



THE AFRICAN LIGHT SOURCE

Towards a Light Source for the African Continent

NEWSLETTER



April 20, 2020



Cover Image (above) is a photo of the European Synchrotron Radiation Facility (ESRF) located in Grenoble, FRANCE

Photo is courtesy of Stef Candé.



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AfLS Steering Committee Chair's Comment

Written by Simon Connell

Welcome to the second edition of the African Light Source Newsletter, keeping you in touch with the AfLS related activities, supplementing our web-pages, blog and social media pages.

The AfLS is a home for all individuals and organizations whose vision includes a light source for Africa. It brings coherence and a common unified voice to the AfLS project. It enables the inclusivity beyond an African base, bringing in all global players, while still establishing a primary Africa-lead and Africa-inspired energy towards the vision.

The **Coronavirus pandemic** is the most serious new threat to world health to emerge this century. It will profoundly change our lives forever. We are living in very historic times. It is an unseen enemy, both because it is submicroscopic, and because asymptomatic victims are unknowingly infections. **Light Sources** have been regarded by many governments as a crucial frontline service, and have therefore been kept open, specifically to fight the coronavirus. We are chronicling the contribution of Light Sources to the targeted search for a vaccine or cure. Some of the articles we report on appear in the feature article "The Coronavirus: Synchrotrons and Cryo-EM to the Rescue" on page 3 of this Newsletter.

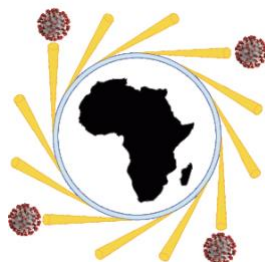
In light of the recent COVID-19 responses, there has been a myriad of activity, both at light sources and as it relates to our research pursuits and conferences. We hope that you are enduring and maintaining a safe and healthy environment for both your family (home life), co-workers (for those essential works who cannot work from home), and surroundings with all those you might encounter. This issue of the AfLS Newsletter brings you exciting information about the utility of light sources in fighting the COVID-19 virus, response of light sources around the world in opening their facilities to study the crystallographic structures related to finding vaccinations and cures, as well as updates from our LAAAMP partners. We are especially pleased to feature the article "Industry @ Light Sources" written by executive steering committee member, Edward Mitchel (ESRF). Ed states the important role that industry plays for light sources and that light course play for industry—highlighting that the African Light source could have far-reaching impacts.

We present the AfLS organizational chart and are excited to have added members with brand new involvement with the AfLS project on our Conceptual Design Report Team and our International Organizing Committee. New members on our Conceptual Design Report team includes: Muaaz Bhamjee (University of Johannesburg); Christine Darve (European Spallation Source); Kenneth Evans-Lutterodt (Brookhaven National Laboratory's NSLS-II); Dorian Bohler (Stanford Linear Accelerator Center); Genito Maure (Eduardo Mondlane University); Joseph Daafuor (University of Ghana-Legon); and Benson Frimpong (University of Ghana-Legon).

New members on our International Organizing Committee includes: : Abram Ledbetter (Brookhaven National Laboratory); Michel Fodje (Canadian Light Source); Peter Ngene (Utrecht University); Diouma Kobor (University Assane Seck of Ziguinchor); Saphina Biira (Busitema University); Bjorn von der Heyden (Stellenbosch University); and David Dodoo-Arhin (Univ. of Ghana-Legon).

To all new members, we welcome you to the project and are excited for your contributions.

We hope you enjoy reading our newsletter. Feel free to provide us with feedback using our web portal: <http://www.africanlightsource.org/>. Follow us on Twitter: @AfSynchrotron and on Facebook: @AfricaLightSource.



