



ACTIVITY REPORTING FORM  
FOR ICSU/ISC GRANTS PROGRAMME 2016-2019

ACTIVITY REPORTING 2017-2020

NOTE THAT THE GRANT HAS BEEN EXTENDED TO LATE 2021 BECAUSE OF COVID

*To be sent to Grants Team (grants@council.science)*

Name of ISC body: International Union of Pure and Applied Physics (IUPAP)  
International Union of Crystallography (IUCr)

Title of activity: *Utilisation of Light Source and Crystallographic Sciences to Facilitate the Enhancement of Knowledge and Improve the Economic and Social Conditions in Targeted Regions of the World*

**1. Comment on the extension to 2021**

We thank ISC for the extensions of the Grant to 2020 and then to 2021 to enable the completion of the FAST Teams task. All other ISC funded activities have been completed.

The section Task 5: Faculty-Student (FAST Teams) at Partner Advanced Light Sources describes this project. As FAST Team visits become possible this section will be extended to indicate the additional institutions which have benefitted from the task. The task has also been extended by additional funding, but the ISC funds will be completely spent, currently in the hands of the ICTP Trieste which manages the program, as soon as possible.

**2. Summary of the project's main goals, findings and outcomes.**

LAAAMP is the acronym for Lightsources for Africa, the Americas, Asia and Middle East Project. The specific Targeted Regions were Africa, Mexico, Caribbean, Southeast Asia and Middle East. At the outset, the Executive Committee adopted an ambitious set of goals. They were as follows:

**I. Develop a Strategic Plan for each Targeted Region.**

The Strategic Plans would be based upon a variety of factors, including surveys of advanced light source and crystallography usage; the status of existing infrastructures; and government priorities, such as decisions to invest in these areas.

**II. Conduct an Advanced Light Source (AdLS)/Crystallography Colloquium Programme.**

This programme would send experienced researchers to the Targeted Regions and professional meetings around the world to advertise LAAAMP's programs and expose researchers to the advantages of employing AdLSs and crystallography in their research and training programmes. This would enhance their research



outputs and better their chances of contributing to the solving of many of their countries' socioeconomic challenges.

**III. Assist in Establishing Crystallography Training Schools in the Targeted Regions.**

The IUCr has partnered with UNESCO for a number of years in establishing IUCr-UNESCO OpenLabs in developing countries to train students in crystallography. Based upon that model and utilizing contacts made via the Colloquium Programme, the Executive set a goal to partner with IUCr and UNESCO to establish such crystallography training programmes in its Targeted Regions.

**IV. Publish and Disseminate an AdLS/Crystallography Informational Brochure.**

Many people, even senior researchers, are not aware of the many advantages of utilising AdLSs in their research and training. Thus, the Executive Committee decided to spread knowledge about both AdLSs and crystallography to researchers, governmental officials and the public. To target all groups, the Executive Committee decided not to publish the Brochure in highly technical language, but to explain the concepts in terms a layperson could understand.

**V. Send Faculty-Students (FAST) Teams to Partner AdLSs for 2-Month Visits, with some returning in subsequent years for another 2 Months.**

AdLSs are revolutionizing a myriad of fundamental and applied sciences, including agriculture, biology, biomedicine, chemistry, climate and environmental eco-systems science, cultural heritage studies, energy, engineering, geology, materials science, nanotechnology, palaeontology, pharmaceutical discoveries, and physics, with an accompanying impact on sustainable industry. Thus, the FAST Team Programme has the goal of reaching out to researchers in many fields and arrange for them to obtain hands-on experiences performing research at LAAAMP's AdLS partners.

**VI. Operate a Sample Mail-In Program for AdLS Data Acquisition.**

The goal of this programme, called Synchronizing Partners to Advance Research Characterization (SPARC), is to allow FAST Team researchers and others to continue utilizing AdLSs from their home institutions.

