



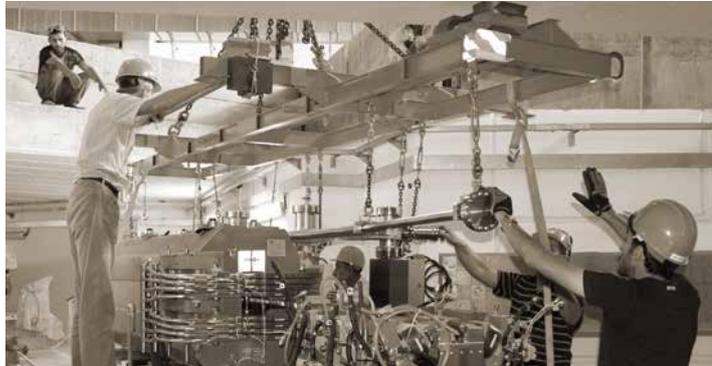
SESAME

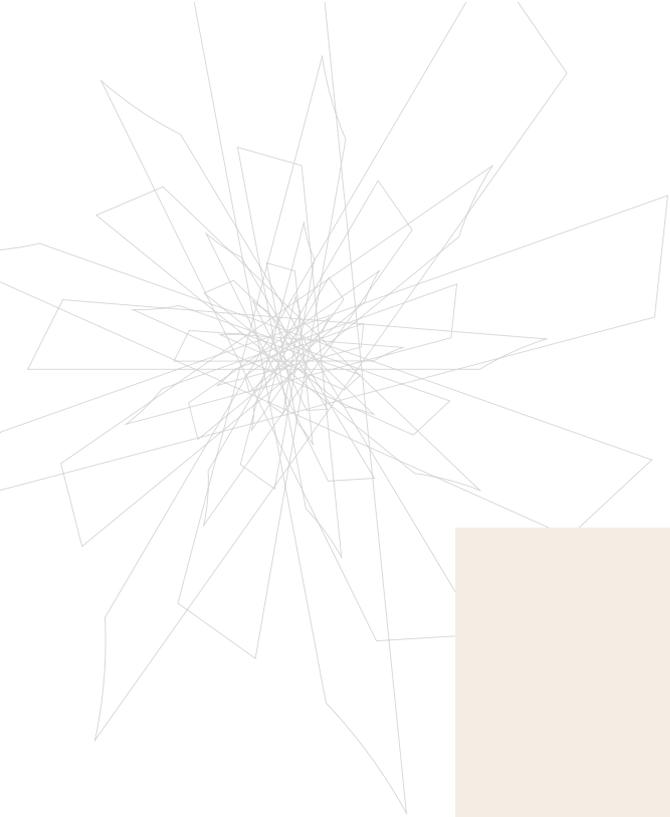
**Official opening under the patronage of
His Majesty King Abdullah II
16 May 2017**

Synchrotron-light for **Experimental Science**
and **Applications in the Middle East**



SESAME STAFF





CONTENTS

WELCOME	4
SEEING BETTER WITH SYNCHROTRON LIGHT	5
SCIENCE AT SESAME	6
SCHEMATIC OVERVIEW OF SESAME	8
SESAME USERS	10
ADVANCED TRAINING; ANOTHER STRING TO SESAME'S BOW	11
THE SESAME STORY	12
THE SESAME COUNCIL	14
THANKS	15

WELCOME

It is our pleasure to welcome you to the opening of SESAME on behalf of all the Members: Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, the Palestinian Authority, and Turkey.

SESAME is an experiment in science and in international collaboration. It is working thanks to the enthusiasm and hard work of all involved, including especially the SESAME Staff and Directors, and the help given by UNESCO, Germany, the IAEA, the European Union, CERN, Italy and numerous international and national organisations and laboratories, such as SOLEIL in France and many others listed on page 15, and especially by the Royal Court and the Government of Jordan.

Today's ceremony provides SESAME with an opportunity to thank all those who have made it possible to fulfil its founders' hopes that:

- ☀ the funding needed to build SESAME could be obtained;
- ☀ a group of initially inexperienced young people could build SESAME;
- ☀ there would be widespread interest in using SESAME; and
- ☀ the diverse Members could work together harmoniously.

It has not always been easy, and has not happened as fast as we would have liked, but today SESAME has come of age. During SESAME's adolescence, its training programme already brought considerable benefits to the region. Henceforth SESAME will foster excellent science, and enable studies of immediate importance for the region, related to health, the environment and agriculture. Furthermore, experience at other light sources suggests



that SESAME will:

- ☀ encourage some of the region's best scientists and technologists to stay in the region, or return if they have left;
- ☀ attract many of the Members' brightest young talent to scientific higher education, thereby contributing to the development of a knowledge-based economy;
- ☀ stimulate the regional economy; and in the longer term
- ☀ spin out new companies.

Meanwhile SESAME will continue to foster better understanding between diverse peoples.

Finally, we would like to express our gratitude to His Majesty King Abdullah II for graciously agreeing that the opening take place under his patronage, and to thank all of you for coming.

Chris Llewellyn Smith
President, SESAME Council

Khaled Toukan
Director of SESAME



SEEING BETTER WITH SYNCHROTRON LIGHT

As in everyday life, in advanced scientific research we learn by 'seeing' things using light – except that scientists use light that ranges beyond the visible, in the infrared and the ultraviolet, to X-rays and beyond. Advanced sources of light (like lasers and synchrotrons) have become prime factors in promoting scientific and technological progress. In recent decades, the extraordinary power of synchrotron light has made it an essential tool for studying matter on scales ranging from biological cells to atoms, using radiation from the infrared to X-rays. It has had an immense impact in fields that include archaeology, biology, chemistry, environmental science, geology, medicine and physics.



