

UJ Students visit to SESAME, Thursday 30/08/2018

A very personal impression

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Our trip started out from the University of Jordan, supervised by Dr. Hanan Sa'adeh, in the early morning of Thursday, August 30th, 2018. Before heading to SESAME, we, 14 students of different scientific backgrounds, gathered around Dr. Hanan in the open air for a brief and quick lecture on the main differences between JUVAC (The University of Jordan Van de Graaff Accelerator) and SESAME (Synchrotron-light for Experimental Science and Applications in the Middle East).

JUVAC is a linear particle accelerator, where positively charged ions are accelerated in a vertical direction before being bent through 90° by an analyzing magnet, to proceed horizontally and hit the target in the experimental chamber at the end station, in what is known as “ion-matter interaction”.

SESAME, as a synchrotron-light source, is a circular particle accelerator. Electrons, which are negatively charged, are accelerated in a circle, which results in a spectrum of electromagnetic waves, i.e. photons of different energies, that are used to interact with matter (the target), in what is called as “photon-matter interaction”. In this type of accelerators “synchrotron light sources”, photons emitted from the accelerated electrons, according to Maxwell's equations, are the ones to interact with the target, not the electrons themselves.

We arrived at SESAME around 10 am. We were welcomed by Dr. Giorgio Paolucci, the Scientific Director. In a two-hour lecture he explained, with a deep sense of knowledge and humor, the history of SESAME, how it works, its applications, and the latest updates concerning its operation. He mentioned many joyous moments from his personal experience, pointing out that the most wonderful thing in this field of work is meeting many people from different cultural and academic backgrounds, who come together in one spot for their love of science and scientific research.

Personally, I enjoyed the various applications of the synchrotron-light source. One which really fascinated me was the ability to discover old paintings which were hidden underneath newer ones. Dr. Giorgio showed a painting “Patch of Grass” by Vincint Van Gogh, dated back to 1887. Using synchrotron-light, scientists were able to reveal an old

painting of a woman's face underneath the painting of the Patch of Grass! It seems like Van Gogh reused his canvas to draw new paintings!

Another fascinating example was about ancient manuscripts (scrolls) dated to hundreds or thousands of years, kept in a library in India. Due to damage over the years, those scrolls were mashed up together, just like a dough! This made it impossible for anyone to read or even handle the manuscripts! Using the synchrotron-light, scientists were able to read the alphabets in the scrolls as if it were just unfolded seamlessly in front of them!

At that moment, I couldn't but be amazed! And immediately remembered the notebook of my early poems, when I was in the 2nd grade (All my poems that I wrote in ink were erased, but the drawings were still there at least!). As my "ancient" poems were very dear to me, I asked Dr. Giorgio whether it is possible to "re-read" them using the synchrotron. "In such a situation, it might be even possible with other traditional lab sources, similar to the ones used by forensic studies to investigate traces of blood." He answered.

It's worth mentioning that this Italian scientist (Dr. Giorgio) seemed fond of stories, besides having a quite delightful spirit. He told us, while presenting the slides of his lecture, that he had once appeared in a movie! And so, at the end of the lecture, there was a question about the name of the movie! "The Best Offer", He answered. And as we started to think about the scene that he appeared in, he told us he was in a restaurant. Eventually, we found out that Dr. Giorgio presented 130 slides during the lecture! We were not bored, not even a bit!

And what also indicated that he really likes stories? He introduced Dr. Maher Attal, the Machine Coordinator at SESAME, as the "Lord of the Ring"!

I want to mention here that a few flyers and booklets were distributed, including useful details about SESAME, its member states, etc. In this report I have only included my personal impression about the visit itself.

During the coffee break, Dr. Hanan introduced us to the major parts of the facility using a miniature simulation displayed in the entrance lobby. Then Dr. Maher Attal led us into the control room where he delivered a thorough explanation on how to control electrons once they are launched, indicating that each synchrotron-light source has its own "response matrix", which is like a fingerprint for each synchrotron. Dr. Maher also guided us to the main experimental hall and explained more about beam optics used there. Dr. Hanan asked an intriguing question, in my opinion, about SESAME's status compared to other synchrotron-light sources worldwide, and whether SESAME

specifications are competitive with other facilities. Dr. Maher said “if it comes to “brilliance”, we do not compete with other synchrotrons till now. But in terms of “flux” then yes; SESAME can compete with other facilities”. He also indicated that nowadays they try not to operate the facility for continuous long operational periods, in order to reduce the operational cost.

Next, Dr. Giorgio led us to one of the operational beamlines, the XRF/XAFS (X-ray fluorescence/X-ray absorption fine structure) beamline. Here I was again surprised that samples need not to be under vacuum (in contrary to the case at JUVAC beamlines). Simply, light is coming out of the beamline (which is under vacuum) and hits the target (in atmosphere) at the end station! I was so surprised until Dr. Hanan told me (and then her master student Sara explained) that such conditions also exist in some ion accelerators, where an external ion beam hits the target in almost ambient conditions.

Another interesting point was when I asked Dr. Giorgio whether scientists pay for using SESAME, especially that each operational day costs SESAME around 11,000 \$! “Scientists pay nothing if they are doing research for the pure sake of science, of course once their proposals are approved by the review committee. But those who need to use the facility for industrial and profitable purposes must pay, depending on the duration they need”. He answered.

Before leaving the facility at about 2:30 pm, we took a group photo in front of SESAME’s building. Other nice photos were also taken during the visit to document this wonderful scientific field trip. Many thanks to Dr. Hanan Sa’adeh and to everyone contributed in a way or another to make this visit happen. It was a great pleasure to visit such a scientific monument for the first time!