

## **Report following T. d'Almeida's trip to Benin as part of the LAAAMP Colloquium Programme**

### **Context**

As part of the LAAAMP Colloquium Programme, I traveled to Benin from April 30 to May 7 in order to deliver a series of talks and lectures about 1) Advanced Light Sources, 2) related techniques and their relevance to specific issues of interest in Africa, and 3) my own synchrotron-based research.

Initially, the lectures were to be held over 2 days (May 4 and 5) at the Institut de Mathématiques et Sciences Physiques (IMSP) in Porto-Novo, one of the major universities of the country. Just before my departure from France, I was asked by the local Organization to schedule two additional lectures on May 2 and 3 at the Université de Abomey-Calavi (UAC) in Cotonou as part of a Workshop on Crystallography which was organized during the same period.

### **Workshop and lectures**

The first workshop was attended by about 75 students and faculties from various fields, mostly biochemistry, physics and chemistry. There were 4 speakers from Algeria, Benin and Cameroun. Most lectures were about crystal symmetry and space groups. Each lecture was followed by assignments and Labs.

My first talk was an overview of the LAAAMP. My second talk was a summary of an introductory lecture on synchrotron radiation (a full introductory lecture (~2 hours) was scheduled at the IMSP). I was able to point out practical use of synchrotron techniques and specific applications in biochemistry, agriculture, material science. I think my second talk served as a teasing for the next workshop, because I noticed that most of those attending the first workshop also attended the second one.

Most faculties and students were totally unaware of the Faculty- Student Team (FAST) programme which aroused considerable interest among them.

During the second workshop at IMSP (~150 attendants) I delivered one talk and 4 technical lectures over two days.

The first talk was a general presentation of the LAAAMP. For this overview, I used some of the slides from Sekazi's talk at the APS March meeting. Also, I included materials from the LAAAMP brochure and insisted on why it is important for Africa to have an Advanced Light Source facility. This was emphasized through specific examples on the biology of diseases, earth science and agriculture, energy, education and research. Finally, I stressed the importance of the recognition of the African contribution to the global scientific efforts.

A very animated discussion followed that first talk. Most people appeared to be discovering that a synchrotron facility is not a remote instrument used for particles or nuclear physics far from the daily concerns of people in Africa. They realized that Light Sources were a "tremendous benefit to many countries' socioeconomic development" and that it is vital for Africa that such facility be built somewhere on the continent in the near future.

Then I proceeded with the next talk titled "Advanced Light Sources: A Worldwide State of the Art" which included a brief history of X-rays from the early discoveries at the end of the 19<sup>th</sup> century to

the advent of the first cyclotrons, the discovery of the power of synchrotron radiation, its early use in parasitic modes in first and second generation synchrotrons and finally the advent of third generation synchrotrons. This historical introduction seemed to captivate the audience and made the remaining of my lecture easily digestible when it came to more technical descriptions of modern synchrotrons: Guns, LINACs, Boosters, Storage rings, electromagnets, insertion devices, optics, etc...I was actually surprised by the focus of the audience and their interest in gaining good insight in notions such as Flux and Brilliance

The title of my third lecture was “Overview of experimental techniques with advanced Light sources”. It covered X-ray scattering (both elastic and inelastic), Spectroscopy (absorption and fluorescence X – ray emission) and Imaging. This was a two and half hour course. Specific examples of applications were provided. Again, the course was very interactive. We had extensive discussion on how to address one of the studies underway at the Chemistry Department at UAC through synchrotron microtomography. It was about understanding the mechanisms governing catalytic deactivation, as one local research team is developing a novel photo-catalyst which showed very promising results for decontaminating polluted waters...

I finished the series of lectures with my own studies titled “Synchrotron Radiation: a powerful tool for investigating matter under dynamic compression” which included the development of various experimental configurations for time-resolved X-ray diffraction measurements, the study of shock-induced polymorphic phase transitions through synchrotron X-ray diffraction experiments and photocrystallography experiments at the ESRF and DIAMOND.

### **People I met**

Besides all the students and faculties I interacted with over the workshops, I had meetings with:

- The staff of the UAC Chemistry Department
- The vice-chancellor of the UAC, Professor AVLESSI
- The director of the IMSP , Professor TODJIHOUNDE and several Faculties
- The Chair of the Société Ouest Africaine de Chimie (SOACHIM), Professor Emeritus SOHOUNHLOUE
- The Commissioner of Education (*Recteur in French*) of the University of BOUIRA (Algeria), Member of the Algerian Academy of Science and Technology, Professor N. BENALI-CHERIF, who was one of the speakers at the UAC Crystallography Workshop
- Professor VILLANI who is Chair of the IMSP Scientific Advisory Board, appointed by the World Bank, and Member of the French Assemblée Nationale
- Ms. Claude BORNA, Scientific Adviser of President TALON

### **Specific Actions and Prospects**

- Professor EZIN who was my local contact and spent considerable amount of time with me throughout my stay in Benin suggested introducing some synchrotron-related subjects in the curriculum at the IMSP starting from school year 2019-2020. We will be working on this matter in order to define the content and volume of these courses;
- I setup a local AfLS Working Group composed of 5 faculties from the Chemistry and Physics Departments: Dr M. AGBAHOUNGBATA, Dr S. BONOU SOUROU, Dr A. CAKPO, Dr W.

KANGBODE and Professor E. SAGBO. Their main task is to disseminate further synchrotron science among the students and to identify specific studies of interest for the local and West African scientific communities that could be submitted as proposals within the framework of the FAST Programme. These are extremely dedicated scientists who take this Working Group very seriously. They will be reporting to me on a monthly basis.

- I asked Professor BENALI to spread news about the LAAAMP back in Algeria, which he already started to do at the 9<sup>th</sup> Conference of the Algerian Society of Chemistry which took place last week at the University of Alger. In his last email to me, he wrote that the Project was very enthusiastically received among the Algerian Scientific Community.
- Claude BORNA has reported our meeting to President TALON of Benin. He is willing to get further information from me, if possible during one of his visits in France. Claude asked if we could arrange the details next week in Paris, as she will be attending the VIVATECH meeting.
- The Head of the Chemistry Department of UAC invited me to present the LAAAMP at the next Conference of the Société Ouest Africaine de Chimie (SOACHIM) scheduled in August in Lomé (Togo). The SOACHIM is one of the regional organizations preparing for the upcoming Panafrican Crystallography Society which will be officially launched at a Congress scheduled in Ghana in 2019. I am not sure if I can attend the meeting in August, but I think some action should be taken in order to present the LAAAMP to people attending this meeting.

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### **My overall feeling**

My overall feeling is that my trip to Benin was important. Most people I met (and these were scientists) had only a vague idea about Advanced Light Sources and were almost totally unaware of the LAAAMP initiative. I believe that the information will spread further thanks to the new awareness among the scientific community and to the commitment of the local Working Group.

My biggest satisfaction came from the young students that I met during my stay in Benin. I have been impressed and deeply moved by their thirst of knowledge, their determination to grab the opportunity of the prospect of an AfLS as a way to play an active role in science.