting, 13 November 2011.

were determined to have advanced ongoing state-of-the-art laser activities, while the other institutions were deemed to have somewhat lesser degrees of activity. The idea was for the User Facilities to assist the other institutions with enhancing their laser research, training and other activities. As the lower level institutions improved sufficiently, they could be promoted to User Facility status. On the other hand, any User Facility that does not continue to improve itself or assist others could be demoted to lower level status. The results of the audits led to the naming of the following inaugural User Facilities, along with some of their areas of specialization:

1. **Centre de Développement des Technologies Avancées (CDTA)**, Algiers, Algeria
Laser spectroscopy, surface studies, laser welding
2. **CSIR National Laser Centre**, Pretoria, South Africa
Location of ALC Headquarters
Manufacturing, machining, materials processing
3. **National Institute of Laser Enhanced Sciences (NILES)**, Cairo University, Egypt
Medical and biological applications of lasers, femtosecond laser system
4. **Tunis el Manar University**, Tunis, Tunisia
Plant and environmental science, molecular spectroscopy
5. **Laser and Fibre Optics Centre (LAFOC)**, University of Cape Coast, Ghana
Agricultural and environmental science
6. **Laboratoire Atomes Lasers**, Université Cheikh Ante Diop, Dakar, Sénégal
Atomic and molecular physics, laser spectroscopy, medical physics.

Currently, the ALC has more than thirty (30) institutional members.

In order to broaden its membership categories, at the November 2011 Board meeting, four categories of membership were established: User Facility, Ordinary, Affiliate and Honorary. The eligibilities for the different membership categories are as follows:

User Facility

- Engaged in significant pre-existing laser activities, such as advanced laser spectroscopy or laser materials processing, as determined by an ALC audit.
- Located in a host country that contributes financially to the ALC (not compulsory, but preferable).

Ordinary

- Engaged in some laser activities, such as the minor usage of commercial laser equipment or the use of lasers in education.
- Produced a strategic plan for significantly increasing the use of lasers for research

and training.

Affiliate

- Determined by the ALC Board to be one of the following:
 - A national or international society having an interest in lasers and their applications
 - An industrial enterprise having a commercial interest in lasers and their applications
 - Leading laser laboratory outside of Africa.
- Professed interest in supporting the goals and activities of the ALC.

Honorary

- Achieved distinction in the field of lasers and their applications.
- Made an outstanding contribution to the advancement of the goals of the ALC.

Operating as a nonprofit under South African law, the ALC convenes Annual General Meetings (AGM) of representatives from its member institutions. Usually, Board meetings are held just before and/or after the AGMs. Figs. 12-25 show various AGM and Board photos over the past decade.



**Figure 12. Participants at ALC Annual General Meeting
Pretoria, July 2004**



Figure 13. Zohra Lakhdar (Tunisia, Winner of 2005 L'Oreal-UNESCO Award) confers with Malik Maaza (iThemba LABS) during an AGM Tea Break Pretoria, July 2004



Figure 14. Participants at ALC Annual General Meeting Pretoria, May 2005



**Figure 15. ALC Board of Directors
Philemon Mjwara, Board Chair, Seated 2nd from left
Pretoria, May 2005**



**Figure 16. Participants at ALC Annual General Meeting
Centurion (near Pretoria), August 2006**



**Figure 17. ALC Board of Directors
Thulani Dlamini, Board Chair, Seated 3rd from left
Centurion, August 2006**



**Figure 18. Hon. Abdelhamid Mellah, Representative of the Algerian Atomic Energy Commission and Head of the Nuclear Research Centre of Algiers, Addresses the ALC AGM, which was opened by the Hon. Peter Daka (Seated behind flowers), Zambia's Minister of Science, Technology & Vocational Training
Lusaka, June 2007**