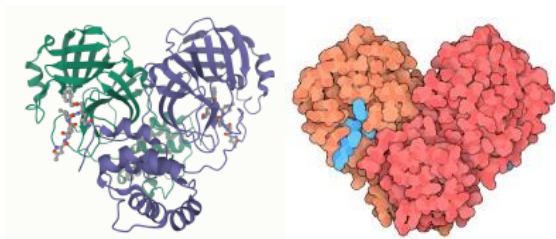
The Coronavirus: Synchrotrons and Cryo-EM to the rescue- Now with Updates!

Written by Simon Connell

A terrible deadly coronavirus epidemic has gripped many countries, and its tentacles are spreading out to ever more countries. The World Health Organisation has just escalated its terminology to announce that the global risk of the outbreak spreading is “very high”. This is just short of a pandemic. Perhaps by the time you read this blog, things may have worsened further and it will have really become a pandemic. We are looking to science to save us. Indeed, we are seeing unprecedented sharing of scientific information. Hopefully all stakeholders can realise that holding back information for future commercial gain may be absolutely counter productive.

What is the role here of the light source ?

The Protein Data Bank (PDB) has the main protease from the coronavirus, which causes the disease COVID 19, as its structure of the month, for February 2020. This is significant because one of the very first important steps in understanding the coronavirus and developing a vaccine, or any medical counter-measure, is to obtain structural information at the molecular level, even atomic resolution, which “helps to elucidate protein function and, in particular, the mechanisms of enzymes. This understanding inspires the design of new drugs”. This quote is also a major motivation for Africa to have its own light source “[Why Africa needs a Light Source](#)”.



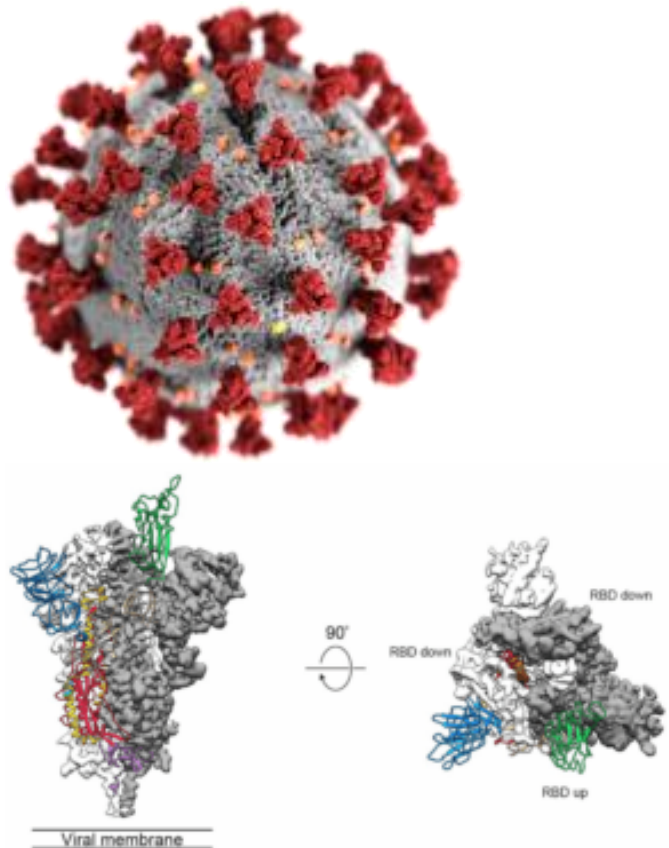
Images from

<https://www.rcsb.org/structure/6LU7> and <https://pdb101.rcsb.org/motm/242>

This is a protease molecular structure obtained from X-Ray diffraction data by the team of Liu, X., Zhang, B., Jin, Z., Yang, H., Rao, Z. and it is still to be published, however its early release in the PDB can aid the search for a vaccine. Function flows from form, to some large extent, and so such information is vital to understanding the new virus. One can look for similarities to other similar protease structures from other viruses, and this can suggest

treatments that may work in similar cases, or one can be inspired to develop completely new treatments.