**VII. Present LAAAMP's Accomplishments at a High-Profile Meeting.**

**3. Thinking of the entire grant period, did the project achieved its main objectives?**

*Please include a description of the major outcomes/achievements and how they were achieved.*

The Executive Committee was able to achieve all its goals and more. The following provides a summary.

**Task 1: Strategic Plans**

A Strategic Plan has been developed for each Targeted Region. They can all be found on the LAAAMP Website at <https://laaamp.iucr.org/tasks/strategic-plans>. As an example of a Strategic Plan, we present below the highlights from that of Mexico.

**A. Short-Term Goals (within 3 years)**

1. Train large numbers of Mexican scientists, engineers, students and technicians in the design and utilization of advanced light sources (AdLSs).
2. Establish formal partnerships with existing international AdLSs.
3. Promote the involvement of industry.
4. Obtain the support of international high-profile persons, such as Nobel Laureates, University Presidents, and Filmmakers.
5. Build an AdLS public and media profile.
6. Promote outreach and communication around AdLS-based Science & Technology.
7. Enhance Mexico's critical feeder infrastructures that support research at AdLSs.
8. Advocate for the Mexican Strategic Plan to top governmental officials.



### **B. Long-Term Goals**

1. Continue all the Short-Term activities, as required.
2. Design and construct a latest generation AdLS in Mexico.

### **Task 2: Colloquium Programme**

The Colloquium Programme has sponsored numerous presentations about *LAAAMP*'s activities at institutions in the Targeted Regions and at conferences and other meetings around the world. We show two examples in Figs. 1 and 2.



**Figure 1. Sandro Scandolo at UNESCO's Opening 2019  
Ceremony of the International Year of the Periodic Table**



**Figure 2. Caribbean Academy of Sciences (CAS) General Meeting & Conference  
University of the West Indies, Mona Campus, Jamaica, 30 November 2018  
(left-to-right: Robert Lancashire, CAS Foreign Secretary; Tara Dasgupta, CAS Jamaica Chapter President; Winston  
Mellowes, CAS President; Sekazi K. Mtingwa, LAAAMP Chair of Executive Committee)**

For more information other presentations given under the Colloquium Programme, see <https://laaamp.iucr.org/tasks/colloquium-programme>.

### **Task 3: Crystallography Training Schools**

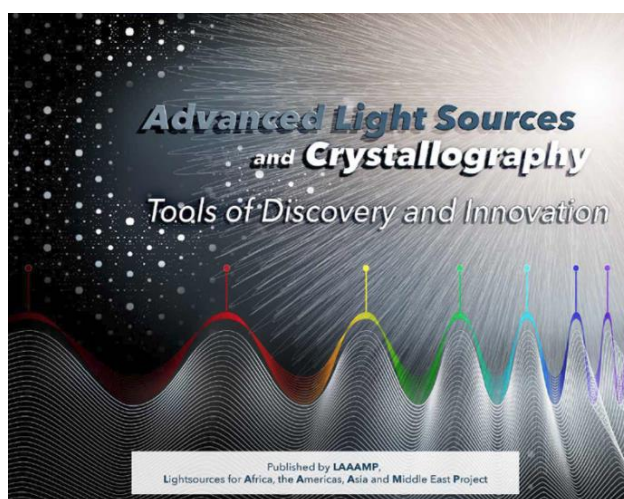
LAAAMP partnered with the IUCr and UNESCO in establishing crystallography training schools, called OpenLabs, in a number of countries, including Ghana, Côte d'Ivoire, Costa Rica, Senegal and Benin. The latter program was launched in Benin from the enthusiasm generated by the LAAAMP Colloquium Programme visit of Thierry d'Almeida, who is originally from Benin and at the time was employed at France's CEA (Atomic Energy Commission). His visit caught the attention of Benin's President, who personally met with D'Almeida and pledged his government's financial support for establishing a crystallography training program, which became known as X-TechLab. With that governmental support and that of LAAAMP, X-TechLab provides training for approximately 100 African students, twice per year in May and November, with roughly half the students from Benin and half from other African countries. The instruction is divided into two parts:

1. Crystallography and X-ray Techniques
2. Tomography and Mathematical Engineering.

D'Almeida is the Project Leader and the Coordinator of X-TechLab is Marielle Agbahoungbata, who is a Member of the LAAAMP Executive Committee. The Scientific Advisory Committee is chaired by Michele Zema, who is Chair of the LAAAMP Executive Committee. For more information, see <https://www.xtechlab.co/>.