**Figure 19. Participants at ALC Annual General Meeting
Lusaka, June 2007**



**Figure 20. ALC Board of Directors
Thulani Dlamini, Board Chair, Seated 3rd from left
Lusaka, June 2007**



**Figure 21. Participants at ALC Annual General Meeting
Pretoria, August 2008**



**Figure 22. Participants at ALC Annual General Meeting
Windhoek, July 2009**



**Figure 23. ALC Board of Directors
Ndumiso Cingo, Board Chair, Seated 3rd from left
Windhoek, July 2009**



**Figure 24. ALC Board of Directors
Ndumiso Cingo, Board Chair, Seated 2nd from left
Paul Motalane, Office Manager, Standing 1st from left
Dakar, January 2010**



**Figure 25. Participants Attending Joint Meeting of the LAM Network, ALC, EBASI, U.S. National Society of Black Physicists, and newly established African Physical Society with Senegal’s President, The Honorable Abdoulaye Wade (middle of second row)
Dakar, January 2010**

ALC Goals and Programmes

As delineated in the *Strategy and Business Plan*, the ALC continues to pursue the following goals:

1. Improve the quality of life of all African peoples.
2. Stop the brain drain from Africa by providing a competitive knowledge base and attractive research facilities.
3. Ensure that African laser facilities become preferred research environments for both the international and African research communities.
4. Facilitate technology transfer to industry of the knowledge acquired from laser research and development (R&D).
5. Provide financial resources, technical assistance and equipment loans to laser researchers and trainers throughout Africa.
6. Promote collaborations among laser researchers and trainers throughout Africa, as well as between African researchers and their international counterparts.
7. Establish flagship research and training facilities in Africa, including

femtosecond lasers, petawatt lasers and synchrotron light sources.

To achieve these goals, the ALC has worked diligently to implement the various programmes outlined in the *Strategy and Business Plan*. That suite of programmes is in various stages of development and consists of the following:

Research Programme

Research in Targeted Areas

Each member institution pursues research depending upon the areas of competence of its ALC participants, as well as its economic needs. By specifying its areas of competence, the ALC management determines how best to target its resources in assisting the institution. Though highly developed, this programme is constrained by the limited financial resources of the ALC. Thus, large capital equipment is not funded at this time, and funding is limited to consumable items. **There is a dire need for financial support to the ALC from African countries to purchase high cost instrumentation.**

To run its research programme, the ALC disseminates solicitations for grant funding opportunities. Proposals are peer reviewed by a panel of international experts, who comprise the *ALC Science Advisory Council*. The main criteria for funding are that any proposed project must have exceptional research and student training merit. Successful projects are supported for two-year periods.

Research Collaborations

Prior to the work of the ALC, many researchers did not know what other researchers were doing, even in their own countries, not to mention the research in progress throughout Africa that may be relevant. By maintaining a database of researchers and their interests, the ALC has alleviated much of this isolation, thereby greatly boosting the interactions among researchers in Africa. This programme is fully developed and the ALC provides mobility grants for researchers and their students. Since the overwhelming majority of funding for the ALC is derived from South Africa's Department of Science and Technology, collaborations using South African funding must be between a South African researcher and other African researchers.

Educational Programme

Lectureships

The intent of this initiative is to spread the news throughout Africa of the latest breakthroughs in laser research. This is to be accomplished by sending two to five distinguished researchers per month to various institutions for periods of one week to one month so that each researcher can give a series of lectures on laser science and applications. The lectures are to be geared especially for university students. Outreach is an important component of this programme; thus, the lecturers also will visit primary and secondary schools in order to inspire the youth through lectures and demonstrations to pursue careers in science and engineering. This programme is not yet fully developed.

Fellowships

In order to make a significant increase in the number of persons pursuing research and training with lasers, the ALC awards two types of fellowships: (1) one- to three-year Junior Fellowships to promising doctoral students and (2) one- and two-year Senior Fellowships to those already holding doctoral degrees. The latter includes both African fellows working anywhere in the world and fellows from other parts of the world coming to work at African laboratories. Including postdoctoral fellows from other continents coming to Africa provides a major assistance to African researchers in learning techniques and usages of equipment with which they would otherwise not be familiar. Although scholarships are being provided to African students, this programme is in the early stages of development.