An equally important source of structural information to X-Rays is the complementary method of Cryo-EM. This new class of electron microscope can also reconstruct near atomic scale resolution 3D images of large biomolecules. These facilities are sometimes made available at light sources using a similar access model to a regular beam line facility.



Images from [Wikipedia](#) and [Science](#)

Above is a protein spike (right) from the coronavirus (left). This structure was obtained by Wrapp D., Wang N., Corbett K.S., Goldsmith J.A., Hsieh C-L., Abiona O., Graham B.S. and McLellan J.S. and is already published in the Science link above. The protein spike participates in the attachment and infection process as the virus approaches and interacts with human cells. Once again, an understanding of its structure and function can lead to the development of complex molecules that will inhibit its function, thereby acting as a vaccine.

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These are two examples of structural studies so far, and they spawn many “educated guesses” which ultimately lead to further studies and new knowledge, then ultimately to the development of medical counter-measures. In due course, subjecting the virus to the scrutiny of science and such high precision will lead to the development of a treatment, much as it has done in so many other cases. Let’s hope it can be fast.

A quick scan of some light source action and the coronavirus re-enforces the role of light sources :

ESRF : [Structural view of coronavirus cell entry and neutralisation](#)

APS : [Trying to stop coronavirus](#)

APS : [New coronavirus protein reveals drug target](#)

SSRF : [A pan-coronavirus fusion inhibitor targeting the HR1 domain of human coronavirus spike](#)

BSRF : [Structure of Main Protease from Human Coronavirus NL63: Insights for Wide Spectrum Anti-Coronavirus Drug Design](#)

Petra III : [Structural Characterization of Human Coronavirus NL63 N Protein](#)

====>Update : [LightSources.org](#) is now maintaining a database of the effort from Light Sources.

====>Update March 3rd, 2020: Light Sources seen as an **ESSENTIAL SERVICE**, some remaining **OPEN** for **RESEARCH** to fight the **Coronavirus**.

Call from NSLS II : With this in mind, NSLS-II is offering a streamlined and expedited rapid access proposal process for groups that require beam time for structural biology projects directly related to COVID-19. The [Center for Biomolecular Structure](#) team is supporting remote macromolecular crystallography experiments at Beamlines [17-ID-1 \(AMX\)](#) and [17-ID-2 \(FMX\)](#) in this research area. In order to submit a macromolecular crystallography proposal for COVID-19 related research, please use the [COVID-19 Rapid Access form here](#). For proposal questions, please contact Nancye Wright at nsls2user@bnl.gov. For scientific and/or beamline guidance, please contact Sean McSweeney at smcsweeney@bnl.gov. We also hope that policymakers and the general public can learn that we need to invest in top quality human capacity development and the establishment of significant facilities. This must be in the context of a culture of new knowledge generation for the common good, where work like this can be carried out.

⇒ Update March 8th, 2020: Light Sources seen as an **ESSENTIAL SERVICE**, some remaining **OPEN** for **RESEARCH** to fight the **Coronavirus**. See also for Europe (open to the world):

- light sources: <https://leaps-initiative.eu/leaps-facilities-research-on-sars-cov-2/>

- neutron sources: <https://www.lens-initiative.org/2020/03/27/lens-fighting-covid-19-how-neutrons-will-contribute/>

⇒ Update March 8th, 2020: Light Sources seen as an **ESSENTIAL SERVICE**, some remaining **OPEN** for **RESEARCH** to fight the **Coronavirus**

