



The African Light Source Project



Connell, S. The African Light Source Project. Presentation at the World Science Forum (WSF):

https://worldscienceforum.org/?ajax=1&block=Wsfresztvevok_Download&id=399

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ACP2018

Simon's slides are being delivered by:

Tabbatha Dobbins

Dept. of Physics & Astronomy

Rowan University





The African Light Source Project

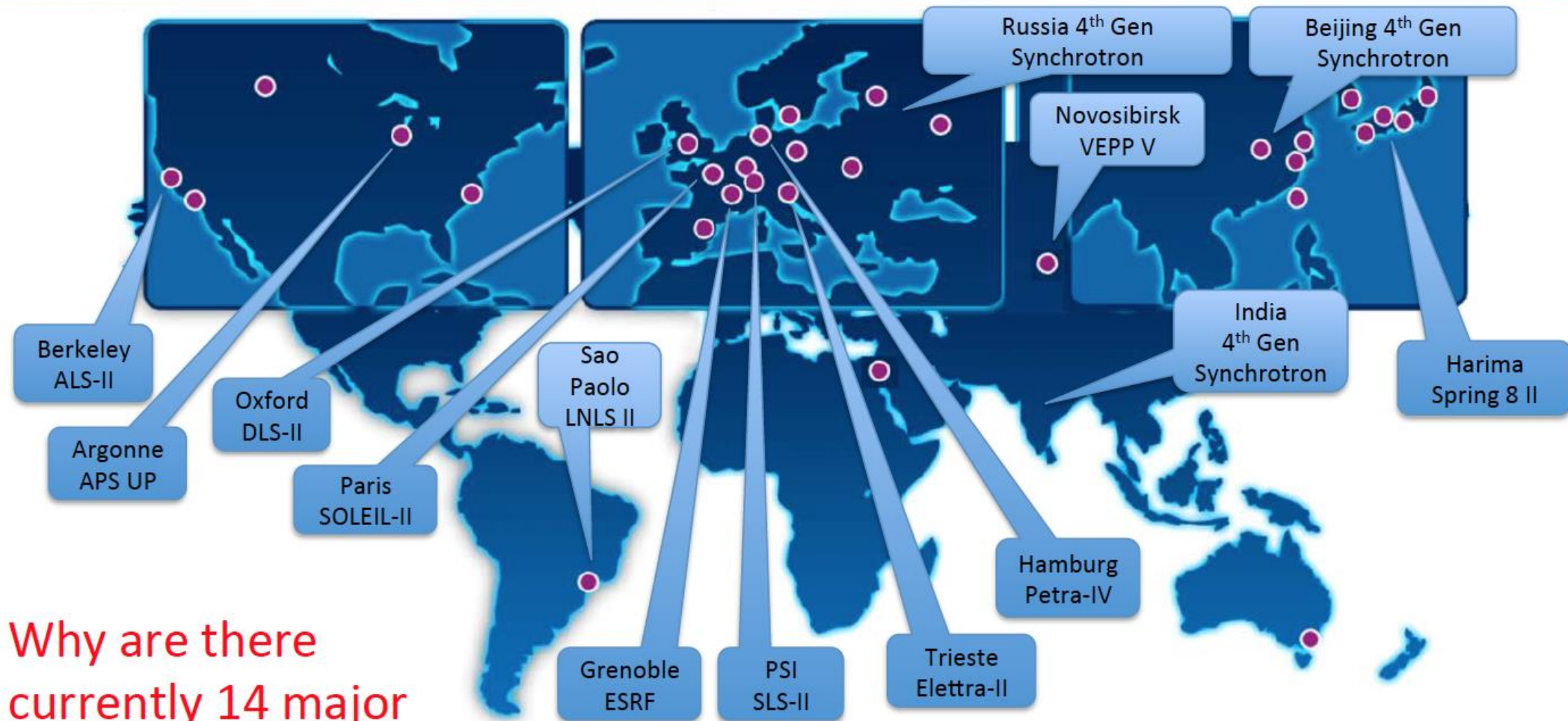


There are about 31
3rd generation **Light
Sources** as at
October 2017 ...

What are they ?
Why are they distributed like this ?

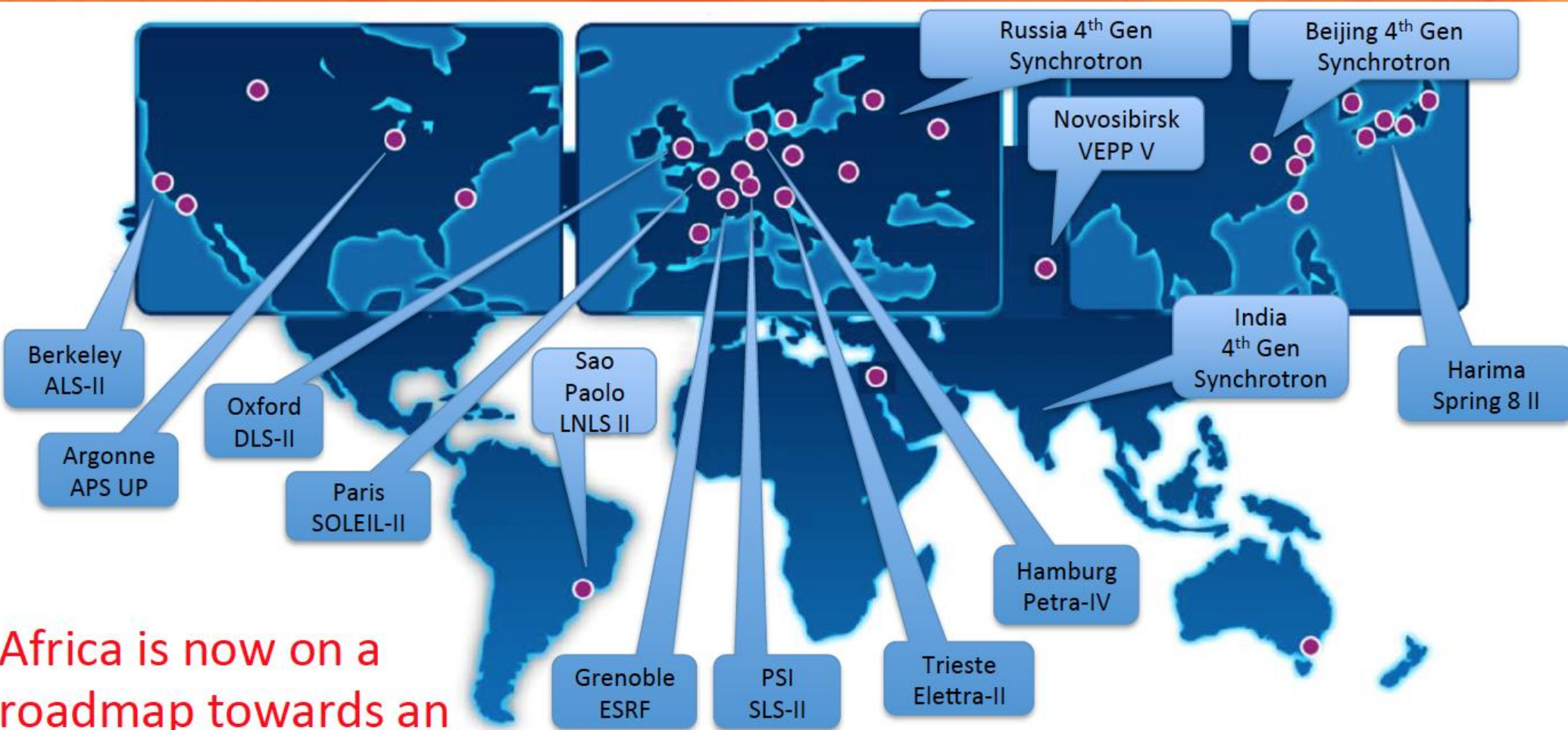


The African Light Source Project



Why are there currently 14 major upgrades / new builds ?

