

**African School for  
Electronic Structure Methods and Applications**  
**Theoretical Physics is Much More than Equations**



Description by Richard M. Martin  
University of Illinois

# 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**

Based on  
Accomplishments in the first 10 years  
New developments such as:  
EAI FR (East African Institute for Fundamental Physics), ASES MANET, .....

Expanded  
Activities - Focused workshops, visits, meetings, collaborations, ....  
Topics - Materials Science, Chemistry, Biology, .....

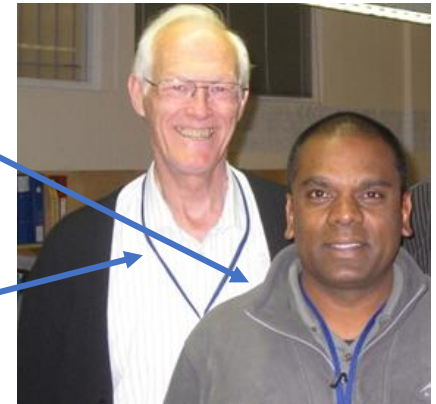
Education – Teaching the teachers, computational sciences, .....

# ASESMA Executive Committee

Nicola Seriani, Chair (ICTP)



Nithaya Chetty (University of Pretoria, South Africa)



Garu Gabreysus (University of Ghana)

Richard M. Martin (U of Illinois and Stanford U, USA)

Shobhana Narasimhan (InternJNCR, India)



***Garu in audience as a participant in 2015***

***Shobhana at 2016 school with Mentor Nisha Mammen***

# 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  $\sim 1/2$  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