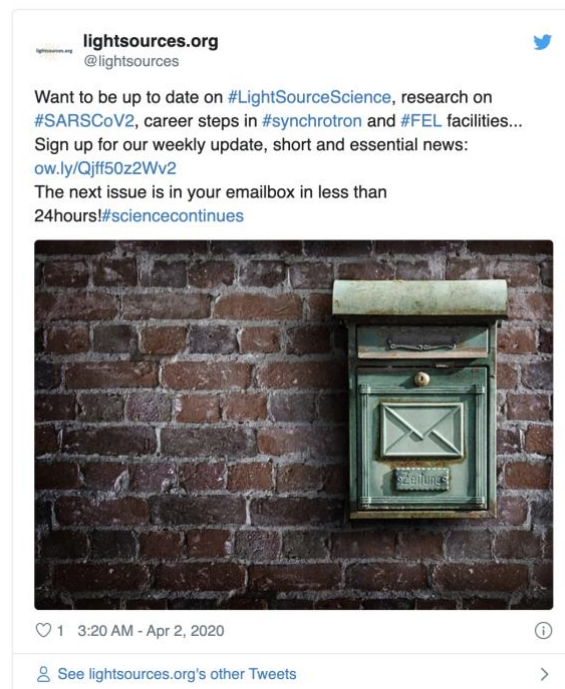


Image of the twitter feed of Lightsources.org (@Lightsources) captured on April 2nd of 2020.

⇒ Update 9/3/2020: Excellent article just appeared as the editorial of the IUCr Newsletter 2020 28/1.

- [Visualizing an unseen enemy; mobilizing structural biology to counter COVID-19](#)

⇒ Update 11/3/2020: Example of structure based proposal for the action of the Remdesivir antiviral drug

- The [paper on the BioRxiv](#) “structures provide critical insights into the working mechanism of viral RNA replication and a rational template for drug design to combat the viral infection”.

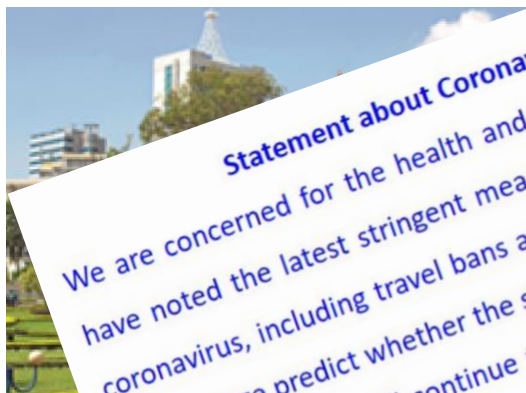
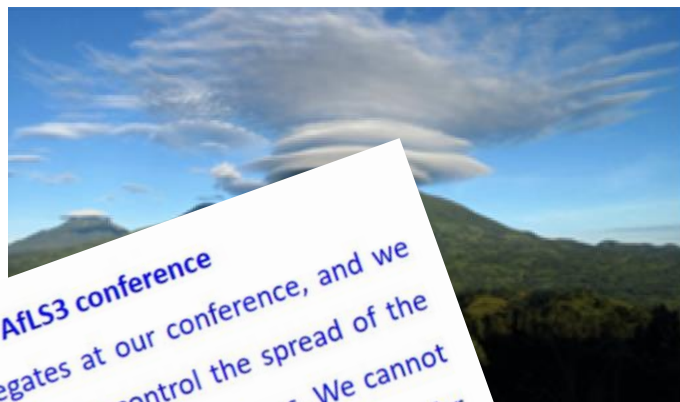


3rd African Synchrotron Light Source Conference AfLS3 : towards a brighter future



AfLS3 CONFERENCE

Save-the-date for the 3rd African Light Source Conference Nov 16th-21st, 2020. The conference will be held in Kigali, Rwanda and hosted by the International Centre for Theoretical Physics (ICTP)/ East Africa Institute for Fundamental Research (EAIFR) located at the University of Rwanda (UR), College of Science and Technology. Abstracts can be uploaded at: <http://afls3.africanlightsource.org/>



Statement about Coronavirus situation for AfLS3 conference

We are concerned for the health and safety of the delegates at our conference, and we have noted the latest stringent measures almost worldwide to control the spread of the coronavirus, including travel bans and extensive personal isolation procedures. We cannot at this stage predict whether the situation will be resolved by November which is rather far in the future. We will continue to plan as if the conference will take place, reviewing the situation continuously, providing a decision by May 8 2020. We will continue to raise funds, and these will be held until the conference takes place. If we do postpone AfLS3, then we would postpone by a year, targeting the 3rd week in November as usual, for the AfLS Conference series.