### **Task 4: LAAAMP Informational Brochure**

The goal of the Brochure, whose cover is shown in Fig. 3, is to explain advanced light sources and crystallography to a broad audience, including the general public, governmental officials who are responsible for funding science and



**Figure 3. LAAAMP Informational Brochure**

technology facilities, university professors, and secondary school science teachers and their students.



Ian Swainson, who is from the Division of Physical and Chemical Sciences in the Department of Nuclear Sciences and Applications at the International Atomic Energy Agency (IAEA), arranged for his colleagues to translate the Brochure from English into several other languages; hence, the Brochure is available in five languages: Arabic, English, French, Portuguese and Spanish. It is available for download in these languages at <https://laaamp.iucr.org/tasks/brochure>. In addition, hard copies are available upon request from the Editor, Ernie Malamud, who is a retired staff physicist from Fermi National Accelerator Laboratory in the USA. His contact information is at the preceding Weblink.

#### **Task 5: Faculty-STudent (FAST Teams) at Partner Advanced Light Sources**

The FAST Team Programme has sent thirty-five (35) FAST Teams for two (2) months of training at LAAAMP's Partner AdLSs. Those Partners include the following:

1. Advanced Light Source, Lawrence Berkeley National Lab (Berkeley, CA, USA)
2. Advanced Photon Source, Argonne National Lab (Outside Chicago, IL, USA)
3. ALBA Light Source (Barcelona, Spain)
4. Australian Synchrotron, Australian Nuclear Science & Tech Org. (Outside Melbourne, Australia)
5. Canadian Light Source (Saskatoon, Saskatchewan, Canada)
6. DELTA Light Source (Dortmund, Germany)
7. Elettra Light Source (Trieste, Italy)
8. European Synchrotron Radiation Facility (ESRF) (Grenoble, France)
9. MAX IV Laboratory (Lund, Sweden)
10. National Synchrotron Light Source-II, Brookhaven National Laboratory (Long Island, NY, USA)
11. Photon Factory, Institute of Materials Structure Science, KEK (Tsukuba, Japan)
12. Pohang Accelerator Laboratory (Gyeongbuk, South Korea)
13. SESAME Light Source (Allan, Jordan)
14. Siam Photon Source, Synchrotron Light Research Institute (Nakhon Ratchasima, Isan, Thailand)
15. SLAC National Accelerator Laboratory (Stanford University, Menlo Park, CA, USA)
16. Taiwan Photon Source, National Synchrotron Radiation Research Center (Hsinchu, Taiwan).

To be eligible to lead a FAST Team, one must (1) be a faculty member at a university in Africa, Mexico, the Caribbean, Southeast Asia or the Middle East, (2) be interested in using AdLSs to further one's research and training endeavors, (3) have a year or less of previous experience using AdLSs, and (4) have the ability to spend 2 months as a full-time visitor in residence at a LAAAMP Partner AdLS. That faculty member must be accompanied by a full-time Ph.D. student.

As for the financial support, LAAAMP provides 1,818 Euros per person [plus 182 Euros administrative cost paid to Abdus Salam International Centre for Theoretical Physics (ICTP)] to cover transportation and partial accommodation costs. The remainder of accommodation and subsistence must be negotiated with the host AdLS and other sources of support.

