Slutrapport

”Vetenskapligt utbyte och träning av forskare och doktorander i samarbete med SESAME-laboratoriet i Jordanien” finansierat av Svenska Institutet (diarienr. 22718/2017)

Projektet syftade till att genom träning och utbyte med forskare och doktorander utveckla verksamheten vid SESAME-laboratoriet (Allan, Jordanien) och finansierades med 366.000 kronor för att täcka stipendier och resekostnader för stipendiaterna. Medlen förvaltades av MAX IV Laboratoriet vid Lunds Universitet. Projektperioden är fullbordad (30 November 2019) och den sista stipendiaten lämnar Sverige 1 december 2019.

Bakgrund

SESAME är ett synkrotronljuslaboratorium i Allan, utanför Amman, i Jordanien. (http://www.sesame.org.jo). Laboratoriet är byggt runt en accelerator som levererar s.k. synkrotronljus, vilket utgör ett viktigt verktyg för forskning inom materialfysik, biologi, medicin, elektronik, life science m.m. I Sverige finns en liknande anläggning i Lund, MAX IV-laboratoriet. Flera av staterna i Mellanöstern är medlemmar av SESAME-organisationen: Cypern, Egypten, Iran, Israel, Jordanien, Pakistan, Palestina och Turkiet. Forskare från alla dessa länder samarbetar nära med varandra med att realisera uppbyggnaden och användningen av laboratoriet. SESAME fyller också rollen som ett fredsprojekt genom att bygga kontakter och samarbeten i regionen samt att ge möjligheter för forskare att stanna och utveckla sin verksamhet på plats.

SESAME-laboratoriet är idag färdigställt när det gäller själva ljuskällan (acceleratorn) och uppbyggnad av experimentstationer pågår, varav de första två är färdigställda. I detta läge finns ett behov att stötta forskare i regionen att utnyttja SESAME, vilket var målet med detta projekt.

Projektet har vänt sig till forskare/doktorander från Egypten, Iran, Jordanien, Pakistan, Palestina och Turkiet som arbetar i grupper med verksamhet vid SESAME eller grupper med ambition att i framtiden nyttja SESAME. Inom projektet har de getts möjlighet att söka stipendier för en vistelse i Sverige under 3-6 månader. Under vistelsen i Sverige har forskaren/doktoranden kunnat utveckla sin kompetens genom att delta i pågående projekt som den mottagande svenska gruppen redan bedriver. Under projektet har stipendiaterna lärt sig t.ex. design av experimentstationer, praktisk träning i uppbyggnad eller igångsättande av experimentstationer och kunskap i användning av synkrotronljus vid MAX IV-laboratoriet och värdinstitutionen.

Utlysning och urvalsmetod

Programmet annonserades under de första veckorna av 2018 genom ett par olika kanaler: MAX IV Laboratoriets hemsida, SESAME laboratoriet, direkt till internationella kontakter inom SESAME projektet och till tidigare kontakter vid Universitet i Jordanien. 37 ansökningar, plus ett par ofullständiga, har inkommit från de behöriga länderna fördelat enligt:

14 Iran, 9 Pakistan, 9 Egypten, 2 Jordanien, 2 Turkiet och 1 Palestina.

En lokal kommittee vid Lunds Universitet bestående av: Eshraq Al-Dmour, Franz Hennies, Joachim Schnadt, Stacey Sorensen, Hamed Tarawneh och Sverker Werin har utvärderat ansökningarna.

Utvärderingen följde de kriterier som angavs i ansökan:

- Projekt inom relevant område
- Vetenskapliga kvalifikationer

- Vetenskapliga referenser
- Projekt möjligt i Sverige och lämplig forskargrupp tillgänglig
- Projektplan och mål med vistelsen
- Ambition och möjlighet att utveckla projekt i riktning mot SESAME
- En jämn könsfördelning mellan stipendiaterna

Eftersom en nödvändig punkt var träning inom ett relevant område skedde urvalet för toppkandidaterna inte endast via kvalifikationer. Stipendiaterna har placerats med en handledare vid MAX IV Laboratoriet, Lunds Universitet eller Chalmers.

Stipendiater

Totalt har fem stipendiater erhållit stipendier för tillsammans 17 månader i Sverige. Stipendiaterna har varit 2 kvinnor och 3 män, 2 från Iran, 2 från Pakistan och 1 från Egypten. Samtliga stipendiater har fullföljt sina projektperioder, med en sista bokad hemresa 1/12-2019.

