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FAST training programme at synchrotron facilities by IUPAP-IUCr LAAAMP project

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Synchrotron Light Sources are the most sophisticated example of an open and multidisciplinary research infrastructure. They have revolutionized research in many science and technology disciplines, leading to a proliferation of facilities worldwide. These, in turn, have facilitated the creation of international scientific communities, improving education and creating new job opportunities, successfully contributing to the socio-economic development of countries and regions. Because of their high costs and multidisciplinary use, synchrotron facilities provide strong opportunities for integration through networking and cost-sharing, and promote multi-disciplinary collaboration with the wider global community, while promoting science diplomacy and peace at large. Thus, light sources have become prime enablers of scientific and technological progress and innovation.

The website lightsources.org has links to some 47 Advanced Light Source (AdLS) facilities in 23 countries in various stages of operation, construction or planning, with some regions being poorly represented (e.g. Latin America and the Caribbean and SE Asia) or not represented at all (Africa). Discussions have started towards the establishment of facilities in those regions, while learning from the experiences of the Brazilian LNLS and SESAME.

Within this framework, the IUPAP and the IUCr have developed a programme named ***LAAAMP*** (***L****ightsources for* ***A****frica, the* ***A****mericas,* ***A****sia and* ***M****iddle East* ***P****roject*), funded by the 2016-2019 ICSU Grants Programme, to promote AdLS-related science in such regions, and focusing on training young researchers, reaching out to professionals, and engaging the public and governmental officials in discussions about the role that AdLSs could play to improve their countries' educational institutions, economies, social structures, health and world competitiveness.

One of the main tasks of *LAAAMP* is the training programme for FAculty-STudent (FAST) teams from targeted regions (namely, Africa, the Caribbean, Mexico, SE Asia or the Middle East) to spend two months at partner AdLSs. The participation of a professor accompanied by his/her PhD student in the training programme makes the experience more challenging and rewarding for the awardees, and, at the same time, proves very efficient in terms of continuation of the activities even after the mobility period. Awarded FAST teams are requested to provide a description of the research conducted, including any resultant publications, and an evaluation of the non-scientific aspects of the visit. The programme also includes the possibility for awarded FAST teams, who have been successful during their first visit, to apply for continuing grants.

Details on the *LAAAMP* FAST training programme are at https://laaamp.iucr.org/calls.

Keywords: researchers' mobility, training, synchrotron

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Crystallographic education in Kazan

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The study of the basic concepts of crystal chemistry is a part of the curriculum of Kazan Federal University. Students of this university are studying at Arbuzov Institute of Organic and Physical Chemistry, FRC Kazan Scientific Center of RAS, where unique crystallographic equipment is available: two single-crystal diffractometers and one powder diffractometer. Third-year students come with a guided tour. They watch how the selection of samples suitable for single-crystal X-ray diffraction is carried out, and how do experiments conducting. At the same time, students assigned to synthetic laboratories are encouraged to grow good single crystals of their samples and return with them on the 4th year of study for a full research at a practical lesson. As a rule, 2-3 people from the group bring their samples, which's amount is sufficient for both single-crystal and powdered X-ray diffraction. The best single crystal is selected, then the experiment is conduct and data is collect to determine the parameters of the crystalline cell within the APEX program. At this stage, students master the concept of crystal systems. Next, the main experiment is launched. During the data collecting, students are invited to use the CCDC to search for X-Ray data for structural analogues of their coursework objects. At the end of the experiment, the entire group of students participate in the process of solving and refining the structure by the programs integrated into the APEX package: SHELXS, SHELXD, SHELXT. At this stage, students become acquainted with the concepts of crystallographic symmetry elements and space groups. Further, after successful refinement and obtaining the final cif file, a group of students proceed to work on a powder diffractometer and examine the same sample. The obtained experimental diffractogram is compared with the one calculated from the results of single-crystal X-ray diffraction and a conclusion is made about the polymorphic homogeneity (or inhomogeneity) of the sample. For memory of the workshop, students carry out a cif-file obtained directly with their participation, which they can view using the popular Mercury program. Practical work in the X-ray laboratory is a favorite among students, rapid definition of the structure and spectacular visualization of the received data is a kind of fascinating "trick", which they remember for a long time.

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Keywords: crystal chemistry, education, workshop