During 2017-2019, thirty-five (35) FAST Teams completed their visits to LAAAMP's Partner AdLSs for training. Because of the COVID-19 pandemic, four (4) ISC-funded FAST Teams were not able to complete their training before the end of 2019, and nine (9) others funded from other sources for 2020 are on hold, for a total of thirteen (13) FAST Teams scheduled for 2021. Thus, by the end of 2021, it is anticipated that LAAAMP will have sent forty-eight (48) FAST Teams to AdLSs for training, for a total of ninety-six (96) FAST Team Individual Awardees.



A highlight of the FAST Team Programme is that Kirsi Lorentz and student, Grigoria Ioannou, Award Recipients for 2017 and 2018, were the first to perform an experiment at the new SESAME AdLS in Jordan. Fig. 4 shows Lorentz and other members of her research team.



**Figure 4. Kirsi Lorentz and her research team (left to right: Yuko Miyauchi, Grigoria Ioannou, Kirsi Lorentz and Iosif Hafez) at SESAME's XAFS/XRF beamline control hut**  
(© Kirsi Lorentz, The Cyprus Institute)

For more information on the FAST Team Programme, see

[https://laaamp.iucr.org/data/assets/pdf\\_file/0017/146141/Call-for-2020-FAST-Team-Applications.pdf](https://laaamp.iucr.org/data/assets/pdf_file/0017/146141/Call-for-2020-FAST-Team-Applications.pdf).

#### **Task 6: SPARC Sample Mail-in Program**

SPARC is the acronym for Synchronizing Partners to Advance Research Characterization. The program was recently launched for LAAAMP by Tabbetha Dobbins, who is Associate Professor of Physics and Astronomy, Acting Vice-President for Research, and Dean of Graduate Studies at Rowan University in the USA. SPARC assists with the following:

1. Understanding sample requirements
2. Understanding available techniques
3. Writing of beamtime proposals
4. Providing a list of mail-in sample programs around the world.
5. Providing funds to ship samples to AdLSs for remote data acquisition.

For details on applying to the program, see <https://laaamp.iucr.org/headlines/sparc>. The response times to applications is typically 2-3 weeks, and access to measured data could take up to 6 months.

#### **Task 7: Presentation of LAAAMP's Accomplishments**

To conclude the ending of its ISC-Funded Programmes, LAAAMP's Sekazi K. Mtingwa, then Chair of the LAAAMP Executive Committee, presented a summary of LAAAMP's accomplishments during the Thematic Session on *Basic*



*Sciences Infrastructures for Ethical and Responsible Collaborative Development*, co-organized by IUPAP, IUCr and Abdus Salam ICTP during the World Science Forum 2019, Budapest (Hungary), 20-23 November 2019. See Fig. 5. Michel Spiro, President of IUPAP, and Michele Zema, then Member and currently Chair of the *LAAAMP* Executive Committee, were Co-Moderators of the Thematic Session.



**Figure 5. Sekazi K. Mtingwa Presenting *LAAAMP*'s 3-Year Accomplishments at the World Science Forum, Budapest, Hungary, 22 November 2019**

**(Seated left-to-right: Sumaya bint El Hassan, President of the Royal Scientific Society of Jordan; Michele Zema, Member of *LAAAMP* Executive Committee; Michel Spiro, IUPAP President-Designate)**

**4. How the thematic focus of the 2016-2019 Grants Programme, i.e. science education, outreach and public engagement, was addressed?**

Advanced Light Sources (AdLSs) are among the most multidisciplinary and transformational scientific tools available, empowering studies in a myriad of disciplines, including biology, chemistry, energy, environment, geoscience, materials science, medicine, paleontology, and physics. Several Nobel Prizes have been awarded for research performed at AdLSs, often using crystallography. Thus, *LAAAMP* undertook an ambitious set of goals to train a substantial number of faculty and graduate students in the utilization of AdLSs and crystallography. Once the pandemic is lifted and *LAAAMP* completes the training of its current cohort of FAST Teams at Partner AdLSs, approximately 100 *LAAAMP* FAST Team awardees will have completed two months of training. Moreover, hundreds of students have been trained at IUCr-UNESCO-*LAAAMP* crystallography training schools. As for mobilising resources for international scientific collaborations, the FAST Teams have established many long-term collaborations with researchers at the Partner AdLSs. Finally, the Informational Brochure describing AdLSs and crystallography, the Colloquium Programme presentations, and meetings with numerous governmental officials have made a tremendous impact on outreach and educating the public about AdLSs and crystallography and how they can have a major impact on their countries' socioeconomic development.