Fyra stipendiater har placerats vid Lunds Universitet och en i en forskargrupp vid Chalmers tekniska högskola. Även för den senare har MAX IV/Lunds Universitet skött resa, stipendium och administrativa kontakter. De fem stipendiaterna är:

Stipendiat	**Heminstitut/senaste**	**Stipendietid och plats**	**Handledare**	**email**
Dr. Saima Rasheed	International Center for Chemical and Biological Sciences, University of Karachi, Pakistan	3 månader vid MAX IV Laboratoriet	Dr. Uwe Muller	
Dr. Naveed Zafar Ali	Quaid-i-Azam University, Islamabad, Pakistan	3 månader vid MAX IV Laboratoriet	Dr. Mads Jorgensen	
Mr. Mazoud Lazemi	University of Tabriz, Iran	6 månader vid Department of Microtechnology and Nanoscience, Chalmers tekniska högskola	Prof. Johan Liu	
Dr. Saed Saeedy	School of Chemical Engineering, Tehran, Iran	1 månad vid MAX IV Laboratoriet	Dr. Andrey Shavorskiy	
Dr. Neama Imam	Atomic Energy Authority of Egypt	4 månader vid Department of Chemical Physics och MAX IV Laboratoriet, Lunds Universitet	Dr. Jens Ühlig	

Genomförande

Samtliga kandidater har valts ut med avseende på vetenskaplig kvalité på ansökan inom ämnesområden som är relevanta inom synkrotronljusforskning samt relevanta för SESAME och där kompetens finns vid MAX IV Laboratoriet eller dess användargrupper. En mycket viktig komponent har varit beskrivning av hur kandidaternas forskning och den träning de förväntade sig i Sverige skulle leda i riktning också till SESAME. Utfallet har i stort blivit mycket bra. Fyra av kandidaterna är mer erfarna forskare med viss erfarenhet från forskning vid en synkrotronljuskälla. En kandidat var tidigare i sin karriär och har genom stipendiet fått en avancerad träning precis i början av sina doktorandstudier. De har alla genom sin vistelse i Sverige kunnat samarbeta nära med kvalificerade forskargrupper, vidga sina kontaktnät och fått träning i planering av forskningsprojekt, driften av experimentstationer och utvärdering av resultat i relation till en anläggning som MAX IV. I vissa fall

har de direkt deltagit i pågående projekt. I ett par av fallen har kontakter knutits som kommer att kunna generera fler framtida forskningssamarbeten och i samtliga fall har forskarkontakter mellan flera nationaliteter och kulturer utvecklats med forskning som gemensam nämnare.

Utvärdering

Sverige, svenska universitet och MAX IV har ett mycket gott anseende bland de inresande forskarna och samtliga har uttryckt stor tillfredsställelse med möjligheten att utveckla sig själva, sin forskning och att knyta nya kontakter. Samtliga hoppas ha större möjligheter att bedriva sin framtida forskning vid SESAME laboratoriet och även att kunna fortsatt hålla kontakten till MAX IV och Sverige. Speciellt de kvinnliga deltagarna har uttryckt att de blivit väl bemötta i Sverige.

Projektet har till största delen uppnått de mål som satts upp. Den direkta fortsättningen för forskarna vid SESAME laboratoriet återstår att se, då det normalt dröjer mer än ett år innan en forskare kan få tid vid laboratoriet. En komplikation är att när forskarnas kompetens och erfarenhet byggs på, som inom ett sådant här projekt, ökar också deras karriärmöjligheter utanför regionen. Detta är förstås ofrånkomligt och även om det ger en viss ”brain drain” betyder det också att intresset för forskning och statusen för SESAME ökar när karriärvägarna blir fler. En kandidat inom projektet har fått en 2 års post doc i Europa.

Vissa praktiska problem har dykt upp, såsom:

- Utbetalning av stipendiepengarna har krävt ett bankkonto, men stipendiaternas hemkonton har inte varit möjliga att använda. (Bankrestriktioner till Iran, ingen möjlighet att nå pengarna utomlands i Sverige, mycket kostsamma växlingar fram-och-tillbaka mm.) Att öppna konton i Sverige utan personnummer har endast gått med tillfälliga lösningar.
- Tid för att erhålla visum har ibland varit betydligt längre än planerat (mer än 3 månader), men samtliga stipendiater har fått visum.
- Bostäder har gått att ordna i samtliga fall, men till relativt höga kostnader. MAX IV laboratoriet har i flera fall även behövt betala ut förskottsbetalningar för hyra.