Internships

The ALC offers laser training to both pre-baccalaureate and graduate university students by providing research opportunities/internships for students to work with ongoing research projects. This programme is well developed and the ALC student mobility grants are an important mechanism for providing these internships.

Doctoral Sandwich Arrangements

In this effort, a doctoral or Master's degree student takes the course requirements at an African university, does the research for the dissertation/thesis/project at some other African or non-African laboratory or university, then returns to the home university to receive the graduate degree. This has been implemented at many universities for some time now.

Technician Training

A shortage of technicians to run and repair facilities exists in most member institutions. In many cases, if equipment breaks down, it takes many weeks, or even months, to repair. Therefore, to shorten such time, the ALC conducts workshops, mainly through the User Facilities, to train technicians on laser operation and maintenance. This is an active, ongoing ALC program.

Awards and Special Recognitions

In order to motivate others to set high goals and work diligently to fulfill those goals, the ALC bestows awards and special recognitions to highlight the accomplishments of the best and brightest. As shown in Fig. 26, the first such award was bestowed upon Philemon Mjwara in 2005, the current Director-General of South Africa's Department of Science and Technology and first Board Chair of the ALC. It was for his outstanding contributions to laser science in Africa, especially for his crucial role in founding the ALC. Since then, a number of other awards have been given to researchers and students, including to Hubertus von Bergmann, of the Laser Research Institute at the University of Stellenbosch, for his outstanding contributions to laser science and the founding of the ALC; and to Ahmadou Wagué, of the Université Cheikh Anta Diop and President of the LAM Network, for his outstanding contributions to laser science and his founding and long-time outstanding leadership of the LAM Network.



Figure 26. Philemon Mjwara receives Outstanding Service Award for his Contributions to Laser Science and his Role in Founding the ALC Durban, November 2005



Figure 27. Award Recipient, Philemon Mjwara, chats with incoming ALC Board Chair, Thulani Dlamini, and Future Board Member, Zohra Ben Lakhdar Durban, November 2005

In Fig. 27, at the awards ceremony, Mjwara receives kind words from incoming ALC Board Chair, Thulani Dlamini, and future ALC Board member and early ALC participant, Zohra Ben Lakhdar.

Conferences, Workshops, and Topical Schools

In order to foster collaborations and train students, as well as to assist in the dissemination of the latest laser developments, the ALC brings African and other researchers together for major conferences and smaller workshops. Fig. 28 shows a



Figure 28. Student Training Workshop held just before the AGM University of Zambia, Lusaka, 2007

hands-on student training session in progress during a workshop in 2007 at the University of Zambia.

Whenever there is sufficient interest among those wishing to enter a new sub-field of laser research, the ALC invites distinguished leaders in that sub-field to a topical school at an appropriate venue for a period of approximately one to two weeks to give lectures to interested students and researchers on the sub-field's latest developments. Consistent with this objective, Alfred Msezane, who is originally from South Africa and for a long time has been Director of the Center for Theoretical Studies of Physical Systems at Clark Atlanta University in the U.S., began the convening of the US-Africa Advanced Studies Institutes at various venues in Africa. The organizers convened these topical Institutes in Durban (November 2005) focusing on atomic and molecular applications of lasers, Cape Town (January 2007) focusing again on atomic and molecular applications of lasers, and Cairo (January 2008) focusing on environmental and biological applications of lasers (EBAL). On the American side, funding from the U.S. National Science Foundation was

obtained by Msezane in 2005 and 2007 and by Sekazi Mtingwa in 2008 to bring approximately thirty (30) researchers and graduate students from the U.S. to Africa. Other funding sources brought attendees from Europe and elsewhere to the Institutes. Most importantly, many researchers and students from a number of African countries attended. Figs. 29-32 show the announcement, sponsors, group photo and a student poster session from the 2005 Durban Institute.