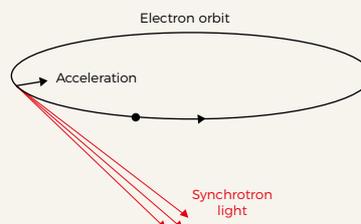
Synchrotron light sources were initially built exclusively in the developed world. Recognising their broad scientific and technical impact, many emerging economies, including Brazil, India, the Republic of Korea, Singapore, and Thailand, have however now built their own sources. There are now some 60 light sources in operation in 25 countries serving around 50,000 scientists. More are under construction or in various stages of planning. Even taking into account the new sources under development, the rapid growth of the user community and ever-increasing range of applications will outpace the available supply of synchrotron light for the foreseeable future.

How is synchrotron radiation produced?

In a synchrotron, bunches of charged particles (electrons in the case of light sources) circulate at nearly the speed of light for several hours inside a long ring-shaped tube under vacuum. As magnets surrounding the tube bend their trajectories, the electrons emit 'synchrotron light', with wavelengths that range from infrared radiation to X-rays. The emitted light is collected by different 'beamlines' (optical systems) connected to the ring; thus, many experiments can be run simultaneously.

In third generation light sources, such as SESAME, devices (called wigglers or undulators) can be inserted in straight sections of the accelerator which put magnetic "bumps in the road"; radiation from successive bumps adds to make a much more intense beam of light.

- ☼ When electrons are accelerated (e.g. in a radio transmitter antenna), part of the energy in the electromagnetic force field that surrounds them is 'shaken off' and emitted as electromagnetic radiation (e.g. radio waves).
- ☼ As their trajectories are deflected, electrons in circular motion in a synchrotron also undergo acceleration, directed towards the centre of the circle, and emit radiation.



The electromagnetic field surrounding the electrons is unable to respond instantaneously when the electrons are deflected; some of the energy in the field keeps going, producing a tangential cone of synchrotron radiation. As the electrons' energy increases, the cone of radiation narrows, and the radiated power goes up dramatically.

SCIENCE AT SESAME

The first beamlines

Beamlines contain optical elements that focus synchrotron light on materials that scientists wish to study, as well as the set up for controlling the sample's environment and for data collection. Each beamline is designed to produce light with characteristics that are suited for certain types of investigation. Seven 'Phase 1' beamlines were chosen following a meeting with the potential users in 2003. Four are now under construction, of which two will be in operation in the near future, a third later in 2017, and the fourth in 2019.

The first four beamlines - for technical details see

<http://www.sesame.org.jo/sesame/machine-and-beamlines/beamlines.html>

X-ray Absorption Fine Structure / X-ray Fluorescence Spectroscopy (XAFS/XFS) Beamline



The XAFS/XFS Beamline, BASEMA

This beamline is known as BASEMA (Beamline for Absorption Spectroscopy for Environment and Material Applications), meaning a smile in Arabic. It is based on the donated Helmholtz Zentrum Dresden-Rossendorf beamline, originally installed at the European Synchrotron Radiation Facility in Grenoble, which has been adapted to the characteristics of SESAME. It is optimized for X-ray spectroscopic studies in all fields of science including *in situ* studies of functional materials. It can be used in materials and environmental science, in designing new materials and improving catalysts (e.g. for the petrochemical industries), and to identify the chemical composition of fossils and valuable paintings in a non-invasive manner. It will be equipped with an advanced state-of-the-art silicon detector (contributed by Italy) with at least 50 times higher sensitivity than any currently available.

A project that studies soil contamination in the Jordan River Valley, which was started at the Elettra light source in Italy by the BASEMA beamline scientist Messaoud Harfouche and his collaborators from Egypt and Jordan, will be brought to BASEMA. X-ray spectroscopic measurements made on samples collected in the area shown in the accompanying figure were used to characterize the distribution of Chromium and Zinc. Together with

knowledge of possible sources of contamination, the results can help to establish appropriate measures to reduce exposure to Chromium which is toxic for humans. Similar work on soil from other areas and on non-conventional (e.g. radiation contaminated) wastes (in collaboration with Al-Quds University in the Palestinian Authority) have also been initiated. These investigations, through collaboration with local authorities, will help to improve environmental conditions and public health in the region.



Soil contamination in the Jordan River Valley will be studied at BASEMA

Infrared (IR) Beamline

The EMIRA (ElectroMagnetic Infrared RAdiation) – Princess in Arabic – beamline is completely new: it was designed and built in collaboration with the French light source, SOLEIL. It will allow application of infrared microspectroscopy and imaging in a wide range of fields, including surface and materials science (e.g. characterization of new nanomaterials for solar cell fabrication and for drug delivery mechanisms), biochemistry, archaeology, geology, cell biology, biomedical diagnostics and environmental science (e.g. air and water pollution).

An infrared microscope, which will be used with EMIRA, was purchased in 2013, and since then has been operational at SESAME with a thermal source of infrared radiation. One of the first experiments that it enabled was a study (now published) of breast tissue by Fatemeh Elmi, which highlighted the different concentrations of cell components in healthy and cancerous samples.

The infrared microscope with Fatemeh Elmi (Iran, right), and Randa Mansour (Jordan) who used it to study the effect of a medicinal oil



Another focus at EMIRA will be on cultural heritage. Non-invasive analyses can be carried out on manuscripts and papyri, and human remains. Recently EMIRA beamline scientist Gihan Kamel, in collaboration with scientists from the Cyprus Institute, started work on ancient teeth at SOLEIL, which will be extended at SESAME.

