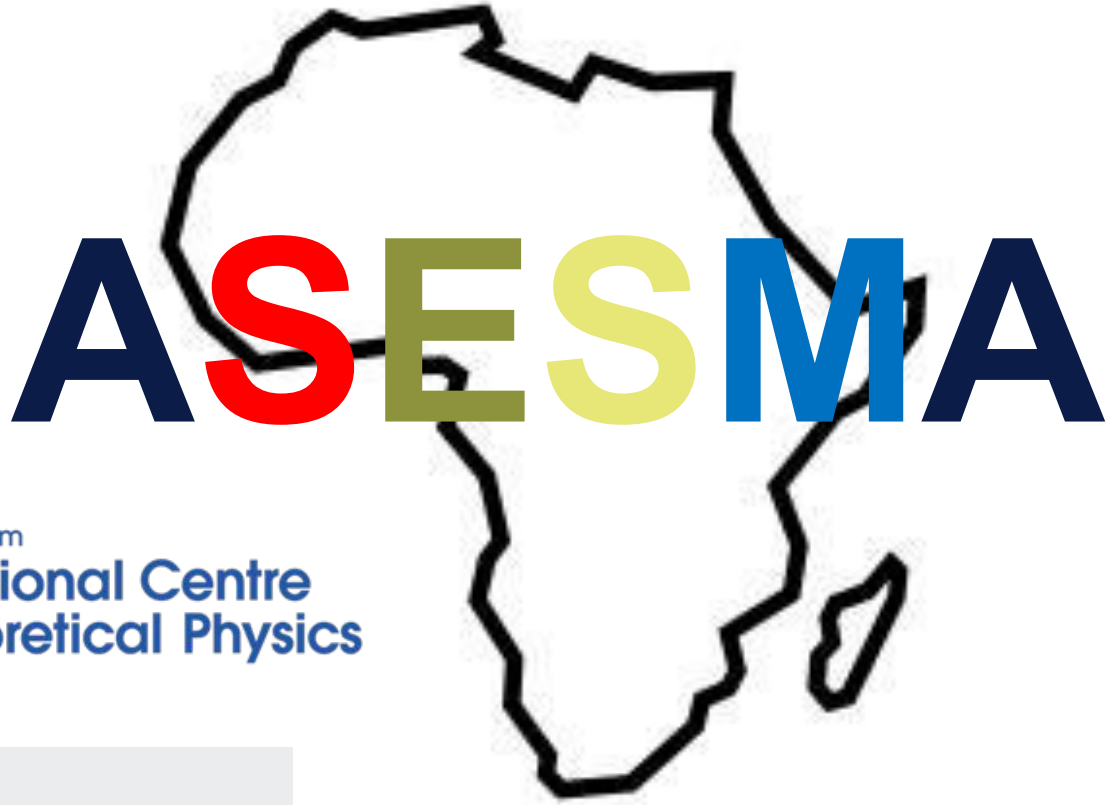
African School for Electronic Structure Methods and Applications



The Abdus Salam International Centre for Theoretical Physics

IUPAP International Union of Pure and Applied Physics

Theoretical Physics is Much More than Equations

ASESMA
Is a long term program to build up African Networks for Computational Materials Sciences, Chemistry, Physics, and other fields

The core of ASESMA is the series of schools held each two years
With ongoing activities between the schools to build expertise and nurture collaborations
The ASESMA Community

ASESMA

A 10-year program from 2010 to 2020

Endorsed by IUPAP (International Union of Pure and Applied Physics)
Supported by ICTP (International Centre for Theoretical Physics) , …..

Schools each 2 years to foster
a collaborative network for research and higher education within Africa

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A new larger vision for ASESMA – 2020-2030

Endorsed by IUPAP for a second decade
Based on accomplishments in the first 10 years

More emphasis on
Problems related to biology
Machine Learning
……..

The key is the long term support of ICTP and IUPAP

The ASESMA Approach

Computational Science

The core guiding principle is that computation makes it possible to do world-class research with modest investment. Computation is important in every area of science and technology.