1st US-Africa Advanced Studies Institute on Photon Interactions with Atoms and Molecules



**Just after World Conference on Physics and
Sustainable Development
October 31 - November 2, 2005, Durban,
South Africa**

**Part of United Nations' International Year of
Physics**

**Celebrating 100 years since Einstein's
Famous 1905 Papers**

Figure 29

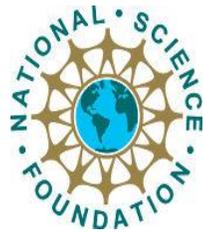


Figure 30. Durban, November 2005



**Figure 31. Attendees at the 1st US-Africa Advanced Studies Institute
Durban, November 2005**



**Figure 32. Student Poster Session at the 1st US-Africa Advanced Studies Institute
Durban, November 2005**

Figs. 33- 38 show various scenes from the 2007 Cape Town US-Africa Advanced Studies Institute, which was held jointly with EBASI and a special meeting to organize the new African Physical Society (AfPS). Organizers of the latter are shown in Fig. 39.



**Figure 33. Session in Progress at the 2nd US-Africa Advanced Studies Institute
& EBASI Meeting
iThemba LABS, Cape Town, November 2007**



Figure 34. Attendees from Ethiopia during a Tea Break at the 2nd US-Africa Advanced Studies Institute & EBASI Meeting iThemba LABS, Cape Town, November 2007



Figure 35. (l-to-r) Herman Winick (Asst. Dir. and Professor, Emeritus, Stanford Synchrotron Radiation Lightsource) and Zeblon Vilakazi (Dir. of iThemba LABS) at the 2nd US-Africa Advanced Studies Institute & EBASI Meeting iThemba LABS, Cape Town, November 2007



Figure 36. (l-to-r) Herman Winick and K. Bharuth Ram (Former Dir. of iThemba LABS) at the 2nd US-Africa Advanced Studies Institute & EBASI Meeting iThemba LABS, Cape Town, November 2007



Figure 37. Attendees during Tea Break at the 2nd US-Africa Advanced Studies Institute & EBASI Meeting iThemba LABS, Cape Town, November 2007



Figure 38. (l-to-r) Francis Allotey (AfPS Main Organizer, Ghana) and Alfred Msezane (Founder of the US-Africa Advanced Studies Institute, U.S.) at the 2nd US-Africa Advanced Studies Institute & EBASI Meeting iThemba LABS, Cape Town, November 2007



Figure 39. Group Photo of the Organizers of the African Physical Society at the 2nd US-Africa Advanced Studies Institute & EBASI Meeting iThemba LABS, Cape Town, November 2007

Fig. 40 shows a group photo of attendees at the 3rd US-Africa Advanced Studies Institute (EBAL) on a visit to the Pyramids of Egypt. Fig. 41 shows Mohamed Abdel Harith, the Institute's main organizer and Director of Cairo University's National Institute of Laser Enhanced Sciences (NILES), with colleagues. In Fig. 42, he is shown making a presentation during a panel discussion.

All the conferences, workshops and institutes, in conjunction with those of the LAM Network, have played a decisive role in uniting laser users across Africa and building a cohesive continental laser community. In particular, the 2007 Cape Town meeting was instrumental in the formation of the African Physical Society (AfPS), which was inaugurated in 2010 in Dakar at a joint meeting of the LAM Network, ALC, EBASI, and U.S. National Society of Black Physicists (NSBP). That meeting attracted such distinguished laser scientists as Sune Svanberg, Director of the Lund Laser Centre at Sweden's Lund University. He is shown in Fig. 43 answering a question during his invited presentation. Fig. 44 shows the 1st AfPS Governing Council installed at the Dakar meeting, with Francis Allotey of Ghana and Amadou Wagué of Senegal chosen as President and Vice-President, respectively.