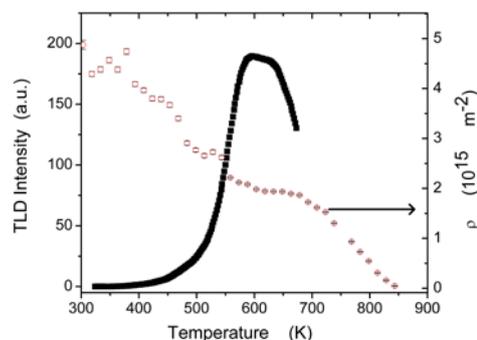
Materials Science (MS) Beamline

The SUSAM (SESAME Users Application for Materials Science) - SESAME in Turkish – beamline will be used in applications of the powder diffraction technique in materials science. SUSAM will provide a powerful tool for studying microcrystalline or disordered/amorphous material on the atomic scale, evolution of nano-scale structures and materials in extreme conditions of pressure and temperature, and for developing and characterising new smart materials. The beamline is based on components donated by the Swiss Paul Scherrer Institute (PSI), with modifications to match the characteristics of the SESAME storage ring. SUSAM will be the first SESAME beamline equipped with an insertion device (a wiggler, also donated by PSI) which enhances the brightness of the synchrotron light, reducing the time needed to make measurements, and making it possible to follow fast processes. A powerful PILATUS 300K area detector, donated by DECTRIS (Switzerland), will provide the fast read-out time that is required to investigate the evolution of nano-scale structures and materials in extreme conditions of heating and cooling under gas flows.



Wiggler magnet awaiting installation at SESAME

The work of Egyptian researchers at the Elettra light source in Italy is a good example of a typical application. They studied the temperature evolution of structural defects in Lithium Fluoride and their role in thermo-luminescence. The density of the dislocations was derived from measurements of the shape of the peaks of scattered X-rays that occur at certain angles. Further studies at SUSAM will provide superior data thanks to the wiggler and the fast detector.



Measurements of the thermo-luminescence dose (filled squares; left-hand-scale) and the density of dislocations (open squares; right-hand-scale) in Lithium Fluoride made out by Egyptian researchers at the Elettra light source in Italy

Macromolecular Crystallography (MX) Beamline

This beamline, which will be completely new, will be used to elucidate the mechanisms of proteins and nucleic acids at molecular level and provide guidelines for developing new drugs and therapies. Substantial funding for the design and construction of this beamline is being provided by the Jordanian Scientific Research Support Fund, in response to a joint proposal by SESAME and Jordan University. It will be a state-of-the-art MX beamline, based on an in vacuum undulator, and will have robotic sample handling and utilize a high-performance photon counting detector. Protein crystallography studies at synchrotrons have contributed to the award of five Nobel prizes, the first in 1997 and the latest in 2012. Pharmaceutical and biotech companies use these beamlines heavily to test new lead compounds with the aim of reducing the time and cost of developing new drugs. Atomic-scale information on biological macromolecules provides insights into functional mechanisms of biological macromolecules, including membrane proteins, protein-DNA and Protein-RNA complexes. It is envisaged that in the early stages there will be strong collaborations with recombinant protein production and crystallization laboratories in the region, e.g. Jordan University and the Israel Structural Proteomics Center (ISPC), which is a centre of the European Union's Integrated Structural Biology Infrastructure project, Instruct.

Beamlines 5-7

Current plans (which are being reviewed and discussed with the user community) are focusing on a Small Angle and Wide Angle X-ray Scattering (SAXS/WAXS) beamline for life and materials sciences, an X-Ray Tomography beamline for cultural heritage studies, and a Soft X-ray beamline for photoelectron spectroscopy on surfaces, atoms and molecules.

SCHEMATIC OVERVIEW OF SESAME

SAXS/WAXS - Small Angle and Wide Angle X-ray Scattering Beamline

Tomography Beamline

Booster synchrotron :
accelerates the electrons and transfers the beam to the storage ring.

Microtron :
generates and pre-accelerates the electrons.