Choice of Topics

Electronic structure is an important field that is narrow enough to build up a network for joint work and collaboration, yet broad enough to span the range from fundamental physics to applications in materials science, chemistry, and many other fields.

An ASESMA school

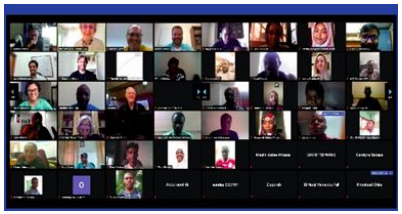
Typically ~ 1/2 participants new to the field, 1/2 returning to increase their knowledge, collaborate, and tutor the new people.

Each school includes basic theory and methods and hands-on computing.
Each participant is involved in a project in an area of current research.

ASESMA Schools

279 participants from 29 African countries (2008 -2023)

ASESMA 2021 - Virtual
(Showing only Lecturers, Mentors)



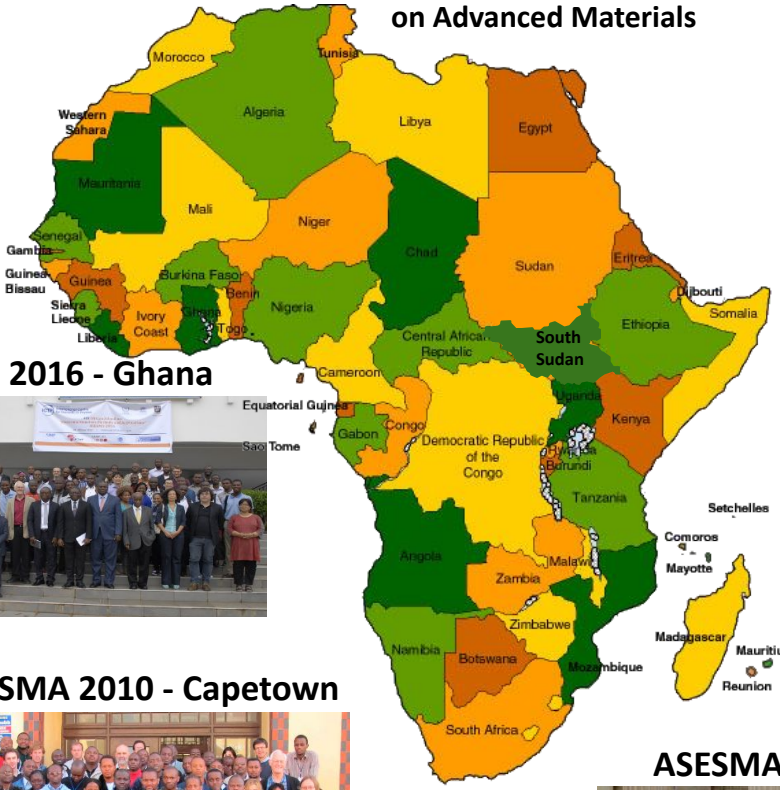
Now Many Active Research Groups!

Sudan 2013, 2015, 2017
Tutorials at Khartoum Workshop on Advanced Materials

ASESMA 2018 - Ethiopia

ASESMA 2012 - Kenya

Regional workshops
(Mini-ASESMAs)
Republic of Congo – 2017, 2021, 2023
Dem. Rep. of Congo - 2022
Cameroon 2018, 2019, 2022
Ethiopia – 2021
Kenya - 2021, 2022, 2023
Rwanda - 2019, 2023
South Africa – 2019, 2022
Tanzania - 2019



ASESMA 2016 - Ghana

ASESMA 2023-Rwanda

Sessions at African Materials Science Society
Botswana – 2017
Tanzania – 2019
Senegal - 2022
Rwanda - 2024