Tre intervjuer (se även appendix) med stipendiater har publicerats via MAX IV Laboratoriets hemsida:

Dr Saima Rasheed: https://www.maxiv.lu.se/news/knowledge-exchange-between-max-iv-and-sesame-is-now-underway/

Dr. Neama Imam: https://www.maxiv.lu.se/news/reflections-from-the-sesame-scholarship-programme-neama-imam/

Dr. Saeed Saedy: https://www.maxiv.lu.se/news/reflections-from-the-sesame-scholarship-programme-saeed-saedy/

Lund 191129

Sverker Werin

Professor, MAX IV laboratoriet och Fysiska institutionen, Lunds Universitet

sverker.werin@maxiv.lu.se, tel: 0709-997942

Reflections from the SESAME Scholarship Programme: Neama Imam

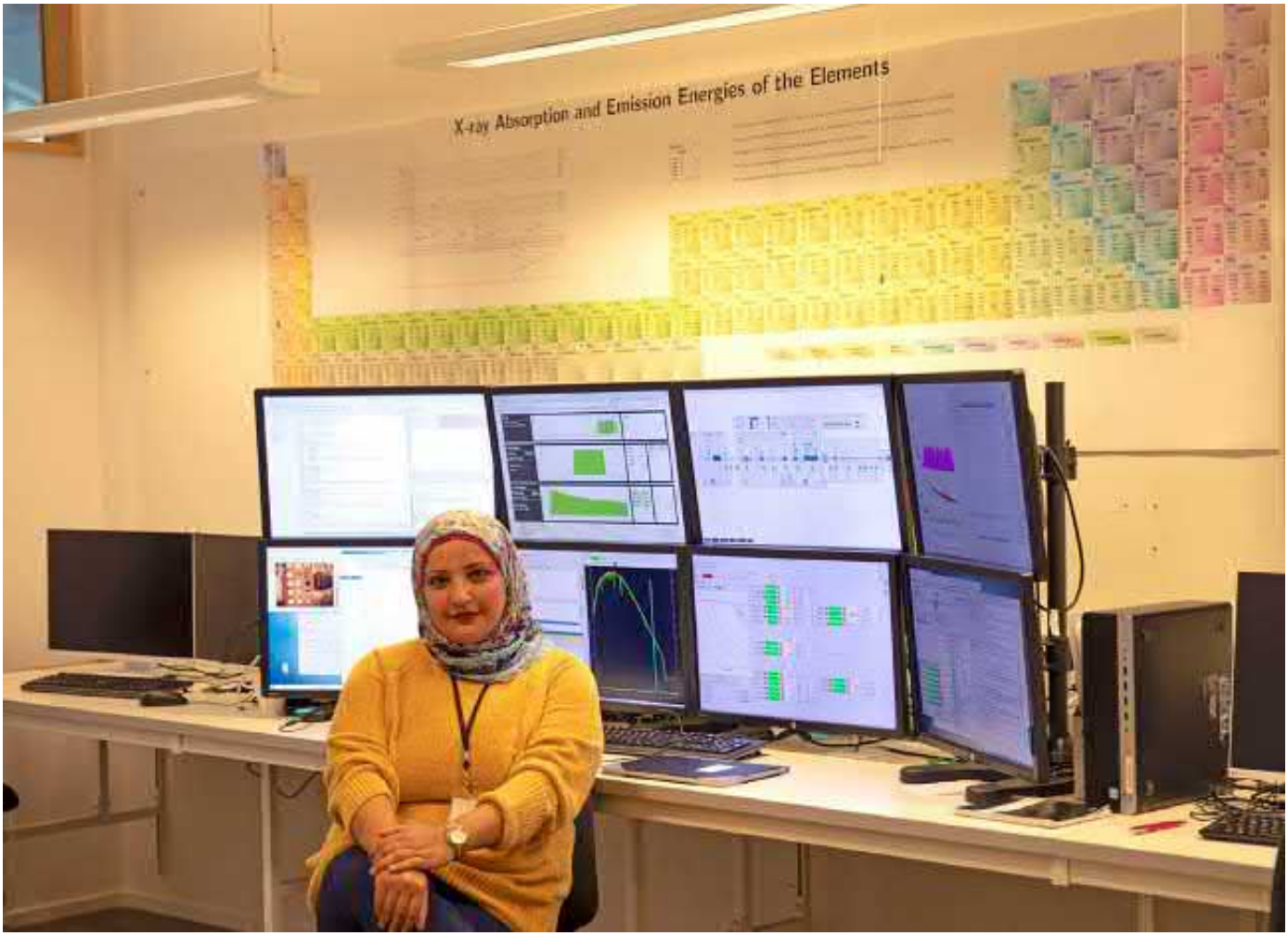


image: Researcher Neama Imam in the Balder beamline control room.