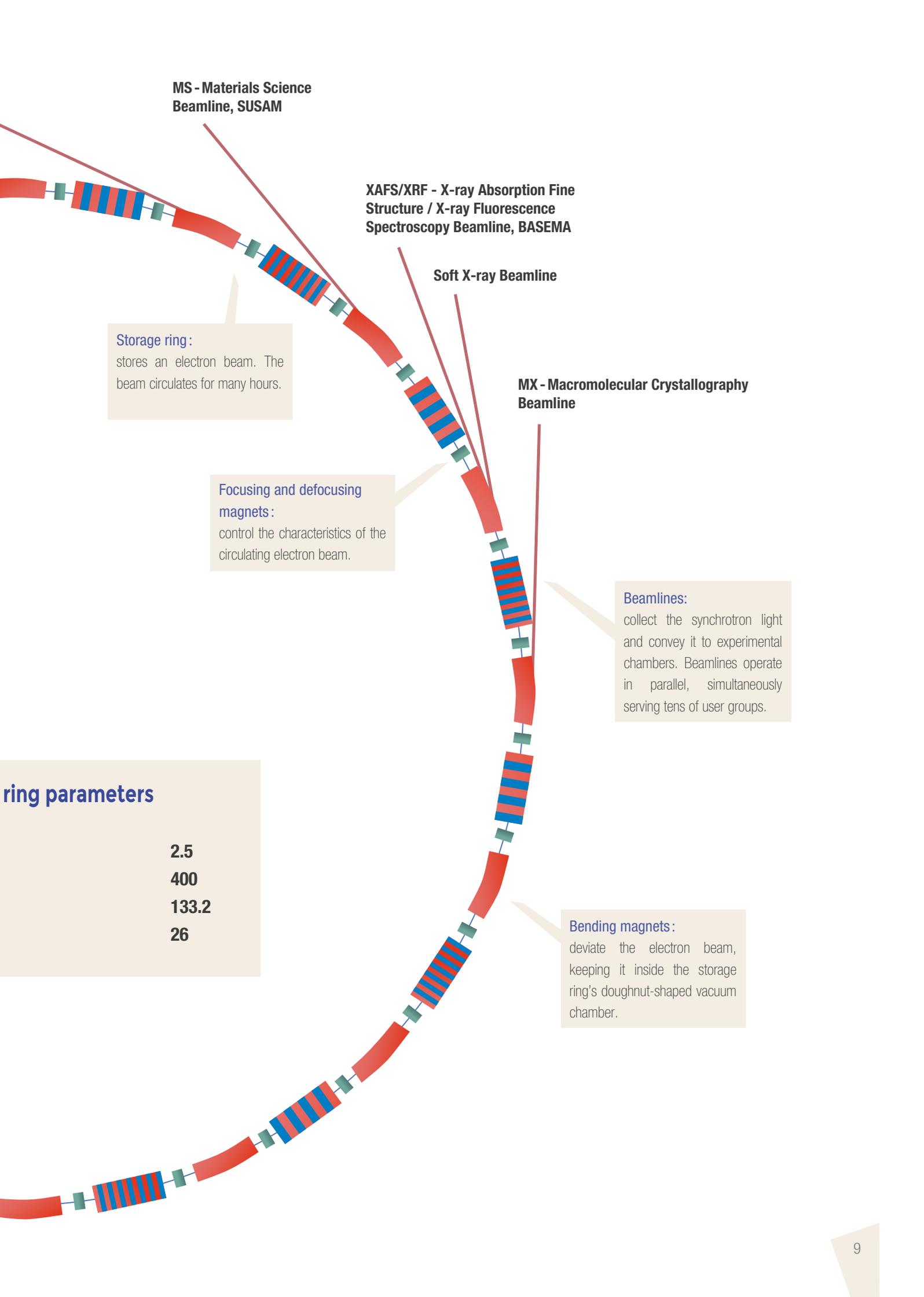
SESAME storage

Energy (GeV)
Current (mA)
Circumference (m)
Natural emittance (nmrad)

Radiofrequency cavities :
restore energy lost by the circulating electrons as they emit synchrotron light.

IR - Infrared Beamline, EMIRA

Synchrotron light is emitted by the circulating electrons as their trajectories are deflected. It can be used to carry out research in fields ranging from medicine and biology, through materials science, physics and chemistry to healthcare, the environment and archaeology.



MS - Materials Science Beamline, SUSAM

XAFS/XRF - X-ray Absorption Fine Structure / X-ray Fluorescence Spectroscopy Beamline, BASEMA

Soft X-ray Beamline

MX - Macromolecular Crystallography Beamline

Storage ring:

stores an electron beam. The beam circulates for many hours.

Focusing and defocusing magnets:

control the characteristics of the circulating electron beam.

Beamlines:

collect the synchrotron light and convey it to experimental chambers. Beamlines operate in parallel, simultaneously serving tens of user groups.

Bending magnets:

deviate the electron beam, keeping it inside the storage ring's doughnut-shaped vacuum chamber.

ring parameters

2.5
400
133.2
26

SESAME USERS

The users of SESAME will mostly be based in universities and research institutes in the Middle East and neighbouring regions. They will visit the laboratory periodically to carry out experiments, often in collaboration with scientists from other countries, where they will be exposed to the highest scientific standards in a stimulating environment for international collaboration. SESAME's beamlines, experimental end stations, laboratories, and other support facilities will be available to users, and the scientific, technical and administrative staff will help to ensure the success of work by both experienced and inexperienced users. For the next two years, a generous grant from the Lounsbery Foundation will cover the expenses of users from the SESAME Members who visit SESAME to carry out experiments.

SESAME has organised 14 Users' Meetings since 2002. Together with the training programme described on page 11, these meetings have prepared a growing community of potential users. Several hundred scientists, working in the biological, medical, physical and environmental sciences and archaeology, are expected to begin using SESAME once the first beamlines are in operation. As more beamlines are built, the number of users is expected to grow to 1000 or more.



Muhammad Imran, Pakistan

"I don't know about all fields, but certainly for protein crystallography I know the scientists who want to come if facilities like SESAME are established. We, as scientists, want to live a professional life, we want to do science, so if problems can be solved in this region, then many people would like to return."

Assistant Professor, Forman Christian College, Lahore, Faculty of Biological Sciences



Roy Beck-Barkai, Israel

"The scientific merit of SESAME is obvious and a synchrotron here is going to be a boost for the region. It will bring the possibility to join hands between countries. Collaborating on scientific problems for all mankind is something that I think is extremely positive and this is why I think SESAME is important."

Associate Professor, Tel Aviv University, School of Physics and Astronomy

Kirsi Lorentz, Cyprus



"The synchrotron has evolved from a playground for physicists to a multi-purpose scientific facility, useful for every discipline in science, including human bioarchaeology – that is the study of our ancestors, their health and life histories. Synchrotron light furthers our knowledge of the biological world, past and present, at its deepest and most intricate levels. We now have a door to this world in our region: SESAME."

Assistant Professor, The Cyprus Institute, STARC - Bioarchaeology

Areej Abuhammad, Jordan



"I think you can consider me as a result of the reverse brain drain that SESAME has started. I think SESAME is very special not only for me but for many other women who work in science. Of course having such a big facility in the same country really contributes to the engagement of women in research."

Assistant Professor, University of Jordan, Faculty of Pharmacy

Maedeh Darzi, Iran



"Here we not only share science together but also culture. I hope I can be one of the first users to work in SESAME, where I'm planning to continue my work on ancient parchment manuscripts. I am very optimistic about the future of SESAME for the region."

Research Scientist, Institute for Research in Fundamental Science, Tehran

Özgül Öztürk, Turkey



"We start to see the light at the end of the tunnel, so we need to be ready to use SESAME. I am working on semiconductor nanowires, mostly using X-ray diffraction. I am waiting for SESAME because I will have more opportunity to get beam time here than at most of the European facilities."