Figure 40. Group Photo of Attendees at the 3rd US-Africa Advanced Studies Institute (EBAL) on a Visit to the Egyptian Pyramids Cairo, January 2008



Figure 41. EBAL Principal Organizer, Mohamed Abdel Harith (5th from left), and Colleagues Cairo, January 2008



**Figure 42. Mohamed Abdel Harith speaking during a Panel Discussion
Cairo, January 2008**



**Figure 43. Sune Svanberg (Director of the Lund Laser Centre, Sweden) answers a
question during the Joint LAM Network, ALC, EBASI, and U.S. NSBP Meeting
Dakar, January 2010**



**Figure 44. First African Physical Society (AfPS) Council Meeting
Francis Allotey, President; Ahmadou Wagué, Vice-President
Dakar, January 2010**

Equipment and Research Infrastructure Programme

Equipment Loans

As discussed previously, the success of South Africa's laser Rental Pool Programme played a crucial role in the founding of the ALC. That programme is robust and currently in operation on an international level.

Equipment Donations

This programme is enjoying a similar history and success as that of the Equipment Loan Programme.

Advanced Light Sources

One of the goals of the ALC is to bring advanced light sources to Africa. Already, femtosecond laser systems are operating at Cairo University's National Institute of Laser Enhanced Sciences (NILES) and Stellenbosch University's Laser Research Institute (LRI).

In another effort, the ALC is assisting South Africa's community of synchrotron light source users in charting a roadmap forward, starting with growing its user base and possibly culminating in the construction of a state-of-the-art synchrotron light source in South Africa. In this regard, a two-day workshop was held 1-2 December 2011 in Pretoria to finalize plans for the drafting of a Strategic Plan to be submitted to the government's Department of Science and Technology (DST), which is broadly

responsible for science and technology in the country, and the National Research Foundation (NRF), which is responsible for the distribution of research funding in most science and technology disciplines. Top officials from those agencies attended the workshop, including Romilla Maharaj, NRF Executive Director of Human and Institutional Capacity Development; Rakeshnie Ramoutar, NRF Program Director of Strategic Platforms; and Takalani Nemaungani, DST Director of Global Projects. Daniel Adams, Chief Director: Emerging Research Areas & Infrastructure at the DST, provided funding for the workshop and the South African Institute of Physics (SAIP), whose president is Simon Connell of the University of Johannesburg, handled the logistics, along with support from iThemba LABS.

The entity that mainly drove the convening of the workshop was the Synchrotron Research Roadmap Implementation Committee (SRRIC), which is chaired by Tshepo Ntsoane from the South African Nuclear Energy Corporation (NECSA) and co-chaired by Wolf-Dieter Schubert from the University of the Western Cape.

Approximately forty scientists attended the meeting, including those from international facilities. Herman Winick of SLAC and Sekazi Mtingwa of MIT attended, and Brookhaven National Laboratory's Erik Johnson and Ken Evans-Lutterodt joined via teleconferencing. Johnson and Evans-Lutterodt discussed the pros and cons of South Africa's inheriting Brookhaven's second generation light source called the National Synchrotron Light Source (NSLS), which is soon to be replaced by the NSLS II. The consensus of the workshop was that a new third generation facility would much better serve national and regional needs. The largest contingent of foreign visitors were from the various European light sources, including José Baruchel, Jürgen Härtwig, and the Laboratory Director General, Francesco Sette, from the European Synchrotron Radiation Facility (ESRF) in Grenoble, France; Jasper Plaisier from Elettra in Trieste, Italy; Trevor Rayment from Diamond in Oxfordshire, UK; and Hermann Franz from Petra III in Hamburg, Germany. Oxford University's Angus Kirkland did an outstanding job of facilitating the two-day meeting.

