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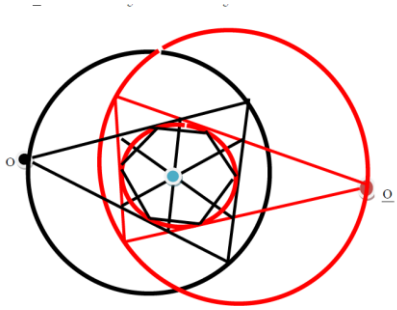

PROCEEDINGS OF THE SECOND INTERNATIONAL SEMINAR ON THEORETICAL PHYSICS & NATIONAL DEVELOPMENT

Abuja, Nigeria July 5-8, 2009

Editors

Godfrey E. Akpojotor

Abebe Kebede

Alex O.E. Animalu

All papers have been peer reviewed

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Group Photograph of the Participants at ISOTPAND09

Preface

This volume contains papers presented at the Second International Seminar on Theoretical Physics and National Development (ISOTPAND09) held at the National Mathematical Centre, Sheda (Abuja, Nigeria) from July 5 – 8, 2009. This year's event kicked off on Monday, July 6 at 9.00 a.m. with a welcome address by the Secretary of the National Mathematical Centre, Mr. C. E. Adeyomo and then by the Secretary of ISOTPAND09, Dr Godfrey Akpojotor. Thereafter, the first technical session commenced. As in ISOTPAND08 last year, the technical sessions were richly informative and motivational as they were a combination of both advanced and pedagogical contents to cut across all the participants made up of senior and junior researchers, postdocs, graduate and undergraduate students. This is in keeping with the goal of ISOTPAND as a forum for bringing senior and eager beginners together and for a systematic development of the African world view. The papers in this volume have also been peer-reviewed.

The major theme of this year's event was on mobilizing physical science-based enterprises with special focus on solar and renewable energy. The premise for this focus is that the Energy Commission of Nigeria was establish by government about 30 years

ago. Since then, there have been series of conferences, seminars and workshops and their focuses have been on how government could kick-start investment in the solar and renewable energy sector. However, the Nigerian Academy of Sciences after some retrospect of the journey so far, realized that government may have laid the needed foundation for the scientists to take the challenge of investing in the alternative energy sector. Therefore, the new focus shifted to mobilizing the scientific community to kickstart the investment in solar and renewable energy driven either as public-private sector and/or private-private sectors. As part of this drive, a book edited by Professor A. O. E. Animalu (former President of the Nigerian Academy of Science and Founding President of the Solar Energy Society of Nigeria), Dr. E.N.C. Osakwe and Mr. U.B. Akuru titled 'Solar and Renewable Energy Company (Nigeria) Limited' was presented at a Roundtable meeting during the ISOTPAND09. In addition, a brief biography of the late solar energy physicist and former Hon. Minister of Science and Technology, Chief (Dr.) Laz Abaecheta Unaogu (1949-2004) was presented. The Roundtable was chaired by the Director-General/CEO of the National Mathematical Centre (Abuja), Professor S. O. Ale, and was attended by both scientists and the representatives of government agencies and the private sector. The discussion was diverse and very enriching.

To motivate young female physicists and physics students, the organizers specially invited Dr Arlene P. Maclin, a Professor of Engineering & Director of the Center for Academic Excellence at Norfolk State University (USA). She was impressed with the number of this group of participants invited by the organizers just as members of the group were motivated by her scholarship. Also as part of motivating the female physics students, a renowned psychologist and the Deputy Vice-Chancellor (Administration) of the Delta State University, Abraka, Professor Otete Okobia, was also invited to ISOTPAND09 to talk on the 'The attitude of the female students towards physics.'

We wish to acknowledge the main sponsors of ISOTPAND09 – the International Centre for Basic Research and the National Mathematical Centre. We also acknowledge the financial support from the following bodies: National Universities Commission, Nigerian Energy Commission, Raw Material and Research Development Council, National Office for Technology Acquisition and Promotion (NOTAP), Board of National Merit award, University of Nigeria (Nsukka), Delta State University as well as individual donors. We also acknowledge the commitment of all the participants to the success of the event. Finally, we express our appreciation to members of the local organising committee coordinated by Dr B. O. Oyelami at the National Mathematical Centre and the International Scientific Committee of ISOTPAND for their various contributions.

Editors

Godfrey E. Akpojotor

Kebede Abebe

Alex O. E. Animalu

WELCOME ADDRESS: THEORETICAL PHYSICS - A RECIPE FOR NATIONAL DEVELOPMENT

Prof. Sam O. Ale mni, OFR

The Director-General
National Mathematical Centre, Abuja

"All that is valuable in human society depends upon the opportunity for development accorded to the individual" (Albert Einstein)

Protocol

On behalf of the management, staff and students of the National Mathematical Centre (NMC) Abuja, I welcome all participants, from outside and inside this country to this historic occasion of a Roundtable on mobilizing Science-based Enterprises as part of the activities to mark the 2nd International Seminar on Theoretical Physics and National Development (ISOTPAND09). This roundtable, which is being organized by the NMC and the International Centre for Basic Rersearch(ICBR) under Public Private Partnership (PPP), will be delivered by distinguished scientists from Nigeria and abroad, while the Theoretical Physicists will have opportunities to present their recent or ongoing research activities.

In our midst today are the following distinguished scholars:

- Professor A.O.E.Animalu, FAS, NNOM, Chairman/CEO Ineternational Centre for Basic Research, Abuja.
- Professor Ephraim E. Okon FAS former Permanent Secretary of the Federal Ministry of Science and Technology and representative of the Nigerian Academy of Science.
- Dr.G.E. Akpojotor, Secretary of the International Scientific Committee on the ISOTPAND series.
- Associate Professor B.O. Oyelami, Acting Coordinator of the Theoretical Physics Programme of the NMC..