The Swedish Institute (SI) (https://si.se/en/) offered a scholarship-based training programme at MAX IV in 2019 for researchers from the eight Middle Eastern countries affiliated with SESAME (http://www.sesame.org.jo/sesame_2018/about-us/what-is-sesame)—Synchrotron-light for Experimental Science and Applications in the Middle East—light source (http://www.sesame.org.jo/sesame_2018/about-us/what-is-sesame) located in Jordan. During the autumn, two visiting researchers participated in the programme for practical learning, experience, and knowledge exchange with MAX IV colleagues and beamline users.

MAX IV interviewed the candidates, Neama Imam and Saeed Saedy (https://www.maxiv.lu.se/?p=24197&preview=true), about their experiences and thoughts on the training.

through November. She currently works in the Chemical Physics Division at Lund University with researcher Jens Uhlig and has practical training at Balder beamline.

Neama's research focus is on nanomaterials preparation and characterization. Her background includes synchrotron-based beamline instrumentation and alignment, data acquisition, sample preparation, as well as data analysis, modelling, and theoretical calculations for X-ray absorption near edge structure (XANES) and extended X-ray absorption fine structure (EXAFS) spectra.

Why were you interested in the scholarship training opportunity at MAX IV?

My current interest is in nanotechnology and its reflection in our life for solving our world challenges, such as energy crises. These challenges can be tackled by novel technologies based on the tailoring and development of nanomaterials that can be fully characterized due to the remarkable properties of synchrotron radiation.

My training at Lund University and MAX IV entails improving my XAFS data analysis skills and learning XAFS calculations, modelling and simulation. I work with gradient core shell cadmium selenide/zinc sulfide (CdSe/ZnS) quantum dot structures.

It is amazing to have an XAFS spectrum at a certain absorption edge where different absorbing atom compounds are actually contributing in this spectrum. With the help of XANES calculations using FEFF or FDMNES code and linear combination analysis we can trace the formation of different compounds in the gradient core shell quantum dots structure. Understanding the local and electronic structure of such quantum dots will give us a deeper understanding and explanation of their optical properties in order to enhance their use in solar cell and lighting applications.

image: Neama Imam working at Balder beamline

What knowledge have you gained from the programme?

The most important point here is that I have learned a beneficial style of scientific thought from Jens Uhlig. This will enable me to solve different scientific issues in my research work particularly in XAFS science, technique, and data analysis.

I have attended nice lectures about XAFS science and technique from the Balder staff and had training at the Balder beamline (https://www.maxiv.lu.se/accelerators-beamlines/beamlines/balder/) with XAFS, X-ray fluorescence (XRF) and X-ray emission spectroscopy (XES) based on synchrotron radiation. It was also possible to measure copper oxide (CuO) and cuprous oxide (Cu2O) as training samples. In that I train in analysis of X-ray spectra with the focus on modelling the complex environment of quantum dots with gradient layers, this programme fit my aims in the best possible way.

One challenge I faced was to learn modelling, simulation, XAFS calculations (a lot of software and codes) and then apply everything in the analysis of X-ray spectra of the complex environment of quantum dots with gradient layers in only four months. A very short time. I succeeded in this intensive training with very focused study.

In addition, I had a very good learning experience with XAFS technique, science at X-ray facilities, and data analysis during summer school at Max IV in cooperation with Uppsala University. In September, I attended the 31th Max IV User Meeting, where I heard about the different beamlines at Max IV based on soft and hard X-ray energies.

I’ve become part of an incredible scientific network in the Chemical Physics Division, which provides a great opportunity for an amazing cultural and science exchange. I have gotten to know and become friends with many people from all over the world. Thanks to Max IV, SESAME, Lund University, the Chemical Physics Division, and the Atomic Energy Authority of Egypt.

What advice would you give other researchers about the experience at MAX IV?

It is very nice to have such a fellowship at the most brilliant synchrotron in the world and at one of the top universities, Lund University. My advice is to try to arrange with people at Max IV before starting to have beamtime there to measure your own samples during the beginning of your training period as this requires an application for beamtime. I’m sure that with increasing standardization and operationality of the beamlines the access will become easier.