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Check Back on the Conference Website after May 8th 2020 for FURTHER UPDATES!

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Additionally, Biostruct-Africa will organize a workshop at AfLS3. More details coming on this workshop and another at the 11th African Congress of Immunology, Lilongwe-Malawi (November 2020)! Visit <http://biostructafrica.org/upcoming-workshops> for updates.

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See details of the Organizational Chart at: <http://www.africanlightsource.org/organizational-chart/>

Industry @ Advanced Light Sources

Written by Edward Mitchell (ESRF, Head of Business Development)

Not just ubiquitous research infrastructures for academics, advanced light sources are used increasingly as tools for R&D, driving forwards innovation for enterprises and industry across advanced and developing economies across the world.

Structural biology has long been the mainstay of industrial use of light sources with its daily use in drug discovery pipelines within pharma and biotech companies. Nowadays, all medium and high-energy synchrotron light sources provide services for pharma through easy-to-use remote access and mail-in protein crystallography services. However, much effort has gone into creating these routine, cost effective services, with common standards and developments, and benefits spill over from the industrial service drivers to also support the public access/peer review programmes.

But other techniques are seeing increasing commercial demand with use by industry in areas such as aerospace, agriculture and food, medtech, consumer products, energy, engineering and metallurgy, nanotech and catalysis, to name but a few.

One such technique is synchrotron X-ray imaging, be it 3D or 4D or even 5D computed tomography (CT) or ultra-high-speed radiography, with its broad applicability to a huge range of raw material production, manufacturing, product ageing and recycling. Synchrotron micro-CT is now on the cusp of emerging into such a regime of democratised commercial access mirroring protein crystallography. Powder diffraction, SAXS/WAXS, IR spectroscopy, XPS, X-ray spectroscopy and X-ray microscopy are also requested regularly by industrial clients of the light sources.

Per sample costs are often at levels that most companies, small or large, can afford, with light sources generally charging at costs recovery to stimulate industrial use.

The speed enhancement due to the new style MBA lattice storage rings with extremely high brilliance, such as the ESRF's EBS ring and with others to follow throughout the world, should enable remarkable throughput allowing libraries of hundreds or thousands of samples, such as medical samples, mineral samples from mining or catalysts to be scanned at newly cost effective levels. This will require a technological innovation at the beamlines, already underway at across



Photo of ESRF's highly automated protein crystallography beamline, ID30B, used by pharma to support drug discovery. Credit: ESRF/S. CANDE.

the world; putting robots to work on the beamline for sample manipulation

and changing, to put in place streamlined experiment workflows and metadata models and efficient administrative and safety procedures.

The growth in exploitation of advanced light sources is supported often via dedicated “industry liaison” or “business development” offices at the light sources themselves. But entrepreneurs have also spotted opportunity. Adding fuel to the industrial use of light sources is the emergence of companies which bridge between the synchrotron world and that of industry. Often micro-sized and very nimble, these companies translate between the two worlds, adding value in ancillary techniques and in interpreting data into numbers that industry researchers can exploit.

Beyond direct paid-for service provision, creative research relationships are springing up between light sources and industry for use of the facilities. This often happens via academic multipliers, with industry welcome at light sources via the public peer review programmes. In Europe, it is generally estimated that between 25-40% of work done via the peer review programmes has industrial involvement in some way – for example via pre-competitive research collaborations, funded PhD student implication or exploitation of the results. At some light sources, industry has taken a direct interest in operating actual beamlines, either via ownership or a

Continued on page 11



LAAAMP Continues to Serve as a Capacity Building Resource

Michele Zema, Sekazi K. Mtingwa, Sandro Scandolo
LAAAMP Executive Committee

2nd African Light Source Conference and Workshop (AfLS2)

An important example of LAAAMP's assistance to local efforts is the African Light Source initiative.