## Participants from 22 countries

Mini-ASESMAs  
Rep. of Congo

Ethiopia - 2018



Kenya - 2012



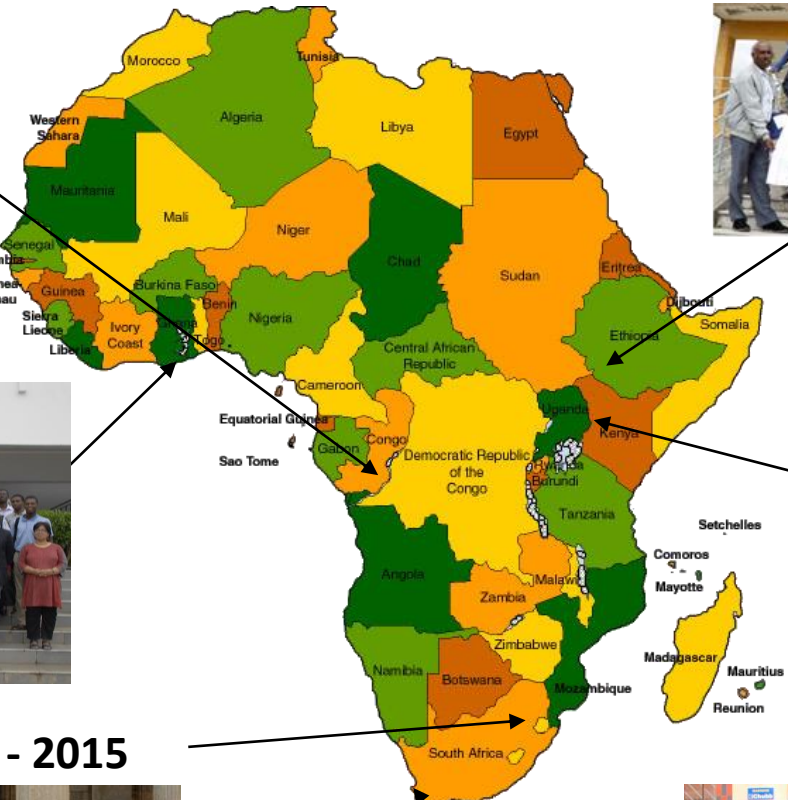
Ghana - 2016



Johannesburg - 2015



Capetown  
- 2010



# What has ASESMA accomplished

## Statistics for 2008-2018 (5 schools)

<b>Total number of participations</b> (counting multiple times for some participants)	<b>243</b>	(~40 in each school)
<b>Total number of individual participants</b>	<b>201</b>	
<b>Number who participated more than once</b>	<b>26</b>	
<b>Number of women</b>	<b>25</b>	
<b>Number of African countries</b>	<b>22</b>	
<b>Number of Lecturers</b>	<b>35</b>	<b>(15 from Africa)</b>
<b>Number of Mentors</b>	<b>33</b>	<b>(12 from Africa)</b>
<b>Publications in refereed journals</b> <b>by participants after attending ASESMA</b> <b>(7 with multiple ASESMA authors)</b>	<b>124</b>	<b>(as of May 2017)</b>

# Active Research Groups

**Cameroon - Yaounde**

**Congo – Brazzaville**

**Ethiopia – Addis Ababa**

**Ghana – Accra, Kumasi**

**Kenya – Nairobi, Eldoret, Kakamega**

**Nigeria – Ibadan, AUST**

**Rwanda – Kigali (new institute - EAIFR)**

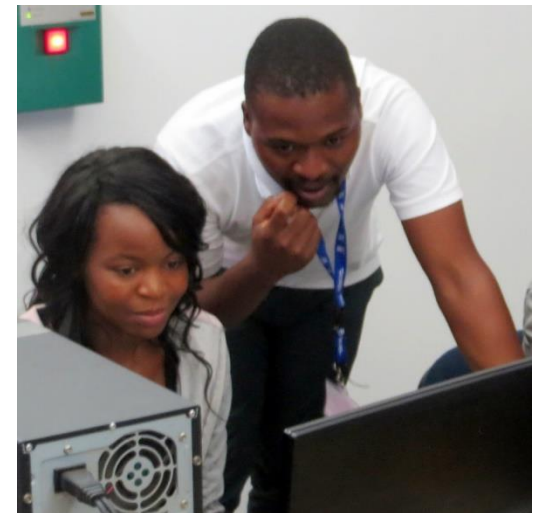
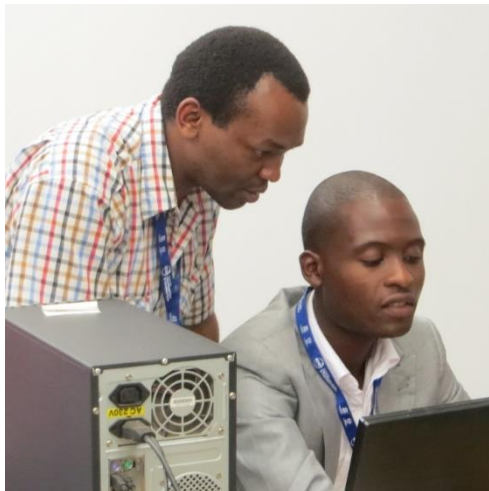
**South Africa – Many locations**

**Sudan - Khartoum**

**Other individuals and new groups growing**

# Theoretical Physics is more than Equations

## ASESMA is People





# Theoretical Physics is more than Equations

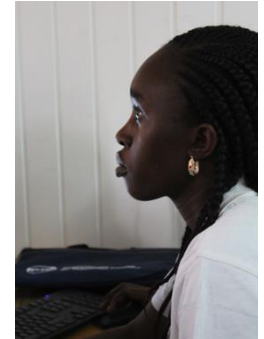


## **Mary Chukwufunaiya Mensah (2016)**

*“Getting to be part of ASESMA came at just the right time in my life. I was thinking of quitting grad school at that point. I started ASESMA in a very confused and grumpy state but ironically I ended up winning the “most joyous student” award at the end of the program. That’s to show how much those two weeks changed my perspective. ... Thank you so much ASESMA for bringing my excitement for studying the behavior of electrons and seeing what they tell us about the macroscopic world”*

## **Perpetua Wanjiru Muchiri (2016)**

*“The school was very beneficial and am grateful for the great learning experience and I purpose to help other students in Kenya”*



## **Ogenyi Sunday Joseph (2016)**

*“[Due to] ASESMA, I had the opportunity to travel out my country for the first time.”*

