



# SESAME - A 3<sup>rd</sup> Generation Synchrotron Light Source for the Middle East

Developed under the auspices of UNESCO, SESAME (Synchrotron-light for Experimental Science & Applications in the Middle East) is a major international research centre in the Middle East / Mediterranean region, promoting understanding & peace through scientific cooperation. It has as its centrepiece a synchrotron light source originating from BESSY I, a gift by Germany. The upgraded machine, a 2.5 GeV 3<sup>rd</sup> Generation Light Source (133m circumference, 26nm-rad emittance & 12 places for insertion devices), will provide light from infra-red to hard X-rays for a wide range of studies, including regional biomedical & environmental issues. SESAME offers excellent opportunities to train local scientists & attract those working abroad to return.

As of Sept. 2008 SESAME Council Members are Bahrain, Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, Palestinian Authority, & Turkey. Negotiations are underway with Iraq & more are expected to join. Members provide the annual operating budget. The facility is located in Allaan, Jordan, 30km North-West of Amman. Jordan provided the site & the recently completed building. Plans for initial beam lines include MAD Protein Crystallography, SAXS/WAXS for Polymers & Proteins, Powder Diffraction for Material science, UV/VUV/SXR Photoelectron & Photoabsorption Spectroscopy, EXAFS & IR Spectroscopy. Pakistan is building a soft x-ray beamline. Other Council Members are expected to do the same. Complete beamlines are provided by the Daresbury

SRS, the Swiss Light Source, & LURE in France, plus beamline equipment from US labs. Additional funds for components of the new ring & beamlines are sought from the EU, US, & other sources. A training program for beamlines, accelerator technology, & applications is underway, funded by IAEA, US/DOE & other sources. A Director, Administrative Director, Scientific Director & Technical Director are on board\*. An accelerator group has finalized the design of the facility. Four Advisory Committees\* work with the staff\* on the technical design, beam lines, training & scientific programs. A "soft" inauguration, marking building completion & staff occupancy, is scheduled for Nov. 3, 2008, & first light in 2011. See [www.sesame.org.jo](http://www.sesame.org.jo)



*Dincer Ulku*, Vice President of the SESAME Council (on left)  
*Chris Levellyn-Smith*, President of SESAME Council Nov.2008  
*Yasser Khalil*, Administrative Director of SESAME  
*Khaled Toukan*, Director of SESAME  
*Herwig Schopper*, SESAME Council President until Nov. 2008  
*Hafaez Hoorani*, Scientific Director of SESAME  
*Amor Nadjji*, Technical Director of SESAME  
*Albin Wrulich*, Chair of the Technical Advisory Committee

SESAME staff at work on 22 MeV Bessy I Microtron

## Science with S E S A M E

Several hundred Middle East scientists have participated in five scientific workshops & six Users' Meetings (see reports on the web site). Based on input from these meetings, 70 proposals received, & joint meetings of the Scientific & Beam Lines Advisory Committees, the following first phase beam lines are planned:

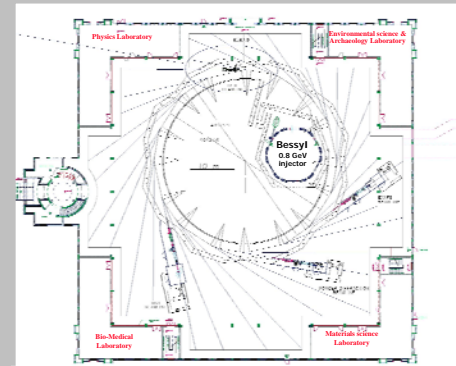
	Beamline	Energy	Source
1	MAD Protein Crystallography	5-15 keV	PM Wiggler (In vacuum undul. in Phase2)
2	PES & Photoabsorption Spectroscopy	0.1-2 keV	Undulator
3	SAX/WAXS	10 keV	Undulator
4	XAFS/XRF	3-30 keV	PM Wiggler
5	Powder Diffraction	3-25 keV	PM Wiggler
6	IR Spectromicroscopy	0.01-1 eV	Bending magnet