Image of AfLS2 Group Photo

During 28 January-2 February, the AfLS Foundation convened a conference and workshop at the University of Ghana-Legon, located just outside the capital city of Accra. AfLS2 convened jointly with the 2nd Pan-African Conference on Crystallography. There were approximately 250 attendees, with Francesco Sette, Director General of the ESRF, being among them. Kwabena Frimpong Boateng, Ghana's Minister of Environment, Science, Technology and Innovation, delivered a message from Ghana's President Nana Addo Dankwa Akufo-Addo, in which the President announced that he will champion the African Light Source to make it an official project of both the African Union and the Economic



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Advanced Light Sources
and Crystallography

Tools of Discovery and Innovation

Published by LAAAMP,
Lightsources for Africa, the Americas, Asia and Middle East Project

Fuentes de Luz Avanzadas
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Herramientas para el Descubrimiento
y la Innovación

Publicado por LAAAMP,
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Sources lumineuses avancées
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مصادر الضوء المتقدمة
و علم البلورات
أدوات للاكتشاف والابتكار

Advanced Light Sources
and Crystallography

Tools of Discovery and Innovation

Community of West African States. According to President Akufo-Addo's statement, *A light source is a seed and magnet for high tech industry and all kinds of associated research institutions in all fields. It would be the most important, common, shared, very-large scale, scientific infrastructure for Africa.*

Three important recommendations from the Workshop are that African countries should form three kinds of consortia: the first consortium to become a collaborative member of an existing AdLS, the second to construct a collaborative multinational beamline at an existing AdLS, and the third to establish four regional research centres for research and training in crystallography and AdLSs in Northern, Eastern, Western and Southern Africa. Finally, a decision was made to collaborate with partners across Africa to develop local researchers' sample preparation and screening feeder facilities prior to taking those samples to AdLS for data acquisition. It was noted that the African Laser Centre (<https://www.africanlasercentre.net/>) is already an extensive network of laser laboratories across the African continent and could serve as the foundation for enhancing local feeder infrastructures.

Mexican Light Source

Another regional initiative to which LAAAMP is providing assistance is the Mexican Light Source. To realize that goal, on 25 November 2018, the Governor of the Mexican State of Hidalgo, Omar Fayad, announced plans to construct an AdLS in his state. He appointed Herman Winick of Stanford University, and originator of the idea for SESAME, President of the *Strategic and International Scientific Advisory Council* to lead the effort. Moreover, he named Lamán Carranza, Hidalgo's Secretary of Planning and Prospective, to lead the local effort within Mexico. The hope is that Mexico's President, Andres Manuel Lopez Obrador, will embrace the goal of bringing an AdLS to Mexico. To seed the effort, Governor Fayad allocated 25 million US dollars to begin planning. Matías Moreno of the Universidad Nacional Autónoma de México and Chair of LAAAMP's Regional Committee for Mexico has worked diligently over the past decade to lay much of the foundation for this effort.

The LAAAMP Executive Committee continues to reach out to the international community to spread the word of its activities. During 27-30 November 2018, author SKM traveled to the University of the West Indies-Mona Campus outside Kingston, Jamaica to attend the 21st General Meeting and Conference of the Caribbean Academy of Sciences (CAS) in celebration of the 30th Anniversary of CAS and 70th Anniversary of the University of the West Indies. There was tremendous interest in the

LAAAMP FAST Team program, and thus LAAAMP was able to communicate its activities to more nations throughout the Caribbean.