## **Denis MAGERO (2012,2016)**

I am one of the greatest beneficiaries of ASESMA. I say so with a lot of confidence because my Ph.D studies is all as a result of the school. .... you work more like colleagues rather than student and professor, which makes learning to be much more interesting. I conclude by saying that today, I would not have been who I am, were it not for ASESMA



## **Elvis Shoko (2010, 2012)**

Overall, ASESMA offered me a great opportunity to meet and interact with researchers and students across Africa. Out of this came an ongoing collaboration with Prof. Daniel Joubert (University of the Witwatersrand) on thermoelectric materials since two years ago. My current position came about in part because of a Nigerian student I met at ASESMA 2012 who went on to study for his PhD at KAUST.

# Success Stories

Three examples illustrating different types of success

***Azima Seidu, from Ghana – Started Many-body work at ASESMA 2016.***

***Visited Matteo Gatti (lecturer 2015, 2016) at Ecole Polytechnique in Paris for 3 months. Now studying for PhD in Finland***



***Azima with the lecturers Andrea Marini and Matteo Gatti Who lectured on many-body methods***

**George Manyali, participant 2010, 2012, Mentor 2015 PhD working with Daniel Joubert in South Africa Now Lecturer Physics Department, Masinde Muliro University of Science and Technology. Leader of Computational and Theoretical Physics Group**



***George as aa mentor in 2015***



***Garu in audience in 2015***

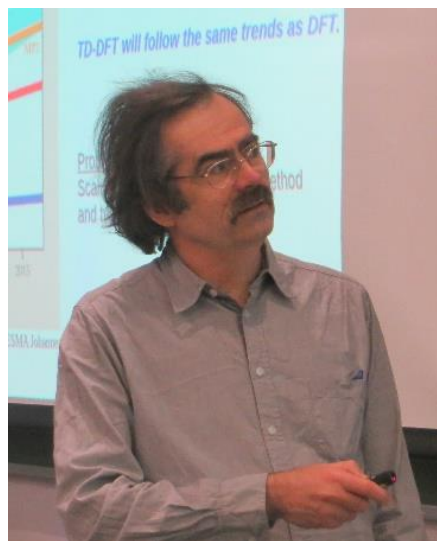
**Garu Gebreysus – Ghana – no electronic structure experience before he was participants in 2015 – Started group in Ghana – organizer of 2016 and 2018 ASESMA schools!**

# ASESMA

Different from any school/workshop I have ever attended!



Roberto Car - pioneer of DFT simulations.  
(Car-Parrinello method)



Marc Casida – pioneer of time-dependent density functional theory (the “Casida” equation”)



Mary Chukwufunaiya Mensah  
Chosen as “Most Joyous” in 2016



# Mentors

**Advanced Students and Postdocs who work individually with participants and lead tutorials and projects**



# Much more than Equations

## Elmina “Slave Castle” on Ghana Coast



A special experience for all of us ---- Europeans, Americans, Japanese, Africans  
(none of the of participants from outside Ghana had been to such a place)



# Much more than Equations

## Recent example of a successful initiative

James Sifuna and Javier Junquera



Javier arranged support from his University (Cambria, Spain) for a student to get a joint degree in Africa and Cambria

ASESMA advertised and identified appropriate students

James Sifuna from Kenya

# ASESMA Schools

## The next ASESMA 2020

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Kenya - 2012



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Capetown  
- 2010



Rwanda - 2020

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# Would YOU like to be involved?

- **Personal involvement**
  - **Host for a visit or longer term studies for a participant**
  - **Project leader at a school - dedicated to carrying a project to completion**
  - **Teacher in courses**
  - **New ideas!**



- **Check the website: [asesma.org](http://asesma.org)**
- **Contact me! [Rmartin@illinois.edu](mailto:Rmartin@illinois.edu)**

# Sponsors – so far



The Abdus Salam  
**International Centre  
for Theoretical Physics**



NATIONAL CENTRE OF COMPETENCE IN RESEARCH