What are your plans after the programme?

I will return to work at the Atomic Energy Authority of Egypt. However, soon after I will go to the Elettra

The new experience that I gained at Max IV and Lund University will enable me to understand more and use SESAME XAFS and XRF beamlines very easily and will empower me to analyse data with new points of view based on my acquired skills. I will also transfer this knowledge to my colleagues at SESAME and everywhere.

Reflections from the SESAME Scholarship Programme: Saeed Saedy

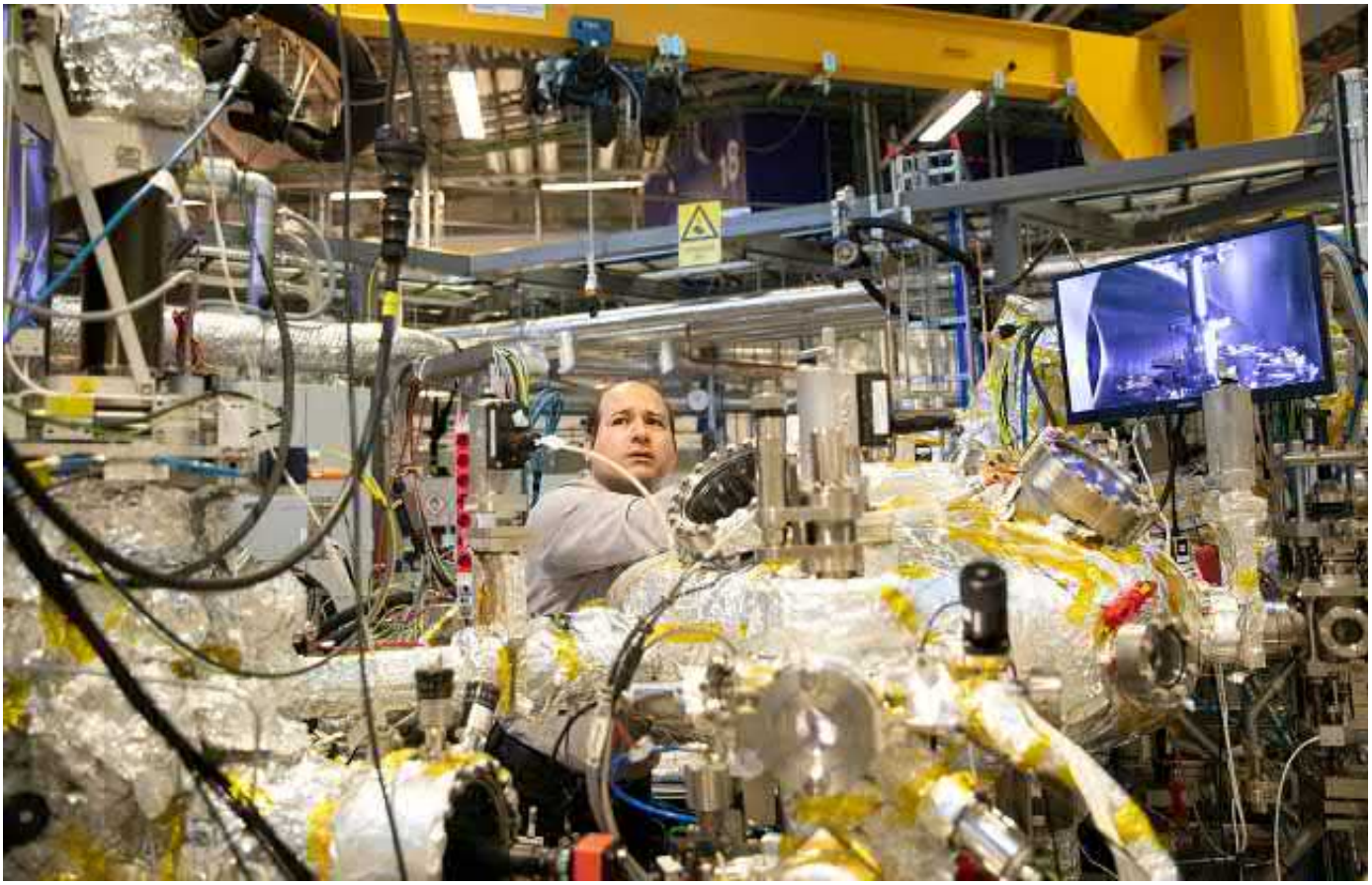


image: Researcher Saeed Saedy demonstrates his work with the HIPPIE beamline.