SRRIC appointed a three-person committee to write the Strategic Plan, consisting of Brian Masara, Executive Officer of SAIP; Douglas Sanyahumbi, Director of the Technology Transfer Office at the University of the Western Cape; and chaired by Sekazi Mtingwa. SRRIC submitted that plan to the DST and NRF, which approved it and gave the go-ahead to proceed with the development of a detailed Business Plan.

Technology Transfer Programme

The ALC recognises that the big payoffs from research breakthroughs reside in the benefits to society via technology. Therefore, the ALC places high priority on the development of methodologies to transfer technology from its affiliated research laboratories to manufacturing, medicine, agriculture, environment, and the broader industrial sectors of African economies. This is seen as an important activity, as it would

assist in bringing the outputs of research in all the laser centres to industry and thereby lead to commercial products that improve the quality of life. Presently, this programme is not well developed, but remains one of high priority for future ALC endeavors.

Financial Development Programme

Perhaps the most important task for the ALC is that of raising sufficient funds to execute its programmes. Already from its first launching at the Ministerial Segment of the African Union's NEPAD Conference on Science and Technology for Development held in Johannesburg in November 2003, the ALC has aligned itself with the AU goals and objectives to such an extent that it has been declared a NEPAD Network Centre of Excellence. Subsequent to that meeting, at NEPAD's 2nd African Ministerial Conference on Science and Technology held 30 September 2005 in Dakar, it pledged US\$20 million to support ALC programmes over the following five years. Clearly, that level of support would have had a significant positive impact on the success of ALC programmes.

To date, essentially all the ALC's financial support has come from the South African government. If the ALC is to achieve its goals, other African nations must step up and provide funding at a meaningful level. This lack of support from other African countries is the biggest impediment faced by the ALC and could derail its future survival as one of the most effective organisations for using science and technology to move Africa forward economically and reversing the brain drain of many of its most precious hi-tech human resources.

Summary

The African Laser Centre has enjoyed many successes over the years, despite its limited funding. Indeed, the ALC Board is excited about what the organization is capable of achieving and look forward to receiving the necessary funding to fulfill its goals for Africa. As a summary, Fig. 45 displays the research and training outputs during the period 2006-2010. The numbers of graduate students who received support is a testament to the ALC's progress in training the next generation of laser scientists, engineers and educators. There is much work to be done, but there is no limit to what is possible. To focus on its past achievements and plans for the future, the ALC looks forward to hosting a 10th Anniversary Celebration of its Launching during the year 2013.