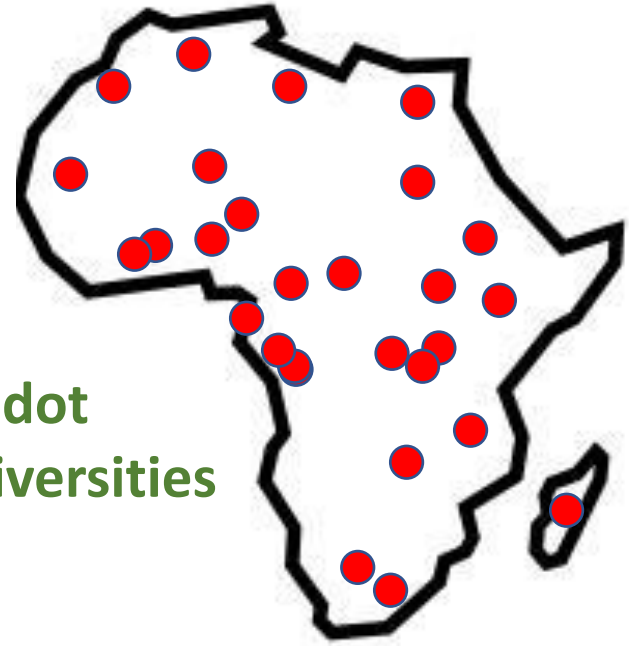
ASESMA 2010 - Capetown

ASESMA 2015 - Johannesburg

2008 - Capetown - Workshop that led to foundation of ASESMA

ASESMA Partcipants

279 participants from 29 African countries (2008 -2023)



In many cases, a dot represents several universities

These are capable students and young scientists!
Teachers/scientists/citizens!

Network of Active Research Groups

In large part due to ASESMA

Partial List

Algeria - Annaba,....
Cameroon – Yaounde, Dschang
Dem. Rep. Congo – Kinshasa, Bukavu
Rep. Congo – Brazzaville
Ethiopia – Addis Ababa, Adama, Assosa, . . .
Ghana – Accra, Kumasi
Kenya – Nairobi, Alupe, Eldoret, Kakamega, Njyro
Morocco - Casablanca, …
Nigeria – Ibadan, Abuja (AUST), Akare, Abeokuta, . . .
Rwanda – Kigali (new institute - EAIFR)
South Africa – Many locations
Sudan – Khartoum
Tanzania – Dodoma
Tunisia - Tunis, …
Other individuals and new groups growing

Working with colleagues is essential for an active researcher!

To keep up with current research one must be a part of local, regional and global science communities

What is the Science? Why is it Important?

The properties of materials, solids, molecules are determined by the quantum system of electrons…..

One of the grand challenges of Physics with intellectual depth

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Walter Kohn
Nobel Prize

In the 1960's was a great advance
Density Functional Theory (DFT)
Which has made it posssible to calculate properties of materials with astounding accuracy

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The most references areas in physics (possibly all of science)

A revolution is how science is done in these fields

This is the main topic of the ASESMA schools
And is the theme that brings together scientists in physics, chemistry, engineering in the ASESMA community

How useful is it?

My own survey of Science Magazine

Main journal in the United States that covers all of science - biology, chemistry, ecology, medicine, neuroscience, physics, …

In every survey I have done in recent years
DFT was an integral part of at least ½ the experimental papers on atomic scale physics, chemistry and materials science

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Example from a paper last week
on materials synthesis and characterization of a set of materials

Sentence is the text:

"This experimental result was in good agreement with the findings from the DFT calculations. … "

A revolution is how science is done in these fields

Walter Kohn
(Nobel Prize 1998)
Invented DFT
Active advisor to ASESMA
(Died 2016)

Executive Committee

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Shobhana Narasimhan (Jawaharlal Nehru Centre for Scientific Research, India)
Steve Ndengue (East Africa Institute for Fundamental Research, Rwanda)

Tony Leggett
(Nobel Prize 2003)
(visitor in Kumasi In 1980's)

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ASESMA

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International Union of Pure and Applied Physics

ICTP
The Abdus Salam
International Centre
for Theoretical Physics

Board on International Scientific Organizations
U.S. Liaison Committee for IUPAP
National Academy of Sciences

cecam
Centre Européen de Calcul Atomique et Moléculaire

UNESCO
United Nations
Educational, Scientific and
Cultural Organization

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

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