The Swedish Institute (SI) (https://si.se/en/) offered a scholarship-based training programme at MAX IV in 2019 for researchers from the eight Middle Eastern countries affiliated with SESAME (http://www.sesame.org.jo/sesame_2018/about-us/what-is-sesame)—Synchotron-light for Experimental Science and Applications in the Middle East—light source (http://www.sesame.org.jo/sesame_2018/about-us/what-is-sesame) located in Jordan. During the autumn, two visiting researchers participated in the programme for practical learning, experience, and knowledge exchange with MAX IV colleagues and beamline users.

MAX IV interviewed the candidates, Saeed Saedy and Neama Imam (https://www.maxiv.lu.se/?p=24204&preview=true), about their experiences and thoughts on the training.

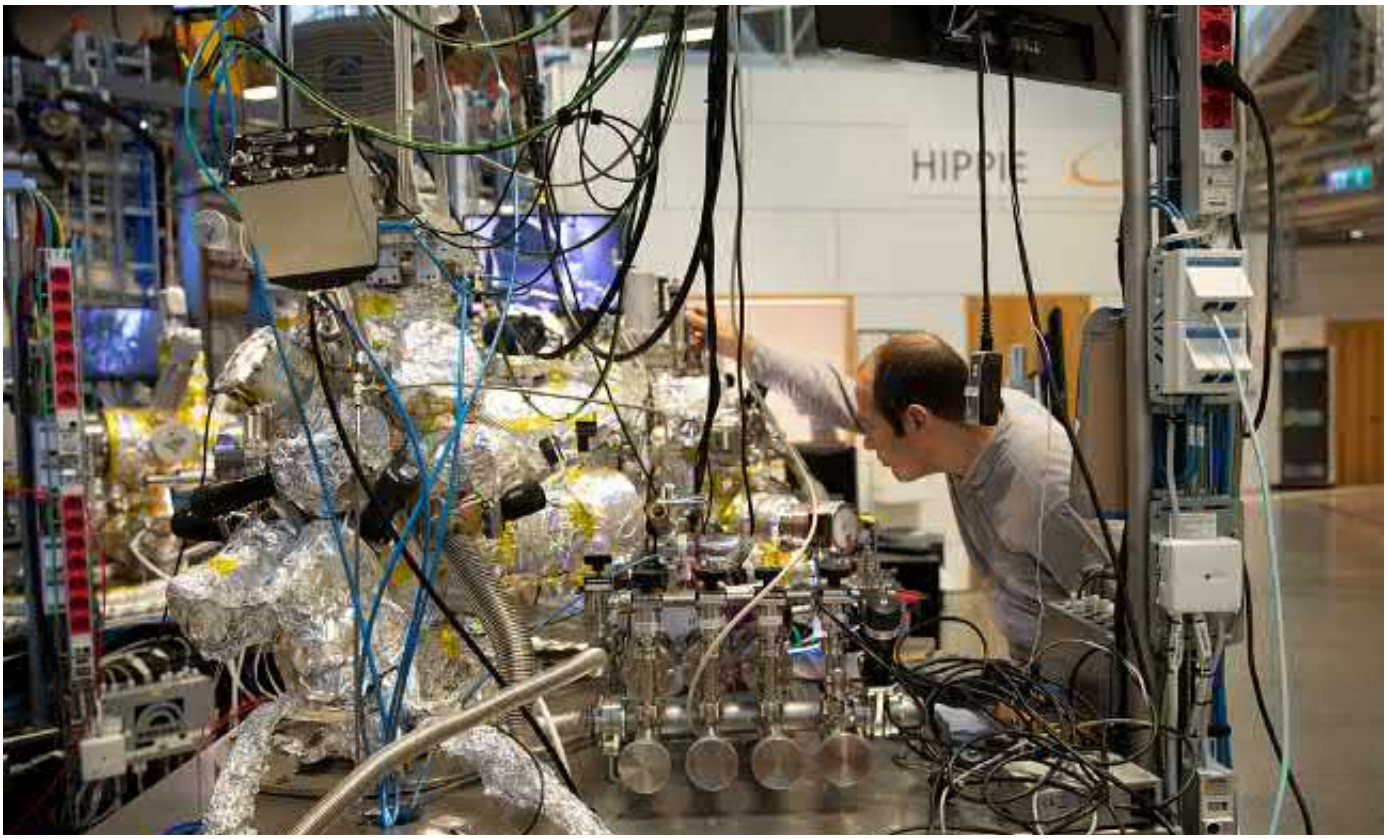
Saeed Saedy is a PhD in nanotechnology from Iran who participated in the programme for one month in September and October. Saeed worked with the groups at HIPPIE and Balder beamlines. His background is

Why were you interested in the scholarship training opportunity at MAX IV?