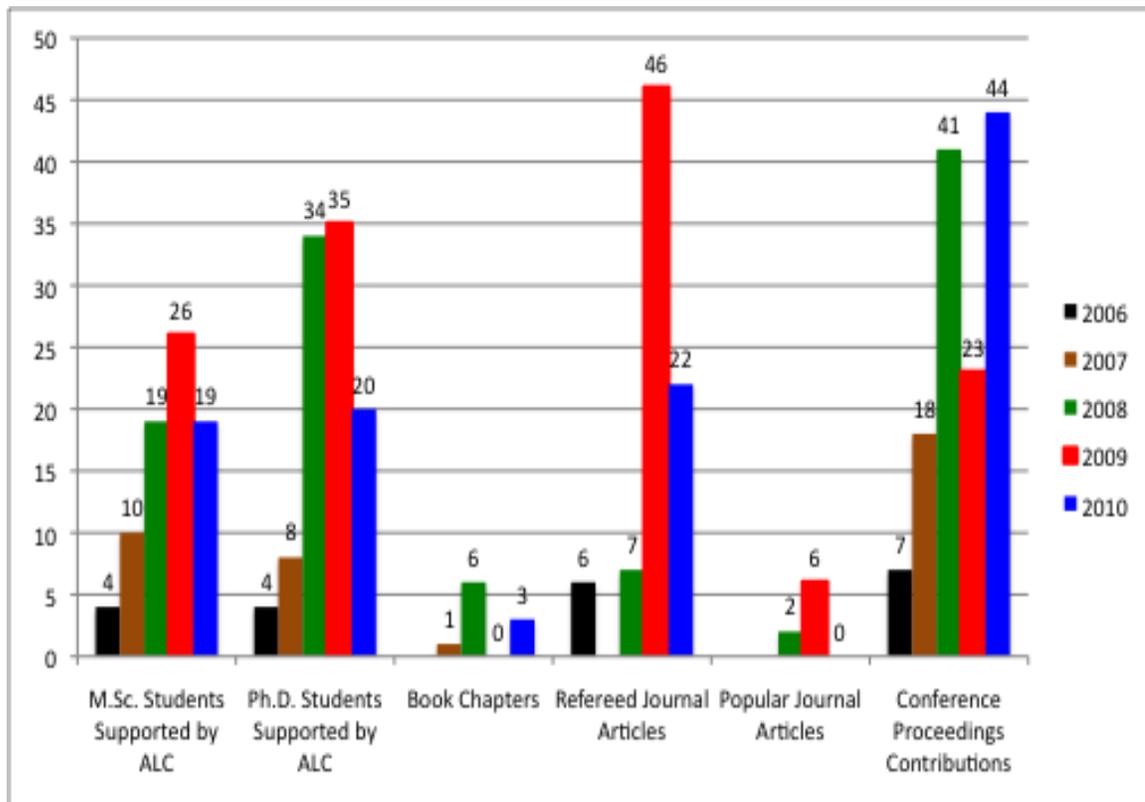


Figure 45. ALC Research and Educational Outputs during 2006-2010

Persons in Photos (Unidentified persons are marked by “Xi” for future identification.)

Fig. 5 Front row, left-to-right: X1, Shyam Singh (Namibia), Paul Buah-Bassuah (Ghana), Ahmadou Wagué (Senegal), Malik Maaza (South Africa), Sekazi Mtingwa (USA)

Second row, l-to-r: Hubertus von Bergmann (South Africa), Philemon Mjwara (South Africa), Giovanni Hearne (South Africa), Erick Rohwer (South Africa)

Third row: Aboubaker Beye (Senegal)

Fig. 7 Front row, l-to-r: Aboubaker Beye, Erich Rohwer (South Africa), Giovanni Hearne (South Africa), Philemon Mjwara (South Africa), Ahmadou Wagué
Second row, l-to-r: J. Darrell Comins (South Africa), Shyam Singh (Namibia), Hubertus von Bergmann (South Africa), Paul Buah-Bassuah, Malik Maaza
Third row: Sekazi Mtingwa, Lourens Botha (South Africa), Niresh Bwagwandin (South Africa), Matthew Moodley (South Africa), Hardus Greyling (South Africa)

Fourth row, l-to-r: Mourad Zghal (Tunisia), Henry Tromp (South Africa)

Fig. 9 l-to-r: Paul Buah-Bassuah, Ahmadou Wagué, Shyam Singh, Malik Maaza, Mourad Zghal

Fig. 10 l-to-r: Mourad Zghal, Shyam Singh, Malik Maaza

Fig. 15 Seated, l-to-r: Aboubaker Beye, Philemon Mjwara, Ahmadou Wagué, Hubertus von Bergmann