In image, l-to-r:

- Robert Lancashire, CAS Foreign Secretary, Professor of Chemistry Emeritus, University of the West Indies, Mona Campus, Jamaica
- Tara Dasgupta*, CAS Jamaica Chapter President, Professor of Chemistry Emeritus, University of the West Indies, Mona Campus, Jamaica
- Winston Mellowes, CAS President, Professor Emeritus of Chemical Engineering, University of the West Indies, St. Augustine, Trinidad and Tobago
- Sekazi Mtingwa, LAAAMP Chair of Executive Committee, TriSEED Consultants, USA

In another outreach effort, on 29 January 2019, author SS attended the *Periodic Table and Sustainable Development Goals Session* at the *Opening Ceremony of the International Year of the Periodic Table 2019* at UNESCO's Headquarters in Paris. During his address, he described LAAAMP as an example of international collaboration.

* **In Memoriam:** The African Light Source Steering Committee expresses its sincere condolences to the Family and Colleagues of Tara Prasad Dasgupta, Former Department Head and Emeritus Professor of Chemistry at the University of the West Indies - Mona Campus. He passed away on 20 April 2020 due to complications from the COVID-19 virus. As reported by one of his former doctoral students, Professor Alvin Holder of Old Dominion University, "Professor Dasgupta was a great mentor and thesis advisor for many Ph.D. and M. Phil. students." He will be greatly missed by all those whose lives he touched.

Read more about the life of Dr. Tara Dasgupta [here](#). His death was the 6th documented COVID death in Jamaica as reported [here](#).



Image of Sandro Scandolo at UNESCO's Opening Ceremony of the International Year of the Periodic Table 2019

World Science Forum 2019

Two of the authors (MZ and SKM) attended the WSF 2019 in Budapest, Hungary during 20-23 November 2019 at the Hungarian Academy of Sciences. Michel Spiro, President of the International Union of Pure and Applied Physics, and MZ served as Co-Moderators of a Thematic Session entitled, *Basic Sciences Infrastructures for Ethical and Responsible Collaborative Development*. Among the speakers, Princess Sumaya bint El Hassan, President of the Royal Scientific Society of Jordan, gave opening remarks, and SKM summarized LAAAMP's first three years and what future plans are under development. This session was one of the most highly attended Thematic Sessions at the WSF 2019, with well over a hundred persons in attendance.

LAAAMP's Response to COVID-19

The National Synchrotron Light Source II, Advanced Photon Source, European Synchrotron Radiation Facility, Linac Coherent Light Source, and other advanced light sources around the world are expediting applications for studies related to COVID-19. See instructions for each facility on how to gain beamtime access. For samples via mail-in access, LAAAMP has funds available to cover postal charges through its program called SPARC (Synchronizing Partnerships to Advance Research Characterization). Those interested should contact the LAAAMP manager of SPARC, Tabbetha Dobbins (Dobbins@rowan.edu). Funding for SPARC is provided from a US\$6K grant from the U.S. Liaison Committee for the International Union of Pure and Applied Physics.

The future is bright for LAAAMP. In anticipation of great achievements to come, it has launched its 2020 fundraising campaign.

Stay tuned!

About the LAAAMP Authors:



Michele Zema is Chair of the LAAAMP Executive Committee and Executive Outreach Officer for the International Union of Crystallography.



Sekazi K. Mtingwa is Chair of the C13 Commission on Physics for Development of the International Union of Pure and Applied Physics and Principal Partner at TriSEED Consultants, LLC.



Sandro Scandolo is Senior Research Scientist at the Abdus Salam International Centre for Theoretical Physics.



**Industry @ Advanced Light Sources
(Continued from page 7)**

strong partnership; permitting a strong implication and use of the technique. Examples include beamlines as the Advanced Photon Source (US), Swiss Light Source, MAXIV (Sweden) and SPring8 (Japan).