**5. How the project supported ICSU/ISC strategic priorities as defined for the grants programme?**

In the ICSU Strategic Plan II, 2012-2017, the following strategic priorities are enunciated: (1) Planning and coordinating research, (2) Science for policy activities, (3) Strengthening the Universality of Science, and (4) Structure-Function issues. AdLSs have introduced an entirely new paradigm of research protocol, whereby researchers can either perform their research at the facility, or have the convenience of mailing in samples for others to acquire their data or for them to operate the instrumentations remotely. The FAST Team and SPARC



programmes have taken full advantage of this new research paradigm and have pushed planning and coordinating research to an entirely new level. The Colloquium Programme has been instrumental in promoting science for policy activities. It has generated a number of crystallography training schools in its Targeted Regions, which have fostered international governmental collaborations. As for strengthening the universality of science, the Brochure and Colloquium Programmes have worked with the ISU Regional Offices to disseminate educational materials and opportunities that have fed directly into the FAST Team Programme and Crystallography training Programmes. Regional Committees were established in each Targeted Region, which worked directly to educate the public, as well as solicit and evaluate applications for LAAAMP's Programmes. Finally, structure-function issues were directly addressed by a well-managed, up-to-date Website (<https://laaamp.iucr.org/>) that informed readers about LAAAMP's Programmes and the latest news about its activities. Moreover, led by IUPAP and IUCr, LAAAMP worked closely with numerous partners to achieve its goals, including sixteen (16) Partner AdLSs, UNESCO, Abdus Salam ICTP, and various physical societies.

**6. Describe the value of collaborative partnerships and benefits to the scientific community and other stakeholders.**

One of the most important attributes of AdLSs is that they can accommodate many researchers conducting experiments simultaneously. Since they are typically hundreds of meters in circumference, the number of experiments possible is limited mainly by the funding available to construct new beamlines, which typically number in the tens up to roughly a hundred. Thus, advanced light sources are truly multidisciplinary facilities and a breeding ground for revolutionary ideas, often leading to Nobel prizes. Hence, LAAAMP has seized upon the advantages of AdLSs and crystallographic sciences and forged research opportunities and collaborations with AdLS scientists for the benefit of FAST Team Awardees in the Targeted Regions. Many of the research results, as described in a number of refereed publications that have been generated, will make important contributions to the socioeconomic development of the countries in which the researchers reside.

**7. Describe the planned follow-on activities in relation to the research undertaken, its results and future implications.**

LAAAMP's programmes will continue to train university faculty and students in all aspects of AdLSs and crystallography, as well as engage the public and governmental officials in discussions about the role that AdLS and crystallographic sciences could play to improve their countries' educational institutions, economies, social structures, health and world competitiveness. All of LAAAMP's programmes will continue to be enhanced and expanded when possible. As an example, the Executive Committee has decided to expand LAAAMP's activities to the Pacific Islands. The new name will be *Lightsources for Africa, the Americas, Asia, Middle East, and the Pacific*; thus, the acronym will not need to change. Soon a *Call for Applications* will be issued for FAST Teams from the Pacific for visits to AdLSs during 2021, provided the pandemic will have abated. We anticipate reaching the goal of having funded 100 FAST Team Awardees before the end of 2021, which would be a remarkable achievement. In addition, LAAAMP is partnering with the IAEA, ICTP, SESAME AdLS in the Middle East, and Italy's Elettra AdLS to offer a workshop during 2021 on AdLS accelerator physics and beamline techniques.

THE FUTURE IS BRIGHT FOR LAAAMP!!