Your presence here is an eloquent demonstration of our desire to put Nigeria on the world map of centres of excellence in science and technology. Please accept my profound thanks. It is a great pleasure meeting our budding physicists from across the country at this capacity building Roundtable being declared open here in NMC Abuja today. We congratulate you all for being part of this seminar and hope you will find the workshop intellectually stimulating and useful towards your primary assignment in your universities. We look forward to welcoming you

again to any of our future programmes in Abuja or in your state. I wish to also welcome our other invited Guests, especially Professors and Researchers from across the nation's universities here present at this ceremony. We hope you will also find your visit to NMC serene environment conducive to your research work and that you will take full opportunity of the Mathematical Sciences Library and make adequate use of them in your research work.

A cardinal objective of the National Mathematical Centre is to promote research and capacity building in the diverse areas of the mathematical sciences including Computer Science, Theoretical Physics, Statistics, and Mathematics. These disciplines are known to be plagued by perennial staff shortages in the nation's higher education institutions. To assist in dealing with this problem, the centre in collaboration with the ICBR has embarked on organizing and publishing the proceedings of annual workshops and Conferences in recent times. The activities enable large numbers in Nigerian higher education institutions to interact right here in Nigeria with world class scholars in a cost-effective way. They also facilitate linkages, cooperation, and partnership between Nigerian scholars at home and Nigerian scholars in the diaspora. The NMC is glad to have been able to collaborate with the International Centre for Basic Research in organizing the **ISOTPAND** series of activities aimed at developing capacity for Nigeria and Africa in area of Physical Science-based enterprises, as well as catalyzing the development of Theoretical Physicists in the inter-disciplinary area of Energy, Environment and Health practice for community development especially in Africa. In this regard, the NMC is greatful to the Chairman/CEO, International Centre for Basic Research Professor Alex Animalu,FAS, for making this cooperation possible.

Experts in the mathematical sciences would readily testify that the pace of development of these experts in the last fifty years or so, has been breathtaking, as whole new branches of the mathematical sciences are continually being created. The trend is generating diverse applications which have high impact on every aspect of our lives. We have today a science landscape that is very dynamic. **The Mathematical Reviews**, published by the American Mathematical society, classifies the mathematical sciences into several distinct branches, each of which possesses several sub branches. It is therefore apparent that no single academic institution, Centre or other specialized outfit in the whole world, whether publicly or privately owned, will ever be in a position to provide training in all these branches including theoretical physics. This situation calls for cooperation and synergy among outfits providing capacity building services in the mathematical sciences, especially in a developing country such as Nigeria in order to minimize duplication and waste.

Several years ago the renowned theoretical physicist and Nobel Laureate, Albert Einstein said, 'He who can no longer pause to wonder and stand right in awe, is as good as dead, his eyes are closed'. This statement is very relevant to the situation in Africa today. We need to pause and make a stock taking of research findings in the continent of Africa. How many findings in the theses in shelves in the libraries have found their way into the industry for commercialization? How many adjudged excellent theses or papers are presented for patents? To what extent are we responding to the global changing problems like global warming and associated entropy rise due to human activities? These are among so many questions that are relevant to our existence as human beings and the economy of the nation to which theoretical physics can proffer solutions. ISOTPAND 09 is an avenue for addressing some of the questions raised above.

For Nigeria to fully realize her Vision 20:2020 and the seven-point agenda of President Umaru Musa Yar'Adua, we need to develop a critical mass of researchers who will develop new basic knowledge, translate into applications, and influence policy. We need, as a nation, to invest in Research and Development (RD) and build capacity to translate theoretical knowledge into applications that can be commercialized. This position is inevitable as Government is making frantic effort to place Nigeria in her rightful position in the world of advanced technology as a vehicle for the achievement of its Vision 20:2020.

Distinguished Ladies and Gentlemen, no meaningful technological development of any nation is possible without mathematics and its allied discipline of computer science and the physical sciences. Currently, in Nigeria any student that does not make at least a credit pass in mathematics finds it difficult to get a university admission. Therefore investment in the capacity building of mathematics and physics teachers or postgraduate students is in the right direction. Knowledge has no boundaries: it changes with time and there is the need to adapt to these changes by participating in workshops, seminars, and conferences so as to update one's knowledge. Let us continue to work harder towards the improvement of the teaching and learning of the mathematical sciences at all levels inasmuch as the extent we fail in developing mathematics and physics in minds of students, to that extent we fail in national development and progress.

We hope this 4-day meeting will be very exciting and rewarding. We also hope that the friendship you would nurture at this forum will continue to bear fruits for the greater glory of the promotion of science and technology education in this country.

I pray that when you conclude this seminar, God will grant you all traveling mercies as you return to your various destinations.

In the coming years, the NMC will, singly or jointly with others, organize many of this kind of capacity building workshops, seminars, conferences, as a way of fostering and deepening a culture of cutting-adge research in the mathematical sciences in this country.

Once again, we thank the Chairman/CEO of International Centre for Basic Research for the collaboration and support to the centre for the hosting of the 4-Day Seminar. We also thank the press for gracing the occasion and for popularization of these capacity building workshops. The National Mathematical Centre wishes all participants a rewarding scientific experience at the Seminar and Roundtable.

Thank you and God bless you.

Professor Sam Ale, OFR, NPOM, mni
Director General

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