The African Light Source Project



Africa is now on a roadmap towards an African Light Source

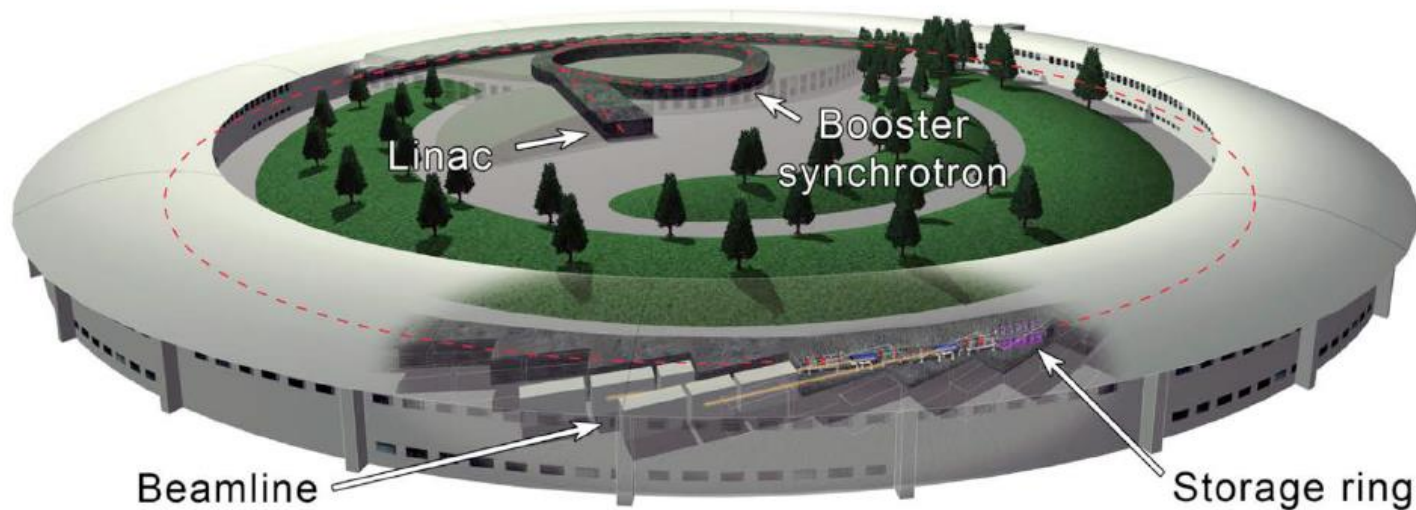


The African Light Source Project



What is a Light Source (synchrotron / FEL) transformative scientific instruments similar to the invention of conventional lasers and computers ...
premier research tool for

- Bio science, materials science, geo science, paleontology, archeology, environmental science, energy science, chemistry, industry





The African Light Source Project



Socio-economic benefits

- Boost African Scientific Research, Research Capacity (Continent, regions, Institutes), Capacity Building - African Science Renaissance
- Global Research Community
- Tackling Diseases (Malaria, TB, Aids, Ebola)
- Unique African Research Opportunities attracting international collaboration : Energy opportunities, African Environment, Cradle of Humankind, Cradle of Culture, Mineral beneficiation, Agriculture.
- Mobility, Conferences, Schools, International Mentoring partnerships in student training, Regional Centres of Excellence, Local feeder instrumentation
- Build Research capacity in Industry, competitive industry
- **Science for Peace (eg SESAME)**
- Return of the African Science Diaspora - new opportunities for young excellent scientists
- For African countries to take control of their destinies and become major players in the international community