- Standing, l-to-r:* Sekazi Mtingwa, Paul Buah-Bassuah, El-Hachemi Amara (Algeria)
- Fig. 17** *Seated, l-to-r:* Aboubaker Beye, El-Hachemi Amara, Thulani Dlamini (South Africa), Mohamed Abdel Harith (Egypt)
- Standing, l-to-r:* Paul Buah-Bassuah, Hubertus von Bergmann, Sekazi Mtingwa
- Fig. 20** *Seated, l-to-r:* Aboubaker Beye, Mohamed Abdel Harith, Thulani Dlamini, Ahmadou Wagué, Hubertus von Bergmann
- Standing, l-to-r:* Ncholu Manyala (Lesotho), El-Hachemi Amara, Ndirangu Kioni (Kenya), Adeniyi Fasasi (Nigeria), Paul Buah-Bassuah
- Fig. 23** *Seated, l-to-r:* Tom Otit (Uganda), Shyam Singh, Ndumiso Cingo (South Africa), Mantoa Sekota (Lesotho), Paul Buah-Bassuah
- Standing, l-to-r:* Jean-Marie Ndjaka (Cameroon), Mourad Zghal, El-Hachemi Amara, Adeniyi Fasasi, Hubertus von Bergmann
- Fig. 24** *Seated, l-to-r:* Ahmadou Wagué, Ndumiso Cingo, Paul Buah-Bassuah
- Standing, l-to-r:* Paul Motalane (South Africa), Hubertus von Bergmann, James Uhomoibhi (UK), Tom Otit, El-Hachemi Amara, Mourad Zghal, Sekazi Mtingwa
- Fig. 26** *l-to-r:* Ahmadou Wagué, Paul Buah-Bassuah, Elizabeth “Libby” Lyons (U.S. National Science Foundation Program Officer that co-sponsored the Institute), Sekazi Mtingwa, Alfred Msezane (USA), Philemon Mjwara, Edmund Zingu (then President of the South African Institute of Physics)
- Fig. 34** *l-to-r:* X1, X2, X3, X4
- Fig. 37** *l-to-r:* X1, X2, Sekazi Mtingwa, X3, Ndumiso Cingo
- Fig. 39** *l-to-r:* Alfred Msezane, John Adedoyin (Botswana), Mantsae Diale (South Africa), Samuel Mensah (Ghana), Francis Allotey (Ghana), Charles McGruder (USA), Ahmadou Wagué, Sekazi Mtingwa
- Fig. 41** *Front row, left-to-right:* Iman Hamed (Egypt), Rehab Amin (Egypt), Manar Hassan (Egypt), Mohamed Abdel Harith (Egypt), El-Hachemi Amara (Algeria), X1, Ghosn El-Ban (Morocco)
- Second row:* Hamdi El-Dessouki (Egypt)
- Fig. 44** *Seated, l-to-r:* X1, Ahmadou Wagué, Francis Allotey, Najeh Thabet-Mliki (President of the Tunisian Physical Society), X2
- Standing, l-to-r:* Joe Niemela (USA and Senior Researcher and Head of Applied Physics at ICTP), John Adedoyin, Malik Maaza, X3, Ndumiso Cingo, Tom Otit, X4, Sekazi Mtingwa, X5, James Uhomoibhi

About the Author

Sekazi K. Mtingwa is an ALC Co-Founder, Board Member, and Representative to the Americas; American Liaison Officer for Special Projects of the African Physical Society; Fellow of the American Physical Society; Member of the Edward Bouchet – Abdus Salam Institute’s (EBASI) Governing Council; Member of the Steering Committee for AIMS-Ghana (African Institute for Mathematical Sciences); Member of the U.S. Liaison Committee for the International Union of Pure and Applied Physics (IUPAP), Commission on Physics for Development (C13); Principal Partner of the consulting firm, Triangle Science, Education & Economic Development, LLC; Senior Physicist Consultant to Brookhaven National Laboratory (U.S.), as sponsored by its Diversity Office; Vice-Chair of the Interdisciplinary Consortium for Research and Educational

Access in Science and Engineering (INCREASE), which promotes the utilization of large research instrumentations, such as synchrotron light sources, by faculty and students at African-, Latino-, and Native-American colleges and universities in the U.S.; Co-Founder, Charter Fellow and Former President of the U.S. National Society of Black Physicists (U.S.); Co-Founder of the National Society of Hispanic Physicists; Retired Professor and Former Chair of the Department of Physics at North Carolina A&T State University; and Retired Senior Lecturer at MIT. His research principally involves particle beam dynamics in accelerators and is one of the creators of the theory of intrabeam scattering, which is one of the most important constraints on the performance of intense particle accelerators.