I wrote my proposal for MAX IV to get training in 3 techniques as related to my research and I will need them for my future work: ambient pressure X-ray photoelectron spectroscopy (AP-XPS), X-ray absorption spectroscopy (XAS), and X-ray diffraction (XRD). Based on the decision of the evaluation committee my scholarship was for work with HIPPIE beamline (https://www.maxiv.lu.se/accelerators-beamlines /beamlines/hippie/), which is specialised for ambient pressure XPS. Learning about these methods is a good opportunity for me to improve my skills and pave my way to become an independent researcher. This was the main motivation for me to apply for this scholarship.

Currently, I'm working on electrochemical reduction of carbon dioxide to fuels and valuable chemicals. So, converting CO2, which is nowadays the problem of our globe, to something useful. Such chemical transformation occurs at the surface of catalysts, and to study this we need some advanced techniques such as XPS. There is a good opportunity at HIPPIE beamline for ambient pressure XPS, where we can study catalytic materials in-situ during a real reaction. During my visit at HIPPIE, I learned how to use this for my own research.

It's one of the best techniques for the study of the surface of materials, and any catalytic reaction in heterogeneous systems. Using AP-XPS, we are able to study the surface and near surface of catalytic materials during pre-treatment and catalytic reactions. There is a good advantage in synchrotron radiation facilities in that we can tune the energy of X-rays, to have a different energy of photons on our sample. We can study the surface at different depths also.



What knowledge have you gained from the programme?

I know exactly what I am looking for, I know the abilities and capabilities of these machines and what kind of information I can obtain because sometimes a machine is much more, can do more, than we think. What I did at HIPPIE was much more useful than measuring my own samples. I learned how to use the machine, and how to become an independent user somehow.

There are lots of kind scientists in MAX Lab, so I had frequent opportunity to ask them questions. For my own research, in addition to ambient pressure XPS, I need to use X-ray absorption spectroscopy techniques that we have at Balder beamline (https://www.maxiv.lu.se/accelerators-beamlines/beamlines/balder/). I went there several times and met kind people—Constantine, Kajsa, Susan. For example, Susan tried to teach me a software they use for data treatment, Constantine helped me with some of my questions, Kajsa as well, because for my own research I need to design a special reaction chamber, an electrochemical cell, to put my samples in and do the measurements.

I spent three weeks at HIPPIE beamline. Andrey, the beamline manager, kindly showed me all of important parts of HIPPIE: the undulator, main optics, and end stations. He answered all of my questions about XPS. One good thing that happened, in my second week at HIPPIE, a group of users came from Finland. They had beamtime and did experiments in electrochemistry. They were working on similar topics that I'm doing now, and with similar experiments. They kindly invited me to observe, and I learned a lot from them. This was a real example of how we can use HIPPIE for such studies. I was quite happy because there was an option to see what I can do.

There was a good opportunity for me here to also learn about the synchrotron. I had the chance to walk around, talk to lots of people not only at HIPPIE, but in the whole of MAX IV lab, so I learned a lot about the synchrotron radiation. For example, how we generate the electron beam, how we maintain it inside the storage ring, and how the insertion objects are making the radiation, and then how the optics work.

It is worth noting that I took the opportunity to be in Lund and MAX IV and I participated in an extended X-ray absorption fine structure (EXAFS) training program at MAX IV that was quite helpful for improve my knowledge about XAS methods.

What advice would you give other researchers about the experience at MAX IV?

First of all, I would recommend to anyone, if they have an opportunity, come and visit even for one week because there's lots of things to learn. If anyone is coming here for a long-term stay, I would recommend coming prepared. Make a bit of study about the facility and the concepts. Check the beamlines. Define your objectives and goals, make a list. You know yourself what you are doing, and you know what you need to learn from a synchrotron. You know which one of the beamlines are useful for you, your future career and research.

You can make it quite fruitful when you have several objectives and goals. It's not just a visit just for the sake of a visit. It's a visit for learning and improving experience and for transferring the knowledge.

I believe that doing experiments even as a user at a synchrotron facility is not just doing a simple experiment. It's an opportunity for learning because always there is something new, and as a scientist we should learn every day.

What are your plans after the programme?