The African Light Source Project

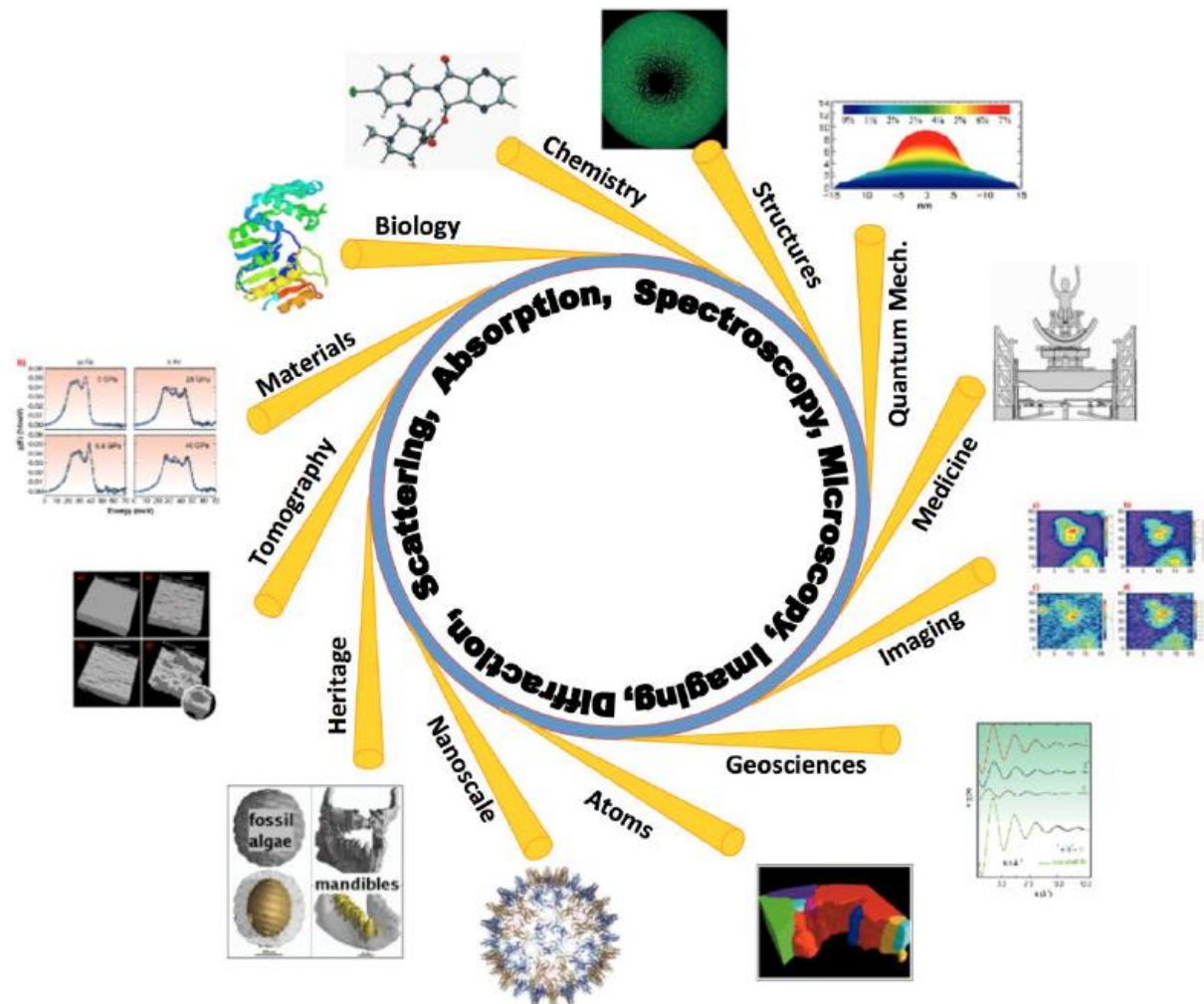


Some examples of Science with Synchrotrons

Multidisciplinary

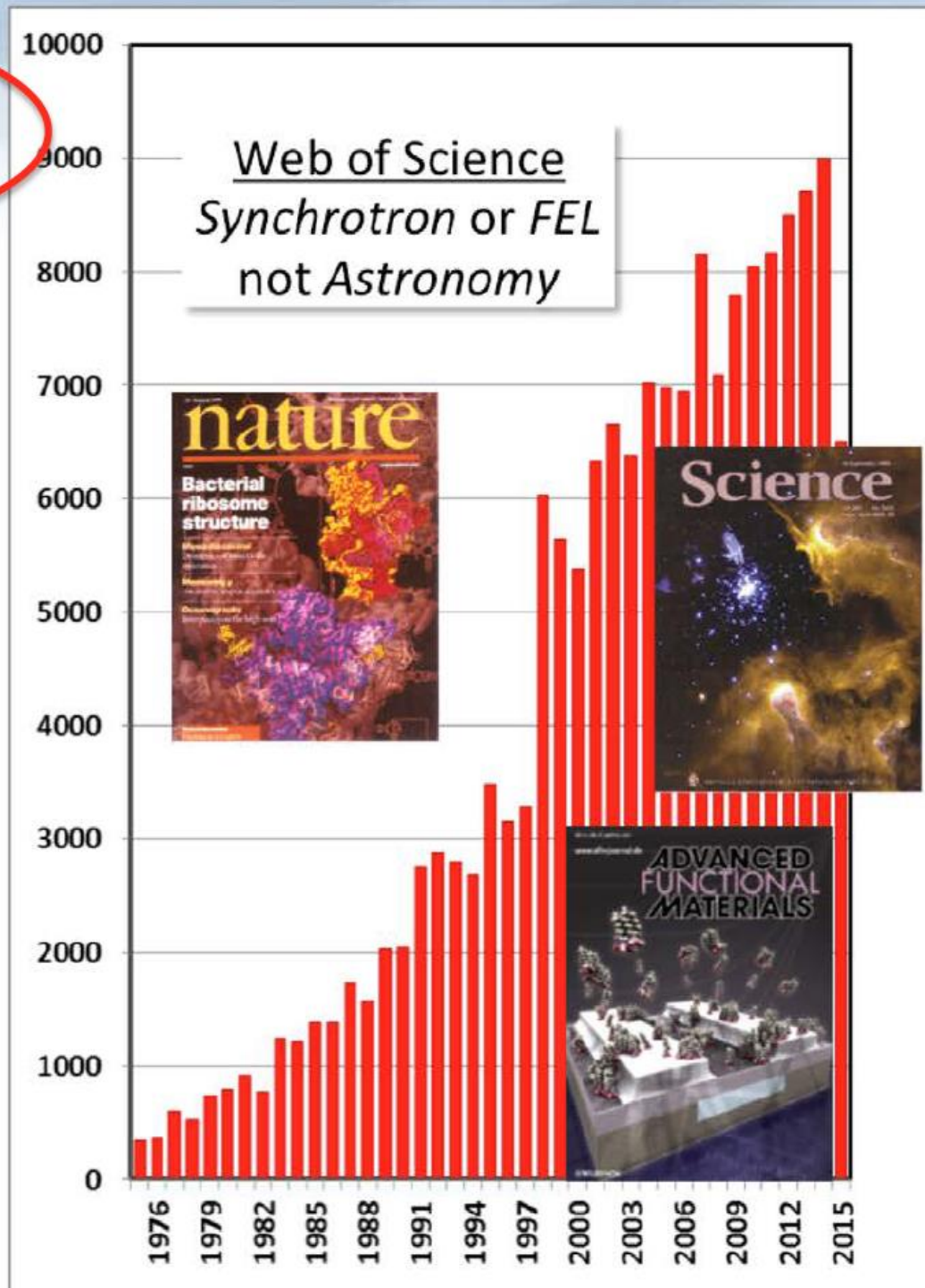
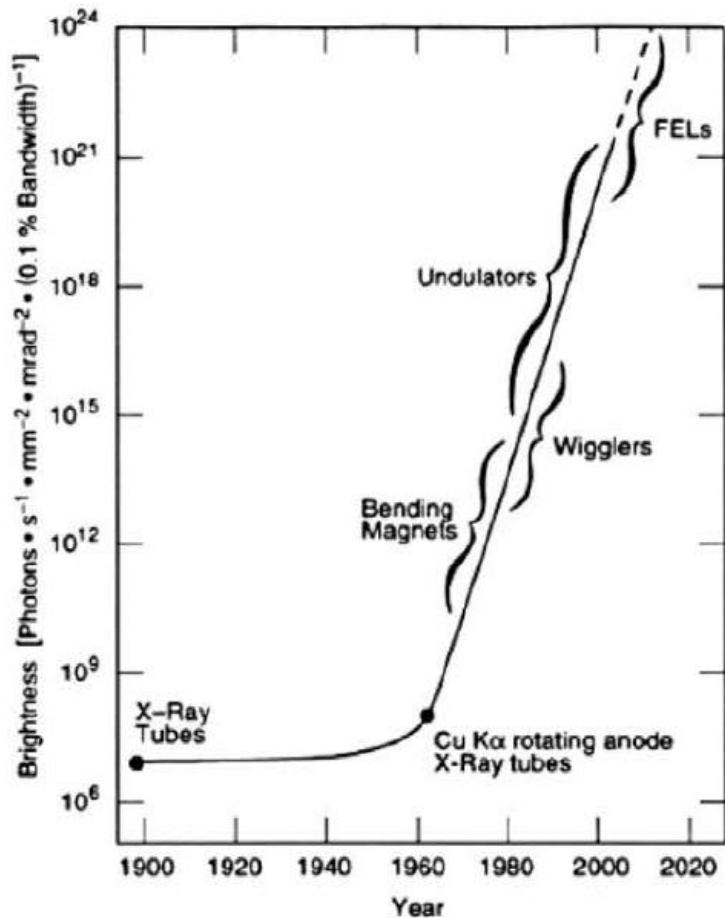
- Research
- Technology
- Industry