Research Scientist, University of Siegen, Department of Physics

ADVANCED TRAINING; ANOTHER STRING TO SESAME'S BOW

The process of training scientists and engineers from the region in the use of synchrotron radiation and the relevant accelerator technology began soon after SESAME came into existence. Thanks to generous support from numerous bodies listed on page 15, SESAME has organised some 30 workshops and schools in the Middle East and elsewhere. These meetings, which have attracted some 750 scientists and engineers, have focussed on applications of synchrotron radiation in biology, materials science and other fields, as well as on informatics (in six meetings organised with the Cyprus Institute in the framework of the EU-funded LinkSCEEM project) and accelerator technology.

In addition, the training programme has allowed approximately 105 young men and women to spend periods of up to two years working at synchrotron radiation facilities and other centres (mostly in Observer countries) in Europe, the USA, Asia and Latin America. This has provided them with first-hand experience and further swollen the ranks of Middle Eastern scientists with experience in using synchrotron radiation sources.

On-going support for training, from the IAEA and others, will be further strengthened by the OPEN SESAME project, funded by the European Union. Its three key objectives are to:

- ✦ Train SESAME staff in storage ring and beamline instrumentation technology, research techniques and administration for optimal use of a modern light source facility.
- ✦ Build-up human capacity in the Middle East and neighbouring regions to optimally make use of SESAME's infrastructure.
- ✦ Train SESAME staff and its user community in public outreach and corporate communications, and to support SESAME and its stakeholders in building awareness and demonstrating its socio-economic impact to assure longer term success.



Mahmoud Abdellatif, Egypt

"During the year that I have been here, I've seen the installation of the storage ring. I'm optimistic because of this. This is an international centre like synchrotrons all over the world. When you go to work in a synchrotron, you feel like it's the United Nations. We're all scientists."



Materials Science beamline scientist, SESAME

Jamal Ghaboun, Palestinian Authority

"Thanks to the efforts of all the people working at SESAME, the situation is very good compared to four years ago, the progress is just enormous. SESAME is important for the scientific community as it will introduce a new era for researchers in the area."



Associate Professor, Bethlehem University, Department of Physics

THE SESAME STORY

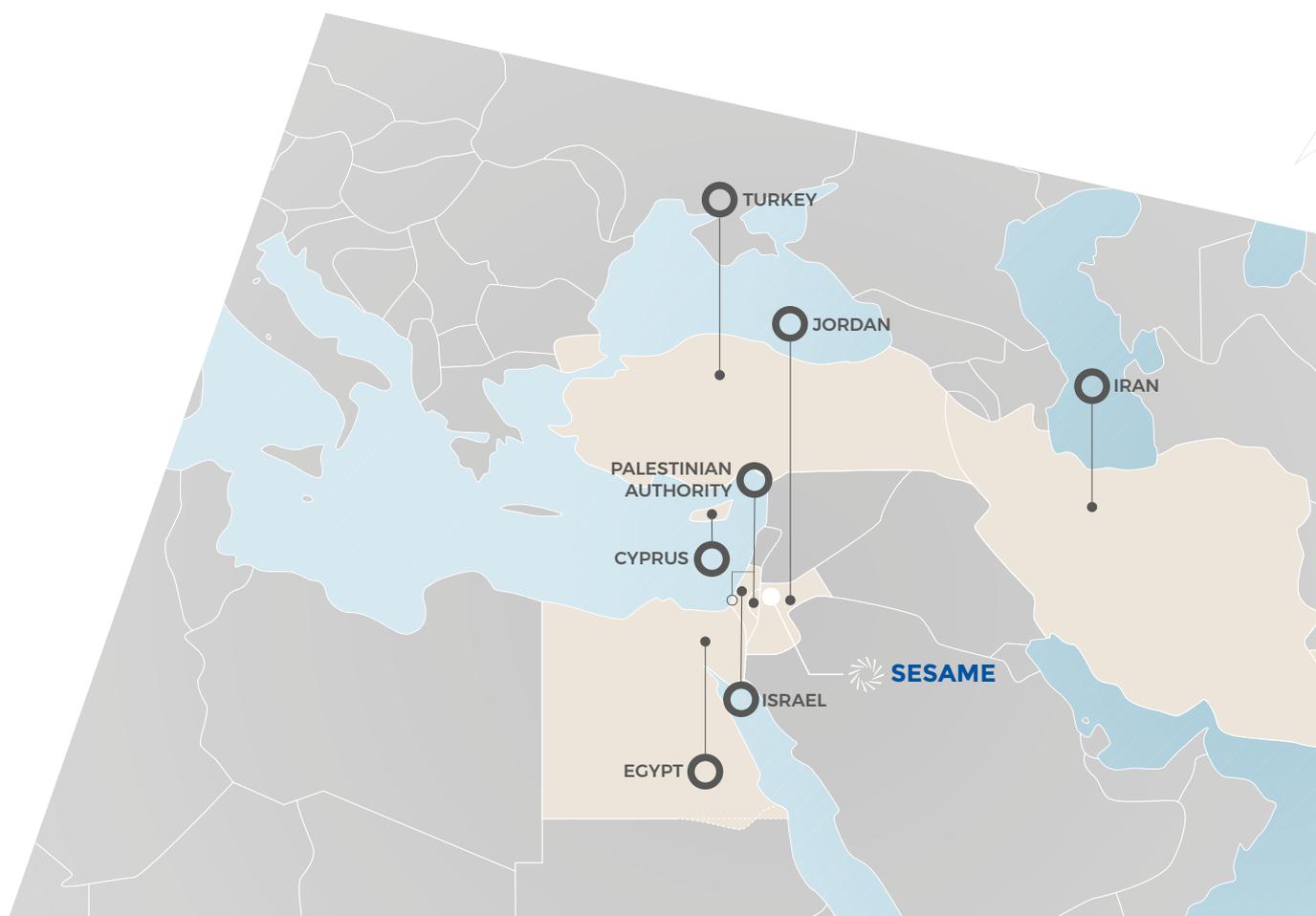
The need for an international synchrotron light source in the Middle East, which SESAME will satisfy, was recognized by eminent scientists such as the Pakistani Nobel Laureate Professor Abdus Salam some 30 years ago. This need was also felt by the CERN and Middle-East based MESC (Middle East Scientific Cooperation) group, headed by Sergio Fubini. MESC's efforts to promote regional cooperation in science, and also solidarity and peace, started in 1995 with the organisation in Dahab (Egypt) of a meeting at which the Egyptian Minister of Higher Education, Venice Gouda, and Eliezer Rabinovici (MESC and Hebrew University, Israel) took an official stand in support of Arab-Israeli cooperation.