I have started a new Post Doc position at Delft University of Technology in the Netherlands. There I will try to introduce MAX Lab to my new colleagues and tell them about the available opportunities, and what they can do here. I will also start to design my experimental electrochemical cell and some experiments based on what I will have there. I plan to write several proposals to work on experiments at SPECIES, Balder and HIPPIE beamlines.

As a general goal, I would like to stay in academia and become an independent researcher, maybe a professor. From here, I will focus on improving myself in this field. The 3 techniques usually available at synchrotron facilities (XPS, XAS, XRD) are really helpful for scientific studies in heterogeneous catalysis, and fortunately I had the chance of learning two techniques here.

Knowledge exchange between MAX IV and SESAME is now underway

Image: The SESAME Synchrotron in Jordan

The Swedish Institute is funding scholarships for training for researchers related to the SESAME synchrotron in Jordan to come to MAX IV for 3 – 6 months. The first researcher to be awarded a grant is now in Lund and well underway with her training. Saima Rasheed is an Assistant Professor at the University of Karachi in Pakistan and joined MAX IV on the 16th of November working with Uwe Müller at the BioMAX beamline. If you would like to apply for a scholarship, please see our application page (https://www.maxiv.lu.se/education-training/max-faculty-of-science/sesame-max-iv-training/).

Here is an interview with Saima on her experience so far and her hopes for the future.

What made you apply?

I am from Pakistan and unfortunately, we have no state of the art synchrotron facility. Recently, in our region, SESAME synchrotron light source was officially opened in Jordan, to foster scientific and technological excellence in the Middle East and neighbouring countries. One of the main purposes of SESAME is capacity building in the region and prevent or reverse the brain drain. From Pakistan, I am actively involved in the scientific activities of SESAME and get benefited from its training programmes. I completed my first post doc from DESY University of Hamburg Germany in 2017 under the IAEA SESAME

and chance to get in touch with the synchrotron-based science.

In 2017, The **Swedish Institute** (https://si.se/en/) offered scholarships for training and exchange at MAX IV Laboratory in Sweden, for the researchers belonging to a SESAME member state. I searched about MAX IV and found that the MAX IV Laboratory is under commissioning and the scientific program has recently been started. So I decided to apply because I think that it would be a great opportunity and a launch pad for my career. By taking this opportunity, and by visiting this new hub of knowledge and science, I can gain knowledge from experienced scientists, as well as earlier stage PIs, whom I can work with directly to develop my career and interests. So, finally,* I am the first one from Pakistan selected to get training at the MAX IV.

What will you learn?

For me science is excitement, facing challenges, and I like challenges. For a few years, I have been completely hooked on the art of crystallography. I am working and keen to find out interactions of lead molecules/drugs with medicinally important protein by unlocking the structural interactions, applying X-ray crystallography.

I have been incredibly fortunate to have wonderful mentors and role models in life, Prof. Dr. M. Iqbal Choudhary (ICCBS, Pakistan), Prof. Betzel (University of Hamburg, Germany), Dr. Uwe Muller, and Dr. Gustavo Lima, here at MAX IV. At MAX IV, we are working on “Fragment Screening” project, to find out how different lead molecules/drugs react with biological macromolecules, and help to rescue the altered function in much more targeted and specific way. This will certainly help us and the scientific community to design and explore safe and effective drugs against different diseases.

What will you do when you have finished at MAX IV?

I am really grateful to The **Swedish Institute, MAX IV and SESAME** for this fellowship because it is going to allow me to strongly enrich my future research and help me in my prospective career. I am mentoring three M.Phil. researchers at the PCMD, ICCBS, University of Karachi, and certainly this training will help me to connect these young researchers, who are just entering in the field of crystallography, to the leaders in the field.

I will hopefully help the young researchers in Pakistan and at SESAME to support each other scientifically, personally, and encourage them to do best in science, because we really need to train them, to accomplish and achieve their full potential of science and this is particularly the main goal of SESAME.

Science demands so much hard work, dedication and time. So by hard work, every person that is trying to discover and understand some smaller piece will be a component of this larger piece of the puzzle that is called science, and together we have huge ability to change the world.

*Advice to fellow applicants: My fellowship was started from 1st October 2018, and I was supposed to join MAX IV on this date, but because of delay in visa process and then getting NOC from my Uni versity, I joined on 16th November 2018, and this resulted in a loss of time. Out of 4 months fellow ship period, I spent 1.5 months waiting for a visa and paperwork which left me with less time than I had hoped to complete my project