* Credit inferred from each slide



Growth in Synchrotron Science

- Steady growth in past four decades – big jump in late 1990's fueled by 3rd-SRs



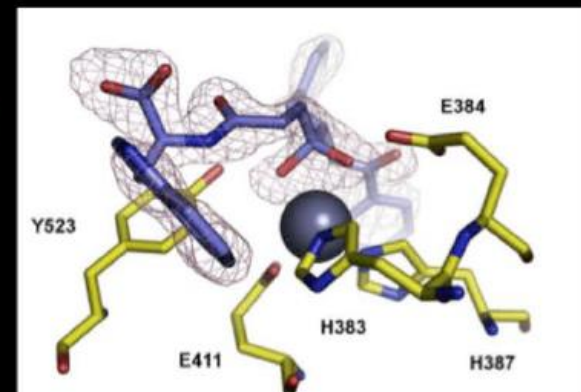
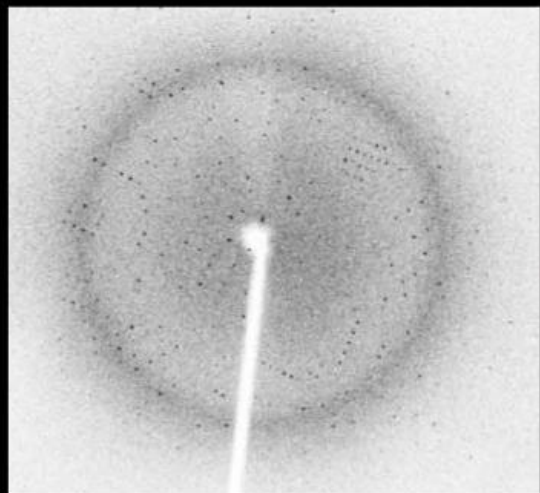
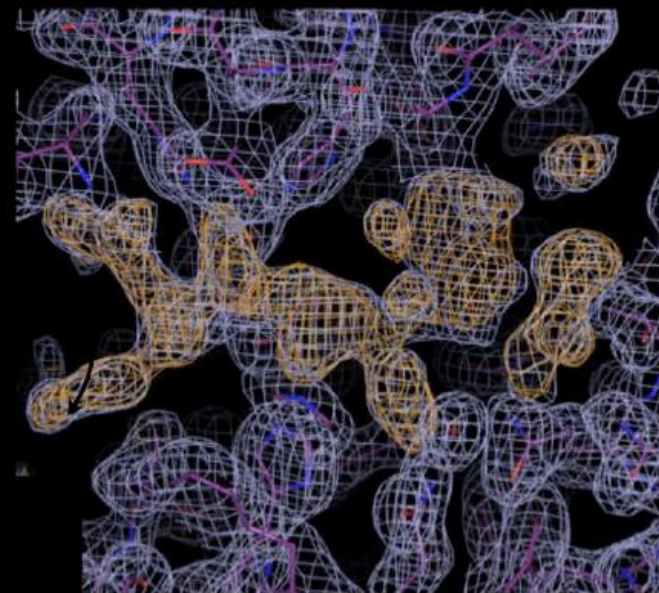
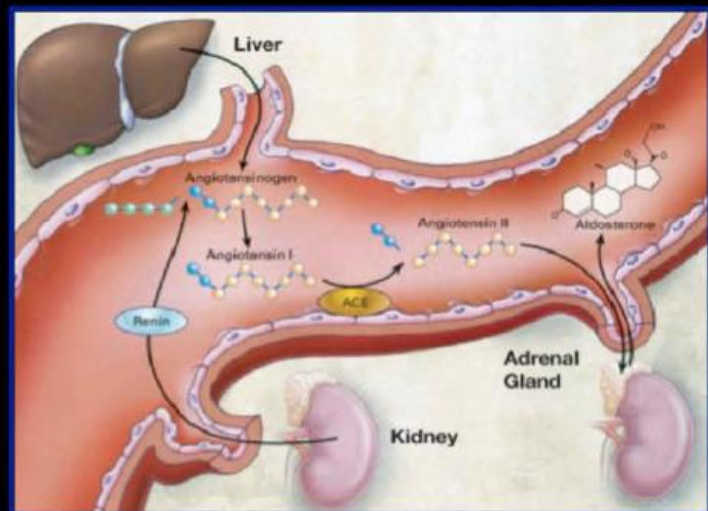
Drug design for hypertension



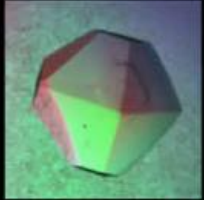
Dr. Jean Watermeyer

High blood pressure is treated using inhibitors of angiotensin-converting enzyme.

X-ray crystallography allows visualisation of locally-designed, novel inhibitors binding to the enzyme.

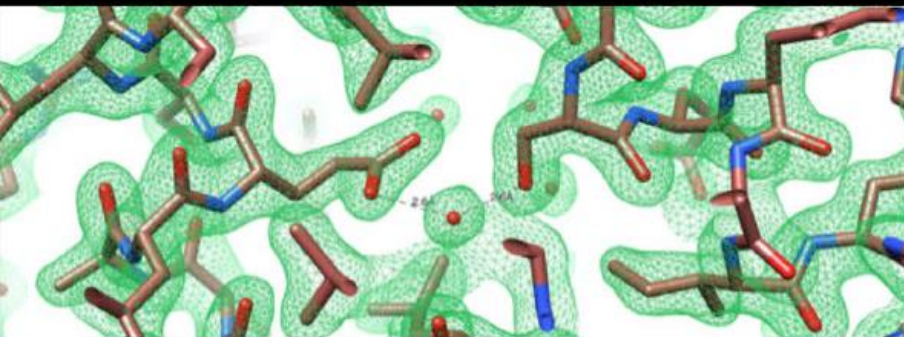


Water purification is achieved through polyacrylamide flocculation
Acrylamide is made in kiloton quantities using nitrile hydratase



Dr Jennifer van Wyk

Naturally occurring nitrile hydratase



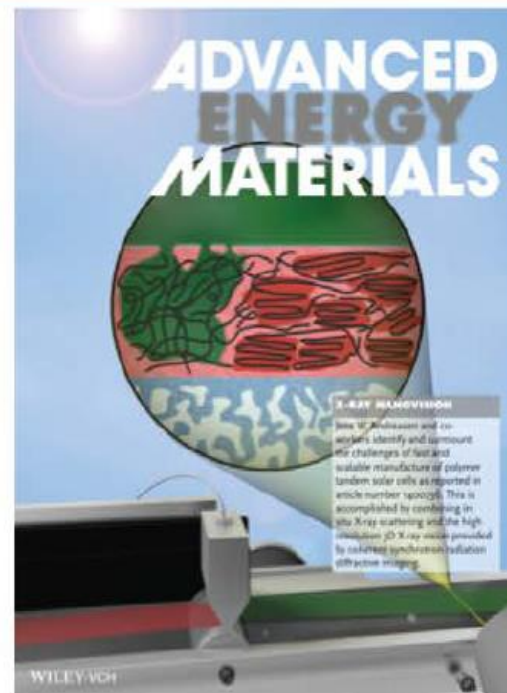
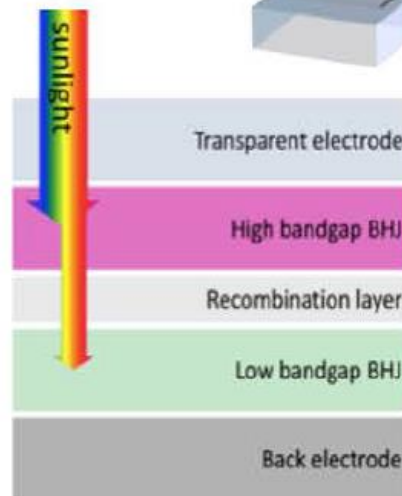
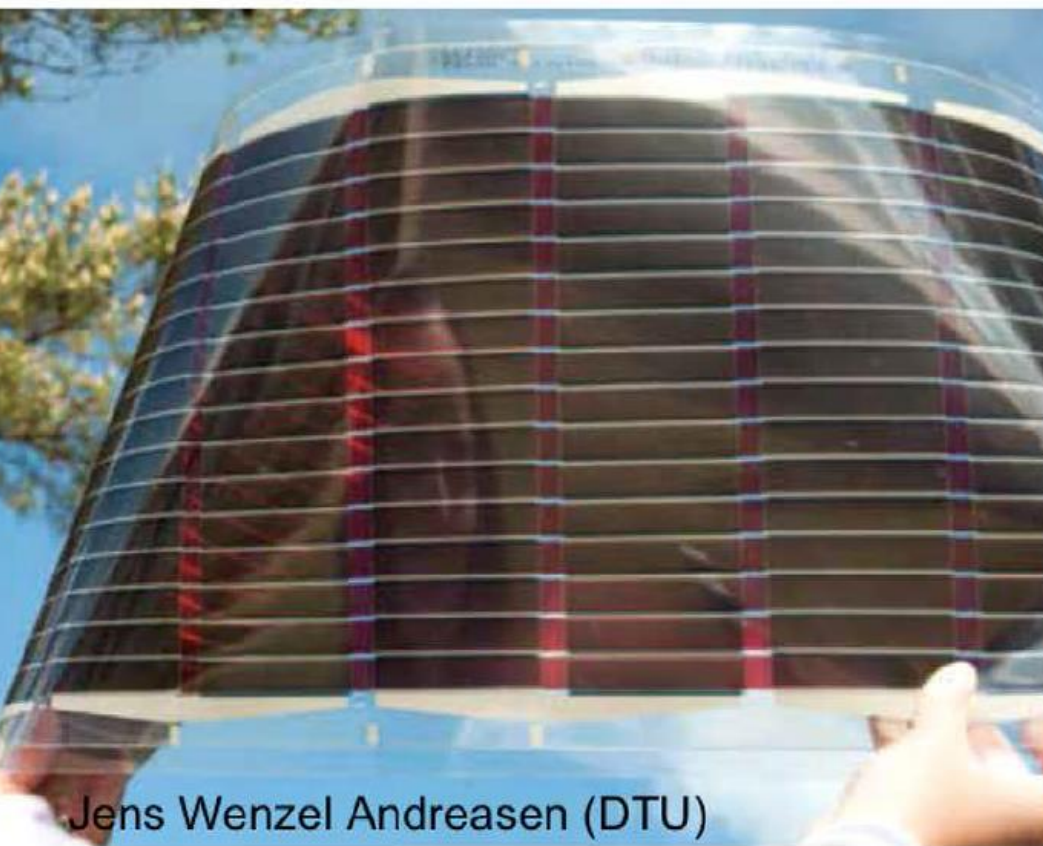
Enzyme modified for greater thermostability