In 1997, Herman Winick (SLAC National Accelerator Laboratory, USA) and Gustav-Adolf Voss (Deutsches Elektronen Synchrotron, Germany) suggested building a light source in the Middle East using components of the soon to be decommissioned BESSY I facility in Berlin. This brilliant proposal fell on fertile ground when it was presented and pursued during workshops organized in Italy (1997) and Sweden (1998) by MESC (which adopted the proposal) and Tord Ekelof (MESC and Uppsala University, Sweden). At the request of Sergio Fubini and Herwig Schopper (former Director-General

of CERN), the German Government agreed to donate the components to SESAME, provided the dismantling and transport (which were eventually largely funded by UNESCO) were taken care of by SESAME.

The plan was brought to the attention of Federico Mayor, then Director-General of UNESCO, who called a meeting at the Organization's Headquarters in Paris in June 1999 of delegates from the Middle East and other regions. The outcome of the meeting was the launching of the project and the setting-up of an international Interim Council under the chairmanship of Herwig Schopper. Jordan was selected to host SESAME in a competition with five other countries from the region. The Government of Jordan provided the land, as well as funds for the construction of the building.

In May 2002, the Executive Board of UNESCO unanimously approved the establishment of the Centre under the auspices of UNESCO, which is the depository of SESAME's Statutes. The Centre formally came into existence in April 2004 when the required number of Members had informed the Director-General of UNESCO of their decision to join.



Meanwhile, in 2002 the idea of re-building and upgrading BESSY I was abandoned in favour of building a completely new 2.5 GeV main storage ring, with straight sections that can accommodate insertion devices (wigglers and undulators), thereby making SESAME a third generation light source, while retaining the microtron and the booster synchrotron, which provide the first two stages of acceleration. A ground-breaking ceremony was held in January 2003 in the presence of HM King Abdullah II of Jordan and Koïchiro Matsuura, then Director-General of UNESCO. The SESAME building was formally opened on 3 November 2008 in a ceremony held under the auspices of HM King Abdullah II, and with the participation of HRH Prince Ghazi Ben Mohammed of Jordan and Koïchiro Matsuura.

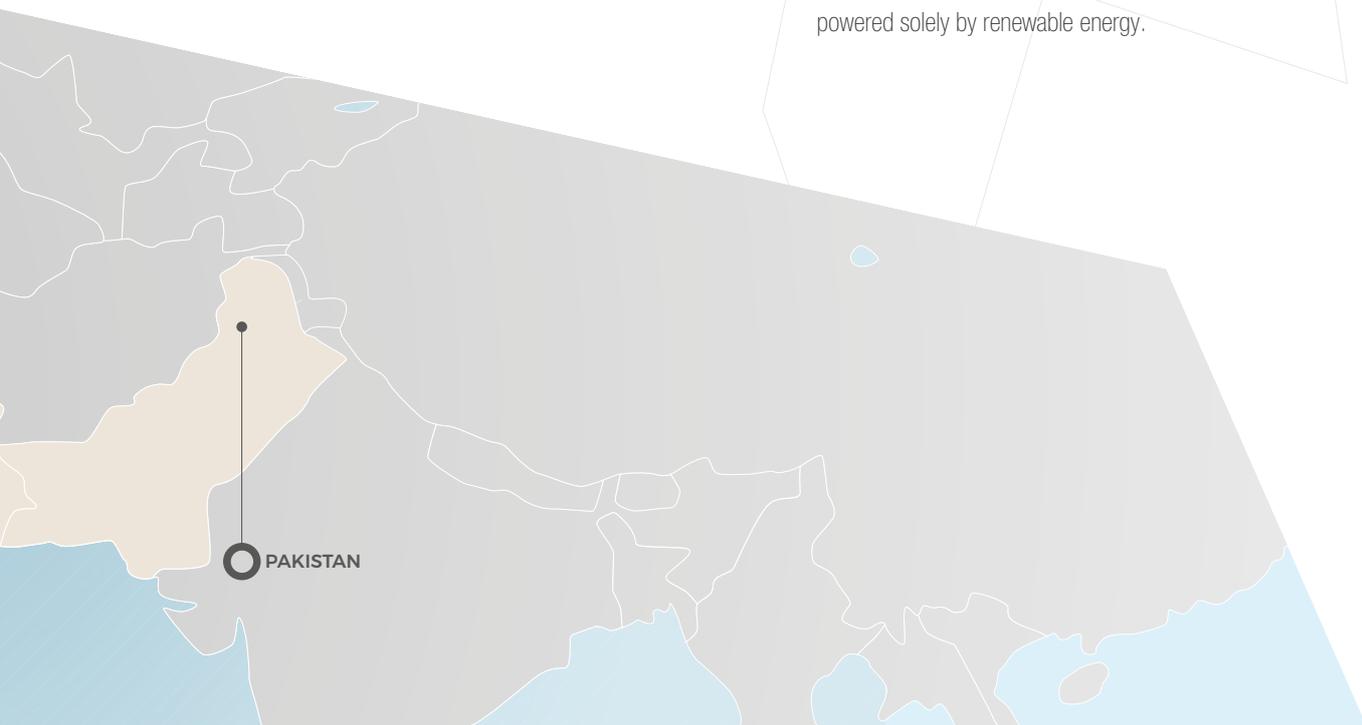
Following the opening of the building in November 2008, Chris Llewellyn Smith (former Director-General of CERN, Oxford University, UK) took over from Herwig Schopper as President of the Council. In November 2009, the SESAME Council endorsed a Strategic Plan, which has been followed subsequently, albeit not as rapidly as hoped, and with some items postponed, because the necessary capital funding was not available.