Light sources are renowned as hubs of international collaboration and scientific and technological cross-disciplinarity, as well as excellent training grounds for young researchers. In this context, work with industry in the rich cultural environment can provide a healthy modern environment for PhD students. At the European Synchrotron, the “InnovaXN” Marie Skłodowska Curie COFUND programme is supporting 40 PhD students on research projects driven by pre-competitive industry interests and exploiting the ESRF and ILL’s synchrotron X-ray and neutron beams. Such industry-academic-research infrastructure partnerships are increasingly common, making good use of those rich environments created at the academic-industry interface with the capabilities of advanced research instruments.

But the application of synchrotron radiation for industry is only barely coming into its teenage years. The foundations are set for a strong future growth in application to industry R&D. With the revolution of the fourth generation “extremely-brilliant” storage rings, advanced detectors, automation and a spreading awareness of the power of advanced light sources, the future is more than bright for these unique facilities in terms of industrial exploitation.



Dr. Edward MITCHELL
Head of Business Development and staff scientist
mitchell@esrf.fr

Ed is responsible for the ESRF’s commercial and industrial programmes, and has over 20 years’ experience in protein crystallography and using synchrotron radiation. He has worked in a variety of roles at the ESRF, including project manager for the Partnership for Structural Biology and for the preparation of the ESRF Upgrade Programme, and has led the construction of three synchrotron X-ray stations. (from <https://www.esrf.eu/Industry/contact-industrial-services>)

The Coronavirus: Synchrotrons and Cryo-EM to the rescue (Continued from page 3)

- ⇒ **Update 11/3/2020: South African work on sequencing the complete SARS-CoV-2 genome.**
 - This [preprint](#) describes recent work where “next-generation sequencing of pathogens can provide new insights into disease transmission and aid in drug and vaccine design”.
- ⇒ **Update 11/3/2020: ACE2 – A rational frontline therapy for COVID-19 summary**
 - See report in this [blog](#). This is also a South African research focus area, as in this [recent paper](#).
- ⇒ **Update 19/3/2020: Brookhaven Lab Mobilizes Resources in Fight Against COVID-19**
 - Scientists and staff combine expertise across disciplines to address drug development, medical supplies, information processing, [read more](#)



Editor’s Note: The Editorial Board of the African Light Source Newsletter is led by Tabbetha Dobbins. Please submit content for inclusion in the newsletter to the email address: secretariat@africanlightsource.org (and mention Newsletter in the subject line) ©2020



THE AFRICAN LIGHT SOURCE CONFERENCE

16 - 21 Nov 2020, Kigali, Rwanda

Conference Venue

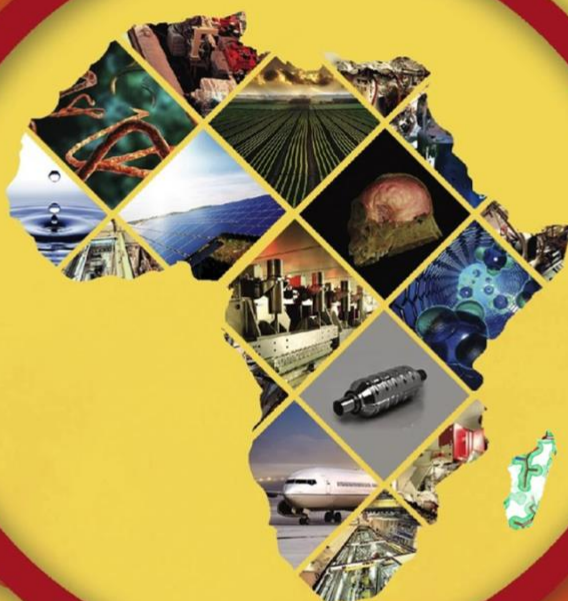
Hosted by ICTP-East African Institute for
Fundamental Research (EAIFR)

Web Pages

AfLS3 Conference: <http://afls3.africanlightsource.org>

ICTP - East African Institute
for Fundamental Research
under the auspices of UNESCO

Download the Conference Poster at:
https://eaifr.ictp.it/media/2853/conferenceposter_afls3-01.pdf



Local Organising Committee

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