Better enzymes for acrylamide manufacture are designed using structural knowledge

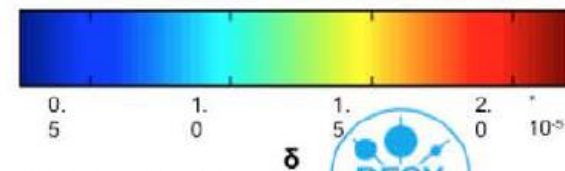
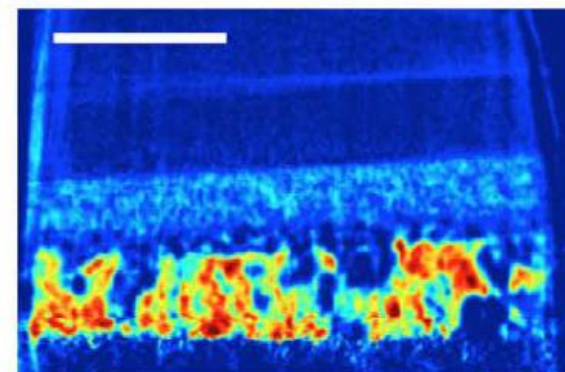
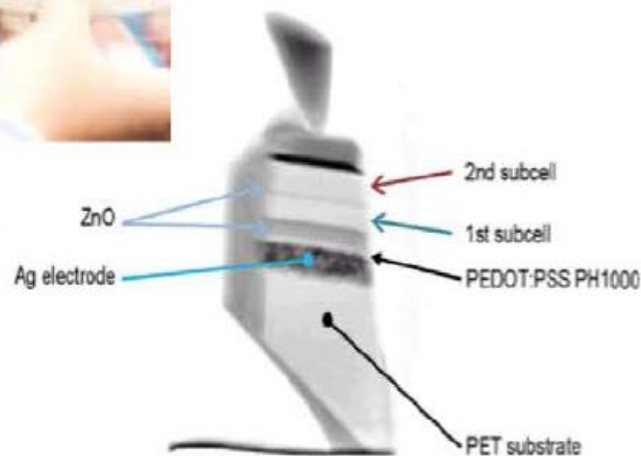
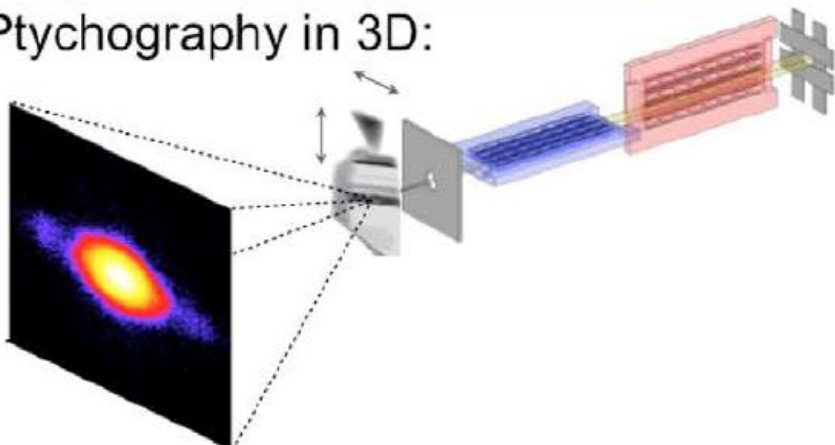


Organic Solar cells @ PETRA III

The Danish Technical University project on organic solar cells

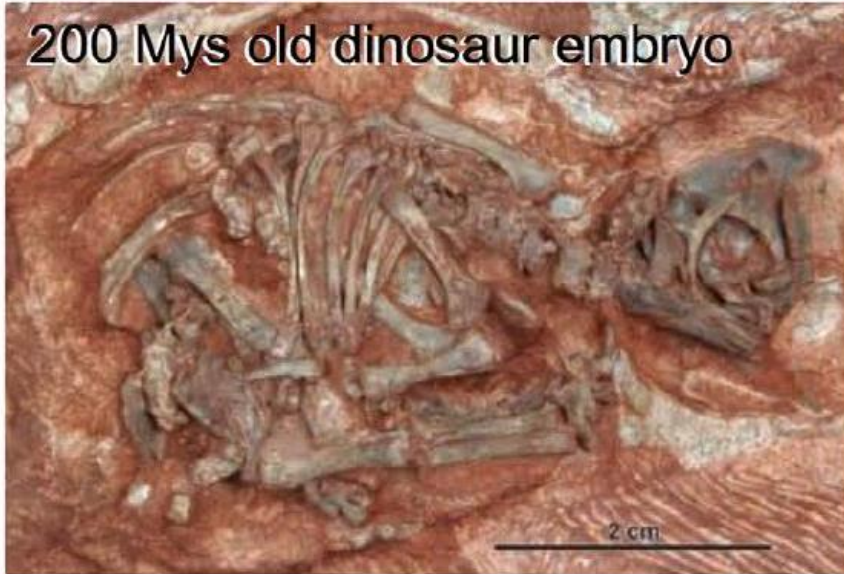


Ptychography in 3D:



Why do palaeontologists are interested in X-rays?

200 Mys old dinosaur embryo



165 Mys old cephalopod



Fragile and unique fossils limit physical preparation



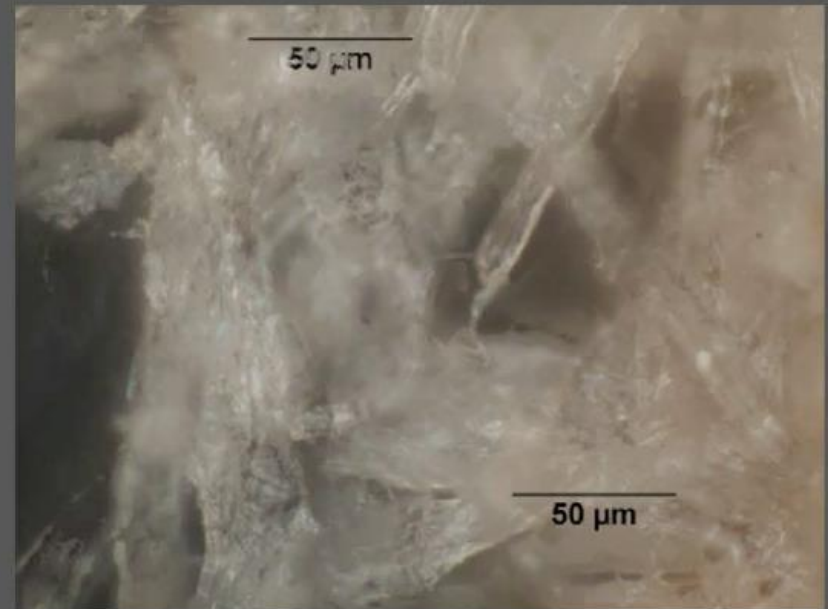
Some sediment must be kept



Micro-jack-hammer

Investigation of the **manufacturing technologies** used to produce historical documents in the southern African region
Chemical composition and degradation pathways of African historical documents
Ink, fibre and sizing analysis of African historical documents