The funding problem was partly overcome when, in March 2012, Iran, Israel, Jordan and Turkey committed to making voluntary contributions of US\$5 million each to SESAME's capital budget, although as a result of sanctions Iran has so far been unable to transmit the funds. This demonstration of commitment by the SESAME Members encouraged the European Union to decide in 2013 to provide €5 million (US\$5.3 million at the February 2017 exchange rate) to CERN to procure the components of the magnetic

system for the SESAME main ring, which has been built in collaboration with SESAME. It also encouraged Italy to provide €1 million in 2014, which was used to procure accelerating cavities; this was followed by further contributions from Italy, which has so far contributed a total of €3.35 million (US\$3.56 million, at the February 2017 rate), of which the most recent part is being used to build a hostel for SESAME users.

These funds, together with donations of equipment, and the Members' annual contributions, which cover staff costs, power and consumables, have proved sufficient to bring SESAME into operation, albeit in the first year with only three of the planned seven Phase 1 beamlines, and minimal supporting infrastructure. A major milestone was reached in September 2014 when the booster synchrotron stored and accelerated a beam to the full energy (800 MeV), becoming the then highest energy accelerator in the Middle East. On 11 January 2017, a beam was transferred from the booster and circulated in the main storage ring for the first time. By late February, a beam had been stored and accelerated to over 2 GeV.

Accelerators are big users of electricity, which is extremely expensive in Jordan. SESAME has therefore been seeking funding for a Solar Power Plant, without which it would not be possible to exploit SESAME fully at a cost the Members could afford. The necessary funding became available in late 2016 when the Jordanian Government agreed to provide SESAME with JD5 million (US\$7.05 million) from funds provided by the European Union to support the deployment of clean energy sources. When its solar power plant comes into operation, SESAME will be the first accelerator in the world powered solely by renewable energy.



THE SESAME COUNCIL

The Council is SESAME's governing body. The current Members are **Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, the Palestinian Authority and Turkey**. The Observers are *Brazil, Canada, China, European Union, France, Germany, Greece, Italy, Japan, Kuwait, Portugal, Russian Federation, Spain, Sweden, Switzerland, UK and USA*.

President of the Council - **Chris Llewellyn Smith** (UK) 2008-17; *President elect* - **Rolf Heuer** (Germany); *Previous President* (earlier, President of the Interim Council) - **Herwig Schopper** (Germany).

Co-Vice Presidents: **Syed Muhammad Javed Akhtar** (Pakistan), **Karim A. Tahboub** (Palestinian Authority). *Previous Co-Vice Presidents*: **Kamal Araj** (Jordan), **Eliezer Rabinovici** (Israel), **Seyed Mahmoud Reza Aghamiri** (Iran), **Mohamed Tarek Hussein** (Egypt), **Dincer Ülkü** (Turkey), **Khaled Toukan** (Jordan).

Delegates to the Council:

Cyprus	George Georghiou, Ioanna Cleanthous
Egypt	Atef A. Abdel-Fattah, Mahmoud Sakr
Iran	Javad Rahighi
Israel	Moshe Paz-Pasternak, Eliezer Rabinovici
Jordan	Kamal Araj, Abdul-Halim Wriekat
Pakistan	Mukhtar Ahmed, Syed Muhammad Javed Akhtar
Palestinian Authority	Karim A. Tahboub, Salman M. Salman
Turkey	Zafer Alper

The Finance Committee provides advice to, and exercises certain powers delegated by, the Council.

Chair - **Tahir Saeed** (Pakistan). *Previous Chairs* – **Salman M. Salman** (Palestinian Authority), **Hany Helal** (Egypt)

Secretary of the Council: Clarissa Formosa-Gauci. Previously Maciej Nalecz (UNESCO)

SESAME ADVISORY COMMITTEES

Scientific Advisory Committee (SAC): Chair - Zehra Sayers (Turkey)

Technical Advisory Committee (TAC): Chair - Albin F. Wrulich (Switzerland). Previous Chair: Costas Papanicolas (Cyprus)

Training Advisory Committee (TrAC): Chair - Javad Rahighi (Iran). Previous Co-Chairs: Reza Mansouri (Iran), Miguel A. Virasoro (ICTP)

Proposal Review Committee (PRC): Chair - Samar Hasnain (UK/Pakistan)

A **Beamlines Advisory Committee (BAC)** - chaired first by Samar Hasnain (UK/Pakistan) and then by Zahid Hussain (USA/Pakistan) - merged with the SAC in 2012

THE SESAME DIRECTORATE

- 🌟 **Director, Khaled Toukan**
- 🌟 **Technical Director, Erhard Huttel.** Previous Technical Directors: Amor Nadjji, Gaetano Vignola, Dieter Einfeld
- 🌟 **Scientific Director, Giorgio Paolucci.** Previous Scientific Directors: Hafeez-ur-Rehman Hoorani. Aslam Baig
- 🌟 **Administrative Director, Mohamed Yasser Khalil.** Previous Administrative Director: Hany Helal

THANKS

The SESAME Members would like to express their deep gratitude to –

UNESCO. SESAME is now a fully independent intergovernmental organisation, but UNESCO (which remains the depository of the Statutes) played a vital role in getting the project started, and has provided unflinching support thereafter. The Director-General of UNESCO convened the meeting that launched the project, and provided the assurances and funding that underwrote Germany's donation of BESSY I. UNESCO organized the meetings of the Interim Council (meanwhile handling SESAME's finances and administration), helped find a site for SESAME, and then facilitated the transfer of BESSY I to Jordan. For many years, UNESCO representatives to SESAME have been making highly-valued contributions to the activity of the intergovernmental Council, the widening of participation in SESAME, and the construction of the Centre.