## The SESAME Building

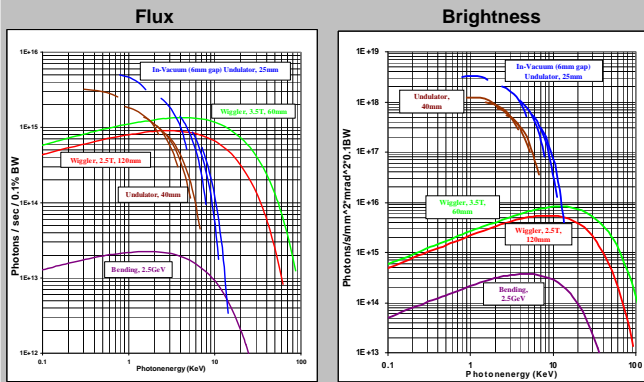
The SESAME building, designed by Rafiq Sarraf & the Engineering Dept of the Al-Balqa' Applied University in Salt, Jordan together with engineers from the Karlsruhe Research Center & funded by Jordan, was completed in 2008. The ground floor contains the ring, injector & up to 27 beam lines. By offsetting the ring by 5 m, some of these beam lines have lengths up to 36m. The experimental area is 60m x 60m with extensions of 7.5m on each side. 12 laboratories & 3 workshops are in the corners. The 1st floor provides 2100m<sup>2</sup> space for 20m<sup>2</sup> offices for staff & users plus the control room.

## The 2.5 GeV Storage Ring

The lattice uses "TME-Optics", for the lowest emittance & highest percentage of the circumference for insertion devices. The ring has eight Super Periods, each with 2 x 22.5 degree bending magnets. The basic elements of the lattice are combined function bending magnets, with a set of quadrupoles & sextupoles on each side to provide the proper focusing & chromatic correction for the beam. Twelve straight sections are available for insertion devices with lengths up to 3.9 meters.

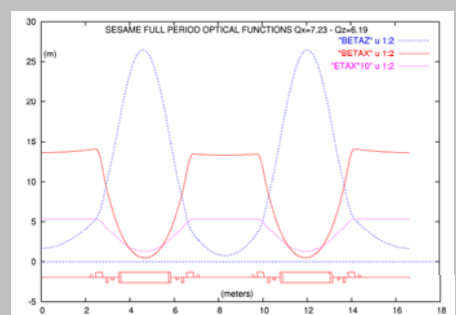


## Radiation from Bending Magnets, Wigglers & Undulators



## Storage Ring Parameters

Energy (GeV)	2.5
Maximum Beam Curr. (mA)	400
Bending Flux Density (T)	1.455
Circumference (m)	133.12
Emittance (nm.rad)	26
Maximum ID Length (m)	3.9
Long Straights Beam Cross Section ( $\sigma_x, \sigma_y$ ) ( $\mu\text{m}$ )	828 x 21
Available Straight Sections for Insertion Devices	12



\* **Directorate:** K. Toukan (Director/Jordan), H. Hoorani (Scientific Dir./Pakistan), A. Nadjji (Technical Dir./France-Algeria), M.Y. Khalil (Administrative Dir./Egypt)

\* **Sesame Staff:** T.Abu-Hanieh, A.Aladwan, M.Alnajdawi, A.Amro, M.Attal, S.Budair, S.Faques, D.Foudeh, M.Gharaibeh, A.Hallak, A.Hamad, A.Kaftoosian, T.Kahn, F.Makahleh, S.Matalgah, M.Saleh, R.Sarraf, M.Shehab, M.Sbahi, H.Tarawneh, S.Varnasseri

\* **Advisory Committee Chairs:** *Beam Lines:* Z. Hussain (ALS-US/Pakistan), *Scientific:* Z. Sayers (Sabanci Univ, Turkey), *Technical:* A. Wrulich (PSI, Switzerland) *Training:* J. Rahighi (AEOL, Iran)

\* **UNESCO:** M. Nalecz (Secretary to the SESAME Council), C. Formosa-Gauci (UNESCO Division of Basic & Engineering Sciences)