Collaboration with institutions that deal with archaeological objects for resource sharing



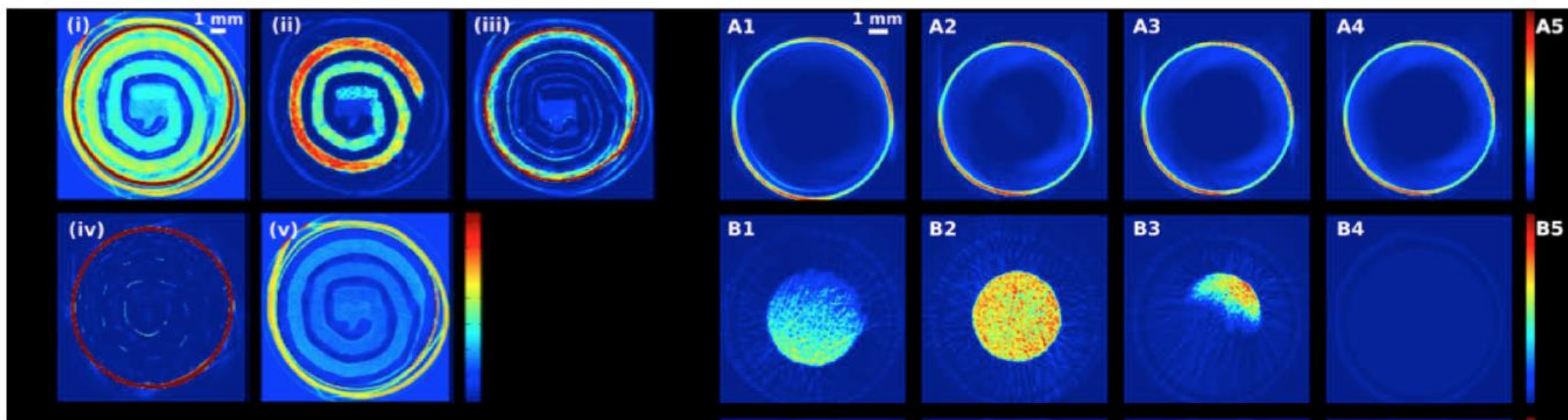
Historical documents : Timbuktu

Research stay of Kaitano Dzinavatonga to work on proposals, start preparing samples and perform preliminary tests

The African Light Source Project



ctPDF of Battery materials



10,000 2D datasets per image, 30 mins per image ~10Tb/day
Jensen, Corr, Di Michiel, SJLB et al., *J. Electrochem. Soc.* (2015)





The African Light Source Project



After a consultative process and an digital election, the Interim Steering Committee for the African Light Source was formed

Launch of the Interim Steering Committee for the African Light Source

Launched electronically on the 16th August 2014

Coinciding with the ASP2014 Forum Day

2014/08/16

Launch : Interim Committee for the African Light Source

Plan 1st African Light Source Conference and Workshop in Nov 2015



Initial members of the Interim Steering Committee of the African Light Source

These members nominated following communications sent to all available mailing lists and records of interested parties.

Herman Winick,	SSRL (SLAC) USA
Sekazi Mtingwa	MIT, USA
Simon Connell	UJ, SA
Tshepo Ntsoana	Necsa, SA
Jonathan Dorfan	OIST, Japan
Mohammad S. Yousef	Cairo University, Egypt
Tarek Hussein	Cairo University, Egypt
Kennedy Reed	LLNL, USA
Brian Masara	SAIP, SA (Zimbabwean)
Ken Evans-Lutterodt	BNL, USA
Sverker Werin	MAX IV, Sweden
Francesco Sette / ESRF representative	ESRF, Europe
Ahamadou Wague	Universite Cheikh Anta Diop, Senegal
Krystle J. McLaughlin	Lehigh University, USA
Philip Oladijo	Wits, SA (Nigerian)



The African Light Source Project



Declaration and Action Plan

1st African Higher Education Summit on Revitalizing Higher Education for Africa's Future,
10-12 March 2015, Dakar, Senegal.

Article 5.3.2 p 22 : Recommends establishing a Synchrotron as a centralized African scientific facility.



DECLARATION AND ACTION PLAN
from the
1ST AFRICAN HIGHER EDUCATION SUMMIT
ON
REVITALIZING HIGHER EDUCATION
FOR AFRICA'S FUTURE
March 10 – 12, 2015,
Dakar, Senegal

DE LA DECLARATION ET PLAN D'ACTION
DU
PREMIER SOMMET AFRICAIN SUR
L'ENSEIGNEMENT SUPERIEUR
SUR LE THEME
REVITALISATION DE L'ENSEIGNEMENT
SUPERIEUR POUR L'AVENIR DE L'AFRIQUE
10 au 12 mars 2015,
Dakar, Sénégal





THE AFRICAN LIGHT SOURCE CONFERENCE AND WORKSHOP

16 - 20 NOVEMBER 2015, ESRF GRENOBLE FRANCE



- After a consultative process and an election, the Interim Steering Committee for the African Light Source was formed in August 2014 to organise this event.



- The conference had an assessment phase and an outcomes phase.

A Synchrotron Light Source for Africa

Sekazi K. Mtingwa

After many discussions both within Africa and globally Three major outcomes emanated from the highly suc-

NEWS

Science & Environment

African synchrotron bid gathers pace

By Jonathan Webb
Science reporter, BBC News, San Antonio
8 March 2015 Science & Environment



The European synchrotron ESRF

physicsworld.com

1st African Light Source Conference

Save the date - 1st African Light Source Conference
First African Light Source Conference and Workshop, 18-20th November 2015, ESRF, Grenoble, France

Scientists and Government officials convene at the European Synchrotron Radiation Facility (ESRF) to discuss an African Light Source, a major scientific facility contemplated to be built on the African continent.

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THE AFRICAN LIGHT SOURCE INITIATIVE

Prof. Sekazi K. Mtingwa, Professor Emeritus, Michigan State University

Grenoble Resolutions mark historical step towards an African Light Source

30-11-2015
The first meeting of the African Light Source Conference and Workshop, funded at the ESRF from 18-20 November, concluded with a set of resolutions aimed at the African continent and a commitment to establish the African Light Source Initiative.

ESRF Welcomes the First African Light Source Conference and Workshop

ESRF International Staff
The ESRF International Staff warmly welcomed the first African Light Source Conference and Workshop, held at the ESRF from 18-20 November 2015.

CRYSTALLOGRAPHY

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Lighting the Way for a Brighter African Future

A movement is growing to construct an advanced light source somewhere on the African continent in the near future. It has been dubbed the African Light Source Initiative (ALSI). To formally initiate this goal, many of those in the discussion called for a meeting to discuss the vision of an ALSI would gradually be able to take form and mature, attracting support. This is a sub-group of the ISC and the leadership of the European Synchrotron Radiation Facility (ESRF) convened the First African Light Source Conference and Workshop during November 18-20, 2015, at the ESRF (Grenoble, France). Fig. 1 is a group photo of the participants, and Fig. 2 shows several of the researcher and student participants along with two traditional African ceremonial sticks. The larger stick metaphorically summarized the participants and allowed the opening of the meeting, and each speaker held up the smaller stick, which gave the authority to speak. This was the first in a series of ALSI meetings, with most of the subsequent meetings to be held in Africa. The organizers decided that the first meeting's venue should be at a flagship international facility so that policymakers, students and others not familiar with advanced light sources would be able to tour a fully operational facility.