Germany. If Germany had not donated BESSY I, SESAME would have been stillborn. The donated Helmholtz-Zentrum Dresden-Rossendorf beamline, until recently in use at the European Synchrotron Radiation Facility (ESRF), forms the basis for SESAME's XAFS/XRF beamline.

Jordan. The Government of Jordan, which provided the site and paid for the SESAME building, has unflinchingly supported the project. Jordan has allocated money to SESAME from its own resources (which funded computing infrastructure) and from EU grants, which *inter alia* funded the cooling system, and will fund SESAME's solar power plant. The Royal Court made a substantial cash grant to SESAME which *inter alia* funded the shielding walls and jump-started the operation of the microtron and booster. Jordan's Scientific Research Support Fund is now supporting construction of the MX beamline.

The synchrotron laboratories (ANKA, Elettra, ESRF, Daresbury, DESY, LURE, Max-Lab and the Swiss Light Source) which hosted 16 scientists and engineers from the SESAME region who were selected at the beginning of the project for training as accelerator experts, and subsequently provided additional training, support, advice and in some cases equipment.

The IAEA. Since 2005 the IAEA has regularly provided substantial funding for training which has been, and will continue to be, vital in building up the community of potential SESAME users. The IAEA played an important role in funding staff visits from and to SESAME related to the CESSAMag project (described below), and in supporting capacity building related to the safe operation of SESAME.

The European Union. In addition to grants to Jordan, which were - and are being - used to provide important support for SESAME as noted above, the EU's Horizon 2020 programme funded construction of the key magnetic system for SESAME's new main ring through the vital CESSAMag (CERN-EC Support for SESAME Magnets) project, and also part of the power supplies.

CERN. SESAME is modelled conceptually and organisationally on CERN, although its scientific aims are very different. CESSAMag, which was led and coordinated by CERN, put CERN's expertise at the service of SESAME, while the ALBA light source in Barcelona played a role in magnet testing. This allowed SESAME to concentrate on other key main ring systems, while SESAME staff (some stationed at European laboratories) obtained important training, knowledge and technology transfer. Three key contracts were placed in SESAME Members (Israel, Cyprus and Pakistan), with the rest placed in Europe, and CERN received in-kind support from three SESAME Members, Iran, Pakistan and Turkey, which facilitated valuable knowledge transfer.

Italy. Italy (through the INFN) has provided very substantial sums which have been used to provide accelerating cavities and a state-of-the-art silicon detector and are funding construction of the Hostel that will be used by SESAME users.

Organisations in many countries (Brazil, Canada, China, France, Germany, Italy, Japan, Portugal, Spain, Sweden, Switzerland, UK, USA), **the EU, international organisations** (CERN, IAEA, ICTP, UNESCO) and **two Foundations** (Canon and Lounsbery), which generously provided support for SESAME's training programme that comprised: the training of scientists and engineers at the start of the project noted above; travel grants; hosting visitors; provision of Fellowships (at the Brazilian, Canadian, Shanghai and NSRRC light sources and in Portugal); support for SESAME Schools by the Japan Society for the Promotion of Science and CERN; and, going forward, funding of OPEN SESAME by the EU and support from a new Lounsbery grant for visits to work at SESAME by users from the Members – see pages 10-11.

Synchrotron light sources that have provided expertise, support and in some cases equipment – including (in addition to the laboratories already named) ALS, LNF, LNLS, SLAC, and SPRING 8. Noteworthy contributions, in addition to training, were made by:

ALBA which, as well as contributing to the CESSAMag project, provided basic designs for the girders that support the magnets in the main ring and for the personal safety system.

ANKA which provided the original design of the building, machines for the workshops and waveguides.

The Daresbury Laboratory/University of Liverpool which donated components that are expected to form the basis for the SAXS/WAXS beamline.

Elettra which donated two surplus RF cavities to SESAME and oversaw the design and manufacture of the four new RF cavities which are installed in the SESAME machine.

ESRF which, in addition to agreeing to the transfer of the Helmholtz-Zentrum Dresden-Rossendorf beamline, provided the design of the experimental hutches, and will continue to provide training as coordinator of the Open SESAME project.

SOLEIL which provided the design (and built the first) of the solid state amplifiers, designed and oversaw the manufacture of the Infrared Beamline, and provided expert help with alignment.

The **Swiss Light Source/PSI** which donated components that form the basis of the MS beamline and the associated insertion device.

Experts who provided advice following the collapse of the roof of the SESAME building – Salvatore Noe' (University of Trieste) and Ueli Schurter (Hoeltzsch-Schurter company).

The Members of the SESAME Council's **Advisory Committees**, who have generously given their time and provided wise guidance.

The **Observers** (Brazil, Canada, China, EU, France, Germany, Greece, Italy, Japan, Kuwait, Portugal, Russian Federation, Spain, Sweden, Switzerland, UK and USA), who have given support and encouragement, in addition to specific contributions recorded above.

Last, but by no means least, the SESAME community thanks the three SESAME Members (**Israel, Jordan and Turkey**) which voluntarily made major capital contributions to the project.