The role of the ISC-ALSI was to initiate a transparent, inclusive and democratic process, culminating in a Conference and Workshop, where it could dissolve itself so that a more inclusive, fully mandated Steering Committee for the African Light Source (SC-ALSI) could be elected. With that foundation, the vision of an ALSI would gradually be able to take form and mature, attracting support. This is a sub-group of the ISC and the leadership of the European Synchrotron Radiation Facility (ESRF) convened the First African Light Source Conference and Workshop during November 18-20, 2015, at the ESRF (Grenoble, France). Fig. 1 is a group photo of the participants, and Fig. 2 shows several of the researcher and student participants along with two traditional African ceremonial sticks. The larger stick metaphorically summarized the participants and allowed the opening of the meeting, and each speaker held up the smaller stick, which gave the authority to speak. This was the first in a series of ALSI meetings, with most of the subsequent meetings to be held in Africa. The organizers decided that the first meeting's venue should be at a flagship international facility so that policymakers, students and others not familiar with advanced light sources would be able to tour a fully operational facility.

- Advanced light sources are the most transformative scientific instruments similar to the invention of conventional lasers and computers.
- Advanced light sources are revolutionizing a myriad of fundamental and applied sciences, including agriculture, biology, biomedicine, chemistry, climate and environmental non-systems science, cultural heritage studies, energy, engineering, geology, materials science, nanotechnology, paleontology, pharmaceutical discovery, and physics, with an accompanying impact on sustainable living.
- The consistency of researchers around the world is driving collaboratively to construct ever more intense sources of electromagnetic synchrotron light sources and X-ray free-electron lasers (XFELs), to address the most challenging questions in biology and condensed matter physics.
- The African Light Source is expected to contribute significantly to the African Science Renaissance, the return of the African Science University Education, the training of a new generation of young researchers, the growth of competitive African industries, and the address of issues, challenges and concerns relevant to Africa.
- For African countries to take control of their destinies and become major players in the international community, it is inevitable that a construction somewhere on the African continent in the near future, which will promote peace and collaborations among African nations, is necessary.

A shining light for African science

Sekazi Mtingwa calls for physicists to get behind African plans to build the continent's first ever light source

Light sources such as synchrotrons or free-electron lasers have been among the most transformative scientific instruments since the invention of traditional lasers and computers. They embrace almost all spectroscopy, scattering and imaging techniques, using radiation from the infrared to the X-ray and even soft gamma rays. They are also orders of magnitude brighter than traditional lasers. Though costly to build, light sources have resulted in thousands of published papers, provided graduate student training and driven technological innovation.

The extremely high photon flux that light sources provide has allowed big advances to be made in many applications, including drug development, data storage and – based upon the deciphering of protein, bacterial and viral structures – disease



Forum on International Physics

After many discussions both within Africa and globally over the fifteen years, momentum is growing for an African advanced light source. The formal movement started with the election of an international Interim Steering Committee for the African Light Source Initiative (ALSI) in 2000. Organizers announced the newly elected members at the 1st African Light Source Conference and Workshop, held at the European Synchrotron Radiation Facility (ESRF) from 18-20 November 2015, at the ESRF (Grenoble, France). The ALSI is chaired by Prof. Sekazi K. Mtingwa, Professor Emeritus at Michigan State University, USA. The ALSI is a sub-group of the International Steering Committee of the African Light Source Initiative (ALSI).

- Governance
- Newsletters
- Meetings
- Announcements

A light source Africa would enable thousands of African scientists, engineers and students to gain access to a superh...

Several of the researcher and student participants, who numbered close to a hundred. Two attendees held traditional African ceremonial sticks. The larger stick metaphorically summarized the participants and allowed the opening of the meeting, and each speaker held up the smaller stick, which gave the authority to speak.

LEHIGH UNIVERSITY

News

'If you build it, will come'

News Article

RESEARCH

ARTS & CULTURE

DIVERSITY & INCLUSION

STUDENT LIFE

ATHLETICS

OPINION

ARCHIVES

BBC NEWS

Home Video World UK Business Tech Science Magazine Entertainment

Science & Environment

African synchrotron bid gathers pace

By Jonathan Webb
Science reporter, BBC News, San Antonio
8 March 2015 Science & Environment

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Your scientific research is essential to the world's progress. Watch now

WATCH NOW
All stages of your scientific research are essential to the world's progress. Watch now

APS physics

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European Synchrotron Radiation Facility (ESRF)

The European Synchrotron

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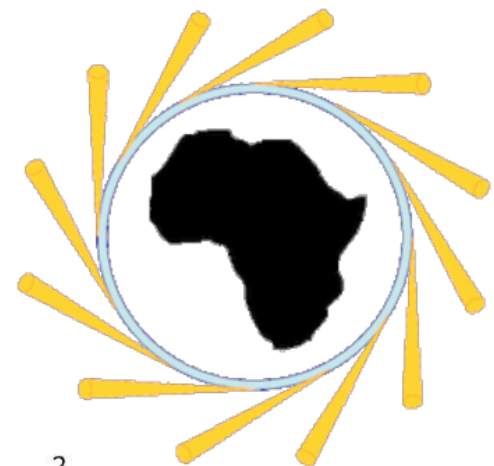
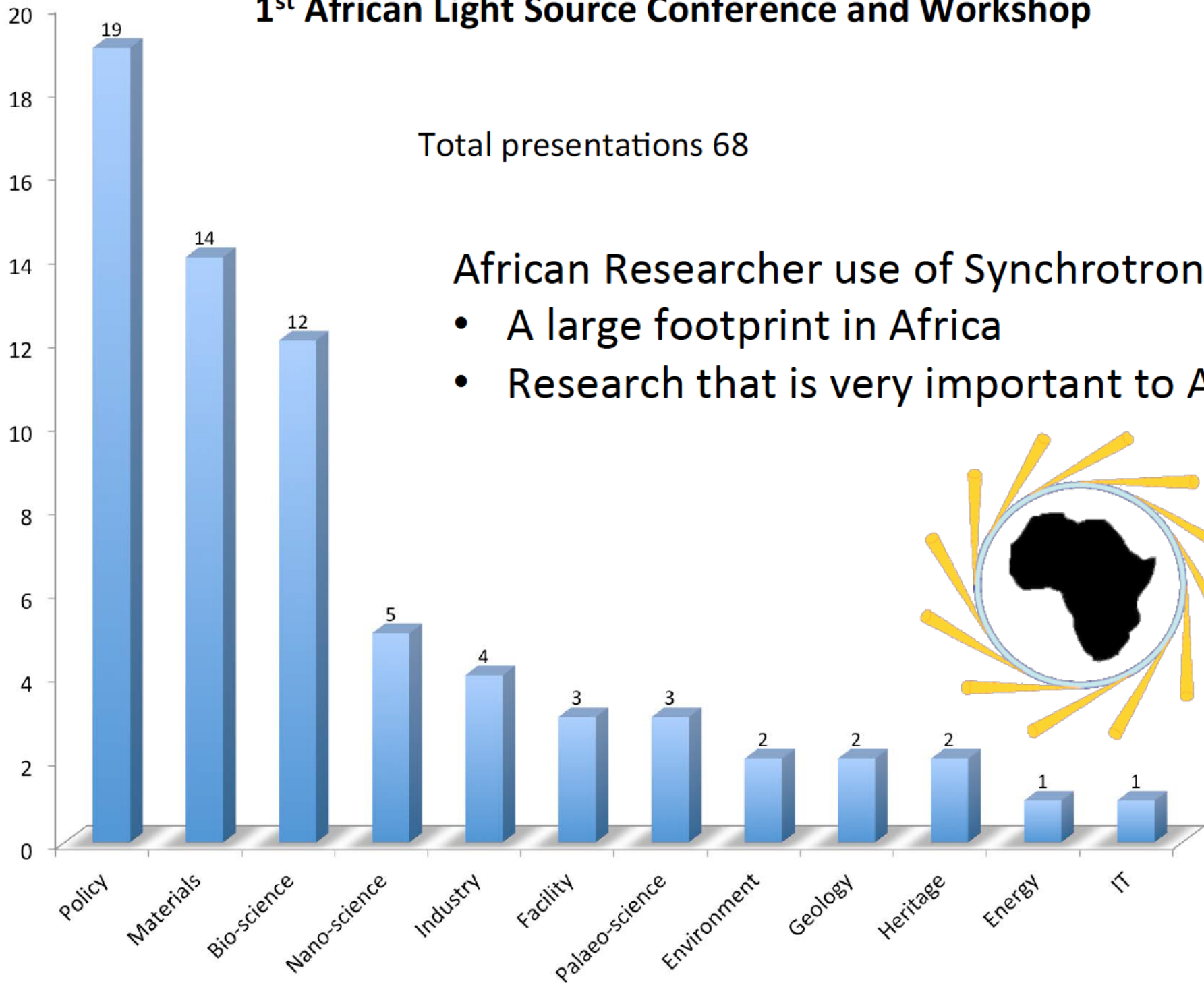
Jobs

Contact

1st African Light Source Conference and Workshop

Total presentations 68

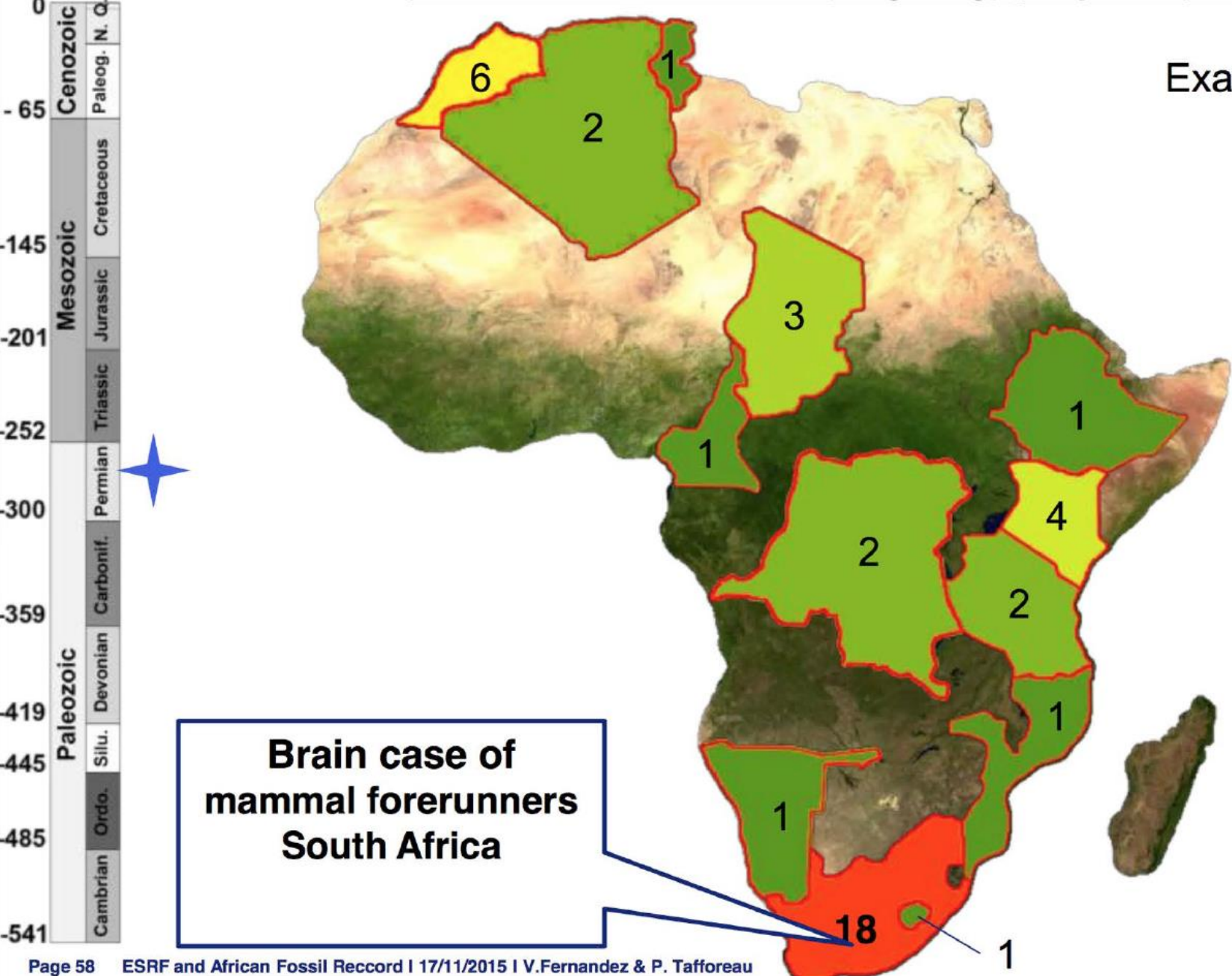
- African Researcher use of Synchrotrons has
- A large footprint in Africa
 - Research that is very important to Africa



Age
(Million years)

Number of articles or (ongoing) projects per country

Example of ongoing projects





THE AFRICAN LIGHT SOURCE CONFERENCE AND WORKSHOP

16 - 20 NOVEMBER 2015, ESRF GRENOBLE FRANCE



AfLS meeting : Part II - Concrete outcomes.

1. Grenoble Resolutions.

- See <http://events.saip.org.za/conferenceDisplay.py/getPic?picId=70&confId=61>

2. Terms of Reference.

- See <http://events.saip.org.za/conferenceDisplay.py/getPic?picId=67&confId=61>

3. Roadmap summary.

- See <http://events.saip.org.za/conferenceDisplay.py/getPic?picId=66&confId=61>

4. Steering Committee to drive this roadmap forward.

- fully mandated
- globally elected
- See <https://docs.google.com/spreadsheets/d/1N1ULgrE7Bu9t2aeiKIYd3zgFALoLbksfEFTqNC8p0q0/edit#gid=0>



The African Light Source Project



See <http://www.africanlightsource.org>

A Roadmap to the African Light Source

We are concerned with capacity building in terms of human resources, local laboratory support infrastructure and regions of excellence. We are building networks, identifying partners, training, mobility, workshops, schools and conferences and optimising the use of existing funding instruments. By degrees we will be building, on strong foundations, a massive campaign for a strong researcher user base with an aware policy-maker cohort, across Africa, and globally linked.

Auditing the progress in terms of Science and Capacity.

Ultimately there will be a feasibility study, business plan, governance model and Technical Design Report, leading to an African Light Source.

The African Light Source Project



Partnership:  African Academy of Science



Royal Society UK



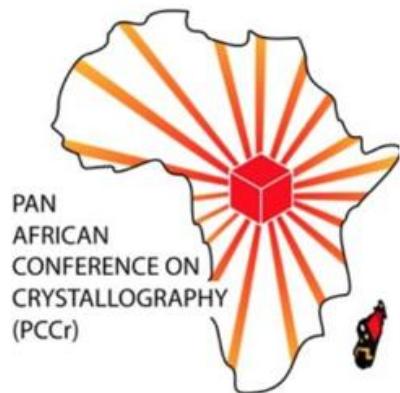
AfLS Steering Committee



The Call to support the creation of an Africa Synchrotron project

See the AAS website

- Build the case the AfLS
- Letter of support / endorsement
- Online petition



**Joint Conference of the
Pan African Conference on Crystallography
(PCCr2)**

And

The African Light Source (AfLS2)

28th January-2nd February 2019

in Accra, Ghana



**Bio Crystallography
Crystal Engineering
Industrial Materials
Inorganic Materials**

**Plenary Talks
Large Scale Facilities
Strategies for Africa
Guided tour of Ghana
and Cape Coast Castle**

**Spectroscopy
3D Tomographic Imaging
Light Sources of the Future
Mineralogy
